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CHAPTER 1: GENERAL

1.1 BACKGROUND

The DFW area was classified as a moderate ozone nonattainment area in accordance with the FCAA Amendments of 1990. As a moderate nonattainment area, DFW was required to demonstrate attainment of the 1-hour ozone standard by November 15, 1996. A SIP was submitted based on a VOC-only strategy. Air quality data from the DFW area ambient air quality monitors from the years 1994-96 showed that the 1-hour NAAQS for ozone was exceeded more than one day per year over this three-year period.

As a result, the EPA reclassified the DFW area from moderate to serious effective March 20, 1998 for failing to monitor attainment of the 1-hour ozone standard by the November 1996 deadline. The EPA required that a serious area SIP revision addressing attainment of the standard be submitted by March 20, 1999. The photochemical modeling investigated the effectiveness of both VOC and NO_x reductions on reducing ground level ozone. The modeling results indicated that a combination of both NO_x and VOC reductions is most effective at reducing ozone levels in the DFW area. Previous modeling results submitted to the EPA in 1994 indicated that attainment of the standard could be reached by VOC reductions alone. The DFW area applied for and was granted a waiver from §182(f) of the FCAA regarding NO_x reductions on November 28, 1994. Because EPA's approval of this waiver was conditional should future photochemical modeling show that NO_x reductions contribute toward attainment in the DFW area, submittal of this modeling resulted in EPA rescinding the NO_x waiver and reinstating the NO_x requirements for DFW which was effective on June 21, 1999. A SIP was submitted to the EPA on March 18, 1999 and contained a 9% ROP target calculation and emission reductions toward satisfying EPA's requirement of reasonable further progress for the DFW four county nonattainment area for the years 1997-99. In addition, the SIP contained photochemical modeling showing the level of reductions needed to attain the standard by 1999. The modeling indicated that reductions of NO_x would be needed to attain the standard. Therefore, the following rules were developed and included in the SIP:

- RACT for NO_x
- Nonattainment NSR for NO_x
- Fix-ups from the change in the major source threshold for RACT for VOCs

The commission indicated to the EPA and the local area that, due to time constraints, the March 1999 SIP would not have the rules necessary to bring the DFW area into attainment by the November 1999 deadline and that a complete Attainment Demonstration would be submitted in the spring of 2000. As a result, the EPA issued a letter of findings that the February 1999 SIP was incomplete which triggered an 18-month sanctions clock effective May 13, 1999.

The attainment deadline for serious areas is November 15, 1999. Because of numerous 1-hour ozone exceedances in 1997, 1998, and 1999 it will not be possible for the DFW area to attain the standard by that deadline. There is mounting technical data which suggests that DFW is significantly impacted by transport and regional background levels of ozone. The reductions from the strategies needed for the HGA area and the regional rules discussed are a necessary and integral component in the strategy for DFW's attainment of the 1-hour ozone standard. The proposed SIP contains a modeling demonstration that shows that the air quality in the DFW area is influenced at times from the HGA area. This demonstration, if approved by the EPA, would allow EPA to determine that the area should not be bumped up from serious to severe under the conditions of a transport policy published in the *Federal Register* on July 16, 1998. The new attainment date for the DFW area would be no later than November 15, 2007, the attainment date for HGA.

The proposed SIP utilizes the photochemical modeling grown out to 2007 with modeled control strategy scenarios showing attainment of the standard. The proposed SIP also incorporates a package of rules that are being developed concurrently under separate rulemaking. The control strategies contained in these rules will be necessary to reduce ozone causing compounds so that attainment can be achieved by the target date. The proposed Attainment Demonstration SIP and associated rules will allow the DFW area to move forward toward attainment of the 1-hour ozone standard and will meet EPA guidance so that the area will not be sanctioned for failure to submit a required FCAA element.

An attainment date of 2007 for the DFW area would allow for the implementation of several federal mobile source programs that involve technology changes. Such programs include heavy duty diesel engines (on and off road), reformulated gasoline phase II, NLEV, Tier II automobile standards, reduced sulfur in gasoline, on-board diagnostics, and on-board vapor recovery. Because of the high percentage of mobile source emissions in the DFW emissions inventory, the implementation of these programs is crucial to the area's ability to attain the ozone standard. A 2007 attainment year would also allow for the reduction in statewide and continental transport of ozone and/or its precursor emissions from upwind sources.

In addition to relying on federal programs, the state is in the process of developing regional rules to control emissions that contribute to the formation of ground level ozone. Such rules include cleaner burning gasoline, stage I vapor recovery, implementation of permitting programs for grandfathered electric generating facilities, grandfathered non-electric generating facilities, and controls for major permitted stationary sources. Additional point source rules associated in this proposed SIP for the four-county DFW nonattainment area include Tier II control levels for NO_x RACT.

In order to develop local control strategy options to augment federal and state programs, the DFW area established a North Texas Clean Air Steering Committee made up of local elected officials and business leaders. Specific control strategies were identified for review by technical subcommittee members. In addition, the NCTCOG hired an environmental consultant to assist with the analysis and evaluation of control strategy options. The consultant was responsible for presenting the findings of the technical subcommittees to the NCTCOG air quality policy and steering committees for final approval prior to being submitted to the state.

The following are the control strategy elements associated with this SIP which are needed in order to get the DFW area into compliance with the 1-hour ozone standard by 2007:

- Federal & State measures to be implemented by 2007 (12 counties)

    - On-road mobile source standards:
      Federal Phase II reformulated gasoline (RFG)
      Tier II vehicle emission standards
      Federal low sulfur gasoline (30 ppm)
      National low emission vehicles (NLEV)
      Heavy-Duty diesel standards

    - Non-road mobile source standards:

Lawn and garden equipment
Tier III heavy-duty diesel equipment
Locomotives
Standards for compression ignition vehicles and equipment
Standards for spark ignition vehicles and equipment
Recreational marine standards

- Point Sources:
  - SB 7 mandated that grandfathered EGFs in central and eastern Texas reduce emissions by 50% of 1997 levels
  - Sources identified as grandfathered were reduced by 30%, while sources identified as permitted were not reduced. Sources whose status could not be determined were reduced by the average (weighted) value of 13%. This is included as part of the Weight-of Evidence Analysis.
  - Emissions from EGFs in the remainder of the state are also to be reduced by 30%
  - In Oklahoma, Arkansas, Louisiana, Mississippi, and Florida, a reduction of 30% from 1996 emission levels was assumed for all point source NO_x to reflect national trends towards lowered emissions. In Georgia, Missouri, Kentucky and Tennessee, NO_x emissions were reduced by 59% from 1996 levels to reflect reductions expected under EPA's NO_x SIP Call. This is included as part of the Weight-of Evidence Analysis.

In addition, the following list contains the controls endorsed and recommended by the North Texas Clean Air Steering Committee. While the commission took all recommendations from the North Texas Clean Air Steering Committee very seriously, some control strategies have been modified from the Committee's recommendations due to technical and other constraints.

- Electric generating facilities reduced up to 88% with use of episodic control technologies

- Up to 50% NO_x reductions in Ellis County from controls on cement kilns

- ASM including VMAS with integrated OBD I/M test with increased enforcement

- Remote sensing to detect high emitting vehicles

- Vehicle Recycling

- Transportation control measures

- Travel Demand Management, such as vanpool, park and ride

- Accelerated purchase of Tier III heavy-duty (>50 hp) construction/mining diesel equipment

- A 4-hour ban (6am to 10am) on heavy-duty (>50 hp) diesel construction equipment between May 1 through October 31

- California Diesel

- Airport electrification standards and operations management with state or local control

- Voluntary non-road mobile emission reduction program

- Energy conservation efforts for buildings which includes 2000 International Energy Conservation Code (IECC), and low NO_x water heaters

- California large spark ignition (LSI) engines (> 25 hp)

- A 5 mph speed limit reduction from currently existing 70 and 65 mph posted limits

A complete description of the control strategies is presented in Chapter 6 of this SIP.

This SIP contains the following elements:

♦ Photochemical modeling of specific control strategies and future state and national rules for attainment of the 1-hour ozone standard in the DFW area by the attainment deadline of November 15, 2007.

♦ A modeling demonstration that shows that the air quality in the DFW area is influenced at times by transport from the HGA area.

♦ Identification of the level of reductions of VOC and NO_x emissions necessary to attain the 1-hour ozone standard by 2007.

♦ Control strategies developed by the State involving controls on stationary sources.

♦ Control strategies selected by the NCTCOG North Texas Clean Air Steering Committee.

♦ A 2007 mobile source budget for transportation conformity.

1.2 PUBLIC HEARINGS INFORMATION

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

CITY	DATE	TIME	LOCATION
El Paso	January 24, 2000	2:00 p.m.	City of El Paso Council Chambers 2 Civic Center Plaza, 2nd floor
Austin	January 25, 2000	10:00 a.m.	TNRCC 12100 N. I-35, Building E, Room 201S
Longview	January 26, 2000	10:00 a.m.	Longview City Hall Council Chambers 300 West Cotton Street
Irving	January 26, 2000	7:00 p.m.	City of Irving Central Library Auditorium 801 West Irving Blvd.
Dallas	January 27, 2000	10:00 a.m.	Dallas Public Library Auditorium 1515 Young Street
Lewisville	January 27, 2000	7:00 p.m.	Lewisville City Council Chambers Municipal Center
Fort Worth	January 28, 2000	10:00 a.m.	Council Chambers, 2nd Floor Fort Worth City Hall 1000 Throckmorton
Beaumont	January 31, 2000	1:30 p.m.	John Gray Institute 855 Florida Avenue
Houston	January 31, 2000	7:00 p.m.	Houston-Galveston Area Council 3555 Timmons Lane
Denton	February 9, 2000	7:00 p.m.	University of North Texas, University Union, 3rd Level, Lyceum, 400 Avenue A

Written comments were also accepted via mail and fax through February 14, 2000.

1.3 SOCIAL AND ECONOMIC CONSIDERATIONS

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

1.4 FISCAL AND MANPOWER RESOURCES

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

CHAPTER 2: EMISSIONS INVENTORY

2.1 OVERVIEW

The 1990 Amendments to the FCAA require that EIs be prepared for ozone nonattainment areas. Because ozone is photochemically produced in the atmosphere when VOCs are mixed with NO_x and CO[1] in the presence of sunlight, it is important that the planning agency compile information on the important sources of these precursor pollutants. It is the role of the EI to identify the source types present in an area, the amount of each pollutant emitted and the types of processes and control devices employed at each plant or source category. The EI provides data for a variety of air quality planning tasks, including establishing baseline emission levels, calculating reduction targets, control strategy development for achieving the required emission reductions, emission inputs into air quality simulation models, and tracking actual emission reductions against the established emissions growth and control budgets. The total inventory of emissions of VOC, NO_x, and CO for an area is summarized from the estimates developed for five general categories of emissions sources, which are each explained below.

2.2 POINT SOURCES

Major point sources are defined for inventory reporting purposes in nonattainment areas as industrial, commercial, or institutional which emit actual levels of criteria pollutants at or above the following amounts: 10 tpy of VOC, 25 tpy of NO_x, or 100 tpy of any of the other criteria pollutants which include CO, SO_x, PM_{10}, or lead. For the attainment areas of the state, any company which emits a minimum of 100 tpy of any criteria pollutant must complete an inventory. Additionally, any source which generates or has the potential to generate at least 10 tpy of any single HAP or 25 tpy of aggregate HAP is also required to report emissions to the commission.

To collect emissions and industrial process operating data for these plants, the commission mails EIQs to all sources identified as having triggered the level of emissions. Companies are asked to report not only emissions data for all emissions generating units and emission points, but also the type and, for a representative sample of sources, the amount of materials used in the processes which result in emissions. Information is also requested in the EIQ on process equipment descriptions, operation schedules, emissions control devices currently in use, abatement device control efficiency, and stack parameters such as location, height, and exhaust gas flow rate. All data submitted via the EIQ is then subjected to rigorous quality assurance procedures by the technical staff of the Industrial Emissions Assessment Section and entered into the PSDB by the Data Services Section.

2.3 AREA SOURCES

To capture information about sources of emissions that fall below the point source reporting levels and are too numerous or too small to identify individually, calculations have been performed to estimate emissions from these sources on a source category or group basis. Area sources are commercial, small-scale industrial, and residential categories of sources which use materials or operate processes which can generate emissions. Area sources can be divided into two groups characterized by the emission mechanism: hydrocarbon evaporative emissions or fuel combustion emissions. Examples of evaporative losses include: printing, industrial coatings, degreasing solvents, house paints, leaking underground storage tanks, gasoline service station underground tank filling, and vehicle refueling operations. Fuel combustion sources include

[1]CO plays a relatively minor role in ozone formation compared with VOC and NO_x.

stationary source fossil fuel combustion at residences and businesses, as well as outdoor burning, structural fires and wildfires. These emissions, with some exceptions, may be calculated by multiplication of an established emission factor (emissions per unit of activity) times the appropriate activity or activity surrogate responsible for generating emissions. Population is the most commonly used activity surrogate for many ASCs, while other activity data include amount of gasoline sold in an area, employment by industry type, and acres of cropland.

2.4 ON-ROAD MOBILE SOURCES

On-road mobile sources consist of automobiles, trucks, motorcycles, and other motor vehicles traveling on public roadways in the nonattainment area. Combustion related-emissions are estimated for vehicle engine exhaust; evaporative hydrocarbon emissions are estimated for the fuel tank and other evaporative leak sources on the vehicle. Emission factors have been developed using the EPA's mobile emissions factor model, MOBILE5a. Various inputs are provided to the model to simulate the vehicle fleet driving in each particular nonattainment area. Inputs include such parameters as vehicle speeds by roadway type, vehicle registration by vehicle type and age, percentage of vehicles in cold start mode, percentage of miles traveled by vehicle type, type of I/M program in place, and gasoline vapor pressure. All of these inputs have an impact on the emission factor calculated by the MOBILE model, and every effort is made to input parameters reflecting local conditions. To complete the emissions estimate the emission factors calculated by the MOBILE model must then be multiplied by the level of vehicle activity, VMT. The level of vehicle travel activity is developed from travel demand models run by the Texas Department of Transportation or the local council of governments. The travel demand models have been validated against a large number of ground counts of traffic passing over counters placed in various locations throughout each county. Estimates of VMT are often calibrated to outputs from the federal HPMS, which is a model built from a smaller number of traffic counters. Finally, roadway speeds, which are required for the MOBILE model's input, are calculated by a post-processor to the travel demand model.

2.5 NON-ROAD MOBILE SOURCES

Non-road mobile sources are a subset of the area source category. This subcategory includes aircraft operations, marine vessels, recreational boats, railroad locomotives, and a very broad category of off-road equipment that includes everything from 600-horsepower engines mounted on construction equipment to 1-horsepower string trimmers. Calculation methods for emissions from non-road engine sources are based on information about equipment population, engine horsepower, load factor, emission factor, and annual usage. Emission estimates for all sources in the non-road category except aircraft, diesel construction equipment, and airport support equipment were originally developed by a contractor to EPA's Office of Transportation Air Quality as a 1990 emissions inventory for all nonattainment areas classified as serious and above. Since Dallas was not included in the study, commission staff has prorated emissions to the Dallas area based on population and then projected the emissions to later years based on EPA's Economic Growth Analysis System (EGAS) model. Aircraft emissions were estimated from landings and takeoff data for airports used in conjunction with a suitable aircraft emissions model (FAAED or EDMS). Diesel construction equipment and airport support equipment were estimated with a new method involving the use of local survey data and EPA's new NONROAD model. These two latter categories are addressed in Appendix V and Appendix W, respectively.

2.6 BIOGENIC SOURCES

Biogenic sources are another subset of area source which includes hydrocarbon emissions from crops, lawn grass, and forests as well as a small amount of NO_x emissions from soils. Plants are sources of VOC such as isoprene, monoterpene, and alpha-pinene. Tools for estimating emissions include satellite imaging for mapping of vegetative types, field biomass surveys, and computer modeling of emissions estimates based on emission factors by plant species (PCBEIS-2). Emissions from biogenic sources are subtracted from the inventory prior to determining any required reductions for a rate of progress plan. However, the biogenic emissions are important in determining the overall emissions profile of an area and therefore are required for regional air quality dispersion modeling.

2.7 EMISSIONS SUMMARY

The July 3, 1996 base case 6a emissions inventory summary for the DFW four-county ozone nonattainment area is included in Figures 2.7-1 (VOC) and 2.7-2 (NO_x). It is evident from the pie charts that the greatest man-made emissions contribution in the DFW area is from mobile sources. Contribution from biogenic emissions are included in the summary, however, control strategies are limited to the reduction of man-made emissions only. The contributions from VOC sources in the July 3, 1996 base case inventory include the following: area and non-road sources 36%; on-road mobile sources 29%; point sources 4%; and biogenic sources 31%. The contribution from NO_x sources in the 1996 base case inventory include the following: on-road mobile sources 55%; area and non-road sources 23%; point sources 17%; and biogenic sources 5%.

The July 3, 2007j future base emission inventory for the DFW nonattainment area is summarized in Figures 2.7-3 (VOC) and 2.7-4 (NO_x). The 2007 future base emissions inventory is an estimation that is projected forward from the 1996 base case inventory using specific procedures approved by the EPA. The contribution from VOC sources in the 2007 base case inventory include the following: area and non-road sources 42%; on-road mobile sources 19%; point sources 4%, and biogenic sources 35%. Contribution from NO_x includes the following: on-road mobile sources 50%; area and non-road sources 33%; point sources 9%; and biogenic sources 8%.

Figure 2.7-1 - 1996 VOC Emissions in DFW

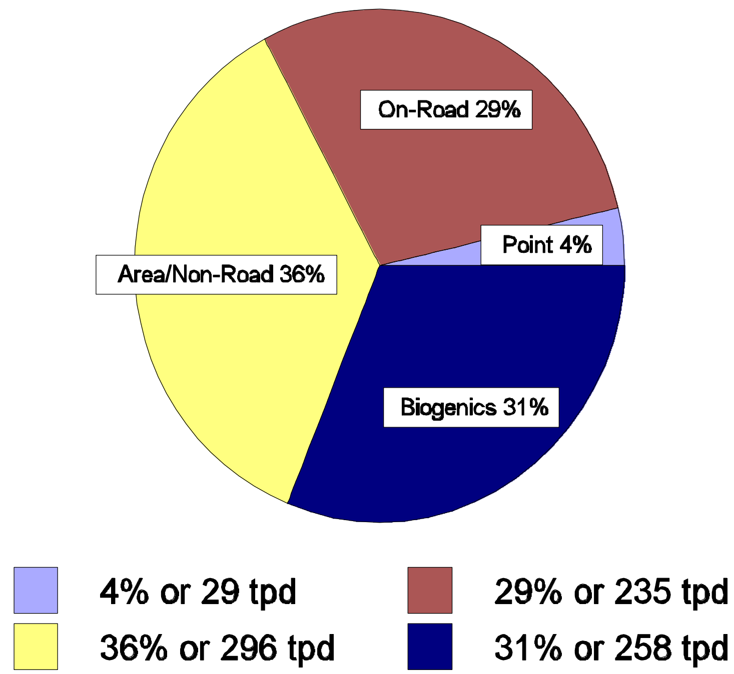


Figure 2.7-2 - 1996 NOx Emissions in DFW

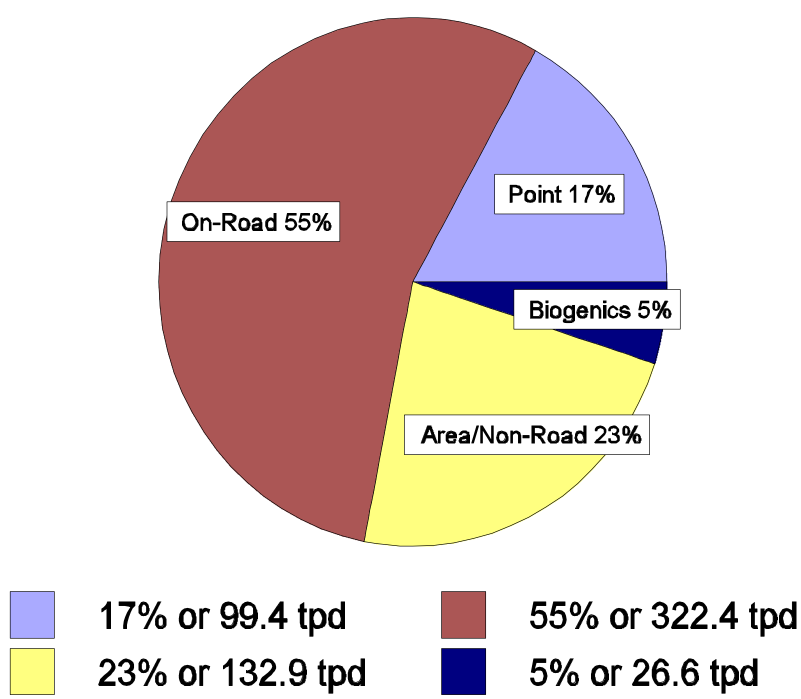
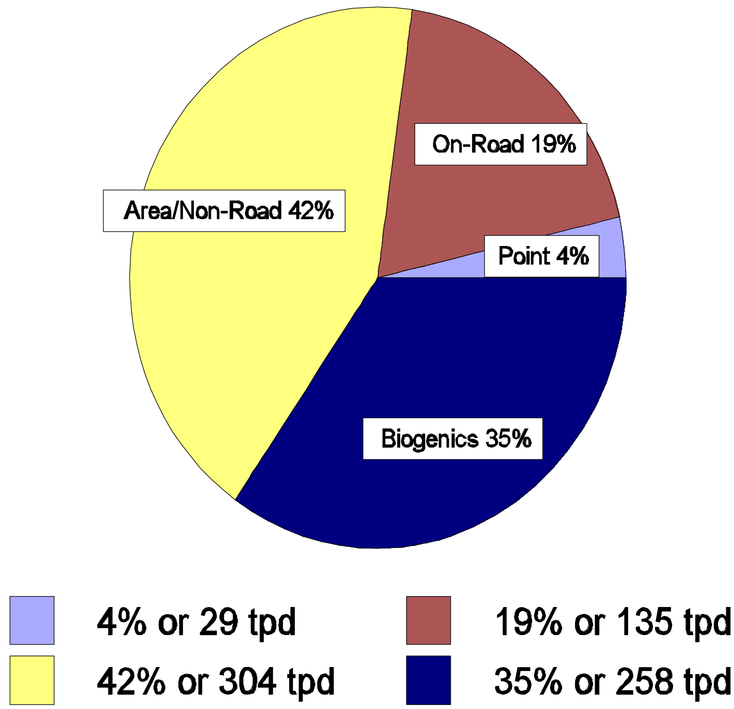


Figure 2.7-3 - 2007 VOC Emissions in DFW



2.8 TRANSPORTATION CONFORMITY

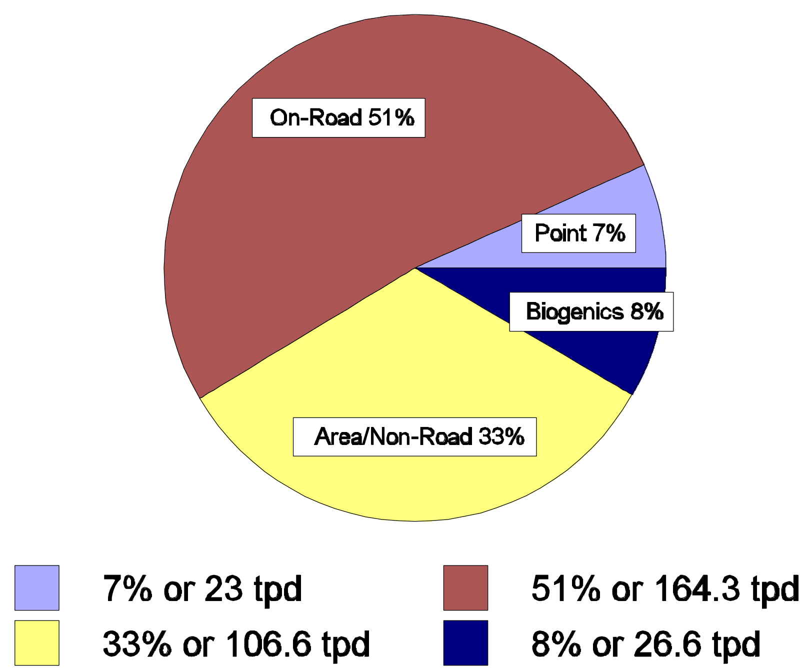
Transportation conformity is required by §176(c) of the FCAA. The FCAA requires that transportation plans, programs, and projects conform to SIPs in order to receive federal transportation funding and project approvals. Conformity to a SIP means that transportation activities will not cause or contribute to new air quality violations, increase the frequency or severity of existing violations, or delay timely attainment of the NAAQS. EPA's transportation conformity rule (40 CFR Parts 51 and 93) contains criteria and procedures for making conformity determinations for transportation plans, programs, and projects. The Texas transportation conformity rule (30 TAC §114.260) adopts EPA's rule by reference, contains Texas specific consultation procedures and is the enforcement mechanism for transportation conformity requirements in Texas.

2.9 MOTOR VEHICLE EMISSIONS BUDGETS

EPA requires all ROP and attainment demonstration SIPs to establish motor vehicle emissions budgets for transportation conformity purposes. A motor vehicle emission budget is the on-road mobile source allocation of the total allowable emissions for each applicable criteria pollutant or precursor, as defined in the SIP. Transportation conformity determinations must be done using the budget test once EPA determines the budget(s) adequate for transportation conformity purposes. In order to pass the budget test, areas must demonstrate that the estimated emissions from transportation plans, programs and projects do not exceed the motor vehicle emissions budget(s).

The 2007 motor vehicle emissions budgets for the 4 county nonattainment area are established at 107.6 tpd for VOC and 164.3 tpd for NO_x. These budgets represent the 2007 projected on-road mobile source VOC and NO_x emissions that demonstrate attainment. These emission levels are based on the July 3, 1996 episode day, projected to 2007 and adjusted for all applicable control strategy reductions. For more information, please refer to Chapter 3, Table 3.10-8.

Figure 2.7-4 - 2007 NOx Emissions in DFW



CHAPTER 3: PHOTOCHEMICAL MODELING

3.1 INTRODUCTION

This section of the DFW Phase II SIP document summarizes the procedures and results of the photochemical modeling conducted in support of the attainment demonstration for the DFW ozone nonattainment area. This photochemical modeling builds upon the Phase I modeling, which is documented in Appendix Q of this document.

The purpose of this DFW Phase II ozone modeling was to:

- Provide compelling evidence of transport of ozone and ozone precursors from the HGA nonattainment area to the DFW nonattainment area. Once transport has been established, then under EPA's transport policy the DFW area will be eligible to share the upwind HGA area's attainment date of 2007.

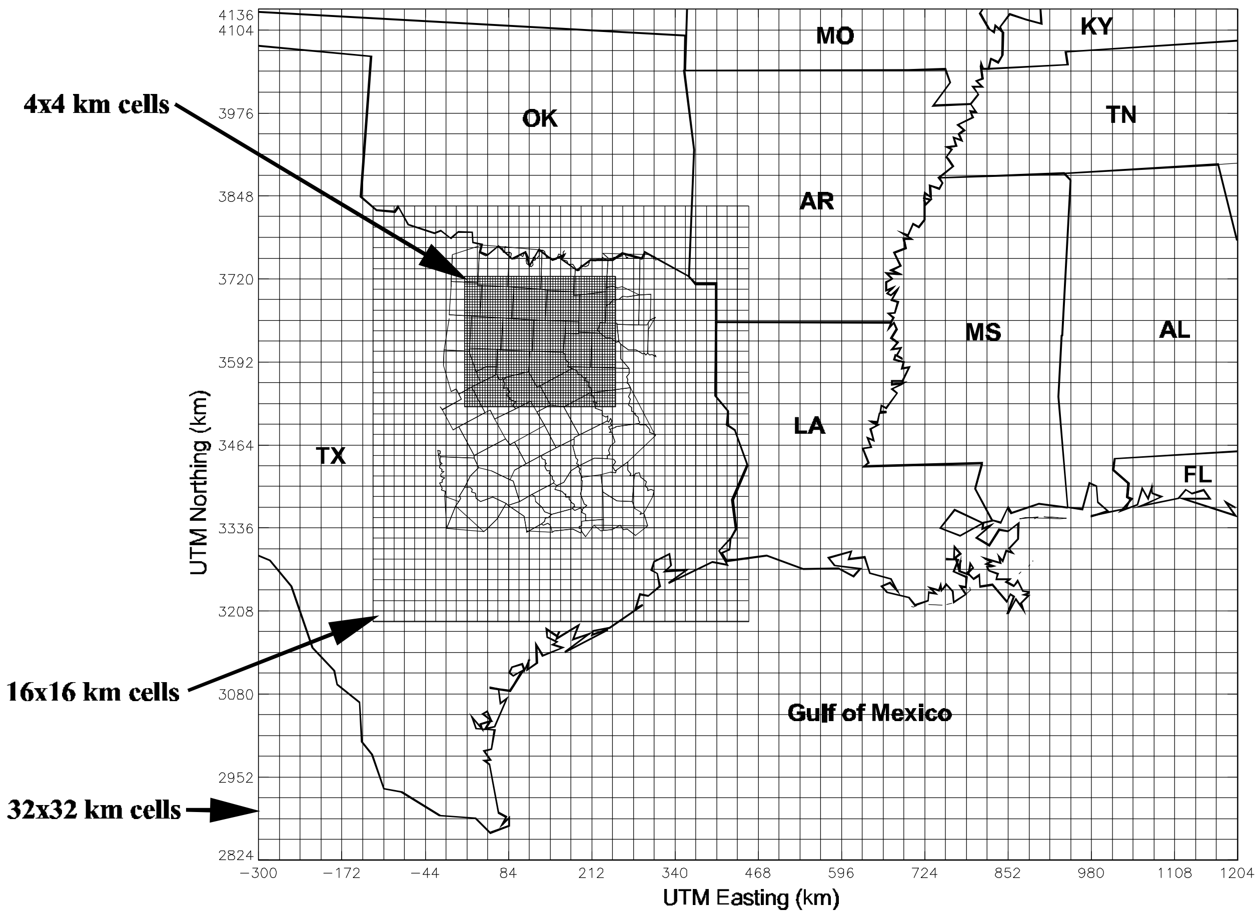
- Review and revise the base case modeling emissions inventory as necessary, then project this base case inventory to the area's attainment date of 2007.

- Use photochemical grid modeling to test control strategies for the future case and to determine the amount of local reduction in ozone precursors that will be required to demonstrate attainment of the 1-hour ozone NAAQS in 2007.

- Finally, demonstrate through photochemical grid modeling that the control strategy selected for the region will in fact bring the area into attainment of the ozone NAAQS by 2007.

Because the Phase II modeling builds upon modeling already performed in Phase I, this SIP will not discuss in detail the portions of the modeling analysis unchanged from the Phase I work documented in Appendix Q. Rather, this document will discuss how the modeling analysis has changed from the Phase I analysis, then will describe the control strategy modeling performed to demonstrate attainment of the ozone NAAQS. Specifically, the interested reader should consult Appendix Q for detailed discussions of episode selection, meteorology, initial and boundary conditions, and the definition of the modeling domain and subdomains. For reference, Figure 3.1-1 shows the DFW modeling domain with the two nested grids. The inner grid, which covers the DFW nonattainment area and surrounding counties, is referred to as the core domain.

Figure 3.1-1 DFW Nested Grid Modeling Domain



3.2 SUMMARY OF THE RESULTS OF PHASE I MODELING

The Phase I ozone attainment demonstration modeling (see Appendix Q) for the DFW area was predicated on the assumption that the area would have a 1999 attainment date, since its FCAA classification at that time was serious (the area failed to demonstrate monitored attainment by 1999, hence the Phase II SIP focuses on a later attainment date). The Phase I modeling did not evaluate specific controls, but rather focused on establishing the preferred VOC/NO_x directional guidance and reduction targets. The major conclusions reached in Phase I are:

- Although the 1999 future emissions show reductions to predicted peak ozone concentrations, additional reductions will be necessary to bring the area into attainment of the ozone NAAQS.

- NO_x reductions are the more effective route to ozone control, but VOC reductions provide additional benefits.

- To show modeled attainment for the July 3, 1996 episode day, NO_x reductions of approximately 74% (together with a 25% VOC reduction) would be required from the projected 1999 levels. For the June 21 and June 22, 1995 episode days, attainment is reached with less than 50% reduction of NO_x (again with a 25% VOC reduction).

- The large reduction requirements may be somewhat mitigated by the fact that the analysis did not include any regional emission reductions, and the fact that the model over-predicted base case ozone concentrations by 12.3%. A design value-based analysis indicated that attainment may be achievable with around 40% NO_x reduction (again combined with a 25% VOC reduction).

3.3 ATTAINMENT YEAR FOR PHASE II SIP

Since the DFW area failed to demonstrate monitored attainment by 1999, the EPA could reclassify the area as severe, with an attainment date of 2005. However, the commission believes the area's ability to reach attainment is affected by transport from the HGA ozone nonattainment area, and that the provisions of EPA's transport policy apply to DFW. Under the transport policy, the DFW area would be given the same attainment date as the HGA area (2007), and would not be reclassified to severe, provided that it can be demonstrated that transport from the upwind area interferes with DFW's ability to reach attainment. Appendix N provides a technical report showing the impact of the HGA nonattainment area on the ozone in the DFW area.

Proceeding under the assumption that EPA Region VI would approve the transport demonstration (conditional approval was granted on October 18, 1999 in a letter from Regional Administrator Gregg Cooke), the commission based its Phase II analysis on the future year of 2007.

3.4 EVOLUTION OF THE PHASE II ATTAINMENT DEMONSTRATION MODELING

This section gives a brief chronology of the developments leading the the Phase II modeling attainment demonstration. Subsequent sections of this chapter discuss in more detail the steps leading to the demonstration that the DFW area will reach attainment by the year 2007.

Because the Phase I base case modeling showed very good model performance, only limited changes were made for Phase II initially. The most significant of these changes were migration to version 2 of the CAMx-2 and repairing some minor flaws in the modeling inventory. After reevaluating model performance (still quite good), a 2007 future base inventory was developed and some initial control strategies were modeled in late August of 1999. A subsequent minor revision was made to the base case and 2007 future base modeling in mid-September, 1999. At this time, the 1995-96 base case was denoted as **Base4d**, and the future base was called **2007b**. Over 20 control strategies were evaluated with the 2007b future base, and the control strategy proposed in this SIP, called **Strategy D29**, was selected from among them.

In late October 1999, a new computer program for estimating biogenic emissions became available to the commission, and staff concluded that the new program's estimates are much more scientifically sound than the estimates used in Base4d. Because the improved biogenic emissions represented a significant decrease from earlier, a new base case, called **Base5** was developed, and model performance was re-evaluated (still acceptable, but not quite as good as previously). Some additional updates were made to the 2007 future base at this time, including adding planned EGFs and cement kilns within 100 miles of the DFW area. This future base was designated as **2007d** (a 2007c future base was used briefly, but is not discussed in detail in this document). Strategy D29 was again run against the 2007d future base, and this model run forms the basis for the attainment demonstration.

3.5 BASE 4d BASE CASE

Several minor changes from Phase I were incorporated into the Base 4d base case for both the June, 1995 and July, 1996 episodes. These changes represent both enhancements to the modeling and corrections to some minor errors discovered subsequently to the last round of modeling:

- Migration from the original CAMx model to the newer version, CAMx-2. For this phase of the DFW modeling, the commission migrated to the newer version of (CAMx). Version 2 is noted as CAMx-2 (note: in this document, the term CAMx is understood to refer to version 2), and offers several enhancements over the original version, as well as incorporating fixes to a number of minor bugs. For information on CAMx, the reader is referred to the CAMx web site at http://www.camx.com.

- Corrected on-road mobile source emissions for the four nonattainment counties (plus Rockwall County), to adjust emissions for daylight-savings time.

- Revised emissions for construction equipment from NCTCOG, using EPA-recommended procedures.

- Corrected CAMx land-use data file for the coarse grid (32 km. × 32 km.).

- Corrected emissions from the Cumberland Power Plant in Tennessee (emissions in the NO_x SIP Call inventory were overstated by a factor of eight).

While these modifications serve to reduce uncertainty in the modeling process, they only resulted in minor modifications in the modeling inventory and in the model performance. Table 3.5-1 compares emissions in the DFW four-county nonattainment area with the corresponding emissions from the Phase I modeling for July 3, 1996, the day with the highest modeled ozone concentrations in both cases. Note that although the on-road mobile source emissions were modified, the emission totals are unchanged, since the adjustment to account for daylight savings time only affected the timing of emissions, not the totals. Also note that the Phase I emissions shown below differ slightly from those reported in Appendix Q. This deviation is due to minor differences in the emission reporting calculation method.

Table 3.5-1: Comparison of Phase I and Base 4d Emissions by Category in the DFW 4-county Area for July 3, 1996

Category	NO_x (tons/day)		VOC (tons/day)	
	Phase I	Base 4d	Phase I	Base 4d
On-road mobile sources	314.5	314.5	234.7	234.7
Area/non-road mobile sources	129.2	156.3	287.8	293.8
Point sources	99.4	99.4	29.0	29.0
Biogenic sources	13.2	13.2	452.6	452.6
Total	556.3	583.4	1004.1	1010.1

Tables 3.5-2 and 3.5-3 show the model performance statistics for Base 4d for, respectively, the June, 1995 and July, 1996 episodes. Values which fall within the EPA-recommended ranges for acceptable model performance are noted in **bold**. Performance statistics for the Phase I base case modeling are shown in *italics*.

Table 3.5-2. CAMx Base 4d Base Case Ozone Performance Statistics for June 18 – 22, 1995 Episode. (Statistics for Phase I base case are shown in *italics*)

Episode Date	Normalized Bias (±5–15%)		Normalized Gross Error (30–35%)		Unpaired Peak Accuracy (±15–20%)		Domain-wide Peak Ozone (ppb)		
							Simulated		Observed
06/18/95	-22.5	*-27.0*	**25.4**	***28.0***	**0.0**	***-3.8***	77.0	*74.0*	77
06/19/95	**4.3**	***0.2***	**10.2**	***8.8***	**1.2**	***-1.8***	114.3	*110.0*	113
06/20/95	**-1.3**	***-2.5***	**12.7**	***13.0***	**15.3**	***13.2***	137.2	*134.7*	119
06/21/95	**-3.8**	***-3.0***	**10.7**	***10.5***	**-1.8**	***-0.9***	141.4	*142.6*	144
06/22/95	**-2.1**	***-2.6***	**10.6**	***10.4***	**10.2**	***10.2***	148.8	*148.8*	135

Table 3.5-3. CAMx Base 4d Base Case Ozone Performance Statistics for June 30-July 4, 1996 Episode. (Statistics for Phase I base case are shown in *italics*)

Episode Date	Normalized Bias (±5–15%)		Normalized Gross Error (30–35%)		Unpaired Peak Accuracy (±15–20%)		Domain-wide Peak Ozone (ppb)		
							Simulated		Observed
06/30/96	-20.8	*-25.8*	**20.8**	***25.8***	**-17.3**	***-19.4***	92.6	*90.3*	112
07/01/96	**10.7**	***-13.1***	**14.6**	***14.3***	**2.9**	***0.5***	115.3	*112.6*	112
07/02/96	**-6.5**	***-6.7***	**14.6**	***12.5***	**7.7**	***7.7***	122.7	*122.8*	114
07/03/96	**12.4**	***12.3***	**21.1**	***20.8***	**21.0**	***20.2***	174.3	*173.1*	144
07/04/96	**1.3**	***7.2***	**10.9**	***11.2***	**12.4**	***23.1***	130.4	*142.8*	116

With the exception of July 4, 1996 (not a primary episode day), it is seen that the Base 4d and Phase I base case models perform almost identically. As was the case in Phase I, model performance for the June, 1995 episode is excellent, while model performance in the July, 1996 episode is acceptable. In both episodes, statistics for each day (excluding the ramp-up days) are within the EPA-recommended tolerances[2].

3.6 THE 2007b FUTURE CASE

[2]On July 3 and 4, 1996, one or both Unpaired Peak Accuracy statistics is nominally higher than the recommendation. However, this condition does not necessarily indicate poor model performance, since the actual peak will usually not coincide with the location of a monitoring station.

Once the performance of Base 4d was evaluated and found to be acceptable, the next step in the modeling process was to create a 2007 future base, which could be used to evaluate control strategies. Development of the future base involved projecting growth from the base episode dates to the attainment year of 2007, then applying federal and state regulations likely to be implemented prior to 2007. The exact procedures were specific to the inventory sectors: on-road mobile, area/non-road mobile, and point sources, as discussed below:

3.6.1 On-road Mobile Sources

On-road mobile source emissions for the 2007 DFW attainment demonstration modeling were developed for six separate regions, with the level of detail decreasing with distance from the core DFW nonattainment area. Link-based on-road mobile source inventories were developed by the NCTCOG using a travel-demand model and Mobile5a. Model input included a projected 2007 roadway network and projected 2007 demographic data for the region. The travel demand model covered the counties of Dallas, Tarrant, Collin, Denton, and Rockwall, which comprise the DFWRTM area.

For the 32 counties surrounding the DFWRTM area, NCTCOG utilized HPMS data in conjunction with MOBILE5a to develop a 2007 on-road mobile source inventory. Link-based inventories for 2007 – originally developed for the COAST project – were available from the Texas Transportation Institute for both the 8-county HGA nonattainment area and the 3-county BPA nonattainment area. For the remaining Texas counties and other states within the modeling domain, the on-road portion of EPA's 1996 NET Inventory was adjusted by the commission using 2007 projections of both VMT and CO, NO_x, and VOC emission rates.

Each portion of the total on-road mobile source inventory was processed by commission staff using both custom-written SAS code and EPS 2.0 software to prepare it for input into the CAMx model. As part of the final processing step, where files from various sources are merged together, the link-based emissions in the DFWRTM area were multiplied by an adjustment factor of 1.056, (an increase of 5.6%) to provide consistency with the HPMS. Additional details on the development of the 2007 on-road mobile source emissions are provided in Appendix X.

Modeling performed by NCTCOG accounted for the NLEV and HDDV standards, federal phase II RFG, and the Texas Motorist's Choice vehicle I/M program in Dallas and Tarrant counties. Additional adjustments were made to the gridded, model-ready emissions files to account for new information not available at the time the emissions data were developed by NCTCOG, such as Tier II/low sulfur rules. Table 3.6-1 lists these adjustments, and shows the adjustment factor applied by region within the core domain.

Table 3.6-1: Adjustments Made to On-road Mobile Source Emissions for the 2007b Future Base

Adjustment	Region					
	Dallas & Tarrant Counties		Denton & Collin Counties		Attainment counties in central and eastern Texas	
	NO_x	VOC	NO_x	VOC	NO_x	VOC
Proposed federal Tier II/Low Sulfur standards	.880	.941	.863	.934	.820	.904
Updated vehicle registration/ Mobile 5b NO_x correction	.900	1.02	.800	.930	.900	1.02
Texas cleaner gasoline	-	-	-	-	.996	.953
Composite Adjustment	.792	.960	.690	.869	.735	.879

The adjustment for Tier II/low sulfur reflects EPA's new proposed rules to implement Tier II vehicle standards nationwide. The adjustment for updated vehicle registration/Mobile 5b NO_x correction is actually a composite factor developed by Eastern Research Group (ERG) under contract to the commission. The first component, updated registration distribution, arises from new Texas Department of Transportation data showing that the average age of vehicles in the DFW area is lower than in previous years. Assuming the age distribution will stay the same until 2007 yields somewhat lower emissions, due to a higher percentage of newer (hence cleaner) vehicles in the fleet. The second component addresses an error in the treatment of federal Phase II RFG by Mobile5a-h, the version of the Mobile model used by NCTCOG. The correction (which is implemented in the Mobile5b version of the Mobile model) reduces NO_x emissions significantly from the original Mobile5a-h estimates. To view the EPA report describing the correction, see http://www.epa.gov/oms/models/mobile5/m5info7.txt.

The final adjustment for Texas clean gasoline accounts for new rules adopted by the commission to mandate the sale of low (7.8) RVP gasoline in counties in central and eastern Texas. This rule does not affect the DFW nonattainment area, since federal Phase II RFG in the area already has RVP of 6.7.

3.6.2 Area/non-road Mobile Sources

Originally, commission staff had intended to use econometric forecasts from the REMI-EGAS to forecast growth of the area and non-road mobile source emissions. However, the latest forecasts from this system available to the commission staff showed unexplained fluctuations, and generally predicted growth which appeared too small in light of robust economic growth expected in the region. Since it was not feasible to develop new REMI-EGAS forecasts in time to begin modeling control strategies for DFW, commission staff decided to use growth of human population in the modeling domain from 1995/1996 to 2007 as a surrogate for area and non-road emissions growth for the future case. Population growth should constitute a reasonable surrogate for activity growth in most area and non-road categories, which consist largely of such items as construction, lawn & garden, pleasure boating, house painting, etc., although a few categories such as locomotives and oil and gas production are only indirectly related to human population.

The population for the DFW four-county nonattainment area and the remainder of Texas in the modeling domain was obtained from the reports "Texas Comptroller of Public Accounts, Winter 1997-98 County Forecast"; and the "Texas State Data Center at Texas A&M University." The population estimates for the remainder of the modeling domain were obtained from the projection of the 1990 US Census data (series A) found on the federal census web-site at the following internet address: http://www.census.gov/population/projections/state/stpjpop.txt. These population growth numbers were used to project the 1995/1996 emission inventories to the attainment year of 2007.

Emission changes associated with federal regulations for non-road mobile sources were derived from EPA's prototype NONROAD model, by setting the equipment population growth rates to zero and running 1996 and 2007 evaluation years. The ratios of these emission estimates were used to develop control factors for non-road equipment (since locomotives are not covered by NONROAD, they were treated separately). One area source control was also modeled, specifically Stage I vapor recovery at large gasoline service stations in central and eastern Texas. Appendix F gives the growth rates and control factors applied to area and non-road mobile source emissions to develop the 2007b future base.

3.6.3 Point (Stationary) Sources

The Texas legislature in 1999 passed two laws governing emissions from point sources in Texas. The first, SB 7 limited NO_X emissions from grandfathered EGFs in central and eastern Texas to 0.14 lbs/MMBtu, which represents a reduction to approximately one-half of 1997 emission levels. Emissions from grandfathered EGFs in the remainder of the state are limited to 0.195 lbs.MMBtu, representing about a 30% reduction from 1997 levels. The second piece of legislation, SB 766 increases emissions fees on grandfathered non-EGF sources and encourages these sources to acquire state permits. The actual implementation of rules associated with these bills is through action of the commission. The development of the 2007b modeling inventory is summarized below:

> *Electric generation facilities in Texas* - Since the original provision of SB 7 was based on 1997 emission levels, commission modeling staff decided to use 1997 emissions for EGF sources to build the future inventory for these sources. An inventory representative of the two episodes was developed by averaging CEM observations from the Acid Rain Program Data Base (ARPDB) for each hour over the 31-day period from June 15, 1997 to July 15, 1997. This inventory provided emissions for each ARPDB source which varied by hour, but not by day (an analysis was conducted which showed no noticeable difference between weekday and weekend usage patterns). Then, to model the effects of SB 7 and the regional EGF rule proposed by the commission, the 1997 NO_X emissions (both grandfathered and permitted) were reduced by 50% in eastern and central Texas (excluding the DFW nonattainment area), and by 30% in the remainder of the state.
>
> *Non-electric generating facilities in Texas* - Non-EGF sources were grown from the 1996 base to 2007 using observed emission trends (see Appendix F). It should be noted that within the DFW four-county area, this method produced almost no predicted change in emissions from 1996 to 2007. Then sources outside the DFW nonattainment area were reduced to account for the expected effects of SB 766: Sources identified as grandfathered were reduced by 30%, while sources identified as permitted were not reduced. Sources whose status could not be determined were reduced by the average (weighted) value of 13%.
>
> *Point sources in other states* - In Oklahoma, Arkansas, Louisiana, Mississippi, and Florida, a reduction of 30% from 1996 emission levels was assumed for all point source NO_x to reflect

national trends towards lowered emissions. In Georgia, Missouri, Kentucky and Tennessee, NO_x emissions from EGFs were reduced by 59% from 1996 levels to reflect reductions expected under EPA's NO_x SIP Call. In these NO_X SIP-call states, emissions from non-EGF sources were reduced by 30%.

DFW nonattainment area point sources - Within the DFW nonattainment counties, reductions associated with SB 7 and SB 766 were not applied, since it is anticipated that more stringent regulations will be necessary in the nonattainment counties than elsewhere. For the 2007b future base, only the NO_x RACT regulations described in the Phase I modeling (see Appendix Q) were applied.

The 2007b point source inventory also included a small number of point sources which had been inadvertently omitted from the Phase I modeling and from Base4d. Appendix F provides additional details on the development of the point source emissions.

3.6.4 2007b Future Base Emissions Summary

Table 3-5 presents a comparison of the 2007b future case emissions with the 1995-6 Base4d emissions used in the base case modeling for the July 3, 1996 episode day, for the four-county DFW nonattainment area.

Table 3.6-2: Comparison of Base 4d and 2007d Future Base Emissions by Category in the DFW 4-County Area for July 3, 1996

Category	NO_x(tons/day)		VOC (tons/day)	
	Base 4d	2007b future base	Base 4d	2007b future base
On-road mobile sources	314.5	211.6	234.7	135.5
Area/non-road mobile sources	156.3	159.0	293.8	301.3
Point sources	99.4	77.0	29.0	28.8
Biogenic sources	13.2	13.2	452.6	452.6
Total	583.4	460.8	1010.1	918.1

Clearly, the 2007b base case represents a significant reduction from the 1995-6 base case emissions, particularly for on-road mobile sources.

3.6.5 Future Case Modeling Results

Table 3.6-3 shows peak predicted ozone in the entire core domain for Base 4d and for the 2007b future base for the three primary days. Note the significant decrease in daily peak ozone that occurs as a result of planned national and state rules.

Table 3.6-3: Peak Modeled Ozone in the Core Domain, 1995-6 Base 4d and Future Base 2007b

Episode date	1995-6 Base 4d	Future base 2007b
6/20/95	141.4 ppb	128.0 ppb
6/21/95	148.8 ppb	133.1 ppb
7/3/96	174.3 ppb	154.8 ppb

Figure 3.6-1 at the end of this chapter shows daily peak ozone predictions for the three primary episode days for the 1995 and 1996 Base 4d and for the 2007b future case. The first row of color isopleths shows the modeled 1995-6 daily maximum ozone concentrations at each location in the core domain, and the second row shows the daily maximum concentrations after replacing the 1995-1996 inventory with the 2007b future inventory. The last row of plots shows results of a control strategy run, and will be discussed later.

3.7 CONTROL STRATEGY DEVELOPMENT

3.7.1 Directional Guidance

Upon completion of the future base 2007b modeling, the next step in the modeling process would normally be to run future case sensitivity analyses to determine the preferred path to attainment. However, Phase I modeling had shown a very strong preference for NO_x controls over VOC as the path to attainment. Since the Phase II modeling differed little from its Phase I counterpart, the commission staff determined that detailed directional guidance modeling was unnecessary[3]. The commission and the North Central Texas Clean Air Steering Committee thus proceeded to evaluate control strategies against the future base 2007b.

3.7.2 Bias Adjustment

One significant conclusion from the Phase I modeling was that reducing the peak ozone prediction on July 3 to below 125 parts/billion would require reductions of up to 75% in NO_x emissions. However, the base case modeling for this day showed a strong positive bias which was close to the EPA recommended threshold for acceptable performance. Overall, the model predicted 12.4% too much ozone at the monitoring sites, so it is likely that the modeled peak is overestimated as well. If the over-prediction in the peak were equal to the model bias, that would indicate that the real base case peak would be about 155 ppb, which is consistent with the measured peak on that day of 144 ppb. Applying this same logic to the future base 2007b prediction, the future base peak ozone concentration would drop from 154.8 ppb to 137.7 ppb. Using a bias-adjusted July 3 peak, commission staff estimated (based on Phase I modeling) that a NO_x reduction of about 42% from 1996 levels would be sufficient to bring the peak below the 125ppb standard. If the July 3 peak is in fact an artifact of the modeling process and not a real phenomenon, then controlling to the unadjusted July 3 peak would result in nearly double the amount of reduction (from 42% to 75%) that would be required otherwise. Thus, the commission and the North Texas Clean Air Steering Committee decided to use the bias-adjusted July 3 peak ozone prediction as the criterion for evaluating candidate control strategies.

3.7.3 Control Strategy Modeling

[3] A limited number of model runs made with the future base 2007a also showed a strong preference for NO_x controls.

Table 3.7-1 shows the 23 control strategies evaluated with the 2007b future base. The left-hand column of the table lists the elements of the control strategies, and the entries in the body of the table indicate which areas in the modeling domain the reductions were applied to. The bottom row lists bias-adjusted peak July 3 predicted ozone for each strategy. In particular Strategy D29 shows peak ozone prediction of 124.9, which is below the standard. This strategy was selected by the North Texas Clean Air Steering Committee and the commission as the attainment demonstration strategy. The last row of Figure 3.6-1 at the end of this chapter shows unadjusted modeled peak ozone concentrations for each of the three primary episode days after applying Strategy D29.

Table 3.7-1: Control Strategies Modeled with 2007b Future Base

Emission control options		Control Strategy								
		D6	D7	D8	D9	D10	D11	D12	D13	D14
Point Sources	Tier 2 point source NO_x reduction	4[1]	4	4	4	4	4	4	4	4
	70% EGF + Tier 2 non-EGF									
	30% point source NO_x reduction								E	E
	50% point source NO_x reduction						E	E		
	Proposed cement kiln regulations									
	Building code modifications									
On-road mobile sources	Texas Motorists Choice I/M program[2]	12								
	Acceleration Simulation Mode I/M prog.		4	12	4	4	4	4	4	4
	On-Board Diagnostics I/M program		8		8	8	8	8	8	8
	Federal phase II Reformulated Gasoline[3]									
	California RFG					12	12	12		
	California diesel fuel					12	12	12	12	12
	55 mph speed							4		
	60 mph speed limit									
	Reduce 65,70 mph speed limits by 5 mph									
	Remote sensing									
	Fed. Heavy Duty Gasoline Vehicle stds.									N
	Transportation Control Measures									4
	Super low sulfur (20ppm)									
	Vehicle recycling, 3000 Cars/Year									
	Vehicle recycling, 5000 Cars/Year									
	California Low Emission Vehicles									
Non-road mobile sources	Construction equipment 10:00 AM start				4		4	4	4	
	Construction equipment 8:30 AM start									
	California RFG					4	12	12		
	California diesel fuel					4	12	12	12	12
	Voluntary Mobile Emissions Program						4	4		4
	Alternate construct. emissions (-31.2%)									
	Accelerated Tier 3 diesel replacement								12	
	Airport support equipment electrification								4	4
	Low NO_x water heaters									
	California spark ignition rules									
Bias-adjusted July 3 peak modeled ozone (ppb)		136.2	132.4	132.3	130.5	132.2	129.6	128.9	128.8	131.1

[1]Notes are provided following Table 3-7.

Table 3.7-1: Control Strategies Modeled With 2007b Future Base (Part 2)

Emission control options		Control Strategy							
		D15	D16	D17	D18	D19	D20	D21	D22
Point Sources	Tier 2 point source NO_x reduction	4	4	4	4	4	4	4	4
	70% EGF + Tier 2 non-EGF								
	30% point source NO_x reduction	E	E	E	E				
	50% point source NO_x reduction					M	M	M	M
	Proposed cement kiln regulations								
	Building code modifications					4	4	4	4
On-road mobile sources	Texas Motorists Choice I/M program								
	Acceleration Simulation Mode I/M prog.	4	4	4	12	12	12	12	12
	On-Board Diagnostics I/M program	8	8	8					
	Federal phase II Reformulated Gasoline								
	California RFG								
	California diesel fuel	12	12[4]	12[4]	12[4]	12[4]	12[4]	12[4]	12[4]
	55 mph speed								
	60 mph speed limit		4	4			4		
	Reduce 65,70 mph speed limits by 5 mph								4
	Remote sensing								12
	Fed. Heavy Duty Gasoline Vehicle stds.	N	N	N	N	N	N	N	N
	Transportation Control Measures	4	4	4	4	4	4	4	4
	Super low sulfur (20ppm)	12	12	12	12			12	12
	Vehicle recycling, 3000 Cars/Year		4	4	4				
	Vehicle recycling, 5000 Cars/Year					4	4	4	4
	California Low Emission Vehicles								S
Non-road mobile sources	Construction equipment 10:00 AM start			12	12				
	Construction equipment 8:30 AM start					12	12	12	12
	California RFG								
	California diesel fuel	12	12[4]	12[4]	12[4]	12[4]	12[4]	12[4]	12[4]
	Voluntary Mobile Emissions Program	4	4	4	4				4
	Alternate construct. emissions (-31.2%)		12	12	12	12	12	12	12
	Accelerated Tier 3 diesel replacement		12	12	12	12	12	12	12
	Airport support equipment electrification	4	4	4	4	4	4	4	4
	Low NO_x water heaters					12	12	12	12
	California spark ignition rules								12
Bias-adjusted July 3 peak modeled ozone (ppb)		130.9	126.8	124.7	124.9	127.4	127.0	126.3	126.1

Table 3.7-1: Control Strategies Modeled With 2007b Future Base (Part 3)

	Emission control options	Control Strategy					
		D23[5]	D24[5]	D25[5]	D23R[5]	D26	D29
Point Sources	Tier 2 point source NO_x reduction	4		4	4	4	4
	70% EGF + Tier 2 non-EGF		4				
	30% point source NO_x reduction						
	50% point source NO_x reduction	M	M	M	M	M	M[6]
	Proposed cement kiln regulations						C[6]
	Building code modifications	4	4	4	4	4	4
On-road mobile sources	Texas Motorists Choice I/M program						
	Acceleration Simulation Mode I/M prog.	12	12	12	12	12	12
	On-Board Diagnostics I/M program						
	Federal phase II Reformulated Gasoline						8
	California RFG						
	California diesel fuel	12[4]	12[4]	12[4]	12[4]	12[4]	12
	55 mph speed limit						
	60 mph speed limit						
	Reduce 65,70 mph speed limits by 5 mph	4	4	4	4	4	12
	Remote sensing	12	12	12	12	12	12
	Fed. Heavy Duty Gasoline Vehicle stds.	N	N	N	N	N	N
	Transportation Control Measures	4	4	4	4	4	12[7]
	Super low sulfur (20ppm)	12	12	12	12	12	
	Vehicle recycling, 3000 Cars/Year						
	Vehicle recycling, 5000 Cars/Year	4	4	4	4		12
	California Low Emission Vehicles	S	S	S	S	S	S[8]
Non-road mobile sources	Construction equipment 10:00 AM start	12	12	12	12	12	12
	Construction equipment 8:30 AM start						
	California RFG						
	California diesel fuel	12[4]	12[4]	12[4]	12[4]	12[4]	12
	Voluntary Mobile Emissions Program	4	4	4	4	4	12
	Alternate construct. emissions (-31.2%)	12	12	12	12	12	12
	Accelerated Tier 3 diesel replacement	12	12		12	12	12
	Airport support equipment electrification	4	4	4	4	4	4
	Low NO_x water heaters	12	12	12	12	12	12
	California spark ignition rules	12	12	12	12	12	12
Bias-adjusted July 3 peak modeled ozone (ppb)		124.8	125.6	125.5	124.3	124.7	124.9

Notes for Table 3.7-1

1. Key: 4 - Four county DFW nonattainment area,
   8 - DFW CMSA minus four nonattainment counties,
   12 - 12-county DFW CMSA,
   E - Ellis County
   M - Ellis County sources in Midlothian area
   C - Counties in central and eastern Texas
   N - Nationwide
   S - Statewide

2. Future base 2007b includes Texas Motorist's Choice in Dallas & Tarrant counties.

3. Future base 2007b includes federal phase 2 RFG in 4-county area

4. Modified California diesel reduction factors based on recent study were used in Strategies D16 through D26. Commission staff decided that insufficient evidence was available to support this revision, so the original California diesel factors were used in the final control strategy evaluation run (D29).

5. Strategies D23, D24, D25 were run with an accidental addition of 3 tons/day of on-road mobile source NO_x. Results of these runs are included to show the effects of two control elements (reducing the Tier 2 point source controls to 70%, and accelerated Tier 3 diesel). Strategy D23R is a re-run of Strategy D23 with corrected on-road mobile source NO_x emissions.

6. Cement kilns in Midlothian area were modeled at 50% reduction; elsewhere, reductions were based on proposed rule.

7. The '12' here includes both TCMs in the four county area and travel demand measures (TDMs), such as van pools, etc. in the surrounding 8 counties.

8. Updated factors were used in Strategy D29.

Most of the strategy elements listed in Table 3.7-1 are described in more detail elsewhere in this SIP, but for convenience the elements are briefly described below:

Point (Stationary) sources

Point source NOx reduction - in the four-county ozone nonattainment area as follows:

! **Tier 2 point source NO_x reduction for EGFs -** flue-gas cleanup, such as SCR. EGFs were modeled with a NO_x emission limit of 0.02 pound per million British thermal unit (lb/MMBtu). This control represents a reduction of approximately 91% from the uncontrolled (i.e. assuming no NO_x RACT) 2007 emission levels.

! **Tier 1 point source NOx reduction for non-EGF sources -** combustion modification such as flue gas recirculation for boilers. Controls for non-EGF industrial, commercial and institutional boilers with a firing rate greater than 40 MMBtu/hr were modeled based on the proposed Chapter 117 NO_x limit of 30 ppmv (0.036 lb NO_x/MMBtu) for existing boilers operated above the Chapter 117 annual heat input exemptions, and on the applicable Chapter 116 permit NO_x limit of 0.06 lb NO_x/MMBtu, for two industrial sources which have replaced or are replacing boilers in the 1996 inventory. Industrial and institutional internal combustion engines were modeled with a NO_x emission limit of 2 grams per 1000-horsepower-hour (2g/1000hp-hr).

70% EGF + Tier 2 non-EGF - This control strategy element is the same as above, except that the EGFs were adjusted so as to represent a 70% reduction from the uncontrolled 2007 emission levels.

30% point source NO_x reduction - across-the-board reduction applied to all point sources in Ellis County. Does not affect emissions within the four-county nonattainment area.

50% point source NO_x reduction - across-the-board reduction applied only to cement kilns near Midlothian in Ellis County. Does not affect emissions within the four-county nonattainment area.

Proposed cement kiln reductions - proposed reductions for cement kilns in central and eastern Texas. These regulations will reduce emissions from cement kiln operations in central and eastern Texas by approximately 27%. Does not affect emissions within the four-county nonattainment area.

Building code modifications - reduce electricity usage through use of better insulation, reflective roofing, etc. This element is estimated to provide a reduction of approximately .5 tpd due to adoption of building code modifications in the four-county DFW nonattainment area. This element was modeled by reducing point source emissions in the four-county area by 2.5%.

For more details on modeling point source controls, see Appendix F.

On-road mobile sources

TMC I/M program - two-speed idle test integrated with the annual safety inspection program and operated by the Texas Department of Public Safety. Currently operated only in Tarrant and Dallas Counties.

ASM I/M program - dynamometer-based test which is more stringent than TMC. In particular, has significant NO_x benefits over TMC.

OBD I/M program - 1996 and later vehicles are self-diagnosing for emissions. This program would require a check of the OBD status as part of the annual safety inspection. The OBD would be used for newer vehicles in either a TMC or ASM program, or could be implemented as a stand-alone program.

Federal phase II RFG - a formulation of gasoline that has lower amounts of certain chemical compounds which contribute to the formation of ozone and air toxins. RFG does not evaporate as readily as conventional gasoline during the summer months. It also contains oxygenates, which increase the combustion efficiency of gasoline and reduce carbon monoxide emissions. The four-county nonattainment area is required by the Clean Air Act to implement RFG.

California RFG - a different formulation of RFG which provides additional reductions beyond federal Phase II RFG.

California diesel - a special formulation of diesel which provides additional reductions beyond federal diesel requirements.

55 or 60 mph speed limit - reduce maximum speed limits to either 55 or 60 mph during ozone season.

Reduce 65 and 70 mph speed limits by 5 mph - During ozone season, roadways with 65 mph speed limits would be reduced to 60 mph, and roadways with 70 mph speed limits would be reduced to 65 mph during the ozone season.

Remote sensing - use of roadside sampling equipment which detects high-emitting vehicles as they drive by.

Federal heavy duty gasoline vehicle standards - proposed federal rules to reduce emissions in light heavy-duty vehicles such as large sport utility vehicles. This regulation was treated as a control strategy element, but strictly should be included in the future base (it is included in future base 2007d).

Transportation control measures - a variety of local measures designed to reduce motor vehicle emissions in the four nonattainment counties. Also includes travel demand measures (TDM's) in the surrounding 8 counties (van pools, etc.).

Super low sulfur gasoline (20 ppm) - reduces sulfur content in gasoline beyond the proposed federal limit of 30 ppm. Provides additional NO_x benefits.

Vehicle recycling, 3000 or 5000 cars/year - a program to remove the dirtiest vehicles from the fleet and take them permanently out of service.

California Low Emission Vehicles - California standards are somewhat tighter than Federal Tier 2 standards, although much of the incremental benefit occurs beyond the DFW area's attainment date of 2007.

Table 3.7-2 shows the reductions for the items above as applied to different parts of the modeling domain.

Table 3.7-2: Reduction Factors Applied to 2007b Future Base On-road Mobile Source Emissions

Control strategy item	Data Source	Pollutant	Region: Dallas, Tarrant Counties	Denton, Collin Counties	Eight counties	Statewide	National
Texas Motorist's Choice I/M program	Radian/ERG	NO_x		.922	.922		
		VOC		.730	.720		
Acceleration Simulation Mode I/M program	Radian/ERG	NO_x	.807[1]	.770	.764		
		VOC	.837[1]	.623	.614		
On-Board Diagnostic I/M program	Radian/ERG	NO_x			.896		
		VOC			.826		
Federal phase II reformulated gasoline	Radian/ERG	NO_x			.954		
		VOC			.735		
California reformulated gasoline	Radian/ERG	NO_x	.988	.988	.988		
		VOC	1.078	1.075	1.078		
California diesel: Strategies D6-D15, D29	Radian/ERG	NO_x	.987	.985	.987		
		VOC	.996	.994	.996		
Strategies D16-D26	Environ	NO_x	.973	.973	.973		
		VOC	.996	.996	.996		
55 miles/hour speed limit	TNRCC	NO_x	.970[2]	.841[2]			
		VOC	.994[2]	.954[2]			
60 miles/hour speed limit	TNRCC	NO_x	.982[2]	.879[2]			
		VOC	1.00[2]	.988[2]			
Reduce 65, 70 mph speed limit by 5 mph: Strategies D22-D26	NCTCOG	NO_x	.987[2]	.896[2]			
		VOC	1.00[2]	1.00[2]			
Strategy D29	NCTCOG/ TNRCC (R)	NO_x	.986[2]	.898[2]	.940		
		VOC	1.00[2]	.977[2]	.975		
Remote sensing	NCTCOG	NO_x	.997	.997	.997		
		VOC	.997	.997	.997		
Federal Heavy Duty Gasoline Vehicle standards	Environ	NO_x	.982	.982	.982	.982	.982
		VOC	.999	.999	.999	.999	.999
TCMs, TDMs	NCTCOG	NO_x	.983	.983	1.00		
		VOC	.991	.991	1.00		
Super low sulfur gasoline	Environ	NO_x	.980	.980	.980		
		VOC	.983	.983	.983		
Vehicle recycling, 3000 cars/ year	NCTCOG	NO_x	.988	.988			
		VOC	.988	.988			
Vehicle recycling, 5000 cars/ year: Strategies D19-D25	NCTCOG	NO_x	.980	.980			
		VOC	.983	.983			
Strategy D29	TNRCC (revised)	NO_x	.998	.998	.998		
		VOC	.998	.998	.998		
CA Low Emission Vehicles: Strategies D22-D26	Radian/ERG	NO_x	.994	.994	.994	.994	
		VOC	1.00	1.00	1.00	1.00	
Strategy D29	Radian/ERG (revised)	NO_x	.981	.981	.981	.981	
		VOC	.980	.980	.980	.980	

[1] Incremental change from TMC I/M program

[2] Composite adjustment. In the four nonattainment counties, emission reductions resulting from speed limit changes were applied on an hour-specific basis.

Area and non-road mobile sources

Construction equipment 8:30 or 10:00 AM start - bans most heavy equipment usage prior to 8:30 or 10:00 AM. Reduces NO_x emissions during the time most critical for forming ozone.

California RFG - same as above.

California diesel fuel - same as above.

VMEP - a federal program which allows areas to take SIP credit for voluntary programs to reduce emissions from on-road and non-road mobile sources. The credit is limited to 3% of the amount required to reach attainment of the NAAQS. VMEP was modeled in the non-road category for convenience, but can include on-road reductions as well.

Alternate construction equipment emissions - a comparison of construction equipment emissions in the DFW area indicates that on a per-capita basis, DFW's emissions are almost three times as high as Los Angeles'. The reduction of -31.2% reduces the discrepancy between the areas by half. This item is not a control strategy, but rather an emissions inventory adjustment. A study currently being conducted in the Houston area is expected to help better quantify construction emissions in Texas, and should help the commission to refine the DFW inventory in the near future.

Accelerated Tier 3 diesel equipment replacement - assumes that by 2007, 50% of the construction equipment fleet will be Tier 3 (available in 2006), and the remainder will be Tier 2 (available in 2001).

Airport support equipment electrification - all ground support equipment at DFW International Airport, Alliance Airport, Love Field, and Meacham Field are assumed to be replaced with electric equipment by 2007.

Low NO_x residential water heaters - requires new water heaters to have pilotless ignition and low-NO_x burners.

California spark ignition rules - California has instituted rules concerning large (>25 horsepower) non-road spark ignition engines. This item assumes similar rules in the DFW area.

Table 3.7-3 shows the reduction factors for the items above as applied to different parts of the modeling domain. Reductions were applied across-the-board to all categories of emissions in the area/non-road inventory unless otherwise noted.

Table 3.7-3: Reduction Factors Applied to 2007b Future Base Area+Non-road Mobile Source Emissions

Control strategy item	Data Source	Pollutant	Region: DFW 4 counties	Region: Eight counties	Region: Central & eastern Texas	Region: State-wide
Construction equipment 8:30 or 10:00 AM start	TNRCC	NO_x	1.00[1]	1.00[1]		
		VOC	1.00[1]	1.00[1]		
California reformulated gasoline and California diesel (combined factor)	Radian/ ERG	NO_x	.950	.950		
		VOC	.985	.985		
California diesel: Strategies D6-D15, D29	Radian/ ERG	NO_x	.958	.958		
		VOC	.990	.990		
Strategies D16-D26	Environ	NO_x	.939	.939		
		VOC	.990	.990		
Federal phase II RFG	Radian/ ERG	NO_x	1.00	1.00		
		VOC	.971	.971		
Voluntary Mobile Emissions Program	TNRCC	NO_x	.960			
		VOC	1.00			
Alternate construction equipment emissions[2]	TNRCC	NO_x	.876			
		VOC	.987			
Accelerated Tier 3 diesel equipment: Commercial equipment[2]	Environ	NO_x	.860	.860		
		VOC	.976	.976		
Construction equipment[2]	Environ	NO_x	.798	.798		
		VOC	.854	.854		
Industrial equipment[2]	Environ	NO_x	.921	.921		
		VOC	.950	.950		
Lawn & garden equipment[2]	Environ	NO_x	.937	.937		
		VOC	.997	.997		
Airport support equipment electrification[2,3]	Environ	NO_x	0.00			
		VOC	0.00			
Low NO_x residential water heaters	TNRCC	NO_x	.997	.997	.997	.997
		VOC	1.00	1.00	1.00	1.00
California spark ignition rules: Commercial equipment[2]	Environ	NO_x	.882	.882		
		VOC	.954	.954		
Industrial equipment[2]	Environ	NO_x	.771	.771		
		VOC	.740	.740		
Lawn & garden equipment[2]	Environ	NO_x	.957	.957		
		VOC	.966	.966		
Stage I gasoline station refueling in attainment counties	TNRCC	NO_x		1.00	1.00	
		VOC		0.98	0.98	

[1]Emissions were shifted temporally, but daily total emissions were not changed
[2]Reductions were applied to specific equipment categories
[3]Reductions applied only at Meacham Field, DFW International Airport, Love Field, and Alliance Airport

Table 3.7-4 summarizes emissions after applying Strategy D29 to the 2007b future base inventory for July 3, 1996, the day experiencing the highest modeled ozone concentrations.

Table 3.7-4: Strategy D29 Emissions by Category in the DFW 4-county Area for July 3, 1996

Category	NO_x (tons/day)		VOC (tons/day)	
	2007b future base	Strategy D29	2007b future base	Strategy D29
On-road mobile sources	211.6	152.7	135.5	103.3
Area/non-road mobile sources	159.0	103.6	301.3	283.4
Point sources	77.0	16.2	28.8	28.8
Biogenic sources	13.2	13.2	452.6	452.6
Total	460.8	285.0	918.1	868.0

3.7.4 Summary of Control Strategy Modeling with the 2007b Future Base

The commission and North Texas Clean Air Steering Committee formed a partnership to develop a comprehensive plan for clean air in North Central Texas. By evaluating dozens of candidate control strategies, the commission and the Committee have selected a plan that promises to greatly reduce the levels of harmful air pollutants in the region, and bring the area into attainment of the federal clean air standard by 2007. The model results presented in Table 3.7-4 clearly show that Strategy D29 will bring peak ozone on the three primary episode days to below the 125 ppb threshold, after adjusting the July 3 prediction to account for base-case model bias.

3.8 MODELING USING THE BASE 5 BASE CASE

Over the last decade, the Commission has devoted thousands of man-hours and millions of dollars to improving the emissions inventory, which forms the basis of the modeling demonstration and control strategy selection. Although continuing efforts by Commission staff and contractors have greatly reduced the uncertainty in the critically important biogenic emissions inventory component, comparisons of measured and modeled isoprene concentrations for the Base 4d base case indicated that biogenic emissions were likely over-represented in the modeling. Similar comparisons in the Houston area showed comparable results, providing impetus for continuing to refine the biogenic emissions inventory. In late 1999, Commission staff took delivery of the newest, most current member of the BEIS (Biogenic Emission Inventory System) family of biogenic emissions modeling systems called GloBEIS (Global BEIS) from its contractor, ENVIRON, Inc. Along with GloBEIS, the contractor delivered updated biomass information for agricultural areas. Since biogenic emissions account for a large fraction of reactive hydrocarbon emissions in the DFW area, Commission staff developed a new base case (Base 5) to accommodate the new biogenic emissions along with some additional updates. Because the Base 5 modeling inventory is believed to provide a more accurate representation of actual emissions than the Base 4d inventory used heretofore, Commission staff performed additional modeling using this new inventory to confirm that the controls proposed in Strategy D29 would lead to attainment.

3.8.1 The Base 5 Modeling Inventory

Changes to the base case modeling inventory from Base 4d to Base 5 are:

- ! Updated emissions estimates for the DFW International Airport based on a detailed bottom-up inventory conducted by the airport. Emissions by aircraft during approach and climbout were treated as elevated point sources using an innovative procedure developed by commission modeling staff.

- ! Minor adjustment to nonattainment county on-road NO_x emissions to account for incidents (accidents, etc.). A similar adjustment was applied to VOC emissions in the inventory prepared by NCTCOG, but the adjustment was not applied to NO_x.

- ! Newly developed biogenic emissions calculated with the state-of-the-science Global System (GloBEIS). This new system dramatically reduces biogenic hydrocarbon emissions in the four-county area compared with previous methodologies, primarily because of updates and corrections to the calculated attenuation of sunlight as it passes through the leaf canopy. This significant reduction in biogenic hydrocarbon emissions is supported by ambient isoprene measurements, which are typically much lower than the modeled isoprene concentrations seen with Base 4d. See Appendix D for details on how the GloBEIS emissions were developed.

Table 3.8-1 provides a comparison of emissions by category for July 3, 1996, between the Base 4d and Base 5 modeling inventories.

Table 3.8-1: Comparison of Base 4d and Base 5 Emissions by Category in the DFW 4-county Area for July 3, 1996

Category	NO_x (tons/day)		VOC (tons/day)	
	Base 4d	Base 5	Base 4d	Base 5
On-road mobile sources	314.5	322.4	234.7	234.7
Area/non-road mobile sources	156.3	173.4	293.8	296.5
Point sources	99.4	99.4	29.0	29.0
Biogenic sources	13.2	26.6	452.6	257.9
Total	583.4	621.8	1010.1	818.1

As Table 3.8-1 shows, by far the most significant change to the inventory is the revision of the biogenic hydrocarbon (VOC) emissions, with biogenic VOC emissions reduced by more than 38% in the four-county area. In fact, emissions in some surrounding counties showed even larger changes. For example Ellis County, which lies south of Dallas County, saw a reduction in biogenic VOC emissions of 54%.

Because substantial modifications were made to the base case inventory, the commission re-evaluated model performance for the Base 5 base case. Model performance statistics for the two episodes are tabulated below in Tables 3.8-2 and 3.8-3. Values within EPA-recommended ranges are shown in **bold**. Note that although statistics are included for June 21, 1995 and June 30, 1996, these days are only used to "ramp-up" the model, and are not expected to exhibit good performance.

Table 3.8-2. CAMx DFW Base Case Ozone Performance Statistics for June 18 – 22, 1995 Episode.

Episode Date	Normalized Bias (±5–15%)	Normalized Gross Error (30–35%)	Unpaired Peak Accuracy (±15–20%)	Domain-wide Peak Ozone (ppb)	
				Simulated	Observed
06/18/95	-27.4	**28.1**	**-4.4**	73.6	77
06/19/95	**0.4**	**8.3**	**-0.4**	112.5	113
06/20/95	**-8.5**	**13.3**	**9.9**	130.8	119
06/21/95	**-10.8**	**12.7**	**-7.3**	133.5	144
06/22/95	**-9.6**	**12.8**	**2.7**	138.7	135

For the primary episode days June 21 and 22, 1995, model performance is slightly degraded compared with the Base 4d modeling. The Base 5 bias values are in the range of -10%, while the Base 4d biases were only about -3%. The gross error figures are also slightly higher (about 12.5% compared with about 10.5%). The Base 5 peak predictions are lower than the Base 4c counterparts, with the predicted peak on June 21 (133.5 ppb) now over 7% below the measured value of 144 ppb. Overall, however, model performance for the two primary episode days is still well within EPA-specifications. Note also that model performance for the near-exceedance days June 19 and 20 is quite good, as was seen in the Base 4d base case.

Table 3.8-3. CAMx Base Case Ozone Performance Statistics for June 30 – July 4, 1996 Episode.

Episode Date	Normalized Bias (±5–15%)	Normalized Gross Error (30–35%)	Unpaired Peak Accuracy (±15–20%)	Domain-wide Peak Ozone (ppb)	
				Simulated	Observed
06/30/96	-26.5	**26.5**	-20.5	89.1	112
07/01/96	-16.1	**17.7**	**-1.6**	110.2	112
07/02/96	**-11.7**	**17.4**	**1.8**	116.0	114
07/03/96	**-4.9**	**16.3**	**12.4**	161.9	144
07/04/96	**-6.4**	**12.1**	**8.5**	125.8	116

For the July 3 primary episode day, Base 5 model performance is significantly better than was seen with Base 4d. The bias is now about -5%, compared with a Base 4d bias of over 12%. Gross error is reduced from nearly 21% to around 16%. The Base 5 modeled peak of 162 ppb is also significantly lower than the Base 4d peak of 173 ppb. Model performance for the near-exceedance days of July 1, 2, and 4 is also generally acceptable, except for the bias on July 1 which is slightly outside the recommended range.

In general, Base 5 model peak ozone predictions are notably lower than the corresponding Base 4d values, although model performance is still well within the EPA specifications. Additional details on Base 5 model performance are found in Appendix E. The top row of plots in Figure 3.8-1 at the end of this section shows Base 5 base case modeled daily peak ozone concentrations across the DFW area for the three primary episode days.

3.8.2 The 2007d Future Base

Once the Base 5 model performance had been established, emissions were projected to 2007 and several federal and state controls were applied. The future base inventory developed upon the Base 5 base case is called 2007d (an intermediate future base, 2007c, was quickly replaced by 2007d). The 2007d future base is similar to the 2007b future base described earlier, with some notable exceptions:

- The biogenic emissions in 2007b were replaced with the new GloBEIS-generated emissions.

- The 2007d projected EGF point source emissions were recalculated using hourly three-year average (1996-8) of continuous emissions monitored data from the ARPDB, taken over the months of July, August, and September. This approach was deemed more representative of typical ozone-season operation than the previous method, which had relied on a single 31-day period in June-July of 1997.

- New 2007 emissions for the DFW International airport were provided directly by airport staff. As in the base case, approach and climbout emissions were modeled as elevated point sources.

- Because SB7 only applies to EGFs in operation in 1997, additional demand is expected to be met through construction of highly efficient combined-cycle gas turbine units in the near future. To account for growth in electricity usage, the commission staff examined permit applications for new sources within a 100-mile range of the DFW nonattainment area. These EGF sources were explicitly added to the future inventory. In addition, permit applications for cement kilns in the same 100-mile radius were added to the future inventory.

- Point source growth in the BPA ozone nonattainment area was modified to account for banked emissions.

- The nonattainment county on-road NO_x emissions were adjusted to account for incidents (accidents, etc.), as was done in Base 5.

- Federal heavy duty gasoline vehicle standards were included in the future base.

Table 3.8-4 gives a comparison of the 1996 Base 5 emissions with the 2007d future base emissions by category for the July 3 episode day.

Table 3.8-4: Comparison of 1995 Base 5 and 2007d Future Base Emissions by Category in the DFW 4-county Area for July 3, 1996

Category	NO_x (tons/day)		VOC (tons/day)	
	Base5	2007d future base	Base5	2007d future base
On-road mobile sources	322.4	207.9	234.7	135.4
Area/Non-road mobile sources	173.4	176.3	296.5	304.4
Point sources	99.4	98.7	29.0	29.1
Biogenic sources	26.6	26.6	257.9	257.9
Total	621.8	509.5	818.1	726.8

As seen in Table 3.8-4, the future base case represents a substantial reduction of both VOC and NO_x from the 1995/96 base cases. Consequently, peak predicted ozone concentrations are seen to decrease significantly from the base cases before applying any additional controls, although peak forecast ozone concentrations are still above the NAAQS of 125 parts/billion. Table 3.8-5 compares peak 2007 ozone predictions with the base case modeled concentrations for the three primary episode days. The second row of Figure 3.8-1 at the end of this chapter shows peak daily predicted ozone concentrations modeled using the 2007d future base for each of the primary episode days. Although the future base modeling indicates that ozone levels will be reduced substantially from the 1995-96 base, the peak ozone levels on two days exceed the 125 ppb ozone NAAQS. While the peak prediction on June 21 is below 125 ppb, we note that the model underpredicted peak ozone in the base case, so underprediction in the future base is likely as well. Thus, the commission believes that substantial additional controls will be necessary to ensure the area will reach attainment by 2007.

Table 3.8-5. 2007 Future Base Peak Ozone Predictions (Compared with Base Case) in ppb

Episode Date	Measured Peak Ozone	Base 5 Simulated Peak Ozone	2007d Future Base Simulated Peak Ozone
6/21/95	144	133.5	122.4
6/22/95	135	138.7	126.7
7/3/96	144	161.9	147.4

3.8.3 Directional Guidance Modeling with the 2007d Base

To confirm that a NO_x-based strategy was still appropriate after significantly changing the inventory, commission modeling staff executed two sensitivity runs from the new 2007d future base. In one sensitivity run, anthropogenic VOC emissions were reduced by 50%, and in the other NO_x emissions were similarly reduced. The results of these analyses are shown in Table 3.8-6.

Table 3.8-6. 2007d Directional Guidance Modeling (in ppb)

Episode Date	2007d Future Base Simulated Peak Ozone	Simulated Peak Ozone with 50% NO_x reduction	Simulated Peak Ozone with 50% VOC reduction
6/21/95	122.4	105.9	115.2
6/22/95	126.7	107.5	118.0
7/3/96	147.4	123.9	135.1

For each primary episode date, the model responded much better to NO_x reductions than to VOC reductions. This confirms that a NO_x-based strategy is still the preferred path to attainment, although VOC reductions are clearly beneficial.

3.8.4 Control Strategy D30

After establishing that a NO_x-based strategy was still appropriate for the DFW attainment plan, the commission modeling staff ran Strategy D30 against the new 2007d future case. Strategy D30 is very similar to Strategy D29, which was evaluated against the 2007b future base. The changes from Strategy D29 are:

! The alternate construction inventory adjustment (-31.2%) was omitted from Strategy D29, since it represents an inventory adjustment and not a control strategy.

! Point source emission reductions associated with building code modifications were expanded from four to twelve counties.

! The reductions modeled for EGF point source NO_x reductions were modified to change the maximum emission rate from 0.02 lbs/MMBtu to 0.033 lbs/MMBtu, in accordance with the current proposed rules governing EGFs in the four-county nonattainment area.

Table 3.8-7 shows the emissions by category for the four-county DFW nonattainment area for the future base and Strategy D30.

Table 3.8-7: Comparison of 2007d Future Base and Strategy D30 Emissions by Category in the DFW 4-county Area for July 3, 1996

Category	NO_x (tons/day)		VOC (tons/day)	
	2007d future base	Strategy D30	2007d future base	Strategy D30
On-road mobile sources	207.9	157.2	135.4	103.4
Area/non-road mobile sources	176.3	128.3	304.4	296.1
Point sources	98.7	24.4	29.1	29.1
Biogenic sources	26.6	26.6	257.9	257.9
Total	509.5	336.5	726.8	686.5

The model was then executed with the Strategy D30 controls applied, and the results are tabulated in Table 3.8-8. The last row of plots in Figure 3.8-1 shows modeled 2007 daily maximum ozone concentrations for three primary episode days after applying strategy D30.

Table 3.8-8. 2007 Future Base Peak Ozone Predictions (compared with base case) in ppb

Episode Date	Measured Peak Ozone	Base Case Simulated Peak Ozone	2007 Future Base Simulated Peak Ozone	2007 Simulated Peak Ozone with Strategy D30 Controls
6/21/95	144	133.5	122.4	113.3
6/22/95	135	138.7	126.7	115.9
7/3/96	144	161.9	147.4	134.5

In the December, 1999 SIP proposal, several Weight-of-Evidence (WoE) arguments were presented which provided a compelling argument that the DFW area would reach attainment in 2007, even though the simulated 2007 peak ozone concentration for Strategy D30 is above the federal standard of 125 parts/billion. As a result of comments received after the December, 1999 proposal, several new modeling runs were conducted and a new final control strategy was selected. The WoE arguments utilizing Strategy D30 have been replaced in this final modeling demonstration (see Sect. 6.3 of this document for the current WoE documentation).

3.8.5 Additional Modeling using the Base 5 Base Case

A number of additional control strategy runs were performed as a result of comments received. Strategies D31 through D42 were run using future bases built upon Base 5. Two new future bases were designated during this analysis, 2007e and 2007f. The 2007e future base incorporated some minor emissions inventory corrections, while the 2007f future base incorporated updated assumptions about regional reductions. Note that the 2007e and 2007f future bases were only run as part of control strategy modeling, so no results for the (uncontrolled) future bases are presented.

The 2007e future base is similar to 2007d, with the following exception: When the newly permitted EGF sources were added to the 2007d future base to account for future demand, the new units were inadvertently subjected to the regional EGF rule, which reduces NO_X emissions from permitted units in Central and Eastern Texas by 50%. In fact, these units should have been modeled at their permitted levels. Future base 2007e corrects this problem.

The 2007f future base is similar to 2007e, with the following exceptions:

> EPA Region VI expressed concern that the 30% point source NO_X reductions assumed in the states of Arkansas. Louisiana, Florida, Mississippi, and Oklahoma was not supportable, and indicated that the attainment demonstration might be found incomplete if these assumptions were included in the modeling without sufficient justification. Although the Commission believes that these assumptions are reasonable, there was insufficient time to develop supporting documentation. Therefore, the 2007f future base drops the assumption of reductions in these states (reductions in states covered by the NO_X SIP call were not changed from the previous future base).
>
> Region VI also expressed concern that the growth rates used to develop the 2007 future bases had not included bankable emissions. To account for banking, commission modeling staff determined the tons of VOC and NO_X in the bank as of July 1, 1996, and added these tons back into the future inventory (minus a 20% discount to account for the Serious area offset ratio). The net effect was to add in .61 tons/day of VOC to low-level points. Since only 5 tons/year (.013 tons/day) of NO_X emissions were in the bank on 7/1/96, emissions of NO_X were not changed.

Table 3.8-9 summarizes the model runs conducted with the 2007d, 2007e, and 2007f future bases. Similar to Table 3.7-1, the bottom row of Table 3.8-9 shows peak 2007 modeled ozone concentration for the July 3 episode day, but unlike Table 3.7-1, the value is not adjusted for base-case bias since the large overprediction seen in Base 4d is no longer present in the Base 5 base case (see Table 3.8-3).

Table 3.8-9: Control Strategies Modeled with the 2007d, 2007e, and 2007f Future Bases, part 1

		Future Base:	**2007d**					**2007e**	
		Control Strategy:	**D30**	**D31**	**D32**	**D33**	**D34**	**D35**	**D36**
Emission Control Options	Point Sources	Tier 2[1] point source NO_X reduction	4[2]	4	4	4[3]	4[3]	4[3]	4[4]
		Regional Cement Kiln Regulations	C[5]	C[5]	C[5]	C	C	C	C
		Building Code Modifications	4	4	4	4	4	4	4
	On-Road Mobile	Acceleration Simulation Mode (ASM)	12	12	12	4	4	12	12
		On Board Diagnostics (OBD)	12	12	12	4	4	12	12
		Federal Reformulated Gasoline	8	8	8	8	8	8	8
		California Diesel fuel (on-road)	12	12	12	12	12	12	12
		Reduce 65, 70 mph speed limits by 5 mph	12	12	12	4	4	12	12
		55 mph Speed Limit							
		Remote Sensing	12	12	12	4	4	12	12
		Transportation Control Measures (TCMs)	4	4	4	4	4	4	4
		Vehicle Recycling Program (VRP)	12	12	12	12	12	12	12
		California Low Emission Vehicles	S	S	S	S	S	S	S
	Non-road mobile sources	Construction Equipment 10:00 AM Start	12			4	4	12	12
		Reduce Construction Emissions by 25%			12				
		Alternate Construction Emissions					12		
		California Diesel	12	12	12	12	12	12	12
		Accelerated Tier 3 Equip. Replacement	12	12	12	12	12	12	12
		Electrify Airport Ground Service Equipment	4	4	4	4	4	4	4
		Low NOx Hot Water Heaters	S	S	S	S	S	S	S
		Voluntary Mobile Emissions Prog. (VMEP)	12	12	12	12	12	12	12
		California Spark Ignition Rules	12	12	12	12	12	12	12
July 3 Peak Modeled Ozone (no bias adjustment)			134.5	135.5	133.5	134.8	133.0	134.7	134.7

[1] Notes on page following part 2 of this table.

Table 3.8-9: Control Strategies Modeled with the 2007d, 2007e, and 2007f Future Bases, part 2

		Future Base:	**N/A[6]**	**2007f**				
		Control Strategy:	**D37[6]**	**D38**	**D39**	**D40**	**D41**	**D42**
Emission Control Options	Point Sources	Tier 2[1] point source NO_X reduction	4[4]	4[4]	4[4]	4[4]	4[4]	4[4]
		Regional Cement Kiln Regulations	C	C	C	C	C	C
		Building Code Modifications	4	4	4	4	4	4
	On-Road Mobile	Acceleration Simulation Mode (ASM)	12	12[7]	4[8]	12[7]	12[7]	9[9]
		On Board Diagnostics (OBD)	12	12[7]	4[8]	12[7]	12[7]	9[9]
		Federal Reformulated Gasoline	8	8				
		California Diesel fuel (on-road)	12	12	4	12	12	9
		Reduce 65, 70 mph speed limits by 5 mph	12	12	4	12		9
		55 mph Speed Limit					12	
		Remote Sensing	12	12	4	12	12	9
		Transportation Control Measures (TCMs)	4	4	4	4	4	4
		Vehicle Recycling Program (VRP)	12	12	4	12	12	9
		California Low Emission Vehicles	S	S	S	S	S	S
	Non-road mobile sources	Construction Equipment 10:00 AM Start	12	12		4		4
		Reduce Construction Emissions by 25%						
		Alternate Construction Emissions						
		Cal Diesel	12	12	4	12	12	9
		Accelerated Tier 3 Equipment Replacement	12	12	4	4	4	4
		Electrify Airport Ground Service Equipment	4	4	4	4	4	4
		Low NOx Water Heaters	S	S	S	S	S	S
		Voluntary Mobile Emissions. Program (VMEP)	12	12	4	12	12	9
		California Spark Ignition Rules	12	12	4	12	12	9
July 3 Peak Modeled Ozone (no bias adjustment)			134.8	134.8	135.2	134.9	135.2	134.9

[1] Notes on following page.

Notes for Table 3.8-9

1. Tier 2 controls as defined in Sect 3.7, except EGF units are limited to 0.33 lbs/MMBtu based on the 3rd quarter ARPDB average emissions from 1996-98
2. Key to geographic regions:
   4 - Four county DFW nonattainment area,
   8 - DFW CMSA minus four nonattainment counties,
   9 - DFW CMSA minus Henderson, Hood, and Hunt counties,
   12 - 12-county DFW CMSA,
   C - Counties in central and eastern Texas,
   S - Statewide
3. Exempt small EGFs (< 25 MW)
4. Exempt small EGFs (< 25 MW), and model Garland and Denton EGFs at 70% reduction
5. Ellis County kilns were modeled at 50% reduction
6. Strategy D37 is identical to Strategy D36, except that it was run without the assumption of 30% reductions in the surrounding states. It is associated with an unnamed future base between 2007e and 2007f.
7. Credit for I/M programs in the four nonattainment counties were reduced by 1.2% to account for commuters from outside the 12-county MSA. See Appendix S for details.
8. Credit for I/M programs in the four nonattainment counties were reduced by 5.8% to account for commuters from outside the nonattainment counties. See Appendix S for details.
9. Credit for I/M programs in the four nonattainment counties were reduced by 1.8% to account for commuters from outside the nine county I/M area. See Appendix S for details.

Notes for specific control strategies:

Strategy D30 is the same strategy presented in the December 16 proposal.

Strategy D31 removes the 10:00 AM construction start from Strategy D30.

Strategy D32 was a sensitivity analysis (based on Strategy D30) which tested the effect of reducing construction equipment emissions by 25%. Strategies D31 and D32 were run together to determine the tons of construction equipment NO_X reduction which provides the same ozone benefit as the delayed activity start (approximately 9 tons/day).

Strategy D33 is based on Strategy D30, but removes the 10:00 AM construction start, I/M, or speed limit reduction in the eight surrounding counties. Also models Ellis County cement kilns were modeled as specified in the proposed rule package (instead of at 50% reductions) and removes controls from small EGFs (less than 25 mega-Watts).

Strategy D34 was a sensitivity analysis based on Strategy D33 which tested the effects of reducing the construction equipment emissions by 31.2%, similar to an assumption that was made in earlier runs (Strategies D16 - D29).

Strategy D35 was similar to Strategy D33, except that it was run with the 2007e future base (corrects reductions inadvertently applied to newly permitted EGFs) and put back the construction start delay, I/M, and speed limit reduction in the eight surrounding counties.

Strategy D36 was the same as Strategy D35, except that the Garland and Denton city-owned EGFs were controlled at 70% (instead of tier 2).

Strategy D37 was like Strategy D36, but removed assumed NO_X reductions in surrounding states not subject to the NO_X SIP Call (Oklahoma, Arkansas, Florida, Louisiana, and Mississippi. This change was part of the new future base 2007f.

Strategy D38 includes the remainder of the 2007f future base (adds banked emissions into the 2007 point source emissions), and introduces an adjustment to the I/M credit in the nonattainment counties to account for commuters not in counties subject to the proposed I/M rule (in this case, counties outside the CMSA).

Strategy D39 is similar to Strategy D38, except that it removes all mobile and area source controls from the surrounding eight counties (except for regional, state, and federal rules). The I/M credit in the nonattainment counties was adjusted to account for commuters from these eight counties which are not subject to an I/M program.

Strategy D40 is similar to Strategy D38, except that it removes the construction start delay, federal reformulated gasoline, and accelerated tier 3 equipment purchase from the surrounding eight counties.

Strategy D41 is the same as Strategy D40, but removes the construction start delay everywhere, and replaces it with a twelve-county 55 mph speed limit.

Strategy D42 is the same as Strategy D40, except that the counties of Henderson, Hood, and Hunt are now exempted from all but regional, state, and federal rules. The I/M credit in the nonattainment counties was again adjusted to account for commuters from these three counties which are not subject to an I/M program.

3.9 MODELING USING THE BASE 6 BASE CASE

The Base 5 base case introduced more accurate emissions estimates for biogenic sources, using the results of several years of applied research and field work directed by Commission staff. The Base 6 base case introduces additional emissions inventory improvements which represent the culmination of years of effort by Commission staff and their contractors. Most importantly, Base 6 replaces the emissions for construction equipment with updated emissions developed from an extensive survey conducted by Eastern Research Group (ERG) under contract to the Commission. While the study was conducted in the Houston-Galveston Area (HGA) nonattainment area, ERG has developed a sound methodology for applying these results to the DFW area. The updated emissions were not included in previous modeling analyses because the HGA study did not conclude until February, 2000. The DFW area construction equipment emissions were updated at this time because several commentors indicated concern with the accuracy of the construction equipment emissions used in the attainment demonstration modeling.

In addition to comments received from stakeholders, Commission staff independently concluded that the previous DFW construction emissions inventory was likely overstated, for several reasons:

- Ambient VOC/NO_X ratios at monitors in the DFW area (as well as in HGA) are significantly larger than inventory-derived VOC/NO_X ratios. Reducing surface-level emissions of NO_X is consistent with reducing the discrepancy between the ambient and inventory-derived ratios.

- The approximately 88 tons/day of construction equipment NO_X emissions in the 1996 Base 5 inventory is significantly larger than the 54 tons/day of NO_X emitted by on-road heavy duty diesel equipment. Considering the large volume of truck traffic along the major interstate highways in the region, it seems unlikely that construction equipment is responsible for 60% more emissions than the on-road diesels.

- Comparing the DFW construction emissions on a per-captia basis with the Los Angles air basin reveals that emissions per person are nearly three times as high in DFW as in the Los Angles area. Again, reducing construction equipment emissions substantially would lead to closer agreement between the inventories.

Overall, there is a significant body of evidence pointing towards reducing the construction equipment emissions in the DFW area. The Base 6 base case reduces 1996 construction equipment NO_X emissions from 87.8 tons/day to 47.3 tons/day, and reduces VOC emissions from 18.7 tons/day to 12.5 tons/day. Development of this improved inventory is documented in Appendix V.

3.9.1 The Base 6 base case

Table 3.9-1 provides a comparison of emissions by category for July 3, 1996, between the Base 5 and Base 6 modeling inventories. The only change is seen in the area/non-road category.

Table 3.8-1: Comparison of Base 5 and Base 6 Emissions by Category in the DFW 4-county Area for July 3, 1996

Category	NO_x (tons/day)		VOC (tons/day)	
	Base 5	Base 6	Base 5	Base 6
On-road mobile sources	322.4	322.4	234.7	234.7
Area/non-road mobile sources	173.4	132.9	296.5	290.3
Point sources	99.4	99.4	29.0	29.0
Biogenic sources	26.6	26.6	257.9	257.9
Total	621.8	581.3	818.1	811.9

Because a significant modification was made to the base case inventory, the commission re-evaluated model performance for the Base 6 base case. Model performance statistics for the two episodes are tabulated below in Tables 3.9-2 and 3.9-3. Values within EPA-recommended ranges are shown in **bold**.

Note that although statistics are included for June 21, 1995 and June 30, 1996, these days are only used to "ramp-up" the model, and are not expected to exhibit good performance.

Table 3.9-2. CAMx DFW Base 6 Ozone Performance Statistics for June 18 – 22, 1995 Episode.

Episode Date	Normalized Bias (±5–15%)	Normalized Gross Error (30–35%)	Unpaired Peak Accuracy (±15–20%)	Domain-wide Peak Ozone (ppb)	
				Simulated	Observed
06/18/95	-27.4	**28.1**	**-4.4**	73.6	77
06/19/95	**0.7**	**8.2**	**-1.7**	111.0	113
06/20/95	**-8.0**	**12.8**	**8.3**	128.8	119
06/21/95	**-10.0**	**12.1**	**-7.8**	132.7	144
06/22/95	**-8.8**	**12.5**	**1.8**	137.4	135

For the primary episode days June 21 and 22, 1995, model performance is slightly improved compared with the Base 5 modeling. Model bias and gross error for each day (except for the ramp-up day of 6/18) are slightly reduced from Base 5. The lone exception to improved performance occurs on 6/21, where a reduction in the peak modeled domain-wide ozone from 133.5 to 132.7 exacerbated the model's underprediction of the observed peak on that day by a small amount. Domain-wide peak ozone was slightly smaller with Base 6 than with Base 5 for each day except 6/18, with reductions of up to 2 ppb.

Table 3.9-3. CAMx Base 6 Ozone Performance Statistics for June 30 – July 4, 1996 Episode.

Episode Date	Normalized Bias (±5–15%)	Normalized Gross Error (30–35%)	Unpaired Peak Accuracy (±15–20%)	Domain-wide Peak Ozone (ppb)	
				Simulated	Observed
06/30/96	-26.5	**26.5**	-20.5	89.1	112
07/01/96	**-14.9**	**17.0**	**-3.6**	107.9	112
07/02/96	**-10.8**	**16.0**	**0.3**	114.4	114
07/03/96	**-3.3**	**15.1**	**10.8**	159.6	144
07/04/96	**-6.5**	**12.2**	**8.3**	125.6	116

For this episode, Base 6 model performance is also slightly better than was seen with Base 5. Bias and gross error are reduced on all days except for the ramp-up day 6/30 (no change) and on 7/4, where bias and gross error increased slightly. For every day except 6/30, domain-wide peak modeled ozone was reduced by a small amount (up to 2.3 ppb).

Overall, Base 6 model performance is nearly identical to that of Base 5, with slightly improved bias and gross error, and slightly lower modeled peak ozone concentrations. Additional model performance information for the Base 6 base case, including time series plots, is available from the Commission upon request.

3.9.2 The 2007g and 2007h future bases

After determining that the Base 6 base case exhibited acceptable model performance, Commission staff then applied the same growth factors to the new construction equipment emissions as were used in Base 5, and applied the same controls as in the 2007f future base to create the 2007g future base. Table 3.9-4 gives a comparison of the 1996 Base 6 emissions with the 2007d future base emissions by category for the July 3 episode day.

Table 3.9-4: Comparison of 1995 Base 6 and 2007g Future Base Emissions by Category in the DFW 4-county Area for July 3, 1996

Category	NO_x (tons/day)		VOC (tons/day)	
	Base 6	2007g future base	Base 6	2007g future base
On-road mobile sources	322.4	207.9	234.7	135.4
Area/Non-road mobile sources	132.9	145.3	290.3	301.8
Point sources	99.4	98.7	29.0	29.1
Biogenic sources	26.6	26.6	257.9	257.9
Total	581.3	478.5	811.9	724.2

As was the case with the 2007d future base, the 2007g future base case represents a substantial reduction of both VOC and NO_x from the 1995/96 base cases. However, it is worth noting that the Area/Non-road mobile sources show relatively more growth than was seen previously (see Table 3.8-4). This change is due to the new inventory allocating much more construction activity to the fast-growing counties of Denton and Collin, which causes the overall construction inventory to grow faster than previously.

As before, peak predicted ozone concentrations are seen to decrease significantly from the base cases before applying any additional controls, with only one day exhibiting modeled concentrations above the NAAQS of 125 parts/billion. Table 3.9-5 compares peak 2007 ozone predictions with the base case modeled concentrations for the three primary episode days. Modeled concentrations are seen to be slightly lower than those seen in Table 3.8-5, which shows peak modeled ozone for both the Base 5 base case and the 2007d future base. Most significantly, the July 3 peak dropped from 147.4 ppb with the 2007d future base to 143.5 ppb with the 2007g future base.

Table 3.9-5. 2007 Future Base Peak Ozone Predictions (Compared with Base Case) in ppb

Episode Date	Measured Peak Ozone	Base 6 Simulated Peak Ozone	2007g Future Base Simulated Peak Ozone
6/21/95	144	132.7	120.3
6/22/95	135	137.4	124.5
7/3/96	144	159.6	143.5

Because the 2007g future base is very similar to the 2007d future base, commission staff concluded that additional directional guidance modeling was unnecessary.

After running one control strategy (D43) using the 2007g future base, an additional change was made which resulted in yet another future base. Because of comments related to the assumptions made in modeling SB766, these reductions were removed from the future base, called 2007h. The 2007h future base also replaces the 30% NO_X reduction assumed for EGFs in western Texas with a 24% reduction which is based on the system cap provided for in SB 7. An additional minor fix was made to the construction emissions to include some source categories which had been dropped during processing (~1 ton/day of NO_X). Note that the 2007h future base was run only as part of control strategies D44 through D47, but was not run individually.

Finally, one additional strategy was run with an unnamed future base. In Strategy D48, the Tier 2/low sulfur reduction factors for on-road mobile sources were revised as shown in Table 3.9-6 below. The revised factors were developed using the Tier 2 spreadsheet model recently released by EPA, and are discussed further in Appendix T.

Table 3.9-6: Revised Tier 2/Low Sulfur reductions

	Tier 2/ Low Sulfur Reduction			
	NO_X		VOC	
Region	Previous	Current	Previous	Current
Dallas and Tarrant Counties	.880	.877	.941	.939
Collin and Denton Counties	.863	.917	.934	.955
Rural Counties	.820	.917	.904	.960

3.9.3 Control strategy modeling with the 2007g and 2007h future bases

Table 3.9-7 describes the controls applied in Strategies D43 through D48, and lists the July 3 peak modeled ozone concentration for each strategy.

Table 3.9-7: Control Strategies Modeled with the 2007g and 2007h Future Bases

		Future Base:	**2007g**	**2007h**				**N/A**
		Control Strategy:	**D43[1]**	**D44**	**D45**	**D46**	**D47**	**D48**
Emission Control Options	Point Sources	Tier 2 point source NO_X reduction	4[2]	4[3]	4[4]	4[3]	4[3]	4[3]
		Regional Cement Kiln Regulations	C	C	C	C[5]	C	C[5]
		Building Code Modifications	4	4	4	4	4	4
	On-Road Mobile	Acceleration Simulation Mode (ASM)	9	9	9	9	9	9
		On Board Diagnostics (OBD)	9	9	9	9	9	9
		California Diesel fuel (on-road)	9	9	9	9	9	9
		Reduce 65, 70 mph speed limits by 5 mph	9	9	9	9	9	9
		Remote Sensing	9	9	9	9	9	9
		Transportation Control Measures (TCMs)	4	4	4	4	4	4
		Vehicle Recycling Program (VRP)	9	9	9	9	9	9
		California Low Emission Vehicles	S	S	S	S	S	
	Non-road mobile sources	Construction Equipment 10:00 AM Start	4	4	4	4		4
		California Diesel	9	9	9	9	9	9
		Accelerated Tier 3 Equip. Replacement	4	4	4	4	4	4
		Electrify Airport Ground Service Equipment	4	4	4	4	4	4
		Low NOx Water Heaters	S	S	S	S	S	S
		Voluntary Mobile Emissions Prog. (VMEP)	9	9	9	9	9	9
		California Spark Ignition Rules	9	9	9	9	9	9
July 3 Peak Modeled Ozone (no bias adjustment)			130.7	131.0	131.5	131.0	131.4	131.4

Notes for Table 3.9-7

1. Controls in Strategy D43 are the same as in Strategy D42, except new future base
2. Key to geographic regions:
   4 - Four county DFW nonattainment area,
   9 - DFW CMSA minus Henderson, Hood, and Hunt counties,
   C - Counties in central and eastern Texas,
   S - Statewide
3. Garland and Denton EGFs changed from 70% reduction to 0.06 lbs/MMBtu
4. Texas Utilities sources modeled at 33 tons/day
5. Regional cement kiln rule was revised to limit NO_X emissions to 4 lbs/ton of clinker (instead of 6 lbs/ton) for wet kilns.

Notes for specific control strategies:

Strategy D43 is identical to Strategy D42, but using a future base incorporating the revised construction equipment emissions. Peak modeled ozone on July 3 dropped from 134.9 ppb to 130.7 ppb using the revised emissions.

Strategy D44 is nearly identical to Strategy D42, but using the 2007h future base (no reductions assumed for SB 766, minor correction to construction equipment emissions). Only control strategy change is that Garland and Denton EGF's are now modeled at 0.06 lbs/MMBtu instead of at 70% reduction.

Strategy D45 is the same as Strategy D44, but with emissions at Texas Utilities sources in the four nonattainment counties modeled at 33 tons/day (instead of 0.033 lbs/MMBtu, which is about 14 tons/day).

Strategy D46 is the same as Strategy D44, but with wet cement kilns in central and eastern Texas limited to 4 lbs. of NO_X per ton of clinker produced, rather than 6 lbs. of NO_X per ton (as had previously been assumed). This modification reflects a change in the proposed rule.

Strategy D47 is the same as Strategy D44, but without the delayed construction start. With the improved construction equipment inventory, the construction delay is seen to reduce peak ozone of July 3 from 131.4 ppb to 131.0 ppb.

Strategy D48 is the same ad D46, except California LEV is replaced by revised federal Tier 2/Low sulfur. Note that the change in peak predicted ozone from Strategy D46 to D48 (.4 ppb) is primarily due to the change in the Tier 2/Low sulfur assumptions, *not* merely to replacing Cal LEV with Tier 2/Low sulfur.

3.10 MODELING USING THE BASE 6a BASE CASE

Another significant improvement to the modeling inventory was completed late in the SIP development process, necessitating the development of one additional base case. The Base 5 base case incorporated new emissions for the DFW International Airport, as provided by the airport staff. These new emissions included 15.08 tons/day of NO_X and 2.26 tons/day of VOC from airport ground-support equipment. Although these emissions appear quite large, they were developed by the airport staff using EPA-approved methodology and were accepted by the commission for use in the attainment demonstration modeling. Subsequent to the original SIP proposal, the Airline Transport Association (ATA) conducted a bottom-up inventory of airport ground-support equipment in the area. The DFW International Airport emissions for NO_X and VOC provided by the ATA were, respectively, 6.61 tons/day and 4.68 tons/day, including buses which operate exclusively on airport property.

After carefully reviewing the ATA methodology and consulting with EPA Region VI, the commission concluded that the ATA emissions provided a more accurate estimate of actual emissions than did the values used previously. A new base case, Base 6a, was created to incorporate this inventory improvement. A discussion of the methods used to develop these latest airport ground-support equipment emissions is provided in Appendix W.

About this same time, commission staff developed a minor revision to the construction equipment emissions introduced in Base 6. This revision used survey-generated operational data instead of default values contained in EPA's prototype NONROAD model, and added 3.3 tons/day of NO_X and 0.5 tons/day of

VOC to the construction equipment emissions (see Appendix V for details). Base 6a also includes this inventory upgrade.

3.10.1 The Base 6a base case

Table 3.10-1 provides a comparison of emissions by category for July 3, 1996, between the Base 6 and Base 6a modeling inventories. As was the case with Base 6, the only changes seen are in the area/non-road category.

Table 3.10-1: Comparison of Base 6 and Base 6a Emissions by Category in the DFW 4-county Area for July 3, 1996

Category	NO_x (tons/day)		VOC (tons/day)	
	Base 6	Base 6a	Base 6	Base 6a
On-road mobile sources	322.4	322.4	234.7	234.7
Area/non-road mobile sources	132.9	123.3	290.3	293.4
Point sources	99.4	99.4	29.0	29.0
Biogenic sources	26.6	26.6	257.9	257.9
Total	581.3	571.7	811.9	815.0

The observant reader may notice that the change in NO_X emissions from Base 6 to Base 6a is larger than would be expected from the modifications to airport ground support equipment and construction emissions described above. The discrepancy arises from an error made originally in the Base 5 base case, wherein the projected 2007 airport emissions (19.6 tons/day) were used instead of the 1996 emissions (15.1 tons/day). This error did not affect control strategy modeling, since all scenarios built on the Base 5 and Base 6 base cases assumed 100% ground support equipment electrification.

The commission once again re-evaluated the model performance for the new base case. Model performance statistics for the two episodes are tabulated below in Tables 3.10-2 and 3.10-3. Values within EPA-recommended ranges are shown in **bold**. Note that although statistics are included for June 21, 1995 and June 30, 1996, these days are only used to “ramp-up” the model, and are not expected to exhibit good performance.

Table 3.10-2. CAMx DFW Base 6a Ozone Performance Statistics for June 18 – 22, 1995 Episode.

Episode Date	Normalized Bias (±5–15%)	Normalized Gross Error (30–35%)	Unpaired Peak Accuracy (±15–20%)	Domain-wide Peak Ozone (ppb)	
				Simulated	Observed
06/18/95	-27.4	**28.1**	**-4.7**	73.4	77
06/19/95	**0.7**	**8.1**	**-2.5**	110.1	113
06/20/95	**-8.1**	**12.8**	**7.9**	128.4	119
06/21/95	**-10.1**	**12.2**	**-7.8**	132.8	144
06/22/95	**-8.8**	**12.5**	**1.9**	137.6	135

For is episode, model performance is nearly identical with Base 6. On the primary episode days June 21 and 22, 1995, modeled peak ozone increased by .1 and .2 ppb, respectively. Both model bias and gross error increased by .1% on June 21, and were both unchanged on June 22. On the remaining days, model predictions were slightly lower, with the largest change seen on June 19 where peak predicted ozone dropped by .9 ppb.

Table 3.10-3. CAMx Base 6a Ozone Performance Statistics for June 30 – July 4, 1996 Episode.

Episode Date	Normalized Bias (±5–15%)	Normalized Gross Error (30–35%)	Unpaired Peak Accuracy (±15–20%)	Domain-wide Peak Ozone (ppb)	
				Simulated	Observed
06/30/96	-26.4	**26.4**	-21.2	88.3	112
07/01/96	**-14.9**	**17.0**	**-3.6**	108.0	112
07/02/96	**-10.8**	**16.1**	**0.3**	114.3	114
07/03/96	**-3.4**	**15.0**	**10.5**	159.2	144
07/04/96	**-6.6**	**11.9**	**7.8**	125.0	116

For this episode, model performance is again very similar to that seen in Base 6. On the primary episode day July 3, the modeled peak decreased by .4 ppb, and bias increased by .1ppb. However, gross error declined by .1 ppb. On the remaining episode days, modeled peak ozone dropped slightly, except for July 1 where the modeled peak increased by .1 ppb.

Overall, Base 6a model performance is nearly identical to that of Base 6, with a general tendency to reduce peak ozone by a fraction of a ppb. All model performance statistics are nearly identical with those seen in Base 6. Additional model performance information for the Base 6a base case, including time series plots, is available from the Commission upon request.

3.10.2 The 2007i, 2007j and 2007k future bases

After determining that the Base 6a base case exhibited acceptable model performance, Commission staff then applied growth factors to the revised inventory to create the 2007i future base. The growth factors used were the same as those used previously, with the exceptions of point sources and the newly-revised airport ground support equipment. In the latter case, projected 2007 emissions were supplied directly by the ATA, and are documented in Appendix W.

Regarding point sources, EPA Region VI had expressed concerns that the growth methodology used previously did not sufficiently account for banked (or bankable) emissions. Staff at Region VI developed a growth methodology based on the observed emission trends described in Appendix F. The methodology itself is documented in Appendix U. The growth factors supplied by Region VI were used to develop the 2007i future base, and are shown below in Table 3.10-4.

Table 3.10-4: Growth factors used to develop the 2007i future base

Region	Annual Growth Rate (%)	1996-2007 Growth Factor
Houston/Galveston	+0.002179	1.0002
Beaumont/Port Arthur	-0.1035	0.989
Dallas/Fort Worth	+0.01557	1.002
Central and Eastern Texas	+0.01808	1.002

As before, these growth factors were applied only to non-EGF sources in the DFW nonattainment counties and in Central and Eastern Texas. However, a revision to the proposed rule language caused a change to the way that the nonattainment area EGF sources are modeled in 2007. The current proposal allows each system to have an emission cap based on the highest 30-day moving average heat input which occurred during the three years 1996, 97, and 98. This significantly increased emissions in the future base, but not necessarily in the control strategies.

Additional changes to the 2007i future base included:

- Incorporation of the revised Tier 2/Low sulfur reductions introduced in Strategy D48.
- Include reductions from Agreed Orders at Texas Eastman and ALCOA facilities.
- Corrected an error in on-road mobile source emissions. The NCTCOG had inadvertently applied reductions for congestion mitigation twice in the four nonattainment counties. This change increased on-road NO_X emissions by 1% and VOC emissions by 1.9%.
- Minor corrections to stack parameters of five stacks not originally included in the 1995/96 modeling inventory.
- Missouri was removed from the states receiving reductions due to the NO_X SIP call.

After two strategies were run with the 2007i future base, one additional modification were made to create the 2007j future base. This change increased emissions at the ALCOA facility to their allowable under the

Agreed Order (30% reduction from 1997 emissions). This change was made in response to comments received, and also to be consistent with the way the EGFs in Central and Eastern Texas were modeled.

Table 3.10-5 shows emissions for the Base 6a base case and the 2007j future base.

Table 3.10-5: Comparison of 1996 Base 6a and 2007j Future Base Emissions by Category in the DFW 4-county Area for July 3, 1996

Category	NO_x (tons/day)		VOC (tons/day)	
	Base 6a	2007j future base	Base 6a	2007j future base
On-road mobile sources	322.4	216.1	234.7	135.8
Area/Non-road mobile sources	123.3	136.5	293.4	304.4
Point sources	99.4	121.3	29.0	29.8
Biogenic sources	26.6	26.6	257.9	257.9
Total	571.7	500.4	815.0	727.8

As was the case with the 2007d future base, the 2007j future base case represents a substantial reduction of both VOC and NO_x from the 1995/96 base cases. However, it is worth noting that the Area/Non-road mobile sources show relatively more growth than was seen previously (see Table 3.8-4). This change is due to the new inventory allocating much more construction activity to the fast-growing counties of Denton and Collin, which causes the overall construction inventory to grow faster than previously.

As seen with previous future bases, peak predicted ozone concentrations decrease significantly from the base case before applying any additional controls, with only one day exhibiting modeled concentrations above the NAAQS of 125 parts/billion. Table 3.10-6 compares peak 2007 ozone predictions with the base case modeled concentrations for the three primary episode days.

Table 3.10-6. 2007 Future Base Peak Ozone Predictions (Compared with Base Case) in ppb

Episode Date	Measured Peak Ozone	Base 6a Simulated Peak Ozone	2007j Future Base Simulated Peak Ozone
6/21/95	144	132.8	121.1
6/22/95	135	137.6	126.1
7/3/96	144	159.2	144.2

Like the 2007h future base, the 2007j future base is also very similar to the 2007d future base. Again, commission staff concluded that additional directional guidance modeling was unnecessary.

After modeling one control strategy using the 2007j future base, one final minor correction was made to the 2007 future base point source emissions. Emissions for the Mountain Creek Unit 3 electric generation facility in Dallas County had originally been added to the future base at a nominal emission rate when it was discovered that this source was not present in the commission's Point Source Database for the years 1996-98. (although it was listed in the Acid Rain Program Data Base). The 2007k future base was developed to replace the nominal emissions from this source with its peak 30-day average value (the same as the other sources in the DFW area). Because this correction was made very late in the attainment demonstration modeling process, the 2007k future base was not modeled except as part of the D_{ATT} control strategy. Table 3.10-7 shows the emissions from the 2007k future base compared with the Base 6a base case emissions.

Table 3.10-7: Comparison of 1996 Base 6a and 2007k Future Base Emissions by Category in the DFW 4-county Area for July 3, 1996

Category	NO_x (tons/day)		VOC (tons/day)	
	Base 6a	2007k future base	Base 6a	2007k future base
On-road mobile sources	322.4	216.1	234.7	135.8
Area/Non-road mobile sources	123.3	136.5	293.4	304.4
Point sources	99.4	123.2	29.0	30.1
Biogenic sources	26.6	26.6	257.9	257.9
Total	571.7	499.4	815.0	728.2

3.10.3 Control Strategy Modeling with the 2007i, 2007j and 2007k future bases

Table 3.10-8 shows the control strategies modeled with the 2007i, 2007j and 2007k future bases, including Strategy D_{ATT} which provides the basis for the attainment demonstration.

Table 3.10-8: Control Strategies Modeled with the 2007i, 2007j and 2007k Future Bases

		Future Base:	**2007i**			**2007j**	**2007k**
		Control Strategy:	**D49**	**D50**	**D51**	**D52**	**D_{ATT}**
Emission Control Options	Point Sources	Tier 2 point source NO_X reduction	4[1,2]	4[2]	4[3]	4[4]	4[5]
		Regional Cement Kiln Regulations	C[6]	C[6]	C[6]	C[6]	C[6]
		Building Code Modifications[7]					
	On-Road Mobile	Acceleration Simulation Mode (ASM)	9	7	7	7	9
		On Board Diagnostics (OBD)	9	7	7	7	9
		California Diesel fuel (on-road)	9	9	9	9	9
		Reduce 65, 70 mph speed limits by 5 mph	9	9	9	9	9
		Remote Sensing	9	7	7	7	9
		Transportation Control Measures (TCMs)	4	4	4	4	4
		Vehicle Recycling Program (VRP)[8]					
		Voluntary Mobile Emissions Prog. (VMEP)[9]	9	9	9	9	9
		California Low Emission Vehicles					
	Non-road mobile sources	Construction Equipment 10:00 AM Start	4	6	6	6	4
		California Diesel	9	9	9	9	9
		Accelerated Tier 3 Equip. Replacement	4	6	6	6	4
		Electrify Airport Ground Service Equipment	4	4	4	4	4
		Low NOx Water Heaters	S	S	S	S	S
		Voluntary Mobile Emissions Prog. (VMEP)[9]	9	9	9	9	9
		California Spark Ignition Rules	9	9	9	9	9
July 3 Peak Modeled Ozone (no bias adjustment)			131.5	131.7	131.7	131.7	131.5

1. Notes on following page.

Notes for Table 3.10-8

1. Key to geographic regions:
   4 - Four county DFW nonattainment area,
   9 - DFW CMSA minus Henderson, Hood, and Hunt counties,
   7 - DFW CMSA minus Henderson, Hood, Hunt, Parker and Johnson counties,
   6 - DFW CMSA plus Parker and Johnson counties only,
   C - Counties in central and eastern Texas,
   S - Statewide
2. Tier 2 point source controls were modified from Strategy D48 as follows:
   Denton EGF's NO_X emissions were reduced 78% from the new future base level.
   Garland EGF's NO_X emissions were reduced 79% from the new future base level.
   Remaining DFW area EGF's NO_X emissions were reduced 88% from new future base level.
3. Added 2.4 tons/day of NO_X emissions to non-municipally owned EGFs.
4. Tier 2 point source controls were modified from Strategy D48 as follows:
   Denton EGF's NO_X emissions were reduced 86% from the new future base level.
   Garland EGF's NO_X emissions were reduced 72% from the new future base level.
   Remaining DFW area EGF's NO_X emissions were reduced 89% from new future base level.
5. Tier 2 point source controls were modified from Strategy D52 as follows:
   Non-Acid Rain sources in Garland and Denton systems were reduced 79% from future base level
   A processing error which had left Handley Unit 5 uncontrolled previously, was corrected.
   A processing error which had uncontrolled the new EGF in Collin County, was corrected.
   Control the Mountain Creek Unit 3 boilers that were added/corrected in the 2007k future base.
6. Cement kilns are now modeled at either 30% reduction or (4 lbs/ton of clinker for wet kilns, 2.8 lbs/ton for dry kilns), whichever allows higher emissions.
7. Building code modifications are no longer explicitly modeled, but will be included as Weight-of-Evidence.
8. Vehicle recycling now assumed to be part of VMEP.
9. VMEP is now divided between on-road and non-road emissions (60/40 split)

Notes for specific control strategies:

Strategy D49 incorporates a number of changes from the previous strategy, besides the changes already incorporated into the 2007i future base. These changes include modifications to controls to EGFs in the four nonattainment counties and to the regional cement kiln rule. Additionally, the building code modifications were removed from the modeling (they will be described in the Weight-of-Evidence section), vehicle recycling is now assumed to be a part of the VMEP, and the VMEP has been distributed over both on-road and non-road mobile sources.

Strategy D50 removes Johnson and Parker counties from the I/M controls (ASM, OBD, remote sensing) and instead includes them in the delayed construction start and accelerated Tier 3 equipment rules.

Strategy D51 is like D50, but allows an additional 2.4 tons/day from non-municipal utility sources in the four-county nonattainment area.

Strategy D52 is a minor revision of Strategy D51, based on the 2007j future base. It adjusts EGU reductions in the four-county nonattainment area to reflect the final rule language.

Strategy D_{ATT} is similar to Strategy D52, but uses the 2007k future base. It adds Parker and Johnson counties back into the I/M program, and removes the delayed construction start and accelerated Tier 3 equipment purchase. This strategy also makes a very minor adjustment to the way that non-Acid Rain EGF sources in the Garland and Denton utility systems were controlled. These seven units are now reduced by 79% each. It also corrects a processing error which had left a Tarrant County EGF (Handley Unit 5) at its uncontrolled 2007 level. Emissions from this unit are now correctly reduced by 89%. Additionally, a processing error which had applied negative control to the new EGF in Collin County, was corrected to apply no control. Finally, the Mountain Creek Unit 3 boilers, which were modeled at the correct peak 30-day average NO_X emissions rate in the 2007k future base, were also controlled. This run provides the basis for the attainment demonstration.

3.10.4 Summary of Strategy D_{ATT} Modeling

Table 3.10-9 summarizes the controlled inventory for strategy D_{ATT}.

Table 3.10-9: Comparison of 2007k Future Base and Strategy D_{ATT} Emissions by Category in the DFW 4-county Area for July 3, 1996

Category	NO_x (tons/day)		VOC (tons/day)	
	2007k future base	Strategy D_{ATT}	2007k future base	Strategy D_{ATT}
On-road mobile sources	216.1	164.3	135.8	107.6
Area/Non-road mobile sources	136.5	106.6	304.4	285.0
Point sources	123.2	23.4	30.1	30.1
Biogenic sources	26.6	26.6	257.9	257.9
Total	499.4	320.9	728.2	680.6

Table 3.10-10 shows the final modeled peak ozone concentrations for each of the three primary episode days with Strategy D_{ATT}. Also included are results from the base case and 2007j future base (2007j is included for comparison, although Strategy D_{ATT} was actually built from the 2007k future base, which was not modeled directly). Although the peak concentration on July 3 is still above the standard if 125 ppb, the peaks for the two other days are well below the standard. The Weight-of-Evidence analysis in Section 6.3 will provide a convincing demonstration that the controls in Strategy D_{ATT} will be sufficient to bring the area into attainment by 2007.

Table 3.10-10 2007 Strategy D_{ATT} Peak Ozone Predictions (Compared with base case and future base) ppb

Episode Date	Measured Peak Ozone	Base 6a Simulated Peak Ozone	2007j Future Base Simulated Peak Ozone	Strategy D_{ATT} Simulated Peak Ozone
6/21/95	144	132.8	121.1	110.3
6/22/95	135	137.6	126.1	113.1
7/3/96	144	159.2	144.2	131.5

Figure 3.10-1 at the end of this chapter shows three ozone isopleth plots for each of the three primary episode days. For each day, base 6a, future base 2007j, and control strategy D_{ATT} are plotted. These figures illustrate graphically the reductions in area and intensity of modeled ozone due to the controls modeled. It is evident that the modeling forecasts a tremendous air quality benefit for the citizens of northern Texas.

Conclusions of the Phase II Ozone Modeling:

- Transport of ozone and precursors from the HGA area will affect the ability of the DFW area to attain the ozone standard.
- A large portion of the ozone precursors are locally generated, and therefore substantial local controls will be required to meet the ozone standard.
- The DFW 4-county area will still be NO_x limited in 2007, therefore a NO_x control strategy is required to bring the area into attainment. However, a combined VOC/NO_x strategy is more effective than a NO_x-only strategy.
- The most effective control package will involve substantial NO_x reductions applied to the mobile and area portions of the emissions inventory.
- Weight-of-Evidence analysis presents a compelling argument that the area will reach attainment by 2007. In fact, the predicted future design value of the area is substantially below 125 ppb, indicating that the area may actually achieve air quality better than that required under the FCAA.

CHAPTER 4: DATA ANALYSIS

Analysis of Impact of Houston Emissions on DFW
A considerable body of evidence has been developed which shows that emissions from HGA affect the DFW area. The most compelling evidence of transport is based on some special modeling runs where we removed all the anthropogenic emissions from the Houston 8-county area to see what difference it would make in the two Dallas episodes. From these HGA-Zero Out runs we see that if HGA emissions are removed from the model, significant ozone reductions occur in a plume downwind of the HGA area.

- During the 1995 DFW episode, the ozone reduction plume impacts the Austin area by more than 10 ppb. The largest ozone reductions from this HGA-Zero Out run occurs in the afternoon when ozone is normally at a maximum.

- During the 1996 DFW episode, the ozone reduction plume impacts the Tyler-Longview area by more than 10 ppb. The largest ozone reductions from this HGA-Zero Out run occurs in the afternoon, when ozone is normally at a maximum.

- A special episode was created with synthetic winds to carry the HGA plume directly towards the DFW area. With the synthetic wind package, the ozone reduction plume impacts the DFW area by 5 ppb during the evening and morning hours, and by 10 ppb during the afternoon when ozone is at a maximum.

- Modeling with CAMx and Ozone Source Apportionment Technology (OSAT) analysis during the 1996 episode shows that 3-6 ppb of the Dallas ozone comes from HGA sources.

Supplementary evidence that emissions from Houston affect the DFW area has also been developed. Some of this evidence comes from surface winds and trajectory data, and some comes from satellite and aircraft measurements.

- Back trajectories calculated from wind flow during ozone episodes imply that parcels and pollution are carried from Houston. Our analysis shows that more than 13 percent of the high ozone days have back trajectories that pass near or through the HGA area.

- Review of the DFW back trajectories indicates parcels that pass closer to Houston have higher ozone, and that this relationship is statistically significant ($p=.0001$).

- Actual measurements from satellite and aircraft missions provide strong evidence of the existence of an urban ozone plume downwind of the Houston area.

- During ozone episodes, surface wind directions in the DFW area shift to a more southeasterly direction, which implies contributions from both the lignite belt and Houston.

Conclusions:

- The HGA urban plume does on occasion contribute to the high ozone that occurs in the DFW area.

- The HGA urban plume is transported to other areas in Texas and adds to the background concentrations.

Graphic images which illustrate the results of the modeling test can be found in Appendix N

CHAPTER 5: RATE OF PROGRESS

(No additions or revisions)

CHAPTER 6: REQUIRED CONTROL STRATEGY ELEMENTS

Table 6-1 shows the emission reduction estimates projected from implementation of federal, state, and local initiatives.

Table 6-1 DFW NO_x Reduction Estimates[1]

July 3, 1996 Base Case Emissions Inventory	1996 Base Case 6a (tpd)	Percent of 1996 Total	2007j Future Base[2]	2007 Future Control Strategy D_{ATT} (tpd)	Percent of 2007 Total
Area and Non-road sources	132.9	23%	136.5	106.6	33%
Point sources	99.4[2]	17%	121.3[3]	23[4]	7%
On-road mobile sources	322.4	55%	216.1	164.3	51%
Biogenic sources	26.6	5%	26.6	26.6	8%
TOTALS	**581.3**		**500.5**	**320.6**	

[1]see Chapter 3, Section 3.10
[2] utility emissions portion of emissions total is based on 7/3/96 episode day
[3] utility emissions portion of emissions total is based on highest 30-day average emissions over 3rd quarter 1996-98, with growth projection to 2007 and previously adopted 30 TAC §117.105 electric utility RACT controls applied.
[4] reductions applied from 30 TAC §117.106 (electric utility) and §117.206 (industrial/commercial/institutional) emissions specifications for attainment demonstration

EPA-ISSUED RULES	Estimated NO_x Reductions in 2007 (tpd)
Federal on-road measures: *Federal Phase II RFG *Tier II vehicle emission standards and federal low sulfur gasoline *NLEV *Heavy-duty diesel standards	93
Federal off-road measures: *Lawn and garden equipment *Tier III heavy-duty diesel equipment *Locomotives *Compression ignition standards for vehicles and equipment *Spark ignition standards for vehicles and equipment *Recreational marine standards	48

TNRCC-ISSUED RULES	**Estimated NO_x Reductions in 2007 (tpd)**
Major Point Source NO_x reductions in 4 counties*	129
I/M (ASM, OBD, and remote sensing in 9 counties)	54.45
Low Emission Diesel in 9 counties	3.48
Heavy-duty Diesel Operating Restriction in 4 counties	The emissions of about 7.1 tons of NO_x are shifted to later in the day (this equates to approximately 2.5 tpd reduced)
Accelerated Purchase of Tier II/III Non-Road Compression Ignition Equipment in 4 counties	13.8
Airport GSE Electrification in 4 counties	9.54
Heavy Equipment Fleets -Gasoline in 9 counties	1.8
Gas-fired Water Heaters, Small Boilers, and Process Heaters (statewide rule)	.5

DFW LOCAL INITIATIVES	**Estimated NO_x Reductions in 2007 (tpd)**
Speed Limit Reduction in 9 counties	5.42
VMEP in 9 counties	2.40 - 5.40
TCMs in 4 counties	4.73

*Major source NO_x reductions from: Title 40 Code of Federal Regulations Part 75 (40 CFR 75) affected utility boilers (126.2 tpd); non- 40 CFR 75 utility boilers (1.3 tpd); and industrial/commercial/ institutional sources (1.6 tpd).

6.1 VOC RULE CHANGES

The commission is not proposing any rules at this time that specifically target VOC sources. However, through some of the strategies proposed the DFW area will see reductions in both VOC and NO_x.

6.2 NO_x RULE CHANGES

In its effort to ensure that the SIP strategies impose no more burden than necessary to protect health and welfare, the commission has decided not to include the counties of Hunt, Hood, and Henderson as affected counties due to their limited impact on the air quality within the DFW nonattainment area. Due to the relatively low population, percentage of commuters, and growth rate of these counties the commission has reevaluated the need for implementing control strategies in these three counties. The reevaluation included new photochemical modeling runs which applied the strategies in the nine remaining counties only. The results of these runs indicated a minor impact of including Hunt, Hood, and Henderson counties but also showed that the area could demonstrate attainment of the NAAQS without those reductions in emissions. However other control measures which were proposed for these counties do have measurable benefits for attainment of the NAAQS.

6.2.1 Ground Support Equipment Electrification

This strategy would affect owners or operators of ground support equipment at airports in Collin, Dallas, Denton, and Tarrant counties with more than or equal to 100 air carrier operations per year (excluding general aviation operations, non-fixed wing aircraft operations, and military operations) averaged over a three-year period.

The rule requires owners or operators of the affected ground support equipment to ensure that their ground support equipment fleet be electric-powered or else utilize alternative emission reduction measures to reduce NO_x emissions by 90% by the end of 2005. This rule will result in a 9.54 tpd reduction in NO_x. The commission believes that this will remove NO_x emissions which will help the DFW area reach attainment for ozone. The rule has a provision allowing for other means to meet the reduction requirements.

6.2.2 Speed Limit Reduction Measure

Substantial emissions reductions can be achieved by implementing a 5 mph reduction in maximum speed limits on all roadways in the 9-county area with current posted speeds of 70 and 65 mph. Beginning September 1, 2001, speed limits on roadways with a current maximum speed limit of 70 mph will be reduced to 65 mph, while speed limits on roadways with a current maximum speed limit of 65 mph will be reduced to 60 mph. This measure will reduce NO_x emissions by at least 5.42 tpd and VOC emissions by at least 0.55 tpd in the 9-county area.

The reduced speed limit measure is based on vehicle emission information from EPA's MOBILE5 model. The MOBILE5 model calculates emissions in grams per mile and indicates that vehicles produce more NO_x emissions per mile at higher speeds. If the speed is multiplied by the emission rate, emissions in grams per hour can be calculated, which indicate that vehicles operating at higher speeds emit more NO_x and VOC per hour (see table below). Example MOBILE5a_H 2007 DFW composite emission rates for VOC and NO_x at various speeds and the resulting emissions per hour are as follows:

SPEED	VOC Emission Rate (g/mile)	VOC (g/hr)	NO_x Emission Rate (grams per mile)	NO_x (g/hr)
30 mph	0.69	20.7	1.17	35.1
35 mph	0.62	21.7	1.18	41.3
40 mph	0.57	22.8	1.19	47.6
45 mph	0.52	23.4	1.22	54.9
50 mph	0.50	25	1.30	65
55 mph	0.49	26.9	1.49	81.9
60 mph	0.52	31.2	1.69	101.4
65 mph	0.56	36.4	1.91	124.1

Composite emission rates are an average rate that accounts for the area's vehicle fleet composition (cars, gas trucks, heavy duty diesel trucks etc.) and age distribution (% of fleet that is 1 year old, 2 years old etc.). The emission rates listed here are for vehicles that participate in the Texas Motorist's Choice inspection and maintenance program, so the rates are generally reflective of rates for properly running cars.

The emissions reductions were calculated using NCTCOG's travel/air quality models and EPA's MOBILE5a emissions model. The modeled area encompasses the metropolitan planning area (MPA), which includes Dallas, Tarrant, Collin, Denton, Rockwall counties and part of Parker, Johnson and Ellis counties. Traffic was simulated for an average weekday (which was divided into 5 time periods) and the associated emissions calculated. The base emissions (before speed limits are reduced) were computed for 2007; the resulting emissions were 275.94 tpd NO_x and 111.13 tpd VOC. Speeds were then lowered on all applicable roadway segments, the travel model rerun and the emissions recalculated, resulting in emissions of 270.52 tpd NO_x and 110.58 tpd VOC. The emissions reductions associated with the speed limit reduction measure are the difference between the two analysis scenarios, or reductions of 5.42 tpd NO_x and 0.55 tpd VOC respectively. Two underlying assumptions support the modeled results. These assumptions are: 1) no credit is taken for emissions reductions from vehicles on roadways where the models indicate traffic is moving slower than the reduced speed limit and 2) the modeling assumes that vehicles will travel at speeds ten percent higher than the reduced speed limits. Although emissions reductions were calculated for the MPA, the speed limit reductions will be implemented in the entire 9 county area, resulting in additional emissions reductions that have not been quantified for this SIP.

Speed limit signs will have to be changed in order to implement this measure. The Texas Department of Transportation estimates costs of $300.00 for small sign replacement and $600.00 for large sign replacement. NCTCOG has estimated overall costs for sign replacement to be approximately $2,000,000.

Benefits in addition to emissions reductions will be achieved through implementation of this measure. The severity of traffic accidents will be reduced. Significant fuel savings will also be realized from the speed limit reductions. NCTCOG modeling of the measure indicates a 1.3% reduction in fuel consumption. In

2007, this is equivalent to fuel savings of approximately 92,000 gallons per day and associated cost savings of approximately $110,000 per day.

The Texas Department of Transportation has proposed revisions to the Texas Transportation Code on February 24, 2000 which would establish procedures allowing speed limits to be changed for emissions reductions purposes. The proposed revisions were filed with the Secretary of State on February 28, 2000 and published in the Texas Register on March 10, 2000. The comment period closed on April 10, 2000. The revisions are scheduled to be adopted on either April 27, 2000 or May 25, 2000.

The speed limit reduction measure will be enforced through state and local speed limit enforcement regulations and practices. The commission will work with other state and local agencies to ensure adequate enforcement of this measure.

6.2.3 Heavy Equipment Fleets - Gasoline

The strategy for off-road large spark-ignition engines establishes exhaust emission limitations on engines 25 horsepower and greater for model year 2004 and subsequent engines.. Excluded from this category are engines less than 175 horsepower which are used in construction or farm equipment and vehicles. Also exempt from these standards are: 1) engines operated on or in any device used exclusively upon stationary rails or tracks; 2) engines used to propel marine vessels; 3) internal combustion engines attached to a foundation at a location for at least 12 months; 4) off-road recreational vehicles and snowmobiles; and 5) stationary or transportable gas turbines for power generation.

The exhaust emission standards for off-road large spark-ignition engines set by the State of California are incorporated in the rule. Engines must be certified for use in the State of California prior to being sold or operated in the 9-county DFW area. Engines must also meet the California warranty requirements and manufacturers must take corrective action if an engine recall occurs in California.

EPA's NONROAD model estimates approximately 15,000 off-road large spark-ignition engines in the 9-county in calendar year 2007. The model also estimates approximately 5.9 tpd of NO_x emissions from these sources. Assuming a 10% fleet turnover per year and applying the implementation schedule in the rule, approximately 6,000 of these engines in 2007 would require certification under the new rule. The new standards will provide an estimated 1.8 tpd NO_x reduction.

Environ reports that the cost of compliance per engine is expected to be $100 to $500 depending upon the engine size and typical engine type. The California Air Resources Board estimates the overall cost effectiveness is less than $500 per ton of $HC+NO_x$.

6.2.4 Accelerated Purchase of Tier 2/Tier 3 Non-road Compression-Ignition Equipment

This strategy will affect state and local governments, businesses and private entities in the 4-county area that own or operate non-road equipment powered by compression-ignition engines 50 horsepower and above.

The rule requires the owners or operators to meet the following requirements; for the portion of the fleet with equipment powered by non-road engines in the 50 hp to 100 hp, the owner or operator must ensure that 100% of such equipment will meet Tier 2 standards by the end of the calendar year 2007, for the portion of the fleet in the 100 hp to 750 hp range, the owner or operator must ensure that at least 50% of such equipment meets Tier 3 standards and the remaining meets Tier 2 standards, and finally for the portion of the fleet greater than 750 hp, the owner or operator must ensure that 100% of such equipment meet Tier 2 standards by the end of calendar year 2007. The proposed rule exempts non-road engines used in locomotives, underground mining equipment, marine application, aircraft, airport ground support equipment, equipment used solely for agricultural purposes, emergency equipment, and freezing weather equipment. This rule will result in a 13.8 tpd reduction in NO_x.

More importantly, owners or operators can be exempted from this rule if they submit an emissions reduction plan by May 31, 2002, that the commission approves by May 31, 2003. The plan must describe in detail how the owner or operator will reduce NO_x emissions by June 1, 2005 by an amount equivalent to the total reductions achieved by implementation of this rule. The owner or operator may also choose to be exempted from the Heavy-Duty Diesel Operating Restriction rule as well by submitting an emission reduction plan that details how the owner or operator will reduce NO_x emissions by an amount equivalent to the total reduction achieved by the implementation of this rule and the Heavy-Duty Diesel Operating Restriction rule. Preliminary estimates indicate that implementation of both this rule and the Accelerated Purchase rule will result in a NO_x reduction of approximately 16 tons per day.

6.2.5 Expanded RFG Program

The state evaluated a NO_x control strategy option to implement a state reformulated gasoline (RFG) program requiring gasoline which meets the federal Phase II RFG standards to be implemented in the additional eight counties making up the DFW Consolidated Metropolitan Statistical Area. The additional counties are: Ellis, Henderson, Hood, Hunt, Johnson, Kaufman, Parker, and Rockwall Counties. The state has made the decision not to adopt this control strategy.

The state's decision not to adopt this control strategy is due in part to the concerns over water quality issues associated with the increased use of MTBE anticipated from expanding the RFG program. In its September 15, 1999 report, “Achieving Clean Air and Clean Water: The Report of the Blue Ribbon Panel on Oxygenates in Gasoline,” EPA’s Blue Ribbon Panel on MTBE recognized the potential threat MTBE poses to water quality and recommended that the oxygenate mandate for RFG be removed and that clarification be provided on federal and state authority to regulate and/or eliminate the use of gasoline additives including MTBE. The state supported the Blue Ribbon Panel’s recommendations and understands that these issues are still under discussion. The state will continue to closely monitor developments relating to the MTBE/oxygenate issues. Once these issues have been resolved, the state will reevaluate the necessity for additional gasoline control strategies in the DFW area.

The state's decision not to adopt this control strategy is also based on the EPA's new Federal low sulfur gasoline regulations, which were finalized in December 1999, that require all gasoline, including reformulated and conventional gasoline, to meet a 30 ppm sulfur content standard beginning in 2004. These new federal gasoline rules will result in a low sulfur conventional gasoline that does not have the oxygenate requirement associated with Federal RFG. In addition, since the DFW ozone nonattainment area is required to have three years of emissions monitoring data demonstrating the area's compliance to the NAAQS to support the 2007 attainment demonstration, the implementation of the Federal low sulfur gasoline in 2004 should provide the area the necessary time to allow the results of this program to be realized through emission monitoring data.

6.2.6 Voluntary Accelerated Vehicle Retirement Program

This control strategy is now being included as part of the VMEP Program. Refer to Section 6.2.13 for more information.

6.2.7 Low Emission Diesel (LED) Rules

This strategy will implement a state LED fuel program requiring diesel fuel which may ultimately be used to fuel diesel fueled compression-ignition engines in automobiles, light and heavy duty trucks and buses, and non-road equipment applications in the affected area to meet the LED fuel standards by May 2002. The fuel required by the state LED fuel program will have a lower aromatic hydrocarbon content and a higher cetane number in each gallon of diesel than required by current federal regulations for on-road diesel.

The state LED fuel program will lower NO_x emissions from diesel fueled compression-ignition engines in the affected areas. Because NO_x emissions are precursors to ground-level ozone formation, reduced emissions of NO_x will result in ground-level ozone reductions. By 2007, the state LED fuel program will reduce NO_x emissions in the affected area by 3.48 tpd.

The state LED fuel program will require LED fuel in Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties. The state LED fuel program will require that diesel fuel produced for delivery and ultimate sale to the consumer in the affected area does not contain more than 500 ppm sulfur, have no greater than 10.0% aromatic hydrocarbons by volume, and have a cetane number of 48 or greater. Alternative diesel fuel formulations that achieve equivalent emission reductions may also be used.

The state LED fuel program will require diesel fuel producers and importers that provide fuel to the affected area to register with the commission. In addition, the state LED fuel program will require diesel fuel producers and importers to test fuel samples for compliance and keep records of the test results. Diesel fuel producers and importers will also be required to submit a report on each blend batch and a quarterly summary report of the results from the fuel testing for compliance to the commission. All parties in the fuel distribution system (producers, importers, pipelines, rail carriers, terminals, truckers, and retailers) will be required to keep records of product transfer documents for two years. Retail fuel dispensing outlets will be exempt from all of the state LED fuel program's testing and record keeping requirements except for the keeping of product transfer documents.

SECTION 211(C)(4)(C) WAIVER REQUEST

Section 211(c)(4)(A) of the FCAA prohibits states from prescribing or attempting to enforce any "control or prohibition" of a "characteristic or component of a fuel or fuel additive" if the EPA has promulgated a control or prohibition applicable to such characteristic or component under section 211(c)(1). EPA regulates diesel fuel used in on-road applications in Title 40 CFR Section 80.29. Section 211(c)(4)(C) provides an exception to this prohibition for a nonidentical state standard contained in a SIP where the standard is "necessary to achieve" the primary or secondary NAAQS that the SIP implements. EPA can approve a SIP provision as necessary if the Administrator finds that "no other measures exist and are technically possible to implement, but are unreasonable or impracticable." Therefore, Texas is submitting this revision to the SIP as adequate justification and is requesting a waiver from Section 211(c)(4)(A) of the FCAA from EPA to implement a state LED fuel program in the areas defined in this SIP revision. Texas is requesting this waiver for the state regulation of on-road diesel fuel only since EPA does not regulate diesel fuel used in non-road applications and as such, no waiver is required.

<u>Waiver Requirements for Alternative Fuel Specifications</u>

Under Section 211 (c)(4)(C) of the FCAA, EPA may approve a non-identical state fuel control as a SIP provision, if the state demonstrates that the measure is necessary to achieve the national primary or secondary ambient air quality standard that the plan implements. EPA can approve a state fuel requirement as necessary only if no other measure exists that would bring about timely attainment, or if other measures exist but are unreasonable or impracticable.

If a state decides to pursue a state fuel requirement, the state must submit a SIP revision adopting the state fuel control and apply for a waiver from federal preemption. The state must include in its petition specific information showing the measure is necessary to meet the ozone NAAQS, based on the statutory requirements for showing necessity. The waiver request must:

- Identify the quantity of reductions needed to reach attainment of the NAAQS;
- Identify possible other control measures and the quantity of reductions each would achieve;
- Explain in detail, with adequate factual support, which of those identified control measures are considered unreasonable or impracticable; and
- Show that even with the implementation of all reasonable and practicable measures, the state would need additional emissions reductions for timely attainment, and the state fuel measure would supply some or all of such additional reductions.

<u>Determining Whether Other Measures are Unreasonable or Impracticable</u>

In determining whether ozone control measures are unreasonable or impracticable, reasonableness and practicability are determined in comparison to the state-specific fuel control program.

While the basis for finding unreasonableness or impracticability is in part comparative, the state still must provide solid reasons why the other measures are unreasonable or impracticable and must demonstrate these reasons with adequate factual support. Reasons why a measure might be unreasonable or impracticable for a particular area include, but are not limited to, the following:

- Length of time to implement the measure;
- Length of time to achieve ozone reduction benefits;
- Degree of disruption entailed by implementation;
- Other implementation concerns, such as supply issues;
- Costs to industry, consumers, or the state;
- Cost-effectiveness; and
- Reliance on commercially unavailable technology.

A strong justification for finding a measure unreasonable or impracticable might rely upon the combination of several of these reasons.

THE NEED FOR THE STATE LOW EMISSION DIESEL PROGRAM

The commission has developed a NO_x control strategy consisting of a state LED fuel program that it believes is an essential element in the control strategy package needed for the DFW ozone nonattainment area to be able to demonstrate attainment of the NAAQS. The fuel that is required by the state LED fuel program is a low aromatic hydrocarbon/high cetane diesel fuel which will be required for use by both on-road and non-road diesel fueled compression-ignition engines.

The main attractiveness of the fuel based strategy is that it has a more immediate impact than other controls. Once the fuel is in the marketplace, it begins having an immediate air quality impact as both old and new vehicles and non-road equipment begin using the new fuel.

The fuel required by the state LED fuel program was chosen based upon the following reasons:

- Emissions performance;
- Effect on advanced technology vehicles and engines;
- Impacts on non-road emissions;
- Modeling;
- Distribution;
- Transport; and
- Length of time needed to achieve benefits.

Emissions Performance

State and federal modeling has shown that reductions in NO_x continue to contribute to reductions in ozone. The use of LED fuel will reduce emissions of NO_x from diesel fueled compression-ignition engines in the four county DFW ozone nonattainment area. The LED fuel will help five surrounding counties included within the DFW CMSA as well since travel from and to and through these areas occur on a daily basis. The LED fuel is also beneficial in that NO_x emission reductions will be seen in all diesel fueled compression-ignition engines - both old and new and from on-road and non-road applications.

Effect on Advanced Technology Vehicles and Engines

Through the NLEV program and agreements between the heavy-duty engine manufacturers and EPA, vehicle and engine manufacturers have made a commitment to introduce cleaner vehicles and engines to the nation earlier than what would have been required by the FCAA. The NO_x reductions from this action will not be enough to get Texas where it needs to be in relation to overall air quality. Improvements in diesel fuel quality alone will not be enough. However, an improvement in diesel fuel quality as the result of a state LED fuel program, combined with the advanced vehicle and engine technology, will bring Texas closer to achieving its overall air quality goals.

Impacts on Emissions from On-road Vehicles and Non-road Engines

By 2007, the state LED fuel program will reduce NO_x emissions in the affected area by 3.48 tons per day.

Modeling

The modeling performed by Eastern Research Group (ERG) for this SIP revision assumed that state LED fuel will be similar to California diesel fuel (CA diesel) in terms of the specifications (sulfur content, aromatic content, and cetane). Thus the emission benefits for the state LED fuel (compared to CA diesel) are based upon the switch from current Federal diesel (industry standard) to CA diesel.

CA diesel fuel benefits were evaluated relative to industry average on-road diesel fuel (as provided in EPA's Heavy-duty Engine Working Group (HDEWG) report).

ERG compared the regression equations generated under the HDEWG study with those from the European Auto Oil study. Given similar inputs these models tend to agree in their NO_x predictions, with < 2.0% difference. Selecting the HDEWG model, NO_x reductions are predicted to be 5.7% for on-road engines with electronic controls (i.e., 1990 and later models for the most part). Note that the European Auto Oil equations estimated a 4.1% NO_x reduction for the same engines.

Also note that pre-1990 engine benefits were estimated using CARB test data from 1988. While this data set is thin, it is the only data available for estimating aromatics effects in pre-electronic control engines (estimated at 7% for NO_x). Therefore ERG relied on this estimate for the older portion of the on-road fleet, as well as the entire off-road diesel fleet. Weighting these reductions by the appropriate model year and fuel type fractions yields the following overall adjustment factors for the on-road fleet.

- NO_x in Collin and Denton Counties – 0.985
- NO_x in other seven counties – 0.987

As described in Table 6-1, modeling has indicated that by 2007, the state LED fuel program will reduce NO_x emissions in the affected area by 3.48 tpd. These reductions are necessary for the area to demonstrate attainment with the NAAQS within the time frame prescribed.

Distribution

LED fuel is estimated to cost 4 cents more per gallon than conventional on-road diesel fuel. A single LED fuel for nine counties in the DFW CMSA facilitates distribution. This will create a large enough market to ease the costs of distribution. Supplies can be co-mingled in the pipeline, trading can take place, and tracking compliance will be simplified. The DFW ozone nonattainment area already distributes a federal reformulated gasoline (RFG) and the state LED fuel will require similar distribution procedures.

Transport

Air pollution knows no boundaries. Federal and state studies have shown that pollution from one area can affect ozone levels in another area. Regional air pollution should be considered when studying air quality in Texas' ozone nonattainment areas. This work is supported by the findings of the OTAG study which is the most comprehensive attempt ever undertaken to understand and quantify the transport of ozone. Both the commission and OTAG study results point to the need to take a regional approach to control air pollutants, such as that described in the state LED fuel program which will affect nine counties in the DFW CMSA.

Length of Time Needed to Achieve Benefits

The most important aspect of using the state LED fuel program is that the benefits are seen immediately. Once the state LED fuel program begins, emission reductions begin for both old and new vehicles, as well as from non-road engines that use the fuel. The larger nine county area that the state LED fuel program covers ensures NO_x emission reductions significant enough to have an immediate impact on the air quality in the DFW ozone nonattainment area.

EMISSION REDUCTIONS NEEDED FOR ATTAINMENT OF THE NAAQS

Modeling for the DFW ozone nonattainment area has shown that NO_x emissions need to be reduced as much as 60% in order for the area to achieve attainment with the NAAQS. Modeling has also shown that over 50% of the NO_x emissions come from mobile sources. As such, the control strategy package for the DFW area needs to include strategies that have an immediate impact on mobile sources. The LED fuel program will have an immediate impact. As demonstrated in Table 3.7.1, modeling has indicated that without a state LED fuel program in the proposed nine county area, which by 2007 will reduce NO_x emissions in the affected area by 3.48 tpd, it will not be possible to demonstrate attainment with the NAAQS within the time frame prescribed.

EVALUATION OF OTHER CONTROL MEASURES

The commission has analyzed other control measures for reasonableness and practicability for implementation to meet the attainment deadline. This included evaluating on-road mobile sources, non-road mobile sources, area, and point sources.

The commission, with the assistance of local stakeholder committees, evaluated approximately 375 control measures from 41 separate categories to determine which control strategy packages were reasonable, practicable, and timely to implement. As demonstrated in Table 3.7.1, of the 29 control strategy packages modeled only four were able to demonstrate attainment within the time frame prescribed and the addition of a state LED fuel program was essential for attainment in all of these packages.

CONCLUSIONS
The state LED fuel program will achieve a 3.48 tpd reduction in NO_x emissions and it is a vital component of the overall NO_x emissions reduction strategy for the DFW ozone nonattainment areas. Modeling has shown that without the 3.48 tpd reduction achieved by the state LED fuel program it will not be possible for the DFW ozone nonattainment area to demonstrate attainment with the NAAQS within the time frame prescribed by EPA. Therefore, the commission finds that the state LED fuel program is essential to the timely attainment of the one-hour NAAQS in the DFW ozone nonattainment area. In addition, the commission believes the state LED fuel program will lead to emission reductions in the counties adjacent to the nonattainment area and could facilitate compliance for these counties with the 8-hour NAAQS.

6.2.8 Gas-fired Water Heaters, Small Boilers, And Process Heaters
This statewide rule would reduce NO_x emissions from new natural gas-fired water heaters, small boilers, and process heaters sold and installed in Texas beginning in 2002. The rules would apply to each new water heater, boiler, or process heater with a maximum rated capacity of up to 2.0 MMBtu/hr. The rules are based upon those of California's Bay Area Management District Regulation 9, Rule 6 and South Coast Management District Rules 1121 and 1146.1.

6.2.9 Major Source NO_x Rules
This strategy applies to certain major stationary sources of NO_x in DFW. The NO_x emission limit of 0.033 lb NO_x/MMBtu for the 23 electric utility power boilers in a large DFW utility system and the limit of 0.06 lb NO_x/MMBtu for the 13 electric utility power boilers in two small DFW utility systems represents an 88% reduction in emissions from this source category. The electric utility boilers typically account for more than 90% of the point source NO_x during the ozone season. The NO_x RACT rules currently require reductions to 0.20 lb NO_x/MMBtu by March 31, 2001. The attainment demonstration utility emission reductions are required in two stages; two-thirds by May 1, 2003 and the remaining amount by May 1, 2005. The industrial, commercial, and institutional source reductions are required on a two-year schedule, by March 31, 2002.

The NO_x emission limit of 30 parts per million by volume for large industrial, commercial, and institutional boilers requires 7 institutionally-owned boilers located at major sources of NO_x to reduce NO_x in the range of 65% to 75%. The emission limit of 2 grams NO_x per horsepower hour for lean-burn gas-fired engines requires 3 engines located at major sources to reduce NO_x by approximately 80%.

The commission recognizes the significant level of reduction in NO_x attributable to the implementation of the electric utility rules applicable in the 4-county DFW nonattainment area. Within the next ten years, should additional NO_x reductions be necessary to meet the 8-hour ozone standard, the commission does not expect to require further reductions from electric utilities in the 4-county DFW area to achieve those reductions.

6.2.10 Heavy-Duty Diesel Operating Restriction

This strategy would implement an operating-use restriction program requiring that the heavy-duty diesel construction equipment, rated at 50 horsepower and greater, be restricted from use between the hours of 6:00 a.m. through 10:00 a.m., June 1 through October 31 beginning June 1, 2005. The commission, at the request of the NCTCOG, has developed this strategy to cover the four-county DFW nonattainment area. The involvement of all four counties as part of the NO_x emission control strategy is necessary for the area to demonstrate attainment of the ozone NAAQS.

The NCTCOG, representing the DFW ozone nonattainment area counties, requested an air pollution control strategy involving the time restriction of heavy-duty diesel construction equipment as part of the DFW Attainment Demonstration to reduce ground level ozone necessary for the counties included in the DFW ozone nonattainment area to be able to demonstrate attainment with the ozone NAAQS. At the request of the NCTCOG, the commission developed the non-road construction equipment operating-use restriction which requires a ban of heavy-duty diesel construction equipment operation during certain hours of the summer ozone season.

Using the Base 4d modeling emissions inventory, commission staff estimated that area and non-road emissions make up 33% of all NO_x emissions in the DFW area. The staff calculated that 48% of the emissions from area and non-road emissions inventory come from construction equipment which amounts to 16% of the region's total NO_x emissions. In the Base 4d inventory, the amount of emissions from construction equipment in the DFW 12-county CMSA was approximately 82 tons per day. Since the time the steering committee made its recommendation, two significant changes have taken place which affect the analysis: First, the construction equipment emissions were significantly revised in the Base 6 inventory, and were further refined in the Base 6a inventory. Second, the commission has reduced the spatial extent of the rule governing hours of operation to now include only the four nonattainment counties instead of the entire 12-county CMSA. The 1996 construction equipment NO_x emission total for the 4 nonattainment counties in the Base 6a modeling inventory is now 50.6 tons/day. Federal controls such as cleaner burning engines and cleaner diesel fuel have been proposed but are not scheduled to be implemented until around the 2004 timeframe.

By shifting the hours of construction for the heavy-duty diesel construction equipment until after 10:00 a.m. during the effective time period, the NO_x emissions will not mix in the atmosphere with other ozone-causing compounds until later in the day. Ozone is formed through chemical reactions between natural and man-made emissions of VOC and NO_x in the presence of sunlight. Higher ozone levels occur most frequently on hot summer afternoons. The critical time for the mixing of NO_x and VOCs is early in the day. By delaying the release of NO_x emissions from construction equipment until later in the day, production of ozone will be stalled until optimum conditions no longer apply thus avoiding the production higher levels of ozone.

Units of state and local government within the DFW CMSA that have ongoing construction projects may have significant fiscal implications in an amount that cannot be determined at this time. Because the proposed strategy does not require additional control equipment or new technology, the commission does not anticipate significant economic impacts to affected agencies and businesses beyond the shift in work schedule and possible implications caused by potential construction delays attributable to the proposed amendments. Delaying use of diesel construction equipment until after 10:00 a.m. may require affected state and local agencies and businesses to adjust their work schedules and could cause extensions of construction timelines. The fiscal impact of potential delays would depend on the scope, magnitude, and time-critical nature of the construction project.

Exemptions allow for the operation of any heavy-duty diesel construction equipment used exclusively for health and safety purposes. In addition, heavy-duty diesel construction equipment used in the processing of wet concrete is also proposed for exemption. Also, operators that submit an emissions reduction plan by May 31, 2002, that the commission executive director and the EPA approves by May 31, 2003, will be exempt from this rule and will be permitted to operate during the restricted time period. The plan must describe in detail how the operators will modify their fleet of equipment to reduce NO_x emissions by June 1, 2005 by an amount equivalent to the total NO_x reductions achieved by implementation of this rule and the Accelerated Purchase of Non-Road Heavy-Duty Diesel Equipment rule. Preliminary estimates indicate that implementation of both this rule and the Accelerated Purchase rule will result in a NO_x reduction of approximately 16 tons per day.

6.2.11 Transportation Control Measures

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

The NCTCOG has identified numerous TCMs that have been, or will be, implemented in the 4 county nonattainment area. By July 2007, these TCMs will reduce NO_x emissions in the nonattainment area by at least 4.73 tpd and VOC emissions by at least 2.95 tpd. The table below summarizes total 2007 emissions reductions by type of TCM. Appendix G contains a project specific list of the TCMs, including TCM location, project limits, emissions reductions and implementation date.

Table 6.2-1 Total 2007 Emission Reductions by Type of TCM

TCM Type	July 2007 NO_x Benefits(lbs/day)	July 2007 VOC Benefits (lbs/day)
HOV Lanes	349	115
Rail Projects	865	532
Bicycle/Pedestrian Projects	2,272	1,132
Intersection Improvements	4,634	2,305
Vanpools	685	341
Park and Ride Lots	437	218
Grade Separations	224	1,259
Total Pounds Per Day	**9,466**	**5,902**
Total Tons Per Day	**4.73**	**2.95**

All TCM emissions reductions were calculated using EPA's MOBILE5a model 2007 emission factors. Specific calculation methodologies for the different types of TCMs are documented in NCTCOG's

Transportation Control Measure Effectiveness Study, Technical Report, August 1996 and part of Chapter 7 of the *Transportation Conformity Determination for the Mobility 2025 Metropolitan Transportation Plan* . Appendix G contains these documents.

A TCM life span is defined as the time period during which the TCM continues to reduce emissions. Different types of TCMs have different life spans; for example, an HOV lane will reduce emissions for a longer time period than a traffic signal synchronization project. Many TCMs that have already been implemented will still reduce emissions in July 2007. Examples of these TCMs include HOV lanes, park and ride lots, bicycle/pedestrian facilities, rail projects and intersection improvements.

Other TCMs will be implemented between November 1999 and July 2007 and those TCMs will also reduce emissions in July 2007. NCTCOG's 1999 call for projects identifies many TCMs that will be funded in the 2000 to 2002 timeframe and implemented before July 2007.

The NCTCOG's call for projects estimates the cost of TCMs implemented between 1999 and 2007 to be approximately $361,600,000. In addition to emissions reductions benefits, the TCMs will also reduce congestion, which will produce time savings for drivers in the nonattainment area. Many TCMs, such as rail projects and bicycle/pedestrian facilities, will also encourage mixed use and sustainable development, which may reduce urban sprawl in the area.

The TCMs have been included in the DFW area long range transportation plan and/or transportation improvement program (TIP), which constitutes evidence that the TCMs were properly adopted and have funding and appropriate approval. Inclusion of the TCMs in the DFW area long range transportation plan and TIP also constitutes evidence of a specific schedule to plan, implement and enforce the measures. Additional evidence of the TCMs' specific implementation schedule is found in Appendix G. The NCTCOG is required by 30 TAC §114.260 to submit an annual TCM status report to the commission. The report must include the TCMs' implementation and emissions reductions status. The status report and supporting activities serve as the TCM monitoring program.

Enforcement and implementation of TCMs is also addressed in the Texas transportation conformity rule (30 TAC §114.260) and the federal transportation conformity rule (40 CFR §93.113), which indicate that the NCTCOG is responsible for ensuring that TCMs are implemented on schedule. According to 30 TAC §114.260 and 40 CFR §93.113, failure to implement TCMs according to schedule can be grounds for the denial of an area's transportation conformity determination.

6.2.12 Voluntary Mobile Source Emission Reduction Program

The Clean Air Act Amendments of 1990 increased the responsibility of states 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, 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 70-90% less than for the 1970 model year. However, transportation emissions continue to be a significant cause of air pollution due to a doubling of VMT from 1970 to 1990, and tripling since 1960.

With the increasing cost of technological improvements to produce incrementally smaller reductions in grams per mile emissions in the entire fleet of vehicles, and the time it takes for technological improvements to penetrate the existing fleets, it becomes clear that supplemental or alternative approaches for reducing mobile source air pollution is necessary. Mobile source strategies that attempt to complement existing regulatory programs through voluntary, non-regulatory changes in local transportation sector activity levels or changes in in-use vehicle and engine fleet composition are being explored and developed.

A number of such 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, TCMs, trip reduction programs, growth management strategies, ozone action programs, and targeted public outreach. These programs attempt to gain additional emissions reductions beyond mandatory Clean Air Act programs by engaging the public to make changes in activities that will result in reducing mobile source emissions.

Current EPA regulations have set a limit on the amount of emission reductions allowed for VMEPs in a SIP. The limit is set at 3% of the total projected future year emissions reductions required to attain the appropriate NAAQS. Specifically in the DFW nonattainment area, the commission estimates that 3% of the regions projected emissions are to be 5 tons per day. Table I summarizes the DFW voluntary commitments under VMEP.

TABLE I

VOLUNTARY MOBILE EMISSIONS REDUCTION PROGRAM (VMEP)
EMISSION BENEFITS BY PROGRAM TYPE

PROGRAM TYPE	VOC BENEFITS (tons per day)	NO_x BENEFITS (tons per day)
Alternative Fuel Program	0.18	0.18
Employee Trip Reduction	0.29	0.53
Public Education Campaign/Ozone Season Fare Reduction	0.08	0.15
Sustainable Development	N/A*	N/A*
Non-Road Ozone Season Reductions	N/A*	N/A*
Tier II Locomotive Engines	0 to 0.6	0 to 3.0
Off-Road Heavy Duty Diesel Engine Retrofits	N/A*	N/A*
Vehicle Retirement Program/Vehicle Maintenance[1]	0.56**	0.77**
TOTAL BENEFITS (tpd)	**1.11 to 1.71**	**1.63 to 4.63****

[1]Emission benefits quantified for the Vehicle Retirement Program only. Emission benefits for Vehicle Maintenance have been credited in the I/M Program.
*No benefits quantified or claimed at this time
**Varying emission reduction benefits based on different methodologies. Currently under EPA review.

***Goal is 5 tpd NO_x. Shortfall will be substituted with additional TCMs
Source: NCTCOG 3/24/00

The North Central Texas area is identifying eight programs that will aid in the improvement of the regions air quality. Currently three of the eight programs, Sustainable Development, Non-Road Ozone Season Reductions and Off-Road Heavy Duty Diesel Engine Retrofits, do not have emission benefits associated with them. The remaining five programs result in a VOC benefit between 1.25 to 1.85 tpd and NO_x benefits of 1.83 to 4.83 tpd.

Any shortfall (of the total 5tpd) will be covered by supplementing additional TCMs. The TCMs to be used to supplement the VMEP program are signal improvements and freeway corridor management. These TCMs are in addition to those already credited in the SIP. Table II summarizes TCM commitments inventoried for the DFW nonattainment area, including those credited in the SIP and those to be used as contingency for VMEP.

TABLE II

ATTAINMENT DEMONSTRATION SIP COMMITMENTS
TCMs OPERATIONAL BY 2007

	TCM COMMITMENTS			
Category	**1990-1996 (1)**	**1997-1999 (2)**	**2000-2007 (3)**	**TOTAL**
Intersection Improvements	393 Locations	96 Locations	286 Locations	775 Locations
Grade Separations			16 Locations	16 Locations
Signal Improvements (4)(5)			3,573 Locations	3,573 Locations
HOV Lanes (6)	33 Lane Miles		27.9 Miles	60.9 Miles
Freeway Corridor Management (5)	14 Corridors	4 Projects	Covers 350 Miles	Covers 350 Miles
Park and Ride Lots	4,518 Spaces	537 Spaces	2,100 Spaces	7,155 Spaces
Travel Demand Management (7)	15 Projects	2 Projects		17 Projects
Ped/Bicycle Facilities	28 Miles	19 Miles	664.6 Miles	711.6 Miles
Rail (6)	20.8 Miles	9 Miles	77.9 Miles	107.7 Miles
Vanpool	132 Vanpools		415 Vanpools	547 Vanpools
Sustainable Development (7)				

(1) Implemented projects/programs from 15% ROP SIP
(2) Implemented projects/programs from 9% ROP SIP
(3) Implemented projects/programs from 1999 Call for Projects and 2000 TIP
(4) No signal improvement emission reduction benefits in 2007 due to 4-year design life
(5) Credits available for VMEP shortfall
(6) Emission benefits quantified directly in travel demand model
(7) No emission reduction credit taken

More information on each of the VMEP commitments follows:

ALTERNATIVE FUEL PROGRAM

Background

The use of alternative fuels is important to the United States, and the DFW region, because it can lessen our dependence on foreign products; create domestic jobs; and have a positive impact on air quality. There are 2,985 dedicated alternative fuel vehicles projected to be in use in the DFW region between 1990 and 2002.

In the DFW region, CMAQ funds have been committed to the AFV Program. Between 1994 and 1998, $4 million in CMAQ funds were used to pay a portion of the incremental cost of AFVs for public fleets. More than 2,200 light-duty AFVs were placed into public fleets during this time period. Area transit agencies also received financial assistance in building a total fleet of 300 alternative fuel buses in the DFW area. Public fleets have requested funding for 700 additional vehicles, and $2.8 million has been awarded for fiscal years 1999 and 2000.

In 1998, Congress passed the Transportation Equity Act for the 21st Century (TEA-21). Under TEA-21, the CMAQ program was expanded to allow public/private partnerships to qualify for incremental funding for alternative fuel vehicles, in the same way public fleets are funded. In May 1999, the NCTCOG issued a Call for Projects for the TIP covering fiscal years 2000-2002. In addition to light duty vehicles and buses, NCTCOG received a request for funding to convert 150 heavy-duty delivery trucks to natural gas. Funding requested through the 1999 TIP Call for Projects totaled more than $8 million. The total CMAQ funding committed over the life of the Alternative Fuel Vehicle Program exceeds $45 million.

Program Participants

The NCTCOG AFV Programs are now open to all public fleets, transit agencies, and private companies. The Regional Transportation Council approves the funding of the programs, and staff members of NCTCOG administer them.

How the Program Works

There are three aspects of the overall program and each is accessed in different ways. For light- and medium-duty alternative fuel vehicles, fleets submit a proposal during the time when NCTCOG has a “Call for Projects” open. If requests exceed available funds, the proposals are scored and ranked. Currently, recipients are eligible to receive 80% of the incremental cost of an AFV compared to its diesel or gasoline equivalent.

Transit agencies are also able to apply for funds that have been dedicated to the AFV Program. Likewise, these funds are used to cover a portion of the incremental costs of transit buses, which can total $50,000 each.

Through the TIP, alternative fuel projects are submitted and compete with projects from other categories that are eligible for the funding program. The amounts requested, awarded, and the required cost-share may vary from project to project.

Activity Effects

The AFV Programs have been successful in putting alternative fuel vehicles on the roadways of the DFW area. In addition to the dedicated AFVs previously mentioned, funding has been requested for 288 dedicated vehicles in fiscal years 1999-2000. The City of Dallas also is interested in 300 additional vehicles in 2000-2001.

Emission Effects
The region is requesting credit for the emission reductions of 2,985 dedicated alternative fuel vehicles that are in operation in the DFW area. These vehicles represent emissions reductions of 47 tons of NO_x per year.

State Commitment for Evaluation, Reporting, Remedying Emission Credit Shortfall
NCTCOG as the regional metropolitan transportation planning agency for the DFW area commits to make a best faith effort to implement this project. NCTCOG will be responsible for monitoring and reporting the emission reductions to the commission. There is not expected to be a shortfall from this program since the credits are based on actual vehicles as opposed to projections. Any VMEP shortfall (of the total 5 tpd) will be covered by supplementing additional TCMs. These TCMs are in addition to those already credited in the SIP.

Technical Support Documentation
Included in the attached Excel file, "Alternative Fuels", are the AFVs In Public Fleets (Funded Through Fiscal Year 2000), AFVs in Private Fleets, AFVs Requested Under 1999 TIP Call for Projects and Methods and Assumptions. These charts detail the fleets in the DFW area who currently own and operate dedicated alternative fuel vehicles, the emissions benefits of each fleet and the costs associated with the emission reductions. The assumptions and methodology for the calculations are also included.

AFVs in Public Fleets (Funded Through Fiscal Year 2000)										
Agency	**Vehicle Size**	**Fuel**	**Quantity**	**Incremental Cost**	**NO_x lbs/yr**	**NO_x tons/day**	**NO_x cost/lbs/Yr**	**VOCs lbs/yr**	**VOCs tons/day**	**VOCs cost/lbs./Yr**
City of Dallas	Light Duty	CNG	235	$822,500.00	1548.72	0.002978308	$23.53	2049.78	0.003941885	$17.78
City of Denton	Light Duty	Electric	1	$3,500.00	19.38	0.000037269	$8.00	19.38	0.000037269	$8.00
City of Plano	Light Duty	Propane	62	$217,000.00	709.04	0.001363538	$13.56	516.76	0.000993769	$18.60
City of Plano	Mid Duty	Propane	4	$14,000.00	75.37	0.000144942	$8.23	54.93	0.000105635	$11.29
City of Plano	Heavy Duty	Propane	6	$240,000.00	169.20	0.000325385	$17.06	123.32	0.000237154	$23.40
U.S. Postal Service	Light Duty	CNG	143	$500,500.00	942.41	0.001812327	$23.53	1247.31	0.002398673	$17.78
U.S. Postal Service	Light Duty	Propane	7	$24,500.00	80.05	0.000153942	$13.56	58.34	0.000112192	$18.60
City of Fort Worth	Light Duty	Propane	136	$476,000.00	1555.31	0.002990981	$13.56	1133.53	0.002179865	$18.60
City of Farmers Branch	Light Duty	Electric	1	$3,500.00	19.38	0.000037269	$8.00	19.38	0.000037269	$8.00
City of Farmers Branch	Light Duty	CNG	1	$3,500.00	6.59	0.000012673	$23.53	8.72	0.000016769	$17.78
Denton ISD	Heavy Duty*	Propane	92	$3,680,000.00	9339.99	0.017961519	$4.74	5382.36	0.010350692	$8.22
Dallas County Schools	Heavy Duty*	Propane	236	$9,440,000.00	23959.09	0.046075173	$4.74	17461.71	0.033580212	$6.50
Carrollton-Farmers Branch ISD	Heavy Duty*	Propane	13	$520,000.00	1319.78	0.002538038	$4.74	760.55	0.001462596	$8.22
TxDOT-Ft. Worth	Light Duty	Propane	220	$770,000.00	2515.95	0.004838365	$13.56	1833.66	0.003526269	$18.60
TxDOT-Ft. Worth	Light Duty	CNG	76	$266,000.00	500.86	0.000963192	$23.53	662.91	0.001274827	$17.78
City of Mesquite	Light Duty	Propane	54	$189,000.00	617.55	0.001187596	$13.56	450.08	0.000865538	$18.60
City of Mesquite	Mid Duty	Propane	100	$350,000.00	1884.36	0.003623769	$8.23	1373.35	0.002641058	$11.29
City of Glenn Heights	Light Duty	Propane	1	$3,500.00	11.44	0.000022000	$13.55	8.33	0.000016019	$18.61
U.S. General Services Administration	Mid-Duty	CNG	33	$115,500.00	358.35	0.000689135	$14.28	474.28	0.000912077	$10.79
DART	Light Duty	LNG	355	$1,242,500.00	2339.56	0.004499154	$23.53	3096.48	0.005954769	$17.78
DART	Heavy Duty*	LNG	139	$5,560,000.00	8132.05	0.015638558	$8.22	10763.01	0.020698096	$6.21
FWTA - The "T"	Light Duty	CNG	39	$136,500.00	257.02	0.000494269	$23.53	340.18	0.000654192	$17.77
FWTA - The "T"	Heavy Duty*	CNG	113	$4,520,000.00	6610.95	0.012713365	$8.22	8749.78	0.016826500	$6.21
DFW International Airport	Light Duty	CNG	35	$122,500.00	230.66	0.000443577	$23.53	305.29	0.000587096	$17.77
DFW International Airport	Heavy Duty*	CNG	18	$720,000.00	1053.07	0.002025135	$8.22	1393.77	0.002680327	$6.21
		TOTAL	**2120**	**$29,118,000.00**	**64256.13**	**0.123569481**	**$348.74**	**58287.19**	**0.112090750**	**$350.39**

Cost Per Ton Per Day
NO_x: $0.00067
VOCs: $0.00067

AFVs in Private Fleets

Owner	Vehicle Size	Fuel	Quantity	Incremental Cost	NO_x lbs/yr	NO_x tons/day	NO_x Cost/lb./Yr	VOCs lbs/yr	VOCs lbs/day	VOCs Cost/lb./Yr
Super Shuttle	Light Duty	Propane	60	$210,000.00	6861.67	0.013195519	$1.36	5000.88	0.009617077	$1.86
McShan Florist	Light Duty	CNG	8	$28,000.00	105.44	0.000202769	$11.76	139.56	0.000268385	$8.89
TXU Gas & Electric	Light Duty	CNG	29	$101,500.00	172.01	0.000330788	$26.14	227.66	0.000437808	$19.75
TXU Gas & Electric	Light Duty	Electric	2	$7,000.00	34.89	0.000067096	$8.89	34.89	0.000067096	$8.89
Northwest Propane	Light Duty	Propane	38	$133,000.00	434.57	0.000835712	$13.56	316.72	0.000609077	$18.60
TX New Mexico Power	Light Duty	Electric	3	$10,500.00	52.33	0.000100635	$8.89	52.33	0.000100635	$8.89
TX New Mexico Power	Light Duty	CNG	1	$3,500.00	5.93	0.000011404	$26.15	7.85	0.000015096	$19.75
TX New Mexico Power	Light Duty	LPG	2	$7,000.00	20.59	0.000039596	$15.06	15.00	0.000028846	$20.67
Central & Southwest Inc.	Light Duty	Electric	3	$10,500.00	52.33	0.000100635	$8.89	52.33	0.000100635	$8.89
Marquis Messengers	Light Duty	Propane	30	$105,000.00	686.17	0.001319558	$6.78	500.09	0.000961712	$9.30
Alcon Laboratories	Light Duty	Natural Gas	6	$21,000.00	35.59	0.000068442	$26.14	47.10	0.000090577	$19.75
Texas Instruments	Light Duty	Electric	5	$17,500.00	87.22	0.000167731	$8.89	87.22	0.000167731	$8.89
Ford Motor Company	Light Duty	CNG	1	$3,500.00	5.93	0.000011404	$26.15	7.85	0.000015096	$19.75
DaimlerChrysler	Light Duty	CNG	1	$3,500.00	5.93	0.000011404	$26.15	7.85	0.000015096	$19.75
Huffhines Gas	Light Duty	Propane	18	$63,000.00	507.61	0.000976173	$5.50	369.95	0.000711442	$7.54
Propane Systems of TX	Heavy Duty	Propane	1	$40,000.00	28.20	0.000054231	$17.06	20.55	0.000039519	$23.41
		TOTAL	**208**	**$764,500.00**	**9096.41**	**0.017493096**	**$237.37**	**6887.83**	**0.013245827**	**$224.58**

Cost Per Ton Per Day
NO_x: $0.00046
VOC: $0.00043

AFVs Requested Under 1999 TIP Call for Projects									
Project Name	**Number of Vehicles**	**Incremental Cost**	**NO_x lbs./yr**	**NO_x tons/day**	**NO_x cost/lb./Yr**	**VOCs lbs./yr**	**VOCs tons/day**	**VOCs cost/lb./Yr**
DFW Airport - Light Duty CNG	162	$640,000.00	3061.20	0.00589	$9.26	4051.59	0.007791519	$7.00
DFW Airport - Mid-Duty (Vans)	10	$40,000.00	108.59	0.00021	$16.32	143.72	0.000276385	$12.33
DFW Airport - Heavy Equipment	19	$684,000.00	308.77	0.000593788	$26.64	408.67	0.000785904	$20.13
DFW Airport Private Sector Sponsorship - Buses	13	$520,000.00	760.55	0.001462596	$8.22	1006.61	0.001935788	$6.21
FWTA - CNG Fueled Buses	68	$9,350,000.00	3978.27	0.007650519	$28.26	5265.36	0.010125692	$21.36
FWTA - CNG Fuel Systems - Light Duty Truck	75	$206,250.00	2355.07	0.004528981	$5.13	2355.07	0.004528981	$3.88
Plano - Alternative Fuel - Light Duty Truck	2	$10,000.00	100.79	0.000193827	$4.39	100.79	0.000193827	$4.39
TXU - Coca Cola LNG Conversion - Heavy Duty Truck	175	$3,500,000.00	11091.38	0.021329577	$3.79	14679.76	0.028230308	$2.87
Grand Total	**524**	**$14,950,250.00**	**21764.62**	**0.04**	**$102.01**	**######**	**0.05**	**$78.17**

COST Per Ton Per Day
NO_x: $0.00020
VOCS: $0.00015

ASSUMPTIONS

These emission reduction calculations are based on an assumed mileage of 36,000 miles per year for buses and 10,000 miles annually for other vehicles unless the city or company noted otherwise. The emission factors, from Transportation Control Measure Effectiveness Study by the NCTCOG, are .88 for light duty vehicles, 1.45 for mid-duty vehicles (vans), and 2.17 for buses and heavy-duty vehicles. The fuel factors (how much an alternative fuel reduces NO_x or VOCs emissions from gasoline) were taken from the Chesapeake Bay Alternative Fuel Vehicle Source Book. Propane reduces NO_x by 59% and VOCs by 43%; CNG reduces NO_x by 34% and VOCs by 45%; and electricity is a 100% reduction of emissions from the vehicle tailpipe. Since these vehicles are dedicated, they have a 100% usage rate.

METHODOLOGY

To Calculate the Tons Per Year:

1. Multiple the number of vehicles by the emission factor.
2. Multiple that rate by the emission factor appropriate for the vehicle type.
3. Take that number and multiple by the total reduction factor (this is the fuel factor multiplied by the usage rate and divided by 454 for the grams conversion) and you will get the pounds per year.
4. The pounds per year can be converted to tons per day by dividing it first by 260 and then by 2000.

To Calculate the Cost Per Pound Per Year :

1. Determine whether the project length is 5 years or 10 years.
2. Divide the project length into the incremental cost. For projects with an unspecified incremental cost, $3,500 was used for light duty vehicles and $40,000 for heavy-duty.
3. Multiply the result by a capital recovery factor of 0.12026 for 10 years and .22149 for 5 years as taken from the TIP "Factsheet".
4. The result is the annualized project cost which then can be divided by the pounds of NO_x and VOCs per year to get the cost.
5. Once you have the cost per pound per year you can convert it to the cost per ton per day by dividing it first by 260 and then by 2000.

EMPLOYEE TRIP REDUCTION PROGRAM

Program Summary

The ETR program is a cooperative effort between the NCTCOG, Dallas Area Rapid Transit, the Fort Worth Transportation Authority, and other public and private sector organizations (in the form of Transportation Management Associations). The voluntary program, aimed at all public and private employers in the region with 100 or more employees (of which there are over 3,200 large employers in this region), is designed to reduce employee commute vehicle trips through implementation of rideshare programs (such as vanpools), telecommuting, flexible work hour programs, transit pass subsidies, bicycling, and similar strategies.

The role of the transportation/transit authorities involved in the program has been to market voluntary TDM programs to the large employers, both in and outside of the transit service areas. One of the main tasks is assisting large employers with setting up their program. Employers are encouraged to designate or hire an employee transportation coordinator (ETC) for the company. The ETC acts as a liaison between the company and the transportation authority in the administration of the program. More importantly, the

ETC markets alternative commute options to fellow coworkers. The transportation authority also provides support to the ETC and employer by offering marketing materials, ETC training and education, administering employee surveys to better determine what programs will work best at that work site, and providing information on tax credits and other incentives from which the employer may benefit.

Transportation Management Associations (TMAs) are private and public/private organizations that implement congestion mitigation strategies and work together on local transportation issues. Many are incorporated, non-profit organizations; they tend to be membership organizations, made up of employers, developers, building owners, and local government representatives. Most TMAs are located in areas of dense employment and focus on the travel demand management programs of public and private employers. In recent years, this region has seen TMAs play increased roles in new areas, including Congestion Management System development, Intelligent Transportation Systems initiatives, and in development of residential and tourism travel markets. Usually, the principle role of a TMA is to involve the business community in transportation planning and to provide a forum for the private sector to impact strategy development and implementation. TMAs can be involved in a variety of transportation activities, as this non-inclusive list indicates:

- Advocacy on transit, roadway, bicycle, pedestrian, land use, and air quality issues
- Transit pass subsidy or voucher programs
- Shuttles or vanpools for employees, customers, or both
- Ridematching services and support for carpools and vanpools
- Parking management programs
- Guaranteed or emergency ride home programs
- Telecommuting/teleconferencing center(s) operation
- Employer transportation coordinator (ETC) training
- Educational, promotional, and incentives programs for alternative travel modes

Taking advantage of future rail transit and HOV system options, while partnering with transit authorities and other transportation agencies, will strengthen the influence of TMAs in positively improving mobility and accessibility around employment and activity areas.

Program Implementation

Currently, at least 394 large employers in the DFW region are active in ETR programs, and 346 smaller employers are participating as well; over 80,000 employees at these companies are reducing vehicle commute trips through various means. Active ETR programs include employer-subsidized vanpools and transit passes, as well as flexible work weeks and telecommuting, among others. Through the continuation of marketing efforts, combined with robust employment growth and construction of alternative transportation infrastructure, a steady growth in employee participation in various trip reduction programs is expected.

Activity Effects

Close to 400 large employers in the region offer some sort of employee commute trip reduction program or incentive. The degree of implementation within a company or organization varies greatly: most companies offer three or less types of programs (about 95%), for instance. These figures are based on the information provided by ETCs on their company's ETR participation and activities to the transportation authority contact. (The Fort Worth Transportation Authority, for example, surveys the ETCs on a quarterly basis.)

Currently, approximately 200 vanpools are operating in this region. The transportation authorities expect the number of vanpools to double by 2003, based on current trends and recent Call for Projects funding.

Two Transportation Management Associations currently operate in the area. The Central Dallas Association operates a TMA in the Dallas Central Business District (CBD). Downtown Fort Worth, Inc., operates as the TMA for the Fort Worth CBD. Studies are currently underway to assess the feasibility of TMAs in Major Investment Study corridors. Emerging TMAs in the DFW Airport, East Side of Farmers Branch, and Richardson-North Central Expressway areas, will soon begin to impact the transportation strategy implementation in their respective areas.

Additional marketing of TDM programs will continue, especially as the transportation system expands. As transit services and systems are expanded and added, including the construction of rail lines and HOV lanes, more transportation options will be available to employees at other employers.

Emission Effects
The ETR program is expected to produce a VMT reduction of 414,334 during the a.m. commute period in 2007. The corresponding air quality benefits are the following:

<u>Emission reductions NO_x</u>
At 34 mph, the EF for NO_x in 2007 is 1.16 g/mile
414,334 daily VMT x 1.16 g/mile = 480,627 g/day or 1058.6 pounds/day

<u>Emission reductions VOC</u>
At 34 mph, the EF for VOC in 2007 is 0.64 g/mile
414,334 daily VMT x 0.64 g/mile = 265,173 g/day or 584.1 pounds/day

Program Commitment
The ETR Program has been funded by NCTCOG in the TIP for the past six years. In addition, the 1999 Call for Projects funded three ETR programs, four vanpool subsidy programs, and the start-up funds for three new TMAs. Funds for the programs are anticipated to be let during the next three years.

NCTCOG imposed a set of requirements to which the program implementers must comply. An element of the implementation criteria is performance reporting, so that the implementation and expected benefits can be more closely monitored. The Travel Demand Management Committee and the Regional Transportation Council (RTC) have been briefed in the past on the progress of these programs. With the stronger requirements, a regular reporting of performance figures will be seen; comments on the direction on how to proceed with the ETR program can then be provided.

Furthermore, analyses conducted in Major Investment Studies (MIS) will help in defining areas in our region that should be targeted by this program, so that the appropriate strategies can be defined. The RTC approved a resolution requesting MISs to study and seek TDM program commitments from large employers in their respective study corridors. In fact, efforts are being undertaken in MIS studies to identify large employers with strong potential to become active in ETR programs. Several MISs are currently underway that will target additional large employers to further increase employee participation in various trip reduction programs. In addition, future vanpool markets are also being identified in the MIS process. This will provide opportunities to increase vanpool participation in these strategic markets.

Results from MIS analyses are transmitted to the transportation authorities in order to help them guide their ETR program efforts.

State Commitment for Evaluation, Reporting, Remedying Emission Credit Shortfall
NCTCOG as the regional metropolitan transportation planning agency for the DFW area commits to make the best faith effort to implement this project. NCTCOG will be responsible for monitoring and reporting the emission reductions to the commission. Any VMEP shortfall (of the total 5 tpd) will be covered by supplementing additional TCM. These TCMs are in addition to those already credited in the SIP.

Technical Support Documentation
Currently (March 2000), an estimated 77,456 employees are active in ETR programs, based on figures from DART and FWTA. This number is included within the estimated 1,242,976 total employees working at large employers. Assuming an annual increase of 2% for employment at large employers (based on employment growth forecasts), the total workforce grows by 14.8% to 1,427,788 in 2007. Assuming the proportion remains constant, 88,919 employees would be active in some ETR program.

Based on an average vehicle occupancy of 1.14 (a recent region-wide estimate for AVO during the peak commute period) this translates into 78,000 vehicles. The average HBW trip distance in this region, based on the NCTCOG travel demand model, is 13.28 miles. Hence, the daily VMT reduced in 2007 would be 1,035,834.

With 40% of these HBW trips being taken in the a.m. commute period, the adjusted VMT reduced due to the ETR program is 414,334.

PUBLIC EDUCATION CAMPAIGN/OZONE SEASON FARE REDUCTION

Background
In response to DFW's air quality problems, the North Texas Clean Air Coalition (NTCAC) was formed in 1993 to educate North Texas about the region's air quality and encourage individuals to "do their share for cleaner air." Founding members include the North Central Texas Council of Governments, the North Texas Commission, the Fort Worth Chamber of Commerce and the Greater Dallas Chamber. The DFW region's transportation authorities: DART, SPAN, and The T are also active members.

Since its inception, the NTCAC has focused on promoting voluntary measures that businesses and individuals can take to help improve the region's air quality. NTCAC has developed and distributed printed materials, and television and radio public service announcements to help increase public awareness of this issue. NTCAC has also succeeded in attracting corporate sponsors for many of their programs.

Program Participants
Program participants are the Dallas Area Rapid Transit (DART), Fort Worth Transportation Authority (The T), and Denton's Program for Aging Needs, Inc. (SPAN), which are the regional transit providers in the DFW region. As described previously, NTCAC will also participate by promoting this program through the Ozone Action Day Program.

How the Program Works
The Ozone Action Day program runs May 1 through October 31. The day before a possible ozone event could occur in the region, the Texas Natural Resource Conservation Commission announces the potential

for an Ozone Action Day. A warning for the following day is announced by the NCTCOG by sending out 1500 faxes to Ozone Action Day participants to remind them that the next day will be an Ozone Action Day. The information is also received and announced on all the major television and radio weather programs. This allows DFW residents to know to take action and participate in programs such as the Ozone Action Day Discounted Transit Fare Program. The DART, The T, and SPAN will be offering reduced fares to transit riders during all Ozone Action days throughout the ozone season. In addition, NCTCOG is working to expand this program to each day in the ozone season, regardless if an ozone alert has been announced.

Activity Effects
The assumed reduced fare reduction per ride will be $0.50. The fare subsidy funds will be coming from $2,500,000 worth of CMAQ, which were approved by the Regional Transportation Council (RTC) for a three-year program.

Emission Effects
The emission benefits for the Ozone Alert On-Road Program: Ozone Alert Fare Reduction are a NO_x reduction of 0.114 tons per day, and a VOC reduction of 0.063 tons per day.

State Commitment for Evaluation, Reporting, Remedying Emission Credit Shortfall
NCTCOG as the regional metropolitan transportation planning agency for the DFW area commits to make the best faith effort to implement this project. NCTCOG will be responsible for monitoring and reporting the emission reductions to the commission. Any VMEP shortfall (of the total 5 tpd) will be covered by supplementing additional TCMs. These TCMs are in addition to those already credited in the SIP.

Technical Support Documentation
The reduction is quantified based on new riders only, and a calculation's review was performed to insure no double counting. Emission benefits are determined by first estimating total transit ridership in 2007 (approximately 202,953). Next, to estimate new riders due to the Ozone Action Day Discounted Transit Fare Program, multiply 2007 total transit riders by 5% (a conservative estimate based on total transit riders). Then take the total new riders, 10,148 (assuming all are work trips currently made by auto), multiply that by average trip length of 13.28 miles (determined by the NCTCOG trip model), and divide it by auto occupancy (1.14 persons per vehicle) to obtain the VMT removed. The total VMT removed is 118,211, then take this number and multiple it by 1.16 g/mi and divide it by 454 g/lb for the grams conversion to obtain the NO_x reduction of pounds per day, which is 302.04 lb/day. Next divide that number by 2000 to get the reduction of tons per day of 0.15 tpd. Finally, To obtain the reduction in VOCs per tons per day, take the 118,211 VMT removed, multiple it by 0.64 g/mi and divide it by 454 g/lb for the grams conversion to obtain the VOC reduction of pounds per day, which is 166.64 lb/day, and then divide that number by 2000 to get the reduction of tons per day of 0.083 tpd.

SUSTAINABLE DEVELOPMENT

Program Summary
The Sustainable Development Element of the region's newly adopted Mobility Plan recognizes that the way transportation is planned, programmed and constructed in this region 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, prevent the continued decline of the region's air quality status and avoid risk of sanctions on federal transportation funds. Promoting sustainable development is a specific objective of

the Mobility Plan because of the direct link between land use, transportation and air quality. A variety of strategies and policies have been adopted by the Regional Transportation Council to insure the development of transportation plans, programs and projects which promote air quality improvements through sustainable development.

Strategies to Meet Financial Constraints, Diversify Mobility and Improve Air Quality	
Topic	**Recommended Strategy**
Sustainable Development	Support NCTCOG "Integrated Regional Process".
Transit Service Providers	Support service providers in areas with recommended rail service and/or HOV lanes.
Increased Densities and Mixed Use Development	Form new Center for Development Excellence.
Speed Limits	Reduce peak limits by 5 mph as per SIP initiative.
Congestion Pricing	Support on selected corridors (case by case).
Trip Reduction Programs	Support voluntary 20% program for major employers during ozone season.
Transportation Accessibility Program	Support sustainable development through facility location decisions.
Borrowing Roadway Funds to Expedite Rail Projects	Staff directed to develop proposal.
Air Quality Transportation Enhancements	Staff directed to develop proposal.
Revise Project Scoring to Favor Sustainable Development in MPO Project Selection	Staff directed to develop proposal.

Overall, the objectives of these practices are 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.

Program Participants
There are three general categories of participants. First, the planning, programming and construction of public facilities is the task of governmental entities such as the North Central Texas Council of Governments, the Texas Department of Transportation, Individual Cities and each of the County Governments. Second, other project implementers will come from the private sector as developers and businesses respond to (or encourage) public initiatives and make location decisions, construct buildings and operate businesses within a more sustainable development framework. Third, actual citizens will change their actual behavior based on changes in the built environment and public and private sustainable development practices.

How the Program Works
The program works by favoring sustainable development through each stage in the transportation planning, programming and construction process. This will provide the platform for businesses and individuals in the DFW area to choose low emission styles of building, development, commuting and mobility.

Activity Effects
In short, denser and/or more multi-use land use leads to fewer VMT and an increase in the use of alternative modes of travel. VMT per person, or per household, rises dramatically from the central business district to urban zones and then out further to suburban and rural areas. The mixed use, higher density and mode choice characteristics of the urban core can be replicated throughout the region. Lower VMT and increased use of alternative modes lead to lower emissions of VOCs and NO_x and a reduced risk of air quality problems.

Emission Effects
These specific strategies and the overall sustainable development approach to transportation will (1) facilitate the development of projects for which the region can take air quality credits and (2) provide an opportunity to claim stand alone air quality credits for sustainable development in future conformity documentation and air quality plans. No benefits are quantified or claimed at this time.

State Commitment for Evaluation, Reporting, Remedying Emission Credit Shortfall
As no benefits are quantified or claimed at this time, no state commitment is required. However, the State and Federal government will be invited to participate in the future development of quantified benefits under this category at the appropriate time.

Technical Support Documentation
As no benefits are quantified or claimed at this time, no technical documentation is provided.

NON-ROAD OZONE SEASON REDUCTIONS

Program Summary
Because the precursors for ozone formation are added to the local atmosphere during the morning hours, a VMEP program to reduce and defer off-road morning emissions is important. This "AM AM" or "Morning Air Measures" program will target specific non-regulated sources of off-road emissions for voluntary reductions.

Program Participants
NCTCOG will facilitate this effort under the oversight of the NTCASC and seek participation from:

- local governments (counties, cities and school districts);
- landscaping businesses and golf courses;
- operators of small engines (go-carts, boats); and
- individuals

How the Program Works
The following voluntary non-road reductions are considered as part of a broad regional public outreach campaign by NCTCOG during 2000 through 2003 focusing on deferral of emission causing activities during the early morning hours, every day during the summer ozone season (May 1 through October 31).

(a) Beginning in 2000, NCTCOG will identify and survey all local governments in the DFW area, including 16 counties, nearly 200 cities, and many school districts. Through the local Dallas and Fort Worth Chambers, NCTCOG will also identify and survey the largest landscaping businesses and golf courses. Voluntary commitments will be sought from lawn mowing and landscaping operations to voluntarily defer or reduce early morning non-road activities that are sources of NO_x emissions. The commitments would include deferring the emission causing activities until 10 am, or the use of manual or electric equipment or other alternatives. Many cities and counties in the DFW area already defer their landscaping activities and the scope of these commitments can easily be surveyed and documented. The written commitments and description of activities would be tabulated across the region to document the program. Periodic surveys and self-reports would assist in monitoring the activities. Voluntary participants would receive recognition within the regional program.

(b) NCTCOG anticipates as a result of the public outreach campaign that a certain number of individuals among the 4.5 million residents of the DFW Metroplex will voluntarily defer their early morning lawn mowing activities. The level of individual change in activities could be assessed using periodic surveys throughout the 3-year period. The result of the surveys will be submitted as reports to the State.

(c) In addition, NCTCOG may earmark some funds during the 2000-2003 period and allocate those towards a lawn mower buy back program. EPA guidelines would be followed to implement the program, document its effectiveness and report the results. No specific details are available at this time as this project is still being negotiated and no funds are committed yet. NCTCOG is the regional metropolitan transportation agency and every year engages in allocation of federal TEA-21 transportation grants, under TxDOT oversight. Congestion Mitigation Air Quality funding could be sought in the 2001 upcoming cycle of grant allocations.

(d) NCTCOG will also target businesses operating smaller equipment sources of off-road equipment such as go-cart facilities and seek commitments to reduce or defer early morning operations. Again, written commitments and surveys would be the instrument for documenting the deferrals.

Activity Effects
The entire program focuses on the voluntary reduction and deferral of early morning emissions until after 10 a.m. The emissions would come from daily activities that would occur anyway: the program simply asks for a shift from early morning hours to later in the day.

Emission Effects
The actual emission reduction on a daily basis would be very minimal.

State Commitment for Evaluation, Reporting, Remedying Emission Credit Shortfall
NCTCOG as the regional metropolitan transportation planning agency for the DFW area commits to make a best faith effort to implement this project. NCTCOG will be responsible for monitoring and reporting the emission reductions to the commission. Any VMEP shortfall (of the total 5 tpd) will be covered by supplementing additional TCMs. These TCMs are in addition to those already credited in the SIP.

Technical Support Documentation
NCTCOG at this time does not have sufficient support documentation to estimate the amount of emissions that might be deferred through this program.

TIER II LOCOMOTIVE ENGINES

Program Summary
This measure seeks to have only Tier II locomotive engines operating in the DFW Area by the ozone season of the year 2005.

Program Participants
NCTCOG will facilitate the program under the oversight of the North Texas Clean Air Steering Committee. Three national railroad companies operate in the DFW area: Burlington Northern/Santa Fe, Union Pacific, and Kansas City Southern Railways. NCTCOG will contact representatives from the affected railway companies and any other related industries.

How the Program Works
Essentially, during 2001-2002, NCTCOG will seek input from the three railroad companies. First, NCTCOG staff would attempt to inventory the rail lines activity and emissions for a year 2000 baseline. Next, NCTCOG staff will seek voluntary commitments from the 3 railroad companies to have Tier II locomotive engines for all rail locomotives traveling through the DFW Metroplex. This would be documented through written commitments as well as reports such as specific equipment lists showing the types of engines used or purchased.

Activity Effects
This program would assume no change in the activity patterns of the railroad engines.

Emission Effects
Assuming that all three railroad companies would voluntarily participate and all engines would be Tier II compliant in 2005, up to 3 tpd NO_x reductions could be achieved from the use of cleaner engines.

State Commitment for Evaluation, Reporting and Remedying Emission Credit Shortfall
NCTCOG as the regional metropolitan transportation planning agency for the DFW area commits to make the best faith effort to implement this project. NCTCOG will be responsible for monitoring and reporting the emission reductions to the commission. Any VMEP shortfall (of the total 5 tpd) will be covered by supplementing additional TCMs. These TCMs are in addition to those already credited in the SIP.

Technical Support Documentation
According to information provided by the NTCASC consultant (ENVIRON), the incremental effectiveness for using only Tier II engines in DFW would be a 37% NO_x reduction from the 2007 base inventory. In the 2007 base inventory, locomotive emissions are predicted to be 8.2 tpd. The reduction due to accelerated implementation of Tier II would thus be:

8.2 tpd * 37% = 3.0 tpd

The 3 tpd figure assumes, of course, 100% compliance. The actual range could potentially be anywhere from zero to 3 tpd. NCTCOG does not have any other data to substantiate a more definitive commitment or more specific reduction figure.

OFF-ROAD HEAVY DUTY DIESEL ENGINE RETROFITS

Program Summary
Owners and operators of heavy-duty diesel off-road equipment in the 12 counties surrounding the DFW nonattainment area will be encouraged to voluntarily retrofit their engines using selective catalytic reduction or other technologies.

Program Participants

NCTCOG will facilitate this outreach program under the oversight of the NTCASC. Target participants would include owners and operators of off-road heavy-duty diesel equipment in the 12 counties surrounding the DFW nonattainment, such as:

- Local counties, cities and school districts (road and site construction, landscaping, materials moving, etc.) and state agencies (TxDOT, General Services, etc.)
- Commercial equipment rental firms
- Commercial construction firms
- Sand and gravel sites and mining operations (such as the cement manufacturing plants with limestone mining facilities in Ellis County)
- Landfill operations
- Agricultural operations
- Commercial/Industrial businesses with stationary generators and material moving equipment such as forklifts.

How the Program Works

NCTCOG will act as the DFW regional planning agency promoting a program along the guidelines of EPA's newly announced "Diesel Retrofit Initiative" (March 20 EPA press release). EPA intends to promote the voluntary retrofit program in three or four pilot project cities, yet to be identified, then nationwide.

At this time, EPA has not finalized the definition of what constitutes a "retrofit". However, some definitions that EPA is considering may include an engine upgrade, use of cleaner fuels or additives, or a combination of definitions. NCTCOG anticipates using as much of the EPA information available through its upcoming web site and staff technical assistance as possible in the near future.

NCTCOG will survey and identify the subsets of targeted heavy-duty diesel equipment activities and seek voluntary participation in a diesel equipment retrofit program. The target area will specifically be the 12-county area surrounding the 4-county urban non-attainment area. NCTCOG is an association of local governments and can easily contact its member county and city governments and school districts. State agencies with significant fleets of heavy-duty diesel equipment such as Texas Department of Transportation will also be targeted for participation. NCTCOG can also work with industry associations and representatives: local chambers of commerce, professional associations representing the construction industry, the solid waste management industry, etc. to identify private sector operations using heavy-duty diesel equipment.

The current proposal for the DFW State Implementation Plan already includes two measures targeting heavy-duty diesel equipment operations in the NCTCOG metropolitan statistical 12-county area:

- An accelerated equipment purchase program requiring 50% Tier II and 50% Tier 3 equipment among heavy-duty equipment fleets in the year 2007;
- A proposed shift of operation hours from 6 to 10 am in the summer ozone season for all construction and mining heavy-duty equipment.

Assuming the accelerated purchase program proceeds, NCTCOG does not believe that a diesel retrofit program for non-road equipment in the 4-county area would add any appreciable emission reduction benefits: all of the heavy-duty diesel equipment fleet is anticipated to be state of the art between 2004 and 2007. Most heavy-duty diesel equipment is on an average replacement schedule of 15 to 25 years. If the equipment fleet in the 4-county nonattainment area is to be entirely replaced between 2004 and 2007, it is unlikely, although, not impossible that equipment owners or operators would consider a retrofit program between 2000 and 2004.

NCTCOG believes that a voluntary emission reduction program in the surrounding counties might be feasible and would provide additional benefits not otherwise targeted in the SIP. This VMEP program would specifically target the public and private sector owners and operators of all classes of heavy-duty diesel equipment in the surrounding member counties in the NCTCOG region, beginning in 2001 through 2007. Note: the metropolitan statistical area identifies 8 counties beyond the 3 county area, but the actual NCTCOG region has 12 more counties in addition to the 4 urban counties. Therefore, this voluntary initiative could potentially target 8 to 12 counties. NCTCOG would actively seek commitments from voluntary participants to retrofit their heavy-duty diesel off-road equipment.

At the current time, no funding is available to provide incentives for a retrofit program. However, NCTCOG intends to seek grant funds in the coming competitive allocation of the federal TEA-21 Congestion Mitigation Air Quality funds managed by the Texas Department of Transportation and NCTCOG in order to fund a "regional diesel retrofit initiative" for both public and private operators. Early EPA guidance indicates that the Department of Energy's Clean Cities Program for projects using clean fuels such as natural gas might be another source of economic incentives and funding.

Pending additional EPA guidance on this voluntary retrofit program, NCTCOG will work with interested program participants in technical work group sessions to research and identify the type of equipment and engine and the type of retrofit technology. Once commitments are made, NCTCOG would monitor the actual implementation of the retrofit equipment and tabulate the emission reductions. Pending the availability of CMAQ or other funding, the program could be much larger than currently anticipated.

Activity Effects
There would be no activity effects from this program, since the initiative targets technology improvements through engine retrofits. Activity patterns and operations are not expected to change.

Emission Effects
The primary impact of this initiative will be on the 8-12 counties surrounding the 4-county nonattainment area. NCTCOG currently does not have sufficient data to evaluate the emission reduction effect of this proposed initiative.

State Commitment for Evaluation, Reporting, Remedying Emission Credit Shortfall
NCTCOG as the regional metropolitan transportation planning agency for the DFW area commits to make the best faith effort to implement this project. NCTCOG will be responsible for monitoring and reporting the emission reductions to the commission. Any VMEP shortfall (of the total 5 tpd) will be covered by supplementing additional TCMs. These TCMs are in addition to those already credited in the SIP.

Technical Support Documentation
Since nonroad equipment powered by diesel engines tend to have relatively long useful lives, often up to 25 years, retrofit of the in-use fleet represents an especially important tool for reducing non- road engine pollution. Achieving emission reductions from in-use diesels is needed because older engines pollute at much higher rates than newer ones due to deterioration and less stringent emission standards. Although the EPA's rule for "Control of Emissions of Air Pollution from Nonroad Diesel Engines," which will be

phased in between 1999 and 2008, will reduce NO_x by 50%, retrofits can reduce emissions prior to 2008 by up to 90%.

According to the report "Heavy-Duty Diesel Emission Reduction Project Retrofit/Rebuild Component" issued by EPA in June 1999, various technologies can reduce emissions from heavy-duty diesel engines. For example, one of the most effective NO_x-reduction retrofit technologies is selective catalytic reduction (SCR). Several field installations of SCR on stationary generators exist and have shown NO_x reductions up to 90% (EPA, 1999). All possible retrofit technologies based on EPA guidance and technology transfer will be considered in this program.

VEHICLE MAINTENANCE/RETIREMENT PROGRAM

A) VEHICLE MAINTENANCE

Background
Vehicle emission reduction programs are comprised of two areas. One of which is regular vehicle maintenance. Routine car maintenance is important for several reasons. First, 10% of our cars produce 50% of the emission-related pollution. Next, the majority of cars that do not pass the vehicle emissions test require only a tune-up. Also, emissions from one badly maintained vehicle can equal those from 25 properly maintained vehicles. Regularly scheduled vehicle maintenance can easily save an individual motorist hundreds of dollars per year. Tire pressure checks, checks of spark plugs and changing of air filters and oil at different intervals adds to the life of a car. They can also help eliminate costly repairs in the future. For those vehicles which cannot economically be repaired, the second type of program is the Voluntary Accelerated Vehicle Retirement (VAVR) Program.

Program Participants
Program participants are the North Texas Clean Air Coalition (NTCAC) and NCTCOG. Also, this program will be folded into part of the NCTCOG's Regional Ozone Action Day Program. Furthermore, all citizens of the four-county nonattainment region (Dallas, Denton, Collin, and Tarrant) for the pollutant ozone will be allowed to participate in this Vehicle Maintenance Program.

How the Program Works
500 vehicles will be identified for tune-ups per year, and each vehicle owner will receive $500 for vehicle maintenance. The Total Program Cost of the vehicle maintenance element of the VAVR Program approved by the RTC is $250,000.

Please see Section B, of this section, regarding the VAVR Program for information concerning:
- Activity effects
- Emission effects
- State commitment for evaluation, reporting, remedying emission credit shortfall
- Technical support documentation

B) VEHICLE RETIREMENT PROGRAM

Background
The FCAA Amendments of 1990 define "programs to encourage the voluntary removal from use and the marketplace of pre-1980 model year light duty vehicles and pre-1980 model light duty trucks" as a TCM in

Section 108(f). Old automobiles with no or few emission controls are typically a source of high emissions. Newer vehicles possessing emission controls which have been tampered with, maintained improperly, have failed, or have otherwise been rendered ineffective are also significant contributors of emissions. While normal attrition of the fleet solves some of this emissions problem, some high emitting vehicles remain in operation and contribute to the problem for long periods of time. Studies have shown 10% of the vehicles cause 50% of vehicle pollution. A vehicle retirement program could be such a measure to remove high emitting vehicles from the fleet. These programs offer a cost-effective alternative to more expensive and difficult stationary source emission control measures.

Program Participants

The Vehicle Retirement Program (VRP) will begin in 2001 and is estimated to cost roughly $3.9 million per year to implement. This cost will involve the repair of high emitting vehicles and the acquisition of vehicles that are unable to be repaired. The successful operation of this program will require cooperation between government agencies, private industry, and the general public. Program funding is expected to come from the private sector or from a possible $1.00 surcharge added to every inspection/maintenance test through legislative action. Other organizations needed for the successful operation for this project are financial institutions. Working in conjunction with these institutions will help provide low interest financing for the purchase of OBD II compliant vehicles. Working with reputable car dealerships is also a necessity for this program, as they will help in identifying vehicles that are in good repair and are not themselves high emitters.

The NCTCOG Regional Transportation Council has committed $3.6 million in the transportation improvement program to serve as supplemental funding, if needed, and will be available in 2003.

How the Program Works

As shown in Exhibit 1, the VRP focuses on removing high emitting vehicles from two areas, local government impound lots and vehicles owned by the general public. A portion of the plan, Part I, calls for the acquisition of vehicles scheduled for auction that are currently held in city impound lots. Acquiring the impounded high emitting vehicles will remove them from the fleet and aid in reducing mobile source emissions in the region. The second part of the program, Part II, involves the acquisition of high emitting vehicles from the general public. Repair (vehicle maintenance) has been quantified as a separate program. Part II is designed in a manner to assist residents with the costs of vehicle replacement. For a typical person with a high emitting vehicle, the replacement of their vehicle will be partially subsidized by the program. They will still have to pay a portion of the cost associated with purchasing a new vehicle. People with low incomes will not have to pay any of the costs. The costs of replacing the vehicle will be fully provided for by this program. The program will replace high emitting vehicles with model year 1996 or newer vehicles that meet clean air standards. This model year was chosen due to vehicle cost and the presence of an OBD II system. The OBD II system allows for a more efficient and reliable test of the vehicle’s emission control systems.

Activity Effects

The Vehicle Maintenance/Retirement Program is designed to capture 2500 high emitting vehicles per year. Selected vehicles will either be repaired or retired if repair is not practical. Vehicles to be retired will be replaced with OBD II compliant vehicles, which will assist in the reduction in emissions of ozone producing pollutants.

Emission Effects

The repair and removal of high emitting vehicles will create emission reduction benefits of approximately 0.77 tons per day by 2007. The methodology for quantifying these emission reduction benefits is included as VRP.xls.

State Commitment for Evaluation, Reporting, Remedying Emission Credit Shortfall
NCTCOG as the regional metropolitan transportation planning agency for the DFW area commits to make the best faith effort to implement this project. NCTCOG will be responsible for monitoring and reporting the emission reductions to the commission. Any VMEP shortfall (of the total 5 tpd) will be covered by supplementing additional TCMs. These TCMs are in addition to those already credited in the SIP.

Technical Support Documentation
The emission reduction benefits were calculated by using EPA's Guidance for the Implementation of Accelerated Retirement of Vehicles Program, February 1993. Specific calculations were provided by the commission and adjusted for region specific criteria. The emission benefits are calculated by first finding the difference in emissions between the high emitting vehicle and the vehicle replacing it. These emissions are then multiplied by the VMT per vehicle per year, to calculate the total emissions for that vehicle per year. The total emissions are then multiplied by the number of vehicles to be replaced, and a conversion factor to change from grams per year to tons per day. The final result gives the emission reduction benefits for the selected vehicles in tons per day.

Recycling/Repairing pre-1980 LDGV in DFW (Dallas and Tarrant County)
2000 Vehicles Are to Be Retired
0.8 Effective Number of Vehicle Factor

	VOC				NO_x		
1st year	2001	2002	2003		2001	2002	2003
Recycled grams/mile	5.25	4.87	4.24	Recycled grams/mile	2.99	2.96	2.77
Replaced grams/mile	0.77	0.72	0.68	Replaced grams/mile	1.27	1.22	1.17
VOC Benefit	4.48	4.15	3.56	NO_x Benefit	1.72	1.74	1.6
VMT/year/vehicle	4,025	3899	3790	VMT/year/vehicle	4,025	3899	3790
Grams/vehicle/year	18,034	16,179	13,492	Grams/vehicle/year	6,924	6,783	6,064
Eff. Vehicle	1,600	2,880	3,904	Eff. Vehicle	1,600	2,880	3,904
Tons per day	0.087	0.141	0.159	Tons per day	0.033	0.059	0.071
2nd year	2002	2003	2004		2002	2003	2004
Recycled grams/mile	4.87	4.24	3.27	Recycled grams/mile	2.96	2.77	3.56
Replaced grams/mile	0.72	0.68	0.64	Replaced grams/mile	1.22	1.17	1.11
VOC Benefit	4.15	3.56	2.63	NO_x Benefit	1.74	1.6	2.45
VMT/year/vehicle	3,899	3790	3790	VMT/year/vehicle	3,899	3790	3790
grams/vehicle/year	16,179	13,492	9,968	Grams/vehicle/year	6,783	6,064	9,286
Eff. Vehicle	2,880	3,904	4,723	Eff. Vehicle	2,880	3,904	4,723
Tons per day	0.141	0.159	0.142	Tons per day	0.059	0.071	0.132
3rd year	2003	2004	2005		2003	2004	2005
Recycled grams/mile	4.24	3.27	3.22	Recycled grams/mile	2.77	3.56	4.02
Replaced gram/mile	0.68	0.64	0.61	Replaced grams/mile	1.17	1.11	1.04
VOC Benefit	3.56	2.63	2.61	NO_x Benefit	1.6	2.45	2.98
VMT/year/vehicle	3,790	3790	3790	VMT/year/vehicle	3,790	3790	3790
Grams/vehicle/year	13,492	9,968	9,892	Grams/vehicle/year	6,064	9,286	11,294
Eff. Vehicle	3,904	4,723	5,379	Eff. Vehicle	3,904	4,723	5,379
Tons per day	0.159	0.142	0.161	Tons per day	0.071	0.132	0.183
4th year	2004	2005	2006		2004	2005	2006
Recycled grams/mile	3.27	3.22	3.18	Recycled grams/mile	3.56	4.02	4.15
Replaced grams/mile	0.64	0.61	0.56	Replaced grams/mile	1.11	1.04	0.95
VOC Benefit	2.63	2.61	2.62	NO_x Benefit	2.45	2.98	3.2
VMT/year/vehicle	3,790	3790	3790	VMT/year/vehicle	3,790	3790	3790

	Grams/vehicle/year	9,968	9,892	9,930
	Eff. Vehicle	4,723	5,379	5,903
	Tons per day	0.142	0.161	0.177
5th year		2005	2006	2007
	Recycled grams/mile	3.22	3.18	3.09
	Replaced grams/mile	0.61	0.56	0.52
	VOC Benefit	2.61	2.62	2.57
	VMT/year/vehicle	3,790	3790	3790
	Grams/vehicle/year	9,892	9,930	9,740
	Eff. Vehicle	5,379	5,903	6,322
	Tons per day	0.161	0.177	0.186
6th year		2006	2007	2008
	Recycled grams/mile	3.18	3.09	3.05
	Replace grams/mile	0.56	0.52	0.48
	VOC Benefit	2.62	2.57	2.57
	VMT/year/vehicle	3,790	3790	3790
	Grams/vehicle/year	9,930	9,740	9,740
	Eff. Vehicle	5,903	6,322	6,658
	Tons per day	0.177	0.186	0.196
7th year		2007	2008	2009
	Recycled grams/mile	3.09	3.05	3.01
	Replaced grams/mile	0.52	0.48	0.44
	VOC Benefit	2.57	2.57	2.57
	VMT/year/vehicle	3,790	3790	3790
	Grams/vehicle/year	9,740	9,740	9,740
	Eff. Vehicle	6,322	6,658	6,926
	TPD	0.186	0.196	0.204

Grams/vehicle/year	9,286	11,294	12,128
Eff. Vehicle	4,723	5,379	5,903
Tons per day	0.132	0.183	0.216
	2005	2006	2007
Recycled grams/mile	4.02	4.15	4.43
Replaced grams/mile	1.04	0.95	0.87
NO_x Benefit	2.98	3.2	3.56
VMT/year/vehicle	3,790	3790	3790
Grams/vehicle/year	11,294	12,128	13,492
Eff. Vehicle	5,379	5,903	6,322
Tons per day	0.183	0.216	0.257
	2006	2007	2008
Recycled grams/mile	4.15	4.43	4.48
Replaced grams/mile	0.95	0.87	0.8
NO_x Benefit	3.2	3.56	3.68
VMT/year/vehicle	3,790	3790	3790
Grams/vehicle/year	12,128	13,492	13,947
Eff. Vehicle	5,903	6,322	6,658
Tons per day	0.216	0.257	0.280
	2007	2008	2009
Recycled grams/mile	4.43	4.48	4.36
Replaced grams/mile	0.87	0.8	0.73
NO_x Benefit	3.56	3.68	3.63
VMT/year/vehicle	3,790	3790	3790
Grams/vehicle/year	13,492	13,947	13,758
Eff. Vehicle	6,322	6,658	6,926
Tons per day	0.257	0.280	0.288

VOC

Calendar Year	2001	2002	2003	2004	2005	2006	2007	2008	2009
Year 1 Credit	0.087	0.141	0.159	0.142	0.161	0.177	0.186		
Year 2 Credit		0.141	0.159	0.142	0.161	0.177	0.186	0.196	
Year 3 Credit			0.159	0.142	0.161	0.177	0.186	0.196	0.204
Total	0.087	0.281	0.477	0.426	0.482	0.531	0.557	0.391	0.204

NO_x

Calendar Year	2001	2002	2003	2004	2005	2006	2007	2008	2009
Year 1 Credit	0.033	0.059	0.071	0.132	0.183	0.216	0.257		
Year 2 Credit		0.059	0.071	0.132	0.183	0.216	0.257	0.280	
Year 3 Credit			0.071	0.132	0.183	0.216	0.257	0.280	0.288
Total	0.033	0.118	0.214	0.397	0.550	0.648	0.772	0.560	0.288

6.2.13 Inspection/Maintenance

The DFW area is expanding and revising the vehicle emissions I/M program as an additional control strategy option. Dallas, Tarrant, Harris, and El Paso Counties will continue to utilize the current two-speed idle test until December 31, 2001. Beginning January 1, 2001, Dallas and Tarrant Counties will incorporate OBD testing into the current two-speed idle program. Beginning May 1, 2002, Dallas, Denton, Collin, and Tarrant Counties will begin emissions testing utilizing OBD and ASM-2 or a vehicle emissions testing program that meets SIP emission reduction requirements and is approved by EPA.. Beginning May 1, 2003, Ellis, Johnson, Kaufman, Parker, and Rockwall Counties will begin the OBD and ASM-2 program or a vehicle emissions testing program that meets SIP emission reduction requirements and is approved by EPA. Program expansion is essential for reduction of NO_x emissions to be able to demonstrate attainment with the NAAQS for ozone. These additional five counties surrounding the DFW nonattainment area are voluntarily opting into the I/M program in accordance with Texas Health and Safety Code §382.037(c) and Texas Transportation Code §548.301(b).

6.2.14 Dedicated Alternative Fuel Vehicles

This control strategy is now being included as part of the VMEP Program. Refer to Section 6.2.13 for more information.

6.3 WEIGHT-OF-EVIDENCE

The 1996 EPA guidance document *Guidance on Using Modeled Results to Demonstrate Attainment of the Ozone NAAQS* presents two approaches to demonstrating attainment, a statistical approach and a deterministic approach. Both approaches -- unlike earlier EPA guidance -- allow for occasional modeled exceedances of the 125 ppb ozone standard. The statistical approach uses the ranked severity of ozone episodes to “adjust” peak ozone predictions downward if particularly severe episodes are modeled. Since monitored ozone levels during the two episodes modeled are not unusually high, the statistical approach will not be pursued in this attainment demonstration.

The deterministic approach is based on comparing peak ozone predictions with the standard, and if the peak for each modeled episode day is below 125 ppb, then this test is passed. As seen in Chapter 3, Table 3-18, modeled peak ozone with Strategy D30 is well below the threshold for two of the three primary episode days. However, peak modeled ozone on July 3 is still above 125 ppb, so we must proceed to the second step in the deterministic approach and use WOE to complete the demonstration that the area will likely reach attainment by 2007.

The key concept behind WOE is that the determination of attainment (based on monitored ozone concentrations) allows for some exceedances of the one-hour standard. Thus, even though the model may show some areas with peak concentrations above 125 ppb, such modeled exceedances do not necessarily imply violations.

6.3.2 Weight of Evidence Supporting Modeling Run D_{ATT}

The WOE argument presented here consists of several elements which, taken together, form a compelling argument that attainment will most likely be achieved by 2007. Because the only day which failed to pass the deterministic test is July 3, 1996, much of the following discussion is specific to that day.

Unusually high peak modeled ozone concentrations:

While the monitored peak ozone concentration on July 3 is not unusually high (144 ppb), the modeled peak is significantly higher. Since the modeled peak occurred several kilometers from the nearest monitor, there is no way to verify whether or not such a peak actually occurred on that day. However, if the model is accurately replicating an actual occurrence, then this event would be rare given the history of ozone violations since 1992. During the eight-year period encompassing the 1992 through 1999 ozone seasons, the area has experienced only two days where the area-wide monitored peak ozone exceeded 160 ppb, and only seven days when the area-wide peak exceeded 150 ppb. It is likely some higher ozone peaks escaped detection during this time period, but with eight (nine beginning in 1997) full-time monitors distributed across the four-county area, many more days with peak ozone exceeding 160 ppb would have been monitored if such events were common. Thus, if the model is accurately replicating events of July 3, 1996, then this day likely represents an extreme event. EPA's guidance indicates that it is inappropriate to develop controls for such rare events, since these infrequent occurrences would not by themselves lead to a violation of the NAAQS.

Two specific reasons why July 3, 1996 may be atypical are 1). the next day is a national holiday, so many people may be expected to leave work early, potentially increasing mobile source emissions in the early afternoon, and 2). a number of scattered showers occurred in the area in mid-afternoon which could have perturbed the normal afternoon wind-flow patterns.

Meteorology:
Since there were no monitors in the area of the maximum predicted ozone concentration on July 3, 1996 (one was installed nearby in 1997), it can never be determined whether or not the model predicted an actual peak near 160 ppb.

It appears likely that scattered thunderstorms in the DFW vicinity on July 3rd had not accounted for effects on the meteorology. These effects would possibly have included; perturbation of the wind flow, temperature variations, and cloud cover effects on actinic flux. The meteorological model which was used, SAIMM, is hydrostatic, meaning it is incapable of accounting for precipitation, clouds, and related phenomena. The presence of thunderstorms would probably create small scale meteorological variations (wind, temperature and clouds) beyond the spatial and temporal scales resolved by the model. To accurately model an event such as occurred on July 3, it would be necessary to use a non-hydrostatic model which can simulate the small-scale events characteristic of convective thunderstorm activity. The limitations of SAIMM indicate that the complexities of the actual meteorology may not be accurately simulated on July 3, particularly at the time the highest ozone was modeled.

For future modeling work the commission plans to use the MM5 non-hydrostatic meteorological model (or other similar advanced prognostic model). Such an advanced model should be able to much more accurately simulate the conditions associated with meteorological events like that observed on July 3.

Additional ozone metrics:
EPA guidance indicates that a key part of a WOE determination is showing the reductions in area of exceedance caused by applying the SIP control strategy. In this section we present three metrics besides the peak predicted ozone concentration: 1). Area of exceedance (the area, in kilometers, where the modeled one-hour ozone concentration is greater than or equal to 125 ppb any time during the day), 2). Area-hours, which sums the number of hours of exceedance across the exceedance area, and 3).

Exposure, which is area-hours weighted by the amount by which predicted ozone exceeds 125 ppb in each location. Table 6.3-1 shows each metric for the 1995-96 base case, the 2007j future base, and Control Strategy D_{ATT} for each of the three primary episode days.

Table 6.3-9. Ozone Measures Modeled for Base5, Future Base 2007i, and Strategy D_{ATT}

Model Run	Area of Ozone > 124 ppb (km^2)			Area-Hours > 124 ppb (km^2-hours)			Exposure (km^2-hours-ppb)		
	6/21/95	6/22/95	7/3/96	6/21/95	6/22/95	7/3/96	6/21/95	6/22/95	7/3/96
1995/6 Base6a	464	608	2464	784	1376	7232	2068.8	6131.7	76046.1
Future Base 2007j	0	32	1404	0	32	3696	0	23.5	23367.7
Strategy D_{ATT}	0	0	272	0	0	416	0	0	852.0

Table 6.3-9 shows that Strategy D_{ATT} produces very significant reductions in each of these measures, both when compared with the 1995-96 base case and with the 2007 future base. For July 3, Strategy D_{ATT} is seen to reduce the exceedance area by 89% from the 1995-96 base case, and by 81% from the future base. Similarly, area-hours is reduced by more than 94% from the 1995-96 base, and by 89% from the future base. Exposure is reduced by almost 99% from the 1995-96 base case, and by over 96% from the future base.

We can calculate the average duration of exceedance in each grid cell by dividing area-hours by exceedance area. For July 3, the average duration in the 1995-96 base case was over 2.9 hours, and is over 2.6 hours in the future base. After applying Strategy D_{ATT}, however, the average duration drops to just over one and one-half hours (since an exceedance is defined in terms of one-hour average concentrations, the minimum value for average duration is one hour). Each of these metrics shows a marked improvement in air quality from 1995-96, and also from the 2007 predictions without additional controls. These results indicate that the control package modeled is sufficient to reduce an extreme exceedance to, at worst, a mild exceedance of short duration in a small geographic area.

Future design value (DV_f)

Originally designed as the guideline methodology for demonstrating attainment of the proposed eight-hour standard, the future design value, or DV_f, is a valuable component of WOE, since it directly predicts whether an area will reach attainment or not. The DV_f is closely related to the monitored design value of an area, and is based upon the relative reduction modeled at each monitoring site in the region. This calculation uses the five episode days which had either measured or modeled exceedances of the ~~the~~ one-hour standard 125 ppb. The future design value is found by determining reductions in peak ozone modeled within a 7 × 7 square of grid cells surrounding each monitor, then reducing each monitor's base design value (average of 1995, 1996, and 1997 design values) by the calculated reduction factor at that monitor. The methodology used to calculate DV_f is described in Appendix O. Table 6.3-10 presents the predicted design values for the future base and for Strategy D_{ATT}.

Table 6.3-10: Future Design Values for the DFW area

1995-97 Design Value	Predicted future design value DV_f	
	2007i Future Base	Strategy D_{ATT}
139 ppb	128.9 ppb	115.3 ppb

Table 6.3-10 clearly illustrates the highly significant reductions in the area's design value from both the national and state regulations assumed in the future base, and especially from the control measures in Strategy D_{ATT}. With this strategy, the predicted design value in the region in 2007 is nearly 10 ppb below the standard. This analysis presents a highly compelling argument that the area will reach attainment by 2007.

VOC-NO_x Ratios at 1996 Auto-GC sites:
This analysis was described in detail in the Phase I SIP. The conclusion is that ambient data analysis indicates that NO_x controls would be somewhat more beneficial than VOC controls in reducing ozone concentrations. This conclusion provides corroboration of the modeling results, and also provides additional evidence that the NO_x-based strategy D30 will lead towards attainment of the ozone standard.

Transport from the Houston-Galveston area

Houston-Galveston zero-out runs - Commission staff evaluated the impact of transport from the HGA area to DFW by reducing anthropogenic emissions from HGA to zero and calculating the resulting difference in modeled peak ozone concentrations in the DFW area. These runs for the 1995 and 1996 episodes showed that the wind field carried Houston emissions toward Austin and Tyler-Longview respectively, and that DFW received only a small contribution from the Houston plume during these episodes. Impact analysis for Austin and Tyler-Longview indicated impacts of 5-10 ppb could be attributed to sources in Houston. It is reasonable to conclude that on some days, transport from the HGA area could contribute similarly to ozone in the DFW area. Since the commission is developing plans to reduce emissions in HGA area by well over 50%, the DFW area will likely see significant air quality benefits on days when the wind blows directly from the upper Texas Coast to DFW.

Back Trajectory Analysis. Analysis of the meteorology associated with ozone in the DFW area indicates that high ozone episodes are associated with light and variable or even stagnant winds in the local area. However, even stagnant air must come from somewhere outside of the city during the days prior to the episode. Analysis of numerous back trajectories for ozone episodes indicates that winds from the south and southeast are quite common and winds from the north and northwest are quite rare. Depending on the altitude evaluated, winds blew directly from HGA to DFW during approximately 15-22% of the high ozone days. Thus, it can be concluded that winds do blow from the HGA area to the DFW area even though those winds directions were not captured in the 1995 and 1996 episodes.

Synthetic Wind Exercise. Although the 1995 and 1996 DFW episodes did not show a direct impact upon DFW from HGA sources, it is clear from the trajectory analysis that transport from the HGA area can occur. Therefore the commission conducted a synthetic wind demonstration to determine the magnitude of the impact of HGA pollutants upon DFW when they are transported directly. This synthetic wind demonstration showed that Houston emissions could contribute as much as 10 ppb of ozone to DFW afternoon exceedances. This value is likely near the upper limit of potential transport from the HGA area to DFW, since both the wind speed and direction were selected to maximize the impact.

It is clear that the HGA has a significant impact on many cities in Texas. When the HGA sources are better controlled the ozone concentrations in the urban plume will be reduced and many cities, including Dallas, will benefit. Depending upon the specific wind direction each day during the ozone season, individual Texas cities will experience reduced background concentrations of ozone and are therefore less likely to violate the ozone standard. The HGA zero-out runs indicate that DFW should also experience fewer ozone exceedances as a result of the emissions reductions required to bring HGA into compliance. Appendix N provides a detailed discussion of issues related to transport from the HGA area to DFW.

Transport from East Texas

As is the case with the HGA area, the episodes selected for modeling DFW did not show significant transport from East Texas. However, numerous flights conduced by Baylor University have shown high background levels of ozone and NO_x being transported towards DFW from the east. A recent analysis suggests that, on average, only about 50% (65 ppb) of DFW's peak ozone concentration is generated locally. Regional background ozone levels contribute, on average, 70 ppb ozone to peak concentrations in DFW.

The attached back trajectories (generated by HYSPLIT 4) and aircraft flight path (Figures 6.3-1 and 6.3-1, respectively) show significant background ozone levels that were generated as air parcels that traveled through Arkansas, Louisiana, and Northeastern Texas on their way to DFW. This particular mission was flown on September 19, 1998. The estimated upwind ozone concentration on this day was 71 ppb. The peak ozone level measured by the aircraft was 136 ppb, suggesting that DFW contributed only 65 ppb to the peak concentration.

Since East Texas is home to several very large coal-fired powerplants and a smaller number of large industrial sources, sources in this area may be expected to contribute significantly to DFW ozone levels when the wind blows from East Texas. Reduction in NO_x emissions in East Texas from regional NO_x point source reductions will, therefore help to reduce both the number and severity of exceedances in the DFW area.

Emission trends:

The following paragraphs summarize conclusions reached in the Phase I SIP (Appendix Q):

Trend Line Analysis for DFW VOCs. TNMOC data was collected near the Hinton Drive monitoring site during the mid to late 1980's and the mid 1990's. Analysis of the morning canister samples shows a statistically significant downward trend in TNMOC concentrations. Overall, the drop from the combined 1985-86 years to the combined 1995-96 years was 62%. Analysis of just the high ozone days during the same periods shows the same downward trend in TNMOC. This analysis indicates that VOC concentrations have declined significantly in the Dallas urban core over the past fifteen years, indicating that the mix of federal and state controls, especially on motor vehicles, has been effective in reducing one of the ozone precursors. This material was previously discussed in detail in the DFW Phase I SIP in Section 4.3.2.

Design value trends:
Analysis of the monitoring data and trend lines between 1981and 1999 has shown a substantial decline in the DFW ozone design value. The design value is based upon the 4th highest ozone measured in the DFW area over the most recent three year period. The downward trend in the design value over the entire the 18 year period is likely due at least in part to the replacement of older, carbureted motor vehicles with a pool of newer, more tightly controlled vehicles with electronic fuel injection. Recently the trend has flattened somewhat, reflecting the completion of this transition to computer controls. A simple linear trend line over the entire period would suggest that attainment is possible in 2007 without the application of any additional controls. (See Figure 6.3-3)

The most recent trend, however, is relatively flat, though the design value did drop from 139 ppb in 1998 to 137 ppb in 1999 (based on preliminary data). Whether this recent decline is indicative of a long-term trend is uncertain, but it is encouraging to note that this decline occurred despite dramatic increases in the level of construction and economic activity, as well as substantial growth in the mobile fleet and VMT. The conclusion is that existing regulations are sufficient to hold the line against ozone pollution, and with the substantial reductions offered through this SIP, we may expect to see a significant decline in the ozone design value in the near future.

New technologies

The commission will continue to review and implement new control strategies based on sound science. In the past few years, significant new discoveries have provided cleaner technologies than were thought possible ten or fifteen years ago. TNRCC is committed to reviewing and implementing these strategies that make sense for Texas. EPA is continuing to mandate cleaner vehicles. Recent announcements have been made regarding cleaner buses and sports utility vehicles. Currently, TNRCC is evaluating the use of cleaner gasoline and the use of a new technology that will reduce ozone by way of an innovative surface coating. This is more assurance that the control strategies proposed coupled with the continuing improvements in technology will result in cleaner air in the Dallas/Fort Worth area.

Additional Measures not Modeled

- <u>Senate Bill 766</u>. Senate Bill 766 encourages non-EGU sources in attainment areas of Texas to acquire permits for their grandfathered units, and significantly increases emission fees for these sources. The commission estimated that SB766 would result in approximately a 30% decrease in emissions of NO_X from grandfathered non-EGU sources across Texas, and this assumption was included in all strategies prior to D44, but was dropped in response to comments from EPA Region VI. The modeling for Strategy D_{ATT} does include the Agreed Orders for two large sources affected by SB 766, but the commission expects many additional sources to make substantial emission reductions prior to 2007. These reductions will aid the DFW area in its quest to reach attainment by reducing background concentrations of ozone and its precursors, which will in turn aid in lowering ozone concentrations in the nonattainment area.

- <u>Reductions in surrounding states</u>. Similar to SB 766, the commission had assumed NO_X reductions would occur in surrounding states before 2007. Prior to Strategy D38, a 30% reduction had been assumed in Louisiana, Arkansas, Oklahoma, Mississippi, and Florida, but this assumption was dropped, also in response to comments received from Region VI. The commission expects that many states will reduce emissions in the near future as awareness of the regional nature of air quality grows, and expects that these reductions will further reduce the levels of ozone and its precursors transported into the DFW airshed.

- Building code modifications. This control strategy element was included in strategies D19 through D47, but was removed as a result of comments from Region VI. The Region noted that in order for these reductions to be used, the actual ordinances from all the municipalities in the area would need to be included in the SIP itself. Because of time limits, the building code modification element was removed from the modeling. However, the commission believes that the local governments share a strong commitment to enact ordinances which will reduce energy consumption. This will in turn lead to reduced emissions from electric generating facilities both within and outside of the four-county nonattainment area.

Model uncertainty:
A common thread throughout the modeling and WOE analyses is the uncertainty in the modeling process. While modeling is by far the best tool for evaluating proposed control strategies, it is imperative to recognize its limitations and the uncertainty in the model predictions. The photochemical model input is almost entirely the result of other models - meteorological models, emissions models, chemistry models, forecast models - which themselves are built upon yet other models. Each component adds its own uncertainty to the process, so that the end result is a composite of hundreds of individual uncertainties. Fortunately, photochemical grid models have proven to be fairly robust in hundreds of applications, and provide reasonable answers under most circumstances. Nonetheless, the policy maker must be aware that the model can only provide general guidance for control strategy development, and cannot be expected to predict future ozone concentrations with high precision.

In the current application, the uncertainty regarding the meteorology on July 3 has already been discussed. Similar concerns apply to other days, although the meteorology on those days was generally simpler and presumably modeled with a lower degree of uncertainty. Significant uncertainty also exists in the modeling inventory. Recent improvements in biogenic emissions modeling have reduced greatly the uncertainty in that very important sector, but of course have not eliminated it. The construction equipment inventory is another area which is suspect, since the emissions on a *per capita* basis are almost triple the corresponding emissions in the Los Angeles air basin. A study of construction equipment emissions currently being conducted in the Houston area may help refine the DFW area emissions. Comparisons of ambient VOC/NO_x ratios with the emissions inventory indicate that the modeling inventory may have a deficit of VOC, an excess of NO_x, or both. The impending arrival of MOBILE6 may change significantly the on-road mobile source emissions, and may affect the reductions modeled for various I/M strategies.

The uncertainties in the modeling process are inevitably reduced over time, but will never be entirely eliminated. Thus, controls must be implemented before it is possible to judge their impact with as much precision as we would like. The WOE process allows for a middle ground, where a reasonable control package is sufficient to demonstrate probable attainment.

New Emissions Data

At the adoption hearing for this SIP, representatives of the construction industry presented data indicating that the construction equipment emissions for DFW may be smaller than previously assumed. The contractor who developed the DFW emissions based on survey work completed in the Houston area had made several conservative assumptions while developing the DFW emission estimates. Since the time that the revised construction equipment emissions were first presented to the commission (and incorporated into the Base 6 base case), the contractor has collected additional data which indicates that the construction equipment NO_X emissions are actually 4.6 tons/day lower than the emissions incorporated in Base 6a. This revision would be expected to lower even further the modeled 2007 peak ozone levels and future design value.

Figure 6.3-1

6.3-2

6.3-3

CHAPTER 7: FUTURE ATTAINMENT PLANS

The commission will perform a mid-course review and submit the results to EPA by May 1, 2004. This effort will involve a thorough evaluation of all modeling, inventory data, and other tools and assumptions used to develop the attainment demonstration. However, the mid-course review will not relate monitored ambient ozone measurements to the effectiveness of the overall control strategy, since the key strategies crucial to attainment probably will not have been implemented by that time. Although NO_x emissions will begin to decrease in the 2001/2002 time frame, these reductions may not result in lowered monitored ozone levels until the 2005/2006 time frame, considering the time needed to implement point, on-road mobile, and non-road mobile source controls.

One aspect of the mid-course review involves an intensive field study planned for the summer of 2000, which will improve understanding of the physical processes leading to high ozone concentrations in East Texas and particularly along the Gulf Coast. Together with improvements to the emissions inventory, the results of this study will provide part of the scientific basis for reassessing the ozone problem in the DFW ozone nonattainment area. The commission plans to perform new modeling after the appropriate quality assurance and analysis of the field study and inventory data are completed. New modeling results may be expected in 2003, at which time the commission would be able to re-evaluate the control strategies for the area. Completing the mid-course review in late 2003 and taking it through the proposal, hearing, and adoption process in early 2004 would allow the mid-course review SIP revision to be submitted to EPA by May 1, 2004.

The commission commits to continue working with EPA and the DFW regional stakeholders in an open, public consultative process to ensure that the mid-course review is a comprehensive and thorough evaluation.

EPA is expected to release MOBILE6, an enhanced version of its mobile source model, by Fall 2000. Application of MOBILE6 to the DFW inventory will likely change the on-road mobile source emissions inventory, and hence the motor vehicle emissions budget (MVEB) used for transportation conformity purposes.

The commission commits to perform new mobile source modeling, using MOBILE6, within 24 months of the model's release. In addition, if a transportation conformity analysis is to be performed between 12 months and 24 months after the MOBILE 6 release, transportation conformity will not be determined until Texas submits a MVEB which is developed using MOBILE 6 and which the Environmental Protection Agency finds adequate. The NCTCOG and the Department of Transportation have been informed of these commitments.