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REVISIONS TO THE STATE IMPLEMENTATION PLAN (SIP) FOR THE CONTROL OF OZONE AIR POLLUTION

COMPLETE ATTAINMENT DEMONSTRATION FOR THE DALLAS/FORT WORTH OZONE NONATTAINMENT AREA

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LIST OF ACRONYMS

ACT - Alternative Control Techniques
AFV - Alternative Fuel Vehicle
AIRS - Aerometric Information Retrieval System
APA - Administrative Procedure Act
ARACT - Alternate Reasonably Available Control Technology
ARPDB - Acid Rain Program Data Base
ASC - Area Source Categories
ASE - Alliance to Save Energy
ASM - Acceleration Simulation Mode
ATC - Air Traffic Control
BACT - Best Available Control Technology
BEIS-2 - Biogenic Emissions Inventory System, version2
BELD - Biogenic Emissions Land Cover Database
BIOME - Biogenic Model for Emissions
BPA - Beaumont/Port Arthur
Cal LEV - California Low Emission Vehicle
CAM - Compliance Assurance Monitoring
CAMS - Continuous Air Monitoring Station
CAMx - Comprehensive Air Model with Extensions
CARB - California Air Resources Board
CARE - Clean Air Responsibility Enterprise
CB-IV HC - Carbon Bond IV Hydrocarbon
CFR - Code of Federal Regulations
CEMS - Continuous Emissions Monitoring System
CMAQ - Congestion Mitigation and Air Quality
CMSA - Consolidated Metropolitan Statistical Area
CNG - Compressed Natural Gas
CO - Carbon Monoxide
COAST - Coastal Oxidant Assessment for Southeast Texas
CTG - Control Technique Guidelines
DART - Dallas Area Rapid Transit
DFW - Dallas/Fort Worth
DFWN - Dallas/Fort Worth North
DFWRTM - Dallas/Fort Worth Regional Travel Model
DOW - Day of Week
DRI - Desert Research Institute
DV - Design Value
EGAS - Economic Growth Analysis System
EGF - Electric Generating Facilities
EI - Emissions Inventory
EIQ - Emissions Inventory Questionnaire
ELP - El Paso
EPA - U.S. Environmental Protection Agency
EPN - Emission Point Number
ERC - Emission Reduction Credit
ETR - Employer Trip Reduction

FAA - Federal Aviation Administration
FCAA - Federal Clean Air Act
FMVCP - Federal Motor Vehicle Control Program
FR - Federal Register
FTP - File Transfer Protocol
GIS - Geographic Information System
g/hp-hr - Grams Per Horsepower-Hour
GSE - Ground Support Equipment
HAP - Hazardous Air Pollutant
HAXL - Houston Air Excellence in Leadership
HB - House Bill
HC - Hydrocarbon
HDD - Heavy-duty Diesel
HDDV - Heavy-duty Diesel Vehicle
HDEWG - Heavy Duty Engine Working Group
HDV - Heavy-duty Vehicle
HGA - Houston/Galveston
H-GAC - Houston-Galveston Area Council
HON - Hazardous Organic NESHAPS
HOV - High Occupancy Vehicle
HP - Horsepower
HPMS - Highway Performance Monitoring System
HRM - Houston Regional Monitoring
IIG - Interim Implementation Guidance
IIP - Interim Implementation Plan
I/M - Inspection and Maintenance
INIT - Initial Condition Tracer
ITWS - Integrated Terminal Weather System
IWW - Industrial Wastewater
KG/HA - Kilograms/hectare
KM - Kilometer
LDT - Light-duty Truck
LED - Low Emission Diesel
LEV - Low Emission Vehicle
LNG - Liquefied Natural Gas
m - Meter
MACT - Maximum Achievable Control Technology
MERC - Mobile Emission Reduction Credit
MMBtu - Million British Thermal Unit
MPA - Metropolitan Planning Area
MY - Model Year
NAAQS - National Ambient Air Quality Standard
NCDC - National Climatic Data Center
NCTCOG - North Central Texas Council of Governments
NEGU - Non-electric Generating Units
NESHAPS - National Emission Standards for Hazardous Air Pollutants
NEVES - Nonroad Engine and Vehicle Emission Study
NLEV - National Low Emission Vehicle

NNSR - Nonattainment New Source Review
NO_x - Nitrogen Oxides or Oxides of Nitrogen
NO_y - Nitrogen Species
NSR - New Source Review
NWS - National Weather Service
O_3 - Ozone
OAQPS - Office of Air Quality Planning and Standards
OBD - On-Board Diagnostics
OSAT - Ozone Apportionment Technology
OTAG - Ozone Transport Assessment Group
PAMs - Photochemical Assessment Monitoring Sites
PEI - Periodic Emissions Inventory
PM_{10} - Particulate Matter less than 10 microns
ppb - Parts Per Billion
ppm - Parts Per Million
ppmv - Parts Per Million by Volume
PSDB - Point Source Database
PSIA - Pounds per Square Inch Absolute
QA/QC - Quality Assurance/Quality Control
RACT - Reasonably Available Control Technology
RAQPC - Regional Air Quality Planning Committee
RCTSS - Regional Computerized Traffic Signal System
RFG - Reformulated Gasoline
REMI - Regional Economic Modeling, Inc.
ROP - Rate-of-Progress
RSD - Remote Sensing Device
RVP - Reid Vapor Pressure
SAIMM - Systems Applications International Meteorological Model
SB - Senate Bill
SCAQMD - South Coast Air Quality Management District [Los Angeles area]
SCC - Source Classification Code
SCRAM - Support Center for Regulatory Air Models
SETRPC - Southeast Texas Regional Planning Commission
SIC - Standard Industrial Classification
SIP - State Implementation Plan
SO_2 - Sulfur Dioxide
SO_x - Sulfur Compounds
SOCMI - Synthetic Organic Chemical Manufacturing Industry
SULEV - Super-Ultra-Low Emission Vehicle
TAC - Texas Administrative Code
TACB - Texas Air Control Board
TAFF - Texas Alternative Fuel Fleet
TCAA - Texas Clean Air Act
TCF - Texas Clean Fleet
TCM - Transportation Control Measure
TIP - Transportation Implementation Plan
TMC - Texas Motorist's Choice
TNMOC - Total nonmethane organic compounds

TCEQ - Texas Commission on Environmental Quality (commission)
TPOD - Tons Per Ozone Day
TPY - Tons Per Year
TSP - Total Suspended Particulate
TTI - Texas Transportation Institute
UAM - Urban Airshed Model
USDA - United States Department of Agriculture
USGS - United States Geological Survey
UTM - Universal Transverse Mercator
VAVR - Voluntary Accelerated Vehicle Retirement
VERP - Voluntary Emission Reduction Permit
VMAS - Vehicle Mass Analysis System
VMEP - Voluntary Mobile Source Emissions Reduction Program
VMT - Vehicle Miles Traveled
VNR or VNRAT- VOC-NO_x ratios
VOC - Volatile Organic Compound
WOE - Weight of Evidence

VI: Ozone Control Strategy

A. INTRODUCTION

This introduction is intended to provide the reader with a broad overview of the SIP revisions that have been submitted to the EPA by the State of Texas. Some sections may be obsolete or superseded by new revisions, but have been retained for the sake of historical completeness. The reader is referred to the body of the SIP for details on the current SIP revision.

Requirements for the SIP specified in 40 CFR §51.12 provide that ". . . in any region where existing (measured or estimated) ambient levels of pollutant exceed the levels specified by an applicable national standard, the plan shall set forth a control strategy which shall provide for the degree of emission reduction necessary for attainment and maintenance of such national standard." Ambient levels of SO_2 and NO_x, as measured from 1975 through 1977, did not exceed the national standards set for these pollutants anywhere in Texas. Therefore, no control strategies for these pollutants were included in revisions to the Texas SIP submitted on April 13, 1979. Control strategies were submitted and approved for inclusion in the SIP for areas in which measured concentrations of ozone, TSP, or CO exceeded an NAAQS during the period from 1975 to 1977. On October 5, 1978, the Administrator of the EPA promulgated a lead ambient air quality standard. The FCAA Amendments of 1977 required that each state submit an implementation plan for the control of any new criteria pollutant. A SIP revision for lead was submitted in March 1981.

The control strategies submitted in 1979 provided, by December 31, 1982, the amount of emission reductions required by EPA policy to demonstrate attainment of the primary NAAQS, except for ozone, in the Harris County nonattainment area. For that area, an extension to December 31, 1987 was requested, as provided for in the FCAA Amendments of 1977.

Supplemental material, including emission inventories for VOCs and TSP submitted with the 1979 SIP revisions, is included in Appendices H and O of the 1979 SIP submittal.

Proposals to revise the Texas SIP to comply with the requirements of the FCAA Amendments of 1977 were submitted to EPA on April 13, November 2, and November 21, 1979. On December 18, 1979 (44 FR 75830-74832), EPA approved the proposed revision to the Texas SIP relating to vehicle inspection and maintenance and extended the deadline for attainment of the NAAQS for ozone in Harris County until December 31, 1987 (see Appendix Q of the 1979 SIP submittal for the full text of the extension request and the approval notice). On March 25, 1980 (45 FR 19231-19245), EPA approved and incorporated into the Texas SIP many of the remaining provisions included in the proposals submitted by the state in April and November 1979. The March 25, 1980 *Federal Register* notice also included conditional approval of a number of the proposed SIP revisions submitted by the state.

Additional proposed SIP revisions were submitted to EPA by the state on July 25, 1980 and July 20, 1981 to comply with the requirements of the March 25, 1980 conditional approvals. By May 31, 1982, all of the proposed revisions to the Texas SIP submitted to EPA in April and November 1979, July 1980, and July 1981, with the exception of provisions relating to the definition of major modification used in NSR and certain portions of the control strategy for TSP in Harris County, had been fully approved or addressed in a *Federal Register* notice proposing final approval. The NSR provisions were approved on August 13, 1984.

The FCAA Amendments of 1977 required SIPs to be revised by December 31, 1982 to provide additional emission reductions for those areas for which EPA approved extensions of the deadline for attainment of the NAAQS for ozone or CO. In 1982 the state submitted a revision to the Texas SIP to comply with the FCAA Amendments of 1977 and EPA rules for 1982 SIP revisions. Supplementary emissions inventory data and supporting documentation for the revision were included in Appendices Q through Z of the 1982 SIP submittal.

The only area in Texas receiving an extension of the attainment deadline to December 31, 1987 was Harris County for ozone. Proposals to revise the Texas SIP for Harris County were submitted to EPA on December 9, 1982. On February 3, 1983, EPA proposed to approve all portions of the plan except for the Vehicle Parameter I/M Program. On April 30, 1983, the EPA Administrator proposed sanctions for failure to submit or implement an approvable I/M program in Harris County. Senate Bill 1205 was passed on May 25, 1983 by the Texas Legislature to provide the Texas Department of Public Safety with the authority to implement enhanced vehicle inspection requirements and enforcement procedures. On August 3, 1984, EPA proposed approval of the Texas SIP pending receipt of revisions incorporating these enhanced inspection procedures and measures ensuring enforceability of the program. These additional proposed SIP revisions were adopted by the state on November 9, 1984. Final approval by EPA was published on June 26, 1985.

Although the control strategies approved by EPA in the 1979 SIP revisions were implemented in accordance with the provisions of the plan, several areas in Texas did not attain the primary NAAQS by December 31, 1982. On February 23, 1983, EPA published a *Federal Register* notice identifying those areas and expressing the intent to impose economic and growth sanctions provided in the FCAA. However, EPA reversed that policy in the November 2, 1983 *Federal Register*, deciding instead to call for supplemental SIP revisions to include sufficient additional control requirements to demonstrate attainment by December 31, 1987.

On February 24, 1984, the EPA Region 6 Administrator notified the Governor of Texas that such supplemental SIP revisions would be required within one year for ozone in Dallas, Tarrant, and El Paso Counties and CO in El Paso County. The Texas Air Control Board (TACB) requested a 6-month extension of the deadline (to August 31, 1985) on October 19, 1984. EPA approved this request on November 16, 1984.

Proposals to revise the Texas SIP for Dallas, Tarrant, and El Paso Counties were submitted to EPA on September 30, 1985. However, the revisions for Dallas and Tarrant Counties did not provide sufficient reductions to demonstrate attainment of the ozone standard and on July 14, 1987, EPA published intent to invoke sanctions. Public officials in the two counties expressed a strong desire to provide additional control measures sufficient to satisfy requirements for an attainment demonstration.

A program of supplemental controls was taken to public hearings in late October 1987. As a result of testimony received at the hearings, a number of the controls were modified and several were deleted, but sufficient reductions were retained to demonstrate attainment by December 31, 1991. These controls were adopted by the TACB on December 18, 1987 and were submitted to EPA as proposed revisions to the SIP. Supplemental data and supporting documentation are included in Appendices AA through AO of the 1987 SIP submittal.

The FCAA Amendments of 1990 authorized EPA to designate areas failing to meet the NAAQS for ozone as nonattainment and to classify them according to severity. The four areas in Texas and their respective classifications include: HGA (severe), BPA (serious), ELP (serious), and DFW (moderate).

The FCAA Amendments required a SIP revision to be submitted for all ozone nonattainment areas classified as moderate and above by November 15, 1993, which described in part how an area intends to decrease VOC emissions by 15%, net of growth, by November 15, 1996. The amendments also required all nonattainment areas classified as serious and above to submit a revision to the SIP by November 15, 1994, which described how each area would achieve further reductions of VOC and/or NO_x in the amount of 3.0% per year averaged over three years and which includes a demonstration of attainment based on modeling results using the UAM. In addition to the 15% reduction, states were also required to prepare contingency rules that would result in an additional 3.0% reduction of either NO_x or VOC, of which up to 2.7% may be reductions in NO_x. Underlying this substitution provision is the recognition that NO_x controls may effectively reduce ozone in many areas and that the design of strategies is more efficient when the characteristic properties responsible for ozone formation and control are evaluated for each area. The primary condition to use NO_x controls as contingency measures is a demonstration through UAM modeling that these controls will be beneficial toward the reduction of ozone. These VOC and/or NO_x contingency measures would be implemented immediately should any area fall short of the 15% goal.

Texas submitted rules to meet the ROP reduction in two phases. Phase I consisted of a core set of rules comprising a significant portion of the required reductions. This phase was submitted by the original deadline of November 15, 1993. Phase II consisted of any remaining percentage toward the 15% net of growth reductions, as well as additional contingency measures to obtain an additional 3.0% of reductions. Phase II was submitted by May 15, 1994. The complete list of contingency measures was submitted by November 15, 1994. The appropriate compliance date was to be incorporated into each control measure to ensure that the required reductions would be achieved by the November 15, 1996 deadline. A commitment listing the potential rules from which the additional percentages and contingency measures were selected was submitted in conjunction with the Phase I SIP on November 15, 1993. That list of Phase II rules was intended to rank options available to the state and to identify potential rules available to meet 100% of the targeted reductions and contingencies. Only those portions of the Phase II rules needed to provide reasonable assurance of achieving the targeted reduction requirements were adopted by the commission.

The DFW and ELP areas achieved sufficient reductions with the 15% ROP SIP to demonstrate attainment by 1996. Attainment Demonstration SIP Revisions for these two areas were submitted on September 14, 1994.

The FCAA Amendments of 1990 classified the BPA area as a serious nonattainment area. The BPA nonattainment area includes Hardin, Jefferson, and Orange Counties. The BPA nonattainment area has an ozone design value of 0.16 ppm, which places the area in the serious classification.

The FCAA Amendments of 1990 required a Post-96 ROP SIP revision and accompanying rules to be submitted by November 15, 1994. According to the FCAA Amendments, this submittal had to contain an Attainment Demonstration based on UAM. Additionally, the revision had to demonstrate how the HGA and BPA nonattainment areas intended to achieve a 3% per year reduction of VOC and/or NO_x until the year 2007, and additional reductions as needed to demonstrate modeled attainment. The plan was also required to carry an additional 3% of contingency measures to be implemented if the nonattainment area fails to meet a deadline. To use NO_x reductions for all or part of the Post-96 controls or the contingency

measures required a demonstration using UAM showing that NO_x controls would be beneficial in reducing ozone.

On November 9, 1994, the state submitted a SIP revision designed to meet the 3% per year ROP requirements for the years 1997-1999. This Post-96 ROP SIP revision detailed how the BPA and HGA nonattainment areas intended to achieve these three years' reductions of VOC (or 9% net-of-growth). Most of this amount was achieved by quantifying additional reductions due to existing rules and reductions due to federally-mandated rules. Rules to achieve the further reductions needed to meet the ROP SIP goal were submitted to EPA on January 11, 1995. This submittal included modeling demonstrating progress toward attainment, using a 1999 future year emissions inventory.

On August 14, 1994, the state submitted preliminary UAM modeling results for the BPA and HGA nonattainment areas that showed the relationship between emission levels of VOC and NO_x, and ozone concentrations. This modeling was conducted with a 1999 future year emissions inventory. Based on the results of this preliminary modeling, which showed that NO_x reductions might increase ozone concentrations, on April 12, 1995 the state received a temporary §182(f) exemption from all NO_x requirements, including RACT, I/M, NO_x NSR, and transportation conformity requirements. Permanent §182(f) exemptions from all NO_x requirements were granted for DFW and ELP, and temporary exemptions until December 31, 1996 for HGA and BPA. The commission subsequently requested that EPA extend this date until December 31, 1997. EPA approved this 1-year extension on May 14, 1997.

On March 2, 1995, Mary Nichols, EPA Assistant Administrator for Air and Radiation, issued a memo which gave states some flexibility to design a phased Attainment Demonstration. It provided for an initial phase which was intended to continue progress in reducing levels of VOC and/or NO_x, while giving states an opportunity to address scientific issues such as modeling and the transport of ozone and its precursor pollutants. The second phase was designed to draw upon the results of the scientific effort and design a plan to bring the area into attainment. To constitute Phase I under this approach, the EPA guidance required that states submit the following SIP elements by December 31, 1995:

- Control strategies to achieve reductions of ozone precursors in the amount of 3% per year from the 1990 baseline EI for the years 1997, 1998, and 1999.
- UAM modeling through the year 1999, showing the effect of previously-adopted control strategies which were designed to achieve a 15% reduction in VOCs from 1990 through 1996.
- A demonstration that the state has met the VOC RACT requirements of the FCAA Amendments.
- A detailed schedule and plan for the "Phase II" portion of the attainment demonstration which will show how the nonattainment areas can attain the ozone standard by the required dates.
- An enforceable commitment to:
  - Participate in a consultative process to address regional transport;
  - Adopt additional control measures as necessary to attain the ozone NAAQS, meet ROP requirements, and eliminate significant contribution to nonattainment downwind; and
  - Identify any reductions that are needed from upwind areas to meet the NAAQS.

Texas submitted the first two of these required sections in November 1994. The remaining three, a VOC RACT demonstration, the required commitments, and a Phase II plan and schedule, were submitted on January 10, 1996 to EPA.

ROP SIP modeling was developed for the HGA nonattainment area in two phases using the UAM. The first phase of ROP modeling was the modeling submitted in January 1995, as described above. The

second phase of the ROP modeling was conducted using data obtained primarily from the COAST project, an intensive 1993 field study. The COAST modeling for HGA and the associated SIP were projected to be completed by December 1996 for submittal in May of 1997. Control strategies developed in this second phase were planned to be based on a more robust database, providing a higher degree of confidence that the strategies would result in attainment of the ozone NAAQS or target ozone value. A discussion of the schedule for the UAM modeling for the Phase II Attainment Demonstration can be found in Appendix 11-F of the January 10, 1996 submittal.

On January 29, 1996, EPA proposed a limited approval/limited disapproval for the Texas 15% ROP SIP revision. EPA proposed a limited approval because the SIP revision would result in significant emission reductions from the 1990 baseline and would, therefore, improve air quality. Simultaneously, the EPA proposed a limited disapproval because it believed that the plan failed to demonstrate sufficient reductions to meet the 15% ROP requirements. It also proposed a limited approval/disapproval of the contingency plans (designed to achieve an additional 3% of reductions if needed because a milestone is missed) along the same lines as the 15% action. EPA stated that some of the control measures submitted along with the SIP revision did not meet all of the requirements of the FCAA Amendments of 1990 and, therefore, cannot be approved. EPA further stated that it was not making a determination at this time about whether the state had met its requirements regarding RACT, or any other underlying FCAA Amendments of 1990 requirements. Finally, EPA proposed approval of the Alternate Means of Control portion of the November 9, 1994 Post-96 SIP submittal, but did not propose action on any other portion of that submittal.

Additionally, on November 29, 1995, the President signed the National Highway Systems Designation Act, which, among other things, prohibited EPA from discounting the creditable emissions from a decentralized vehicle I/M testing program if an approvable conditional I/M SIP revision was submitted to EPA within 120 days of the bill's signature. EPA's Office of Mobile Sources issued guidance stating that it would accept an interim I/M SIP proposal and Governor's letter 120 days after signature of the bill in lieu of an adopted SIP revision. The SIP proposal and letter was submitted to the EPA prior to the March 27, 1996 deadline to meet the 120-day time frame. The final I/M SIP revision (Rule Log No. 96104-114-AI), commonly referred to as the "Texas Motorist's Choice Program," was adopted by the commission on May 29, 1996 and submitted to the EPA by the state on June 25, 1996. On October 3, 1996, EPA proposed (61 FR 51651-51659) conditional interim approval of the Texas Motorist's Choice Program based upon the state's good faith estimate of emission reductions and the program's compliance with the Clean Air Act.

Part of EPA's determination that the new I/M SIP is approvable depends on the program's ability to achieve sufficient creditable VOC reductions so that the 15% ROP can still be achieved. The commission designed the revised I/M program to fit in with the other elements of the 15% SIP to achieve the full amount of creditable reductions required. The I/M program also achieves creditable reductions for the Post-96 ROP SIP.

Changes to the I/M program have had an impact on the ELP §818 Attainment Demonstration as well. This demonstration was predicated on the assumption that the I/M program would be implemented as adopted for the 15% SIP. An addendum to the §818 Demonstration shows that the basic underlying assumptions of the modeling still pertain despite the revisions to the I/M program.

The ETR program revision to the SIP and ETR rule were adopted in October 1992 by the TACB to meet the mandate established in the FCAA Amendments of 1990 (§182(d)(1)(B)). This section of the FCAA

required states with severe or extreme ozone nonattainment areas to develop and implement ETR programs in those areas. For Texas, the only area affected was the HGA area. The ETR program required large employers (those with 100 or more employees) to implement trip reduction programs that would increase the average passenger occupancy rate of vehicles arriving at the workplace during the peak travel period by 25% above the average for the area.

Congress amended the FCAA in December of 1995 by passing House Rule 325. This amendment allows the state to require an ETR program at its discretion. It also allows a state to "remove such provisions (ETR programs) from the implementation plan . . . if the state notifies the Administrator, in writing, that the state has undertaken, or will undertake, one or more alternative methods that will achieve emission reductions (1.81 tons/day) equivalent to those achieved by the removed . . . provisions." As such, large employers will no longer be mandated to implement trip reduction programs. The HGA ozone nonattainment area will, however, through the coordination of the Houston-Galveston Area Council, implement a voluntary regional initiative to reduce vehicle trips.

The 1990 Adjusted Base Year EI was submitted on November 12, 1993. It is the official inventory of all emission sources (point, area, on-road and non-road mobile) in the four nonattainment areas. There have been several changes to the EI due to changes in assumptions for certain area and non-road mobile source categories. Changes to the baseline EI have affected the target calculations and creditable assumptions made in the 15% and 9% SIPs.

In December of 1990, then-Texas Governor William Clements requested that the BPA area be reclassified as a "moderate" ozone nonattainment area in accordance with §181(a)(4) of the FCAA Amendments of 1990. That request was denied on February 13, 1991. A recent review of the original request and supporting documentation has revealed that this denial was made in error. As provided by §110(k)(6) of the Act, the EPA Administrator has the authority to reverse a decision regarding original designation if it is discovered that an error had been made.

Monitoring data from a privately-funded, special purpose monitoring network which was not included in the Aerometric Information Retrieval System database was improperly used to deny this request. Furthermore, subsequent air quality trends demonstrated that BPA is more properly classified as a moderate nonattainment area, and could attain the standard by the required date for moderate areas of November 15, 1996. Therefore, Governor Bush sent a letter and technical support to EPA on July 20, 1995, requesting that the BPA area be reclassified to moderate nonattainment status. BPA planned to demonstrate attainment one of the following ways:

- Monitored values showing attainment of the standard at state-operated monitors for the years 1994-1996, which is the time line the FCAA Amendments of 1990 specifies for moderate areas.
- UAM modeling showing attainment of the standard but for transport of ozone and/or precursors.

EPA Region 6 verified the data submitted in support of this request and concurred that it is valid. On June 3, 1996, the reclassification of the BPA area became effective. Because the area was classified as serious, it was following the SIP submittal and permitting requirements of a serious area, which included the requirements for a Post-96 SIP. With the consolidated SIP submittal, the commission removed the BPA area from the Post-96 SIPs, which became applicable to the HGA nonattainment area only.

The State of Texas, in a committal SIP revision submitted to EPA on November 15, 1992, opted out of the Federal Clean Fuel Fleet program in order to implement a fleet emission control program designed by

the state. In 1994, Texas submitted the state's opt-out program in a SIP revision to the EPA and adopted rules to implement the TAFF program. In 1995, the 74th Texas Legislature modified the state's alternative fuels program through passage of SB 200. In response to SB 200, the commission adopted regulations modifying the TAFF program to create the TCF program.

Since adoption on July 24, 1996 and subsequent submission to EPA of the TCF SIP revision, the 75th Texas Legislature modified the state's alternative program once again through passage of SB 681. Staff modified the TCF program, now called the TCF Low Emission Vehicle program, to reflect changes mandated by SB 681.

On June 29, 1994, the commission adopted a revision to the SO_2 SIP regarding emissions in Harris County. The SIP revision was required by EPA because of exceedances of the SO_2 NAAQS in 1986, 1988, and 1990. An EPA study conducted by Scientific Applications International Corporation also predicted SO_2 exceedances. On April 22, 1991, the EPA declared that portions of Harris County were potentially in nonattainment of the SO_2 NAAQS. Consequently, the HRM Corporation volunteered to find reductions in SO_2 in order to prevent being redesignated to nonattainment. HRM's efforts resulted in finding voluntary SO_2 reductions. These reductions were adopted in 13 commission Agreed Orders and were included as part of the June 29, 1994 SIP revision. The EPA approved the Harris County SO_2 SIP on March 6, 1995 (60 FR 12125).

On May 14, 1997, the commission adopted an additional revision to the Harris County SO_2 SIP to incorporate modifications to two of the 13 commission Agreed Orders. The remaining sections of the SIP remained the same. While on the scale of "minor technical corrections," the modified orders were submitted as a SIP revision because the new emission rates differ from what EPA had previously approved. The two Agreed Order modifications concerned grandfathered units at Simpson Pasadena Paper Company and Lyondell-Citgo Refining Company, Ltd. The commission approved changes to both Agreed Orders on July 24, 1996.

On May 14, 1997, the commission also adopted a revision to the SIP modifying the vehicle I/M program. This revision removed the test-on-resale component that had been included in the vehicle I/M program, as designed in July of 1996. Test-on-resale required persons selling their vehicles in the I/M core program areas to obtain emissions testing prior to the title transfer of such vehicles. Test-on-resale was not required to meet the FCAA Amendments of 1990 and did not produce additional emissions reduction benefits. The SIP revision also incorporated into the SIP the Memorandum of Understanding between the commission and the Department of Public Safety, adopted by the commission on November 20, 1996.

The FCAA Amendments of 1990 required that, for severe and above ozone nonattainment areas, states develop SIP revisions that include specific enforceable TCMs, as necessary, to offset increases in motor vehicle emissions resulting from growth in VMT or the number of vehicle trips. This SIP revision would also satisfy reductions in motor vehicle emissions consistent with the 15% ROP and the Post-1996 ROP SIPs.

Therefore, the commission developed and submitted to EPA a committal SIP revision for the HGA nonattainment area on November 13, 1992, and VMT Offset SIP revisions on November 12, 1993 and November 6, 1994, to satisfy the requirements of the 15% ROP SIP revision. The former SIP revision laid out a set of TCMs and other mobile source controls which reduced emissions below the modeled ceiling. The 1994 SIP revision did not require additional TCMs.

As a result of changes in the I/M and the ETR programs, it was necessary to do the 1997 VMT Offset SIP revision for the HGA area, which was adopted on August 6, 1997. Additional TCMs were included: high occupancy vehicle lanes, park and ride lots, arterial traffic management systems, computer transportation management systems, and signalization. These TCMs were part of the "Super SIP" submitted to EPA on July 24, 1996.

Using the best technical guidance and engineering judgement available at the time, the State of Texas calculated emissions reductions available from the enhanced monitoring rule that was to be part of the Title V permitting program. The enhanced monitoring rule was later revised and transformed into the CAM Rule. Texas maintained that its calculation methodologies still accurately reflected the amount of creditable reductions available. EPA disagreed with the calculation methodologies used by the state and intends to disapprove the 9% SIP as a result. EPA also indicated that the emission reduction credits claimed for the Texas Clean Fuels Fleet program were not approvable due to a legislative change to the program. The state plans to submit a SIP revision for this program in a separate action, but has removed the credits claimed in the 9% SIP in this action. The State of Texas proposed to submit a revision to the 9% SIP which revises the reductions claimed by the state toward the 9% emissions target.

The State of Texas did not reapply for an extension of the NO_x §182(f) waivers for HGA and BPA as discussed previously. Therefore, on December 31, 1997, the waivers expired. The state is now required to implement several NO_x control programs. Among them is a requirement for all major NO_x sources within the area to implement RACT. The state has adopted a revised compliance date of November 15, 1999 for this program.

The commission, in a committal SIP revision adopted on June 3, 1998, and submitted to EPA on June 23, 1998, agreed to implement OBD checks as part of the I/M program by the federal deadline of January 1, 2001.

On July 29, 1998, the commission adopted regulations and a revision of the TCF SIP to set forth the LEV requirements for mass transit fleets in each of the serious and above nonattainment areas, and for local government and private fleets operated primarily within the serious and above nonattainment areas. These rules satisfy the state requirements to adopt rules to implement SB 681.

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 to demonstrate, through monitoring, attainment of the 1-hour ozone standard by November 15, 1996, or face being "bumped up" to the serious classification. Air quality data from DFW ambient air quality monitors for the years 1994-96 show that the 1-hour NAAQS for ozone has been exceeded more than one day per year over this three-year period. On February 18, 1998, the EPA issued a final notice in the *Federal Register* that the DFW area was being reclassified to the serious classification for failing to attain the NAAQS for ozone. As a result of this reclassification, the EPA required that a new SIP demonstrating attainment of the ozone standard in DFW be submitted by March 20, 1999. The state submitted a SIP for DFW that included photochemical modeling showing the level of reductions needed to attain the standard by 1999, a 9% ROP target calculation for the years 1997-99, VOC RACT rules in Chapter 115 applicable to sources meeting the 50 tpy major source level, NO_x RACT rules in Chapter 117 applicable to major sources of NO_x, and amendments to Chapter 116 reinstating nonattainment new source review for NO_x. The governor submitted this SIP to EPA on March 16, 1999. Because there was not enough time to implement the rules to achieve necessary reductions of ozone precursor emissions in the DFW area by the required attainment

date of November 15, 1999, the state proposed to submit in March 2000 a full attainment demonstration including a complete rule package necessary to attain the 1-hour ozone standard.

On February 24, 1999 the commission adopted a SIP revision for the DFW area which was submitted to EPA on March 16, 1999. This SIP was not only intended to demonstrate how the DFW area would attain the standard through the submission of an updated emissions inventory and photochemical modeling, but to also include a 9% ROP target calculation in order to satisfy EPA's requirement of reasonable further progress in emission reductions for the DFW area for the years 1997-99. The reductions toward ROP were short of the 9% target and the SIP lacked required modeled control strategies; therefore, a follow-up SIP was developed. More information about the follow-up submittal is addressed later in this introduction.

On May 12, 1999 the commission adopted a revision to the SIP for the Northeast Texas region which would make certain local ozone precursor emission reductions federally enforceable. This revision was submitted to EPA on June 4, 1999. Four affected companies (Norit Americas, Inc.; La Gloria Oil and Gas Company; Eastman Chemical Company, Texas Eastman Division; and ARCO Permian) in the Northeast Texas region voluntarily agreed to be subject to the implementation of enforceable emission reduction measures pursuant to Part A, Sections 2-5 of the Northeast Texas Flexible Attainment Region (FAR) Memorandum of Agreement. The FAR approach allows time for the area's control program to work, similar to contingency measures in a post-1990 maintenance agreement, prior to EPA issuing a call for a SIP revision or nonattainment redesignation. The MOA required the immediate implementation of control measures through the use of Agreed Orders, which are included in the SIP revision to make them federally enforceable.

On June 30, 1999 the commission adopted a revision to the SIP in order to incorporate cleaner gasoline rules. The cleaner gasoline is required to have a lower RVP outside the DFW and HGA areas, and a limit on the amount of sulfur in each gallon of gasoline. The RVP required in this SIP revision is 7.8 psi starting May 1, 2000. The RVP limit would be in effect every summer from May 1st through October 1st. A 7.8 psi RVP fuel is expected to reduce evaporative emissions from automobiles, off-highway gasoline powered equipment, and all gasoline storage and transfer operations. Evaporative VOC emissions from automobiles will be reduced by at least 14%. The sulfur cap requirement is 150 ppm per gallon of gasoline, starting January 1, 2004. Low sulfur gasoline is expected to reduce NO_x emissions from today's cars by 8.5% according to the EPA complex model. The rules would further provide for counties or large cities to opt into these regulations earlier than required provided that certain conditions are met. If EPA were to adopt sulfur regulations to require compliance by January 1, 2004, the commission's rules would no longer apply, allowing the federal sulfur rules to take precedence. However, areas that choose to opt-in early would continue to follow the sulfur requirements of their early compliance plan until EPA actually implemented its regulations, unless otherwise specified in the commission order.

On July 28, 1999 the commission adopted a site-specific revision to the SIP which provides for the redesignation to attainment of that portion of Collin County currently designated as nonattainment for the lead NAAQS. The revision also provides a maintenance plan for the area to ensure continued compliance. As part of the maintenance plan, the revision establishes a new contingency plan through an agreed order and replaces Agreed Board Orders 92-09(k) and 93-12 and Board Order 93-10. The revision also provides for a commitment by the commission to keep the existing monitoring network in place until the end of the maintenance period.

On October 15, 1999 the commission adopted a revision to the SIP for the DFW ozone nonattainment area. This SIP was developed in order to address the shortfall in the reductions toward the 9% ROP target and the lack of modeled control strategies from the February 24, 1999 revision. Potential emission reduction credits were reviewed that were not claimed in the February 1999 SIP in order to make up the ROP shortfall. The focus was on VOC reductions because fewer VOC reductions would be needed to make up the shortfall compared to NO_x emission reductions. The ROP lacked about 20% of the VOC reductions needed, which amounted to 5.87 tpd. Making the 9% TOP portion of the SIP complete should allow certain transportation projects to avoid being put on hold. Elements have been identified that were not previously considered that would bring SIP emission reduction credits in order to complete the 9% TOP requirements for the years 1996-99. These technical corrections were included in the October 1999 revised SIP.

In November 1998, the H.A. SIP revision submitted to EPA in May 1998 became complete by operation of law. However, EPA stated that it could not approve the SIP until specific control strategies were modeled in the attainment demonstration. EPA specified a submittal date of November 15, 1999 for this modeling. As the H.A. modeling protocol evolved, the state eventually selected and modeled seven basic modeling scenarios. As part of this process, a group of H.A. stakeholders worked closely with commission staff to identify local control strategies for the modeling. This modeling showed a gap in reductions necessary for attainment of the 1-hour ozone standard. The commission adopted these revisions to the SIP on October 27, 1999.

In January 1997 the commission proposed a program that, for the first time in Texas' air pollution control history, extended beyond the confines of the urbanized areas. The concept of the regional strategy was developed as a result of several major occurrences. These events include the COAST Study, participation in the OTAG process, deployment of intensive aircraft monitoring by Baylor University, and the development of regional photochemical modeling. While Texas was not involved in the OTAG SIP call requiring mandatory statewide NO_x reductions, the commission realized the importance of the role of transported ozone and/or its precursors and the need for a statewide comprehensive plan in order to assist the areas that are struggling to attain the ozone standard. The impact on several states from the smoke and haze episodes from fires in Central America during the summer of 1998 helped reinforce the fact that air pollution is capable of traveling hundreds of miles.

The purpose of the regional strategy is to reduce ozone causing compounds in the eastern half of the state in order to help reduce background levels of ozone in both non attainment areas as well as those areas close to a noncompliance for the new 8-hour ozone standard. Components of the regional strategy included support for the NLEV program, cleaner burning gasoline and stage. I vapor recovery, voluntary involvement in the permitting of grand fathered facilities, and reductions from major stationary sources.

On July 16, 1998, EPA issued a guidance memorandum titled "Extension of Attainment Dates for Downwind Transport Areas." The guidance, referred to hereinafter as the "transport guidance," provides a means for EPA to extend the attainment date for an area affected by transported air pollution, without reclassifying ("bumping up") the area to a higher classification. The transport guidance is particularly relevant to B.A., which is downwind of the H.A. area and is affected by transport from H.A. If EPA approved such a determination for B.A., the area would have until no later than November 15, 2007, the attainment date for H.A., to attain the 1-hour ozone standard. There is also mounting technical data which suggests that the DFW area is impacted by transport and high regional background levels of ozone. A modeling demonstration has been developed and shows that the air quality in the DFW area is influenced at times from the H.A. area. This demonstration, if approved by the EPA, would allow EPA to

determine that the area should not be bumped up from serious too severe under the conditions of the July 16, 1998 transport guidance. If approved by the EPA the new attainment date for the DFW area would be no later than November 15, 2007, the attainment date for HGA.

As a result of the transport demonstrations for BPA and DFW, the development of SIPs in Texas will be, for the first time ever, on a coordinated timeline. This coordinated planning effort will include three of the state's four 1-hour ozone nonattainment areas as well as future 8-hour ozone areas. While there is uncertainty with the 8-hour ozone standard due to a pending court case, EPA's original plan calls for designations of 8-hour areas in 2000, SIP submittals by 2003, and attainment of the 8-hour standard by 2007. This statewide comprehensive planning with 2007 as a target date will allow Texas to utilize its resources in the most efficient manner to develop control strategies to reduce air pollution not only in the urbanized areas but regionally as well.

The challenges associated with reducing pollution levels to comply with the federal standards are very great, especially in the state's two largest urban areas - DFW and HGA. Commission staff worked very closely with local entities to develop recommendations that will get the respective areas into attainment. Future attainment relies on not only the development of local and state control measures, but on future federal rules involving new technologies as well. These especially involve cleaner fuels and cleaner engines for both on-road as well as non-road mobile sources. Unfortunately, many of these federal measures will not be available until the 2004 time frame and then time will be required to provide for turnover before they will become effective at reducing pollution levels. This would make it very difficult for any large urban nonattainment area to comply before the 2007 time frame. As a result of federal measures, state regulations, and local initiatives it is estimated that emissions in the eastern and central part of the state that contribute to the production of ground level ozone will be reduced by approximately 100 tpd by 2001; approximately 1200 tpd by 2003; approximately 1400 tpd by 2005; and approximately 1500 tpd by 2007. Texas is committed to implementing these strategies as quickly as practicable.

In the April 2000 SIP revision for HGA the state made the following enforceable commitments: 1) to quantify the shortfall of NO_x reductions needed for attainment; 2) to list and quantify potential control measures to meet the shortfall of NO_x reductions needed for attainment; 3) to adopt the majority of the necessary rules for the HGA attainment demonstration by December 31, 2000, and to adopt the rest of the rules as expeditiously as practical, but no later than July 31, 2001; 4) to submit a Post-99 ROP analysis by December 31, 2000; 5) to perform a mid-course review by May 1, 2004; and 6) 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 an MVEB which is developed using MOBILE 6 and which the EPA finds adequate. Finally, if any of the measures adopted in the SIP pertain to motor vehicles, the commission commits to recalculate and resubmit a MVEB by December 31, 2000.

The BPA area is classified as moderate, and therefore was required to attain the 1-hour ozone standard by November 15, 1996. The BPA area did not attain the standard by that date, and also did not attain the standard by November 15, 1999, the attainment date for serious areas. In determining the appropriate attainment date for an area, EPA may consider the effect of transport of ozone or its precursors from an upwind area which interferes with the downwind area's ability to attain. On April 16, 1999, EPA proposed in the *Federal Register* to allow BPA to take advantage of the transport guidance if an approvable attainment demonstration is submitted by November 15, 1999. The SIP revision, adopted by

the commission on October 27, 1999 and submitted to EPA by November 15, 1999, contained results of photochemical modeling demonstrating transport from HGA to BPA, and, following EPA's transport guidance, demonstrating that BPA attains the 1-hour ozone standard. In addition, the November 1999 SIP revision contained adopted rules for IWW and batch process sources to ensure that VOC emission limits for these sources meet EPA's guidelines for RACT. Furthermore, the SIP revision included adopted rules establishing NO_x RACT emission limits for gas-fired, lean-burn stationary internal combustion engines. These NO_x rules represented "Phase I" of a two-part revision to the BPA attainment demonstration SIP.

The April 2000 SIP revision represented "Phase II" of the BPA attainment demonstration SIP, and contained adopted rules specifying NO_x emission limits for electric utility boilers, industrial boilers, and industrial process heaters. In accordance with EPA guidance, implementation of these NO_x emission limits represented a reasonable level of control, necessary for an approvable attainment demonstration. Modeling of these Phase II reductions showed that the BPA area attains the 1-hour ozone standard, using WOE analyses.

The DFW area's attainment deadline as a serious ozone nonattainment area was November 15, 1999.

In March 1999 the state submitted an attainment demonstration to EPA, however this SIP submittal did not contain the necessary rules to bring the DFW area into attainment by the November 1999 deadline. As a result, EPA issued a letter of findings that the March 1999 submittal was incomplete. This finding triggered a 18-month sanctions clock effective May 13, 1999.

The state now has been mounting technical data suggesting that DFW is significantly impacted by transport and regional background levels of ozone. The reductions from the strategies needed for the H.A. 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 April 2000 SIP contained a modeling demonstration which showed that the air quality in the DFW area is influenced at times from the H.A. area. This demonstration, if approved by EPA, would allow EPA to determine that the DFW area should not be bumped up to a more severe classification. It would also allow DFW to have until no later than November 15, 2007, the attainment date for H.A., to reach attainment.

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. A WOE argument was developed for DFW consisting of several elements which, taken together, formed a compelling argument that attainment will be achieved by 2007.

The commission adopted the DFW Attainment Demonstration SIP on April 19, 2000. The SIP submittal contained the following elements: 1) photochemical modeling of specific control strategies and future state and national rules for attainment of the 1-hour ozone standard by November 15, 2007; 2) a modeling demonstration that shows that the air quality in the DFW area is influenced at times by transport from the H.A. area. ; 3) control strategies selected and developed by the NCTCOG and the state; 4) transportation conformity MVEBs for NO_x and VOC; and 5) a commitment to perform and submit a mid-course review by May 2004.

In a further revision of the DFW SIP on May 23, 2001, the commission repealed the airport GSE rule for the DFW area because agreed orders were signed with the area's major airlines, airports, and governmental entities to achieve the same NO_x reductions that would have been achieved by the rule.

On April 19, 2000 the state adopted a revision to the Northeast Texas FAR SIP. The Flexible Attainment Region Agreement requires that contingency measures be implemented as a result of exceedances of the National Ambient Air Quality Standard for ozone. As outlined in the FAR Action Plan under Part B, Contingent Measures, in the event of a subsequent violation the SIP must be revised to include quantifiable and enforceable control measures. Through the use of Agreed Orders these measures were adopted and included in the Northeast Texas FAR SIP to make them federally enforceable.

The commission adopted a revision to the I/M SIP on April 19, 2000 that includes onboard diagnostics checks and ASM test equipment and extends the program to all four of the core counties of the DFW ozone nonattainment area and five surrounding counties. On December 6, 2000, the commission adopted a revision to the I/M SIP that extends the program to the entire 8-county HGA ozone nonattainment area. The revision also incorporated program changes that apply in all I/M program areas.

On May 3, 2000 the state adopted a revision to the TCM and VMT portions of the SIP. This revision required TCM project-specific descriptions and estimated emissions reductions to be included in the SIP and allowed nonattainment area MPOs to substitute TCMs without a SIP revision if the substitution results in equal or greater emission reductions.

The commission adopted the HGA Post-1999 ROP and Attainment Demonstration SIP on December 6, 2000 . The December 2000 submittal contained the following elements: 1) rules and photochemical modeling analyses in support of the HGA ozone attainment demonstration; 2) post-1999 ROP plans for the milestone years 2002 and 2005, and for the attainment year 2007; 3) transportation conformity MVEBs for NO_x and VOC; 4) enforceable commitments to implement further measures in support of the HGA attainment demonstration; and 5) a commitment to perform and submit a mid-course review by May 2004.

In order for the state to have an approvable attainment demonstration, the EPA indicated that the state needed to adopt those strategies modeled in the November 1999 SIP submittal, and then adopt sufficient measures to close the remaining gap in NO_x emissions. The modeling indicated an emissions gap such that an additional 91 tpd of NO_x reductions was necessary for an approvable attainment demonstration. The HGA nonattainment area needs to ultimately reduce NO_x by more than 750 tpd to reach attainment with the 1-hour ozone standard. In addition, a VOC reduction of about 25% will also have to be achieved.

The September 2001 SIP revision for the HGA ozone nonattainment area included the following elements: 1) corrections to the ROP table/budget for the years 2002, 2005, and 2007 due to a mathematical inconsistency; 2) incorporation of a change to the idling restriction control strategy clarifying that the operator of a rented or leased vehicle is responsible for compliance with the requirements of Chapter 114 in situations where the operator of a leased or rented vehicle is not employed by the owner of the vehicle (the commission committed to making this change when the rule was adopted in December 2000); 3) incorporation of revisions to the clean diesel fuel rules to provide greater flexibility in complying with the requirements of the rule while preserving the emission reductions necessary to demonstrate attainment in the HGA area; 4) incorporation of a stationary diesel engine rule that was developed as a result of the state's analysis of EPA's reasonably available control measures; 5)

incorporation of revisions to the point source NO_x rules; 6) incorporation of revisions to the emissions cap and trade rules; 7) the removal of the construction equipment operating restriction and the accelerated purchase requirement for Tier 2/3 heavy duty equipment; 8) the replacement of these rules with the Texas Emission Reduction Plan program; 9) the layout of the mid-course review process which details how the state will fulfill the commitment to obtain the additional emission reductions necessary to demonstrate attainment of the 1-hour ozone standard in the HGA area; and 10) replacement of 2007 Rate of Progress MVEBs to be consistent with the attainment MVEBs.

In August 2001 the DFW SIP, in accordance with SB 5, was revised to remove two rules submitted with the area's attainment demonstration SIP in 2002: 1) operating restrictions for construction and industrial equipment and 2) accelerated purchase of Tier 2/3 heavy-duty diesel equipment. The SIP revision stated that the diesel emission reduction incentive program contained in SB 5 would replace the above-referenced rules and result in reductions in excess of the reductions expected from the repealed rules. The SIP stated that the NO_x reductions previously claimed in the DFW attainment demonstration SIP would be achieved through an alternate but equivalent federally enforceable mechanism.

In June 2002 the commission proposed to revise the HGA SIP, partly as the result of a legal challenge of the 90% NO_x reduction requirement for stationary sources in HGA. A court order required the commission to perform an analysis of the causes of rapid ozone formation events and to identify potential mitigating measures not yet identified in the HGA attainment demonstration. The scientific study conducted by the commission showed that highly-reactive VOCs play a significant role in this rapid ozone formation and were previously under reported in the December 2000 H.A. SIP. This study concluded that controlling industrial highly-reactive VOC emissions is necessary to reduce ozone concentrations. Additional analyses provide a directional indication that it may be possible to achieve the same level of air quality benefits with reductions in industrial highly reactive VOC emissions, combined with an 80% reduction in NO_x emissions from industrial sources, as would be realized solely with a 90% reduction in industrial NO_x emissions. In light of these findings and in compliance with the court order, in June 2002 the commission proposed new rules to reduce emissions of certain highly-reactive VOCs from four key industrial sources: fugitives, flares, process vents, and cooling towers. The commission also proposed a revision to the speed limit strategy, and the development of the energy efficiency program and the protocol for the TERP program through EPA's Economic Incentive Program.

Background on the March 2003 Revision

This SIP revision addresses three elements of the SIP:

(1) Revision of the NO_x control strategy for cement kilns as the result of a settlement agreement with two affected industries. The commission has adopted a revision of the associated rules in Chapter 117.

(2) Incorporation of the energy efficiency measures contained in the SIP.

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NOTE: These figures were all created as color graphics. Due to cost and time constraints they have been photocopied in black and white. To request copies in color please contact Heather Evans at (512) 239-1970 or via email hevans@TCEQ.state.tx.us

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 for 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 on future photochemical modeling showing 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, effective June 21, 1999. A SIP was submitted to the EPA on March 18, 1999 that 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 was not possible for the DFW area to attain the standard by that deadline. There is mounting technical data suggesting 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 are a necessary and integral component in the strategy for DFW's attainment of the 1-hour ozone standard.

In order to develop local control strategy options to augment federal and state programs, the DFW area established 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.

On April 19, 2000, the commission adopted a SIP revision and associated rules for the DFW ozone attainment demonstration. The SIP revision contained the following control strategy elements:

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

  < On-road mobile source standards:
  Federal Phase II reformulated gasoline (RFG)
  Tier 2 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 3 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 toward 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 controls were 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 were 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 van pool, park and ride
- Voluntary incentive program for off-road and on-road diesel vehicles
- 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.

The April 19, 2000 SIP contained 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.

, A commitment to perform and submit a mid-course review by May 1, 2004.

This attainment demonstration SIP, if approved by the EPA, would allow EPA to determine that the DFW 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.

In this same SIP revision, the commission repealed the airport GSE rule for the DFW area because agreed orders were signed with the area's major airlines, airports, and governmental entities to achieve the same NO_x reductions that would have been achieved by the rule.

In August 2001 the commission adopted revisions to the DFW SIP which repealed of two of the rules adopted on April 19, 2000 as part of the control strategy for the DFW ozone attainment demonstration. The first rule restricted the use of construction and industrial equipment (non-road, heavy-duty diesel equipment rated at 50 hp and greater). The second rule required the replacement of diesel-powered construction, industrial, commercial, and lawn and garden equipment rated at 50 hp and greater to with newer Tier 2 and Tier 3 equipment, with the amount and timing of reductions depending on the hp rating of the engine fleet. These repeals were required by SB 5, passed by the 77th Legislature of the State of Texas in May 2001. This legislative requirement was implemented by submitting the rule repeals to EPA as a SIP revision. The diesel emission reduction incentive program contained in SB 5 will replace the above-referenced rules and result in reductions in excess of the reductions expected from the rules that are being repealed. Therefore, the NO_x reductions previously claimed in the DFW attainment demonstration SIP will be achieved through an alternate but equivalent federally enforceable mechanism.

The current SIP revision addresses three elements of the SIP:

(1) Revision of the NO_x control strategy for cement kilns as the result of a settlement agreement with two affected industries. The commission has adopted a revision of the associated rules in Chapter 117.

(2) Expansion of the energy efficiency measures contained in the SIP.

1.2 PUBLIC HEARINGS INFORMATION

The commission held public hearings at the following times and locations:
Arlington, Texas at 1:30 p.m. on December 5, 2002, at the North Central Texas Council of Governments, 616 Six Flags Dr., Suite 200; and in Austin, Texas at 1:30 p.m. on December 9, 2002, at the Texas Commission on Environmental Quality, 12100 Park 35 Circle, Building F, Room 2210. The public comment period closed on December 9, 2002.

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 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

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

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

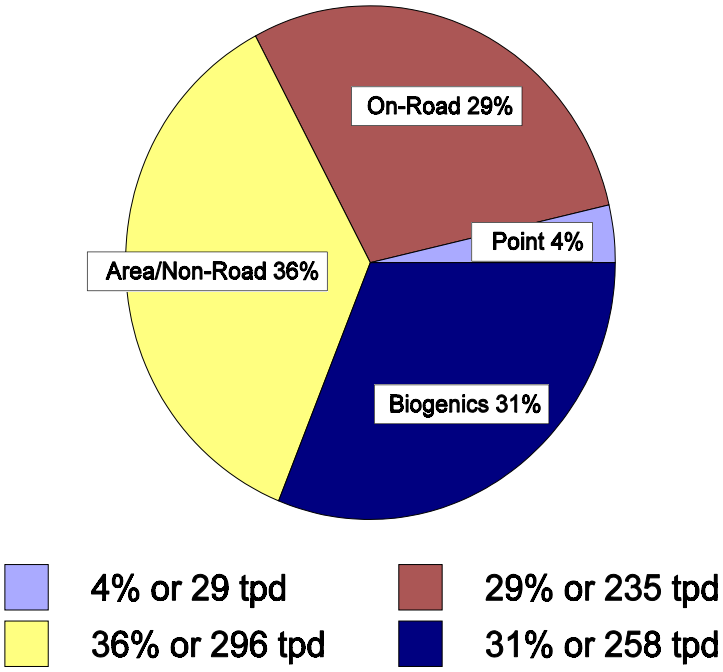


Figure 2.7-2 - 1996 NOx Emissions in DFW

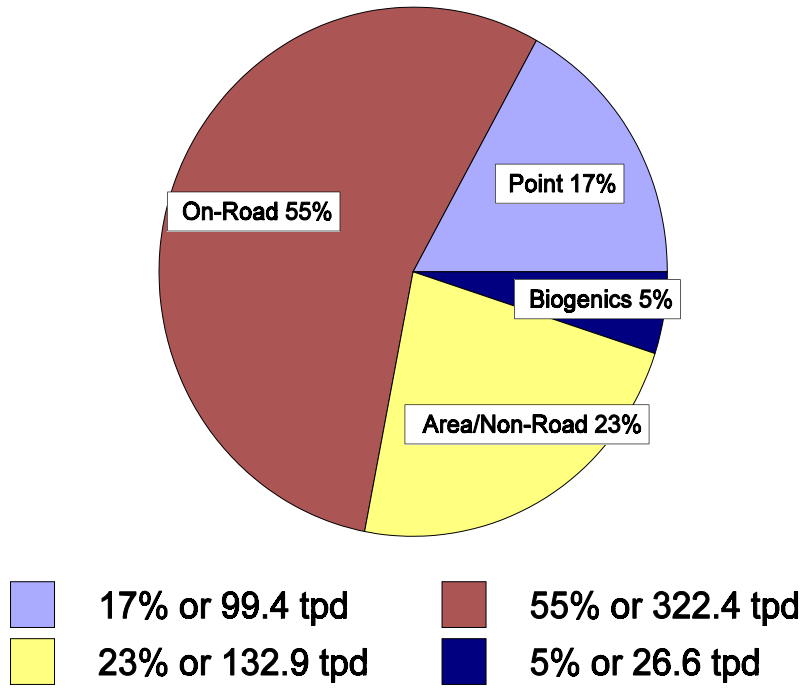
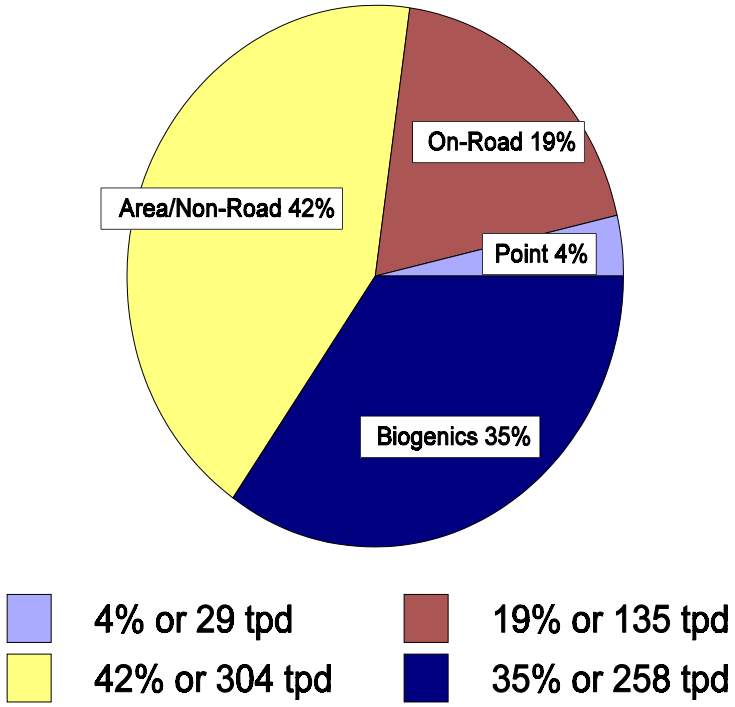


Figure 2.7-3 - 2007 VOC Emissions in DFW



2.8 TRANSPORTATION CONFORMITY

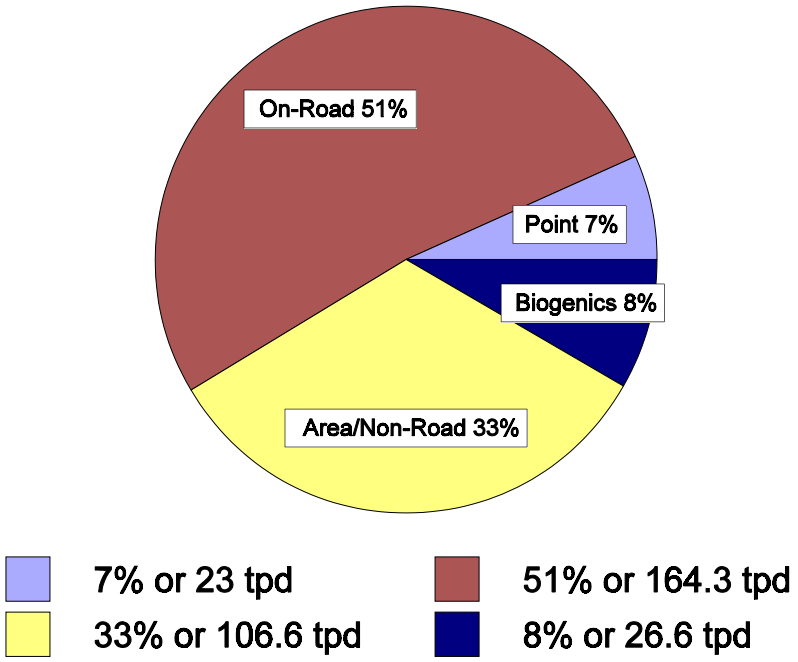
Transportation conformity is required by §176(c) of the FCAA. The FCAA requires that transportation plans, programs, and projects conform to SIPs in order to receive federal transportation funding and project approvals. Conformity to a SIP means that transportation activities will not cause or contribute 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.

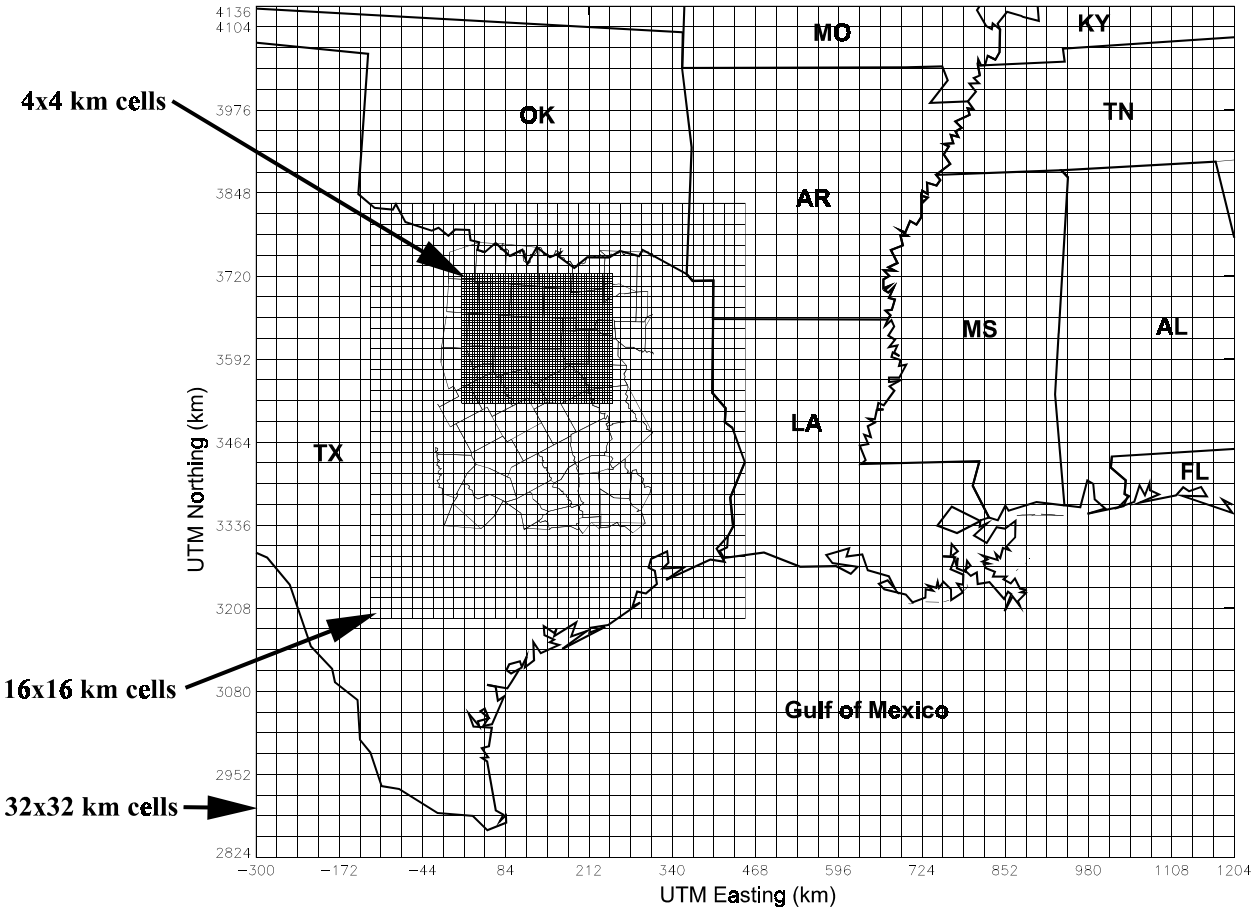
- Review and revise the base case modeling emissions inventory as necessary, then project this base case inventory to the area's attainment date of 2007.

- 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

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

[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.

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

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

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

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	TCEQ	NO_x	.970[2]	.841[2]			
		VOC	.994[2]	.954[2]			
60 miles/hour speed limit	TCEQ	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/ TCEQ (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	TCEQ (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	Eight counties	Central & eastern Texas	State-wide
Construction equipment 8:30 or 10:00 AM start	TCEQ	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	TCEQ	NO_x	.960			
		VOC	1.00			
Alternate construction equipment emissions[2]	TCEQ	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	TCEQ	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	TCEQ	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

5.1 OVERVIEW

The DFW ozone nonattainment area was classified as a moderate area as a result of the FCAA Amendments of 1990. As a moderate area, the State of Texas was required to submit a SIP demonstrating a 15% VOC emission reduction, net of growth, for the DFW area for the years 1990 through 1996. The 15% ROP SIP was adopted by the commission on November 10, 1993 and May 13, 1994 and submitted to the EPA. The DFW area did not attain the 1-hour ozone standard by the November 1996 deadline. On March 18, 1999 the commission submitted a SIP to the EPA addressing attainment of the ozone standard for the DFW area. The revised SIP also included ROP toward satisfying EPA's requirement of reasonable further progress in emission reductions for the DFW area for the years 1997-99.

Because of the short amount of time to develop the 9% ROP portion of the SIP, placeholder numbers were used until certain emission estimates could be more firmly established. The reductions ultimately submitted toward ROP were short of the 9% target. The combination of this shortfall, a lack of modeled control strategies, and non-inclusion of rules needed to bring the area into attainment led to a determination of incompleteness by the EPA.

Subsequently, the request of the NCTCOG, commission staff met to discuss the 9% ROP portion of the DFW SIP. As the metropolitan planning organization for the DFW region, the NCTCOG is concerned about meeting transportation conformity. The SIP that was submitted in March 1999 contained for the first time a transportation conformity budget for NO_x. Because the SIP was found to be incomplete, the NO_x budget will be unusable and it will be extremely difficult to show conformity in the future. This will affect the region's ability to implement their metropolitan transportation plan.

Potential emission reduction credits were investigated that were not claimed in the March 1999 SIP in order to make up the ROP shortfall. The focus was on VOC reductions because fewer would be needed to make up a shortfall compared to NO_x emission reductions. The ROP lacked about 20% of the VOC reductions needed, which amounted to 5.87 TPD. A complete 9% ROP SIP would allow certain transportation projects from being put on hold. Reductions not previously considered were identified that would make up the shortfall in order to complete the 9% ROP requirements for the years 1996-99. These additions are included in this revised 9% ROP SIP.

EPA's method for calculating ROP targets involves growing emissions out to the future year of attainment. Because of the tremendous growth in the DFW area over the last several years, the on-road and non-road mobile source emission estimates for NO_x from the years 1997, 1998, and 1999 outweigh the NO_x emission reductions from mobile source control strategies implemented in the area. As a result, the commission has decided to pursue the full 9% ROP through the use of VOC reductions.

However, because photochemical modeling for the DFW area shows that NO_x reductions are necessary in bringing the area into attainment. The State of Texas submitted to the EPA on November 13, 1998 a letter indicating that this most recent photochemical modeling has triggered their condition of the NO_x waiver and thus it should be rescinded. The EPA initiated steps to rescind the NO_x exemption which was made effective on June 21, 1999.

5.2 CALCULATION OF THE 1999 TARGET LEVELS

Table 5.2-1 shows the amount of VOC reductions needed to achieve the ROP requirements. EPA has devised a complex method for calculating the rate of progress target. This process was developed to ensure that the rate of progress calculation reflected growth in the emissions inventory, and appropriately accounted for both creditable and non-creditable emission reductions achieved since 1990.

The VOC calculation in Table 5.2-1 starts with the 1990 Base Year EI (Step 1). This EI is then adjusted to remove non-creditable reductions that occurred since 1990 (Steps 2, 3, and 5). This new EI is called the "Adjusted Base Year EI". The ROP percentage of 9% in this case is taken from this new Adjusted Base Year EI (Step 4). The 1999 Target Level is calculated in Step 7 by subtracting Steps 4 and 5 from Step 6. This new target level can be considered as a ROP budget for the area. In Step 8, the uncontrolled 1999 forecast emissions inventory is listed. Step 9 is the difference between where the area would be in 1999 without controls (Step 8) and where they are required to be (their Target Level in Step 7). Step 10 lists the creditable reductions made through the 15% SIP, and Step 11 calculates the difference between Steps 9 and 10 to yield the remaining needed reductions for the ROP demonstration, or the excess.

Table 5.2-1

1999 ROP Required VOC Emissions Target Calculations
Dallas/Fort Worth Ozone Nonattainment Area Ozone
Season VOC Tons Per Day January 18, 1999

Step	Emissions Basis	Stationary		Mobile		Total
		Point	Area	On-road	Non-road	
1	1990 ROP Nonattainment Area Base Year EI	63.98	174.02	306.60	105.19	649.79
2	Adjusted Base Year EI Relative to 1996	63.98	174.02	204.35	105.19	547.54
3	Adjusted Base Year EI Relative to 1999	63.98	174.02	192.59	105.19	535.78
4	9% of Adjusted Base Year EI Relative to 1999					48.22
5	RVP and Fleet turnover correction [steps (2-3)]			11.76		11.76
6	1996 Target Level					465.52
7	1999 Target Level [steps (6-5-4)]					405.54
8	1999 Emissions Forecast (Grown) With Pre-90 Control	26.16	182.02	247.75	119.35	575.28
9	Total Reductions Required by 1999 With Growth [steps (8-7)]					169.74
10	Creditable Reductions (1990-1996)	0.00	50.99	76.40	12.59	139.98
11	***Required Reductions 1996-1999***					29.76

Notes for On-Road Mobile

1. Forecast in step 8 is 1999 Emissions Forecast (Grown) With Pre-90 Control.
2. Base year on-road mobile emissions calculated with MOBILE5 for an ozone season weekday.
3. Adjusted base year on-road mobile emissions and 1999 forecast on-road mobile emissions calculated with MOBILE5A for an ozone season weekday.
4. Point source reductions from step 10 have been removed to avoid double counting.

5.3 CONTROLS TO ACHIEVE THE RATE OF PROGRESS TARGET

5.3.1

A summary of the reductions toward achieving the 9% ROP target are included in Table 5.3-1. The table shows VOC reductions net of growth from the 1990 baseline by 1999. Table 5.3-2 shows NO_x net of growth reductions that will occur from the 1990 baseline by 1999. Contingency measures for VOCs are included as well as further NO_x reductions that will occur by 2001.

Table 5.3-1

VOC ESTIMATES TOWARDS 9% ROP SIP - DALLAS/FORT WORTH

Emissions Inventory	1990	Percent	Growth	1999	Percent
Area Sources	174.02	26.8%	4.6%	182.02	31.6%
Point Sources	63.98	9.8%	-59.1%	26.16	4.5%
On-road Mobile Sources	306.60	47.2%	-19.2%	247.75	43.1%
Off-road Mobile Sources	105.19	16.2%	13.5%	119.35	20.7%
TOTALS	**649.79**		**-11.5%**	**575.28**	

ESTIMATED VOC REDUCTIONS

Control Strategy	**1999 Projected Tons Per Day**	**Reduction Tons Per Day**	**Percent of Requirement**
Aircraft Engines	6.73	1.52	5.30%
TCMs	247.75	3.74	13.04%
Windshield Washer Fluid	2.27	0.29	1.01%
1998 Vehicle Registration	244.18	3.57	12.45%
Utility engine 1997-1999	68.45	2.37	8.26%
UST Remediation	1.81	1.81	6.31%
Tier I, I/M, RFG	161.47	16.82	58.65%
	Subtotal	**30.12**	**105.02%**
Contingency Strategy			
Commercial Bakeries	0.51	0.15	0.77%
Offset Printing	0.55	0.24	1.23%
I/M, Tier I, RFG Phase II	247.75	10.94	56.12%
Naphtha Dry Cleaners	4.77	2.41	12.36%
Utility Engine 2000	68.45	0.92	4.72%
	Subtotal	**14.66**	**75.20%**

Required Target	**29.76**	100.00%
Creditable Reductions	**30.12**	101.21%
Excess	**0.36**	1.2%
Required Contingency	**19.49**	100.0%
Required Target + Contingency	**49.25**	100.0%
Total Reductions	**44.78**	90.9%
Shortfall	**4.47**	9.1%

Table 5.3-2

NO_x ESTIMATES FOR DALLAS-FORT WORTH

Emissions Inventory	1990	Percent	Growth	1999	Percent
Area Sources	19.99	3.6%	3.3%	20.64	3.1%
Point Sources	71.76	13.0%	-0.1%	71.70	10.9%
On-road Mobile Sources	293.03	53.2%	16.2%	340.39	51.7%
Off-road Mobile Sources	166.05	30.1%	35.8%	225.54	34.3%
TOTALS	550.83		19.5%	658.27	

ESTIMATED NO_x REDUCTIONS		
Control Strategy	**1999 Projected Tons Per Day**	**Reduction Tons Per Day**
TU Reductions (by 12/31/98)	71.70	10.45
RFG, I/M, FMVCP Tier I	340.39	56.25
Off-road Heavy-Duty Diesel	153.74	11.98
	Subtotal	**78.68**
Further Reductions by 2001		
NO_x RACT (by 3/31/01)		10.93
I/M, Tier I, RFG Phase II	271.96	5.29
	Subtotal	**16.22**
Total Reductions by 2001		**94.90**

Mobile Source reductions due to FMVCP Tier I, Vehicle I/M and Reformulated Gasoline occurred between 1990 and 1999 and are included in the calculation of the target level.

5.3.2 Windshield Washer Fluid

In the September 11, 1998 issue of the *Federal Register* (63 FR 48819), EPA published the adopted national VOC emission standards for certain categories of consumer products under §183(e) of the FCAA. Title 40 CFR 59.203 (Standards for Consumer Products) states:

> (a) The manufacturer or importer of any consumer product subject to this subpart shall ensure that the VOC content levels in table 1 of this subpart and HVOC content levels in table 2 of this subpart are not exceeded for any consumer product manufactured or imported on or after December 10, 1998, except as provided in paragraphs (b) and (c) of this section, or in Secs. 59.204 or 59.206.

In turn, Table 1 limits automotive windshield washer fluid to 35 weight-% VOC. EPA calculated VOC reductions from this national consumer products rule to be 20% and allowed states to take this emission reduction credit in their SIPs. Consequently, Texas took credit in its SIPs for a 20% VOC reduction in emissions from consumer products, based upon EPA's national rule.

Prior to EPA's issuance of its national rule, Texas adopted a consumer products rule in 30 TAC Chapter 115, §§115.600, 115.610, 115.612-115.617, and 115.619. The limits for automotive windshield washer fluid (23.5 weight-%), nonaerosol glass cleaners (6 weight-%), nail polish removers (75 weight-%) in the Texas rule are more stringent than the corresponding limits in the national rule (35, 8 and 85 weight-%, respectively).

On May 13, 1999, Mr. Bruce Moore of EPA's OAQPS stated that the 35 weight-% limit for windshield washer fluid in the national rule represented the "status quo" (i.e., resulted in no reductions). Mr. Moore agreed that Texas could take credit for the difference between 23.5 and 35 weight-%. Therefore, Texas is taking VOC emission reduction credit for this difference. Texas has incorporated an 80% rule effectiveness for its windshield washer fluid rule in Table 5.3-3. As with the other Texas rules, the Texas consumer products rule is enforced by the Field Operations Division, and unresolved violations result in enforcement action, which may include penalties, as appropriate.

Table 5.3-3

DFW Windshield Wiper Fluid

35-23.5%	1990		1990 WITH RE		1999		1999 WITH RE		NEW 1999		REDUCTIONS	
COUNTY	TPY	TPD	TPY	TPD	TPY	TPD	TPY	TPD	TPY	TPD	TPY	TPD
COLLIN	85.73	0.2349	54.44	0.1492	135.68	0.3717	86.16	0.2361	76.25	0.2089	9.91	0.0271
DALLAS	601.61	1.6482	382.02	1.0466	709.49	1.9438	450.52	1.2343	398.71	1.0924	51.81	0.1419
DENTON	88.81	0.2433	56.40	0.1545	132.12	0.3620	83.90	0.2299	74.25	0.2034	9.65	0.0264
TARRANT	379.93	1.0409	241.26	0.6610	494.40	1.3545	313.94	0.8601	277.84	0.7612	36.10	0.0989
TOTAL	1156.09	3.1674	734.11	2.0113	1471.69	4.0320	934.52	2.5603	827.05	2.2659	107.47	0.2944

35%	1990		1990 WITH RE		1999		1999 WITH RE		NEW 1999		REDUCTIONS	
COUNTY	TPY	TPD	TPY	TPD	TPY	TPD	TPY	TPD	TPY	TPD	TPY	TPD
COLLIN	85.73	0.2349	54.44	0.1492	135.68	0.3717	86.16	0.2361	56.00	0.1534	30.16	0.0826
DALLAS	601.61	1.6482	382.02	1.0466	709.49	1.9438	450.52	1.2343	292.84	0.8023	157.68	0.4320
DENTON	88.81	0.2433	56.40	0.1545	132.12	0.3620	83.90	0.2299	54.53	0.1494	29.36	0.0804
TARRANT	379.93	1.0409	241.26	0.6610	494.40	1.3545	313.94	0.8601	204.06	0.5591	109.88	0.3010
TOTAL	1156.09	3.1674	734.11	2.0113	1471.69	4.0320	934.52	2.5603	607.44	1.6642	327.08	0.8961

23.5%	1990		1990 WITH RE		1999		1999 WITH RE		NEW 1999		REDUCTIONS	
COUNTY	TPY	TPD	TPY	TPD	TPY	TPD	TPY	TPD	TPY	TPD	TPY	TPD
COLLIN	85.73	0.2349	54.44	0.1492	135.68	0.3717	86.16	0.2361	65.91	0.1806	20.25	0.0555
DALLAS	601.61	1.6482	382.02	1.0466	709.49	1.9438	450.52	1.2343	344.65	0.9442	105.87	0.2901
DENTON	88.81	0.2433	56.40	0.1545	132.12	0.3620	83.90	0.2299	64.18	0.1758	19.72	0.0540
TARRANT	379.93	1.0409	241.26	0.6610	494.40	1.3545	313.94	0.8601	240.17	0.6580	73.78	0.2021
TOTAL	1156.09	3.1674	734.11	2.0113	1471.69	4.0320	934.52	2.5603	714.91	1.9587	219.61	0.6017

POPULATIONS

County	1990	1999
Collin	264036	417874
Dallas	1852810	2185052

Windshield washer fluid: calculated 1999 using factor and population. Recalculated 1999 (new 1999) using the percentage options associated

Denton	273525	406905	with the rule (35-23, 35, and 23). Then showed reduced emissions.
Tarrant	1170103	1522627	

5.3.3 Transportation Control Measures

Additional Credits from Existing 15% ROP TCMs

On July 7, 1999, the EPA responded to questions posed by the commission regarding TCMs and their appropriateness in SIPs. Specifically, the 9% ROP must show all projects implemented for the 15% ROP SIP before 1996 and remaining projects that will be counted as emission reduction in the 9% ROP SIP. Therefore, it was determined that benefits from TCMs, as listed in the submitted DFW 9% ROP, were not all inclusive. Specifically, benefits were only determined for those projects being funded between November 1996 and November 1999, and operational by November 1999. This initial analysis did not include benefits to those projects accounted for in the previous 15% ROP (through November 1996). Many of these TCMs have a long design life that will have benefits in November 1999. Examples of these projects include HOV lanes, corridor management, park-n-ride lots, bicycle/pedestrian, commuter rail, light rail, intersection improvements, and signal improvements. Only those signal improvements that were implemented in calendar year 1996 were re-evaluated for the 9% ROP. Table 5.3-4 summarizes the approach to quantifying expected benefits to these long-term projects. November 1996 benefits are documented in NCTCOG's Transportation Control Measure Effectiveness Study, Technical Report, August 1996. An emission factor ratio (based on EPA's MOBILE5a model) of 0.874, suggests a loss of 12.6% in benefits over a three year period. Therefore, accounting for projects with a long design life from the 15% ROP, an additional VOC reduction of 3.07 TPD is expected by November 1999.

Table 5.3-4

LONG TERM 1996 TCM's EVALUATED TO 1999 Volatile Organic Compounds			
TCM	**November 1996 Benefits (lbpd)**	**1996 to 1999 Emission Factor Adjustment**	**November 1999 Benefits (lbpd)**
HOV	398	0.874	348
Corridor Management	1,088	0.874	951
Park-n-Ride Lots	154	0.874	135
Bicycle/Ped	22	0.874	19
Commuter Rail	9	0.874	8
Light Rail	27	0.874	24
Intersection Improvements	2,085	0.874	1,822
Signal Improvements (Implemented in 1996)	3,249	0.874	2,840
Total Pounds per Day (lbpd)			6,147
Total Tons per Day (TPD)			3.07

Appendix G includes the inventory of TCMs implemented through November 1996, as determined for the 15% ROP SIP.

Additional TCMs Implemented Between 1996 and 1999

As submitted in late 1998, the 9% ROP inventoried TCM's to be let, constructed, and operational by November 1999, and placed each project in one of two categories. Projects receiving funds between November 1996 and November 1998 were categorized as committed. As originally identified in the 9% ROP, committed projects accounted for 0.29 TPD of VOC reductions. Projects receiving funds between November 1998 and November 1999 were categorized as contingent. Contingent projects account for an additional 0.38 TPD of VOC reductions. Since one year has elapsed since this evaluation occurred, it was determined to be appropriate to consider the extra 0.38 TPD as committed. Therefore, this 9% ROP SIP is accounting for the additional 0.38 TPD of VOC reductions from committed TCMs in 1999. In summary, a total of 0.67 TPD has been identified from implementing TCMs between November 1996 to November 1999. Table 5.3-5 summarizes these SIP commitments.

Table 5.3-5

DALLAS-FORT WORTH OZONE NONATTAINMENT AREA 9% RATE OF PROGRESS STATE IMPLEMENTATION PLAN TRANSPORTATION CONTROL MEASURE COMMITMENTS		
TCM Category	**1997-1999 Implementation Levels**	**1999 VOC Emission Reductions (per day)**
Intersection Improvements/ Signal Improvements	360 Locations	1,141.9 lbs
Freeway Corridor Management	4 Projects	72.0 lbs
Travel Demand Management	2 Projects	54.6 lbs
Park and Ride Lots	1 Lot	6.4 lbs
Alternative Fuel Vehicles	387 Vehicles	0.0 lbs
Ped/Bicycle Facilities	19 Miles	34.7 lbs
Light Rail	9 Miles	29.2 lbs
Total (lbs)		1,338 lbs
Total (TPD)		0.67 tons

Appendix G includes the inventory of TCMs implemented from November 1996 through November 1999, as inventoried for the 9% ROP SIP. TCM details include location, length, emission reductions, implementation date, and other information within each category, where appropriate.

Two project categories were established at the time the analysis was conducted because of EPA's requirement to identify projects by location, length, emission reductions, implementation date, and other information within each category. NCTCOG believes this creates an obstacle to efficient record management, since a revision must be made to the SIP each time a project location changes. Therefore, since project descriptions are apt to change due to a wide variety of circumstances, a conservative approach was taken in the development of the 9% ROP SIP originally submitted.

5.3.4 Updated Vehicle Registration Distributions

In developing MOBILE5a_h emission factors for the 1999 on-road mobile source emission inventory, observed 1996 vehicle registration distributions were originally used as input since it was the latest and best data available when the emission inventory was being created (December 1997). NCTCOG and the commission determined that it would be sensible to update the vehicle registration distributions with the

most recent data available from TxDOT Vehicle Titles and Registration Division. Updating the vehicle fleet with current data, from 1996 to 1998, will allow the inventory to take credit for cleaner and more emission efficient vehicles due to annual vehicle fleet turnover. The VOC emission benefits associated with this change in the DFW nonattainment area is a reduction of 3.57 TPD. Final 1998 vehicle registration distributions for Dallas/Tarrant Counties (core urban) and Collin/Denton Counties (core rural) are summarized in Tables 5.3-6 and 5.3-7, respectively.

Table 5.3-6

DALLAS-FORT WORTH NONATTAINMENT AREA
1998 VEHICLE REGISTRATION DISTRIBUTION FOR
DALLAS AND TARRANT COUNTIES (CORE URBAN)

MODEL YEAR	LDGV	LDGT1	LDGT2	HDGV	LDDV	LDDT	HDDV	MC
1998	0.097	0.093	0.112	0.030	0.097	0.093	0.125	0.182
1997	0.088	0.097	0.142	0.054	0.088	0.097	0.113	0.144
1996	0.080	0.074	0.066	0.045	0.080	0.074	0.107	0.137
1995	0.094	0.084	0.091	0.179	0.094	0.084	0.066	0.112
1994	0.076	0.078	0.064	0.043	0.076	0.078	0.077	0.097
1993	0.071	0.060	0.051	0.033	0.071	0.060	0.063	0.075
1992	0.062	0.051	0.034	0.034	0.062	0.051	0.044	0.054
1991	0.061	0.050	0.033	0.029	0.061	0.050	0.069	0.040
1990	0.059	0.047	0.037	0.030	0.059	0.047	0.061	0.038
1989	0.054	0.048	0.032	0.027	0.054	0.048	0.045	0.042
1988	0.048	0.043	0.039	0.030	0.048	0.043	0.035	0.038
1987	0.041	0.033	0.038	0.036	0.041	0.033	0.033	0.041
1986	0.037	0.041	0.041	0.051	0.037	0.041	0.031	0.000
1985	0.032	0.035	0.049	0.044	0.032	0.035	0.035	0.000
1984	0.025	0.031	0.028	0.040	0.025	0.031	0.026	0.000
1983	0.015	0.019	0.014	0.017	0.015	0.019	0.013	0.000
1982	0.010	0.017	0.020	0.026	0.010	0.017	0.015	0.000
1981	0.008	0.013	0.012	0.026	0.008	0.013	0.014	0.000
1980	0.006	0.009	0.010	0.034	0.006	0.009	0.008	0.000
1979	0.007	0.013	0.015	0.049	0.007	0.013	0.008	0.000
1978	0.006	0.012	0.010	0.033	0.006	0.012	0.005	0.000
1977	0.004	0.010	0.016	0.022	0.004	0.010	0.003	0.000
1976	0.003	0.007	0.013	0.015	0.003	0.007	0.001	0.000
1975	0.002	0.003	0.010	0.014	0.002	0.003	0.001	0.000
1974	0.014	0.032	0.023	0.060	0.014	0.032	0.003	0.000
Total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Table 5.3-7

DALLAS-FORT WORTH NONATTAINMENT AREA
1998 VEHICLE REGISTRATION DISTRIBUTION FOR
COLLIN AND DENTON COUNTIES (CORE RURAL)

MODEL YEAR	LDGV	LDGT1	LDGT2	HDGV	LDDV	LDDT	HDDV	MC
1998	0.092	0.109	0.164	0.019	0.092	0.109	0.074	0.159
1997	0.104	0.126	0.220	0.024	0.104	0.126	0.088	0.165
1996	0.101	0.094	0.101	0.063	0.101	0.094	0.093	0.154
1995	0.109	0.095	0.081	0.139	0.109	0.095	0.033	0.122
1994	0.088	0.084	0.064	0.016	0.088	0.084	0.077	0.092
1993	0.081	0.062	0.044	0.020	0.081	0.062	0.067	0.075
1992	0.068	0.053	0.023	0.028	0.068	0.053	0.061	0.055
1991	0.063	0.047	0.031	0.046	0.063	0.047	0.060	0.035
1990	0.055	0.041	0.027	0.032	0.055	0.041	0.061	0.038
1989	0.048	0.042	0.030	0.012	0.048	0.042	0.050	0.038
1988	0.040	0.036	0.015	0.026	0.040	0.036	0.041	0.033
1987	0.032	0.027	0.013	0.040	0.032	0.027	0.038	0.034
1986	0.028	0.033	0.032	0.040	0.028	0.033	0.035	0.000
1985	0.022	0.027	0.023	0.054	0.022	0.027	0.054	0.000
1984	0.017	0.023	0.018	0.045	0.017	0.023	0.044	0.000
1983	0.010	0.013	0.014	0.026	0.010	0.013	0.022	0.000
1982	0.007	0.013	0.014	0.023	0.007	0.013	0.023	0.000
1981	0.005	0.010	0.007	0.023	0.005	0.010	0.027	0.000
1980	0.004	0.006	0.017	0.035	0.004	0.006	0.017	0.000
1979	0.005	0.010	0.015	0.067	0.005	0.010	0.013	0.000
1978	0.004	0.009	0.010	0.046	0.004	0.009	0.010	0.000
1977	0.003	0.007	0.005	0.028	0.003	0.007	0.008	0.000
1976	0.002	0.005	0.009	0.021	0.002	0.005	0.001	0.000
1975	0.001	0.002	0.004	0.033	0.001	0.002	0.001	0.000
1974	0.013	0.024	0.018	0.094	0.013	0.024	0.004	0.000
Total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

A simple analysis was performed by adjusting final emission estimates, by county, with an adjustment factor accounting for the percent change in emission rates from 1996 to 1998 vehicle registration distributions. Specifically, VOC emission factors in Dallas and Tarrant Counties (core urban) were reduced by 2.36%. Likewise, VOC emission factors in Collin and Denton Counties (core rural) were reduced by 3.99%. Therefore, VOC emission benefits associated with updating observed vehicle registration data in the DFW nonattainment area is a reduction of 3.57 TPD.

5.4 1999 MOTOR VEHICLE EMISSIONS BUDGETS

Motor Vehicle Emission Budgets for transportation conformity purposes are established at 147.22 TPD for VOC and 284.14 TPD for NO_x. These figures have been calculated by subtracting all on-road mobile source reductions from the 1999 on-road mobile source emissions forecast. These calculations are shown below:

	VOC	**NO_x**
1999 On-Road Emissions Forecast	247.75 TPD	340.39 TPD
1996 Tier1, I/M, RFG credits	69.46	0.00
1999 Tier1, I/M, RFG credits	16.82	56.25
1996 Transportation Control Measures	6.94	0.00
1998 Vehicle Registration	3.57	0.00
1999 Transportation Control Measures	3.74	0.00
1999 Motor Vehicle Emissions Budget	147.22 TPD	284.14 TPD

Calculation of motor vehicle emission budgets (MVEB) are based on data from Table 5.2-1 and 5.3-1. Table 5.2-1 lists a quantity of information including "1999 Emissions Forecast (grown with Pre-90 Control" (Step 8), "Total Reductions Required by 1999 with Growth" (Step 9), "Creditable Reductions (1990-1996)" (Step 10), and "Required Reductions 1996-1999" (Step 11). The required reductions 1996-1999 subtracts 1990-1996 reductions from the total reductions required.

Table 5-3.1 lists on-road mobile source VOC reductions as 247.75 TPD. This is the same number as Step 8 in Table 5.2-1. The "Required Target" in Table 5.3-1 is 29.76 TPD for VOC and is the same as Step 11 in Table 5.2-1. Although it does not specifically list the creditable reductions from 1990-1996, the required target in Table 5.3-1 takes into account creditable reductions from 1990-1996.

The motor vehicle emission budget calculation begins with 245.75 TPD VOC and subtracts 1990-1996 on-road mobile source controls and 1997-1999 on-road mobile source controls.

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 2 vehicle emission standards and federal low-sulfur gasoline • NLEV • Heavy-duty diesel standards	93
Federal off-road measures: • Lawn and garden equipment • Tier 3 heavy-duty diesel equipment • Locomotives • Compression ignition standards for vehicles and equipment • Spark ignition standards for vehicles and equipment • Recreational marine standards	48

TCEQ-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
SB 5 Voluntary Incentive Program**	16.3
Airport GSE electrification in 4 counties	6.12
Heavy equipment fleets–gasoline in 9 counties	1.8
Gas-fired water heaters, small boilers, and process heaters (statewide rule)	0.5
Other State measures: Energy efficiencies	0.7

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).

** This credit is equal to the sum of NO_x credits previously taken for the Tier 2/Tier 3 equipment accelerated purchase rule (13.8 tpd) and the heavy-duty diesel operating restriction rule (2.5 tpd), which are being proposed for repeal. Reductions from the new SB 5 voluntary incentive program in the 12-county DFW area are projected to surpass 16.3 tpd NO_x, based on the size of the equipment inventory eligible to participate in the program.

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

On April 19, 2000, the commission adopted a rule that required owners or operators of affected GSE to ensure that their GSE fleet be electric-powered or else utilize alternative emission reduction measures to reduce NO_x emissions by 90% by the end of 2007. The rule had a provision allowing for other means to meet the reduction requirements. On May 23, 2001, the commission repealed the airport GSE rule for the DFW area because agreed orders were signed with the area's major airlines, airports, and governmental entities to achieve the same NO_x reductions that would have been achieved by the rule.

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

On April 19, 2000, the commission adopted a rule implementing an accelerated purchase program requiring the owners or operators of diesel-powered construction, industrial, commercial, and lawn and garden equipment rated at 50 hp and greater to replace their affected equipment with newer Tier 2 and Tier 3 equipment, with the amount and timing of reductions depending on the hp rating of the engine fleet.

In May 2001 the 77th Legislature of the State of Texas passed SB 5. Section 18 of SB 5 requires the commission to submit a SIP revision to the EPA, deleting the requirements of the above-referenced rule from the SIP no later than October 1, 2001. The diesel emission reduction incentive program contained in SB 5 will replace the above-referenced rules and result in reductions in excess of the reductions expected from the rules that are being repealed. Therefore, the NO_x reductions previously claimed in the DFW attainment demonstration SIP will, as a result of this rulemaking, be achieved through an alternate but equivalent federally enforceable mechanism. The rule repeals are being proposed concurrently with this SIP revision as part of the implementation of SB 5.

In the April 19, 2000 DFW SIP, the state took credit for 13.8 tpd NO_x from the Tier 2/Tier 3 equipment accelerated purchase rule. This credit, which appeared in the summary table on page 6-2 of the referenced DFW SIP revision, has been deleted. In its place, the table now contains the estimated credit resulting from the new SB 5 voluntary incentive program rule.

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.

Waiver Requirements for Alternative Fuel Specifications

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.

Determining Whether Other Measures are Unreasonable or Impracticable

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)

On April 19, 2000, the commission adopted new cement kiln rules as part of the ozone SIP control strategy for the DFW ozone nonattainment area. The rules required portland cement kilns in Bexar, Comal, Ellis, Hays, and McLennan Counties to meet specific NO_x emission limits.

Under these rules, owners or operators of cement kilns were given several options to meet the emission requirements in Chapter 117. The commission is adopting rules concurrent with this SIP revision to give the owners and operators of cement kilns in the affected areas additional flexibility in meeting their NO_x reduction requirements, through either the use of a technology option (for dry-process cement kilns) or emission reduction credits. In addition, owners and operators of wet-process kilns could, in lieu of mid-kiln firing, use some other form of secondary combustion which achieves equivalent levels of NO_x reductions, or could make other additions or changes to the kiln system which achieve at least a 30%

reduction in NO_x emissions. Finally, owners and operators would be able to use a 90-day rolling average for determination of compliance with the source cap in lieu of the current 30-day rolling average.

The proposed changes would result in a similar level of emission reductions compared to the SIP rules originally adopted. Therefore, the NO_x reductions previously claimed in the DFW attainment demonstration SIP will, as a result of this rulemaking, be achieved through alternate, but equivalent, Chapter 117 rules.

6.2.10 Heavy-Duty Diesel Operating Restriction

On April 19, 2000, the commission adopted a rule to implement an operating-use restriction program requiring that 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 basis for the rule is that emissions of NO_x, a key ozone precursor, are delayed until later in the day, thus limiting ozone formation.

In May 2001 the 77th Legislature of the State of Texas passed SB 5. Section 18 of SB 5 requires the commission to submit a SIP revision to the EPA, deleting the requirements of the above-referenced rule from the SIP no later than October 1, 2001. The diesel emission reduction incentive program contained in SB 5 will replace the above-referenced rules and result in reductions in excess of the reductions expected from the rules that are being repealed. Therefore, the NO_x reductions previously claimed in the DFW attainment demonstration SIP will, as a result of this rulemaking, be achieved through an alternate but equivalent federally enforceable mechanism. The rule repeals are being proposed concurrently with this SIP revision as part of the implementation of SB 5.

In the April 19, 2000 DFW SIP, the state took credit for 2.5 tpd NO_x from the heavy-duty diesel operating restriction rule. This credit, which appeared in the summary table on page 6-2 of the referenced DFW SIP revision, has been deleted. In its place, the table now contains the estimated credit resulting from the new SB 5 voluntary incentive program rule.

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

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

ATTAINMENT DEMONSTRATION SIP COMMITMENTS TCMs OPERATIONAL BY 2007				
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:

Emission reductions NO_x
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

Emission reductions VOC
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 Commission on Environmental Quality 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 <u>voluntary</u> 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

1st year	2001	2002	2003
Recycled grams/mile	5.25	4.87	4.24
Replaced grams/mile	0.77	0.72	0.68
VOC Benefit	4.48	4.15	3.56
VMT/year/vehicle	4,025	3899	3790
Grams/vehicle/year	18,034	16,179	13,492
Eff. Vehicle	1,600	2,880	3,904
Tons per day	0.087	0.141	0.159

2nd year	2002	2003	2004
Recycled grams/mile	4.87	4.24	3.27
Replaced grams/mile	0.72	0.68	0.64
VOC Benefit	4.15	3.56	2.63
VMT/year/vehicle	3,899	3790	3790
grams/vehicle/year	16,179	13,492	9,968
Eff. Vehicle	2,880	3,904	4,723
Tons per day	0.141	0.159	0.142

3rd year	2003	2004	2005
Recycled grams/mile	4.24	3.27	3.22
Replaced gram/mile	0.68	0.64	0.61
VOC Benefit	3.56	2.63	2.61
VMT/year/vehicle	3,790	3790	3790
Grams/vehicle/year	13,492	9,968	9,892
Eff. Vehicle	3,904	4,723	5,379
Tons per day	0.159	0.142	0.161

4th year	2004	2005	2006
Recycled grams/mile	3.27	3.22	3.18
Replaced grams/mile	0.64	0.61	0.56
VOC Benefit	2.63	2.61	2.62
VMT/year/vehicle	3,790	3790	3790

NO_x

	2001	2002	2003
Recycled grams/mile	2.99	2.96	2.77
Replaced grams/mile	1.27	1.22	1.17
NO_x Benefit	1.72	1.74	1.6
VMT/year/vehicle	4,025	3899	3790
Grams/vehicle/year	6,924	6,783	6,064
Eff. Vehicle	1,600	2,880	3,904
Tons per day	0.033	0.059	0.071

	2002	2003	2004
Recycled grams/mile	2.96	2.77	3.56
Replaced grams/mile	1.22	1.17	1.11
NO_x Benefit	1.74	1.6	2.45
VMT/year/vehicle	3,899	3790	3790
Grams/vehicle/year	6,783	6,064	9,286
Eff. Vehicle	2,880	3,904	4,723
Tons per day	0.059	0.071	0.132

	2003	2004	2005
Recycled grams/mile	2.77	3.56	4.02
Replaced grams/mile	1.17	1.11	1.04
NO_x Benefit	1.6	2.45	2.98
VMT/year/vehicle	3,790	3790	3790
Grams/vehicle/year	6,064	9,286	11,294
Eff. Vehicle	3,904	4,723	5,379
Tons per day	0.071	0.132	0.183

	2004	2005	2006
Recycled grams/mile	3.56	4.02	4.15
Replaced grams/mile	1.11	1.04	0.95
NO_x Benefit	2.45	2.98	3.2
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.

6.2.15 Voluntary Incentive Program

In May 2001 the 77th Legislature of the State of Texas passed SB 5, which establishes the Texas Emissions Reduction Program to provide grants and other financial incentives for emission reductions and alternatives to certain components of the SIP. SB 5 authorizes the commission to operate the emission reduction program, manage the funds collected and allocated under the bill, submit the provisions of the bill as a revision to the SIP, and delete the Tier 2/Tier 3 equipment accelerated purchase and heavy-duty diesel operating restriction requirements from the SIP by October 1, 2001.

One of the provisions of SB 5 establishes the Diesel Emissions Reduction Incentive Program, modeled on the Carl Moyer program in California, under which grant funds are provided to offset the incremental costs of projects that reduce NO_x emissions from heavy-duty diesel trucks and construction equipment in the nonattainment and near-nonattainment areas of the state.

The current proposed SIP revision reflects the proposed repeal of the Tier 2/Tier 3 equipment accelerated purchase and heavy-duty diesel operating restriction rules. The diesel emission reduction incentive program contained in SB 5 will replace the above-referenced rules and result in reductions in excess of the reductions expected from the rules that are being repealed. Therefore, the NO_x reductions previously claimed in the DFW attainment demonstration SIP will, as a result of this rulemaking, be achieved through an alternate but equivalent federally enforceable mechanism. The rule repeals are being proposed concurrently with this SIP revision as part of the implementation of SB 5.

Photochemical modeling will be performed according to the schedule outlined in Chapter 7, as part of the mid-course review to be submitted to EPA by May 1, 2004. This modeling will show that the emission reductions from the referenced withdrawn rules, which were part of the modeled control strategies, are preserved by the new voluntary incentive program rule, and that attainment of the 1-hour ozone standard is demonstrated for the DFW area.

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. TCEQ 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, TCEQ 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

- Senate Bill 766. 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.

- Reductions in surrounding states. 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.

6.4 PROTOCOL FOR IMPLEMENTING THE ENERGY EFFICIENCY PROGRAM (New)

The commission is proposing that the development of the energy efficiency program be incorporated into the DFW SIP. The Texas Legislature anticipated the need for air quality improvement programs and initiated both energy efficiency measures and the TERP program through legislation. The commission seeks to continue the development of these programs to demonstrate progress in reducing NOx emissions.

Energy efficiency measures are a critical part of the commission's plan for clean air. Not only do they decrease NO_x emissions, they also produce significant reductions in other criteria pollutants such as PM, SO_2, VOC, CO, and CO_2. When combined, various efficiency measures have the potential to add up to significant energy savings as well as emission reductions, thereby contributing to the overall goal of clean air in Texas.

The primary benefit of energy efficiency is its ability to decrease the demand for electrical generation, which provides for greater reliability, with the secondary benefit being emission reductions. However, one significant challenge is how to allocate the emission reductions on a geographic basis. Since Texas' electricity needs are primarily served by an isolated power grid controlled by the Electric Reliability Council of Texas (ERCOT), this issue can be overcome.

The Texas Legislature anticipated the need for energy efficiency programs in Texas and passed legislation to initiate such programs. The 76th Texas Legislature passed Senate Bill 7 which included, among other things, a commitment to improving air quality through an energy efficiency mandate to offset future growth in the demand of energy production. The details of this plan are set out in Chapter 25 of the Public Utility Commission of Texas' rules, which require at least a 10% reduction of electric utility's growth in demand by January 1, 2004 and each year thereafter. These reductions can be achieved through energy efficiency measures or by utilizing renewable energy, such as wind power. The 77th Texas Legislature passed Senate Bill 5 which requires each political subdivision to establish a goal to reduce electricity consumption by five percent each year for five years, beginning January 1, 2002, with an annual report submitted to the State Energy Conservation Office demonstrating these reductions. To meet the goals set forth by the Texas Legislature, political subdivisions may develop municipal planning requirements, energy efficiency performance standards, home energy rating programs, and Energy Star programs. The bill also provides for a grant program to be administered through the PUC to provide financial incentives for energy efficiency measures. Furthermore, SB 5 establishes new building code requirements for all new construction statewide.

The energy savings resulting from the SB 7 and SB 5 measures are expected to achieve reductions of NO_x emissions from electricity generators. This proposed SIP estimates county-wide NO_x reductions within the ERCOT territory. The EPA's Office of Atmospheric Programs, in coordination with the TCEQ, ERCOT and PUC, has developed a methodology for quantifying NO_x emission reductions resulting from energy savings due to energy efficiency measures. The inputs consider the amount of expected energy savings (kWh) in different areas of the state above what is expected in the baseline. The outputs are an estimate of the emission reductions at each plant within the ERCOT region, which can be summed for each county. Using Matrix Algebra, Power Control Area Generation and Interchange Data are combined into simultaneous equations to determine how much of each power control area's generation is directed to each power control area. This is the first step in quantifying emission reductions associated with energy efficiency measures. The commission plans to refine the analysis of these reductions as part of the mid-course review process. Furthermore, the commission is soliciting comments on the management of this program in other regions of Texas, the incorporation of this program into the cap and trade program, and

solutions to any other unresolved issues. Appendix A of the proposal details the methodology through which the emission reductions were estimated.

The proposed tonnage associated with energy efficiency measures is based on the most recent available given inputs. The commission expects the inputs to be updated prior to adoption if more information becomes available. The change in inputs will result in a change in the tonnage. In an attempt to enhance the energy efficiency program in terms of potential emission reductions, particularly since those reductions can now be quantified, the commission encourages interested parties to develop additional programs that utilize energy efficiency measures.

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.