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

NORTHEAST TEXAS REGION OZONE SIP REVISION

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
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SECTION VI. CONTROL STRATEGY

A. Introduction (No Change)

B. Ozone (Revised)

1. *Dallas/Fort Worth* (No change.)
2. *Houston/Galveston* (No change.)
3. *Beaumont/Port Arthur* (No change.)
4. *El Paso* (No change.)
5. *Regional Strategies* **(**No Change**)**
6. *Northeast Texas*
   Chapter 1: General
   Chapter 2: Emissions Inventory
   Chapter 3: Photochemical Modeling
   Chapter 4: Data Analysis
   Chapter 5: Control Strategies And Rate Of Progress

C. Particulate Matter (No change.)

D. Carbon Monoxide (No change.)

E. Lead (No change.)

F. Oxides of Nitrogen (No change.)

G. Sulfur Dioxide (No change.)

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

I. Site Specific (No change.)

J. Mobile Sources Strategies (No change)

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LIST OF ACRONYMS

AEP - American Electric Power
BACT - Best Available Control Technology
Base Case - Base Case Performance Evaluation
BEIS-2 - Biogenic Emissions Inventory System, version2
BPA - Beaumont/Port Arthur
CAMx - Comprehensive Air Quality Model with Extensions
CB-IV - Carbon Bond Mechanism, version IV
CO - Carbon Monoxide
CFR - Code of Federal Regulation
DFW - Dallas/Fort Worth
EDMS - Emissions & Dispersion Modeling System
EGAS - Economic Growth Analysis System
EGF - Electric Generating Facilities
EI - Emissions Inventory
EIQ - Emissions Inventory Questionnaire
ENVIRON - ENVIRON International Corporation
EPA - U.S. Environmental Protection Agency
EPS2 - Emissions Processing System 2
ETCOG - East Texas Council of Governments
FAR - Flexible Attainment Region
FCAA - Federal Clean Air Act
FR - Federal Register
GloBEIS - Global Biogenic Emissions Inventory System
GLoBEIS2 - New Global Biogenic Emissions Inventory System Model
HB - House Bill
HDD - Heavy Duty Diesel
HGA - Houston/Galveston
HPMS - Highway Performance Monitoring System
I/M - Inspection and Maintenance
KM - Kilometer
Kv - Verticle Mixing Coefficients
m - Meter
MM5 - Fifth-Generation Penn State/National Center for Atmospheric Research Mesoscale Meteorological Model
MOA - Memorandum of Understanding
NAAQS - National Ambient Air Quality Standard
NETAC - North East Texas Air Care
NET96 - National Emission Trends (NET96) database
NLEV - National Low Emission Vehicle
NO - Nitric Oxide
NOAA - National Oceanic and Atmospheric Administration
NO_x - Nitrogen Oxides
NO_y - NO_x plus Oxidation Products of Nitrogen Oxides
OTAG - Ozone Transport Assessment Group
PiG - Plume-in-grid
PM_{10} - Particulate Matter less than 10 microns

ppb - Parts Per Billion
PPM - Piece-wise Parabolic Method
PSDB - Point Source Database
RFG - Reformulated Gasoline
RVP - Reid Vapor Pressure
SAIMM - SAI Mesoscale Model
SB - Senate Bill
SIP - State Implementation Plan
SO_2 - Sulfur Dioxide
SO_x - Sulfur Compounds
TLM-Tyler/Longview/Marshall
TNRCC - Texas Natural Resource Conservation Commission (commission)
TPY - Tons Per Year
TTI - Texas Transportation Institute
VMAT - Vehicle Miles of Travel
VOC - Volatile Organic Compound
WDR - Wind Direction Resultant

CHAPTER 1: GENERAL INFORMATION

1.1 BACKGROUND

The Northeast Texas Region is composed of Gregg, Harrison, Rusk, Smith, and Upshur counties. The Gregg County portion of the Northeast Texas area was previously classified as nonattainment for ozone between the years 1977-1990. Based on monitoring data, Gregg County was determined to be in attainment of the one-hour ozone standard prior to enactment of the Federal Clean Air Act Amendments of 1990. In 1994 a voluntary effort was initiated in Northeast Texas to enhance public awareness and begin establishing programs to reduce emissions of ozone precursors. The Northeast Texas Air Care (NETAC) was formed in March 1996 as a voluntary cooperative association of local governments and industries within Gregg, Harrison, Rusk, Smith and Upshur Counties. The NETAC Policy Committee is composed of elected officials and senior management from both local governments and industry in the NETAC Region and was created because of the need for a more organized and comprehensive approach to improving air quality based on regional needs and abilities.

During the summer of 1995, the Gregg County ambient air quality monitor recorded four exceedances of the one-hour ozone NAAQS. As a result of these exceedances EPA indicated that one possible option would be to enter into a Memorandum of Agreement (MOA) similar to what had been done in Tulsa, Oklahoma, establishing the Northeast Texas Region as a Flexible Attainment Region (FAR). The FAR concept was developed by the U.S. Environmental Protection Agency (EPA) in order to recognize and encourage the efforts of local areas to maintain levels of ground level ozone below the National Ambient Air Quality Standard (NAAQS) and thus remain in attainment of the one-hour ozone standard. The FAR was first established in Tulsa, Oklahoma in August 1995 and then Corpus Christi, Texas in July 1996. The intent of the NETAC FAR agreement, executed on September 15, 1996 was to allow time for the area's control program to work, similar to contingency measures in a post 1990 maintenance agreement, prior to the EPA issuing a call for a State Implementation Plan (SIP) revision or a nonattainment designation. Representatives from the Northeast Texas Region, which includes Gregg, Harrison, Rusk, Smith, and Upshur Counties, developed a MOA that defined a detailed plan to improve the local air quality and to conduct needed scientific research on the region's ozone air quality problems. It also served to formalize the Texas Natural Resource Conservation Commission (commission) and the EPA's respective roles and responsibilities.

Pursuant to the FAR agreement the commission submitted a SIP revision to the EPA addressing the exceedances of the ozone standard at the Gregg County monitor. The SIP contained Agreed Orders from four companies in the Northeast Texas Region: Eastman Chemical Division; Texas Eastman Division; La Gloria Oil and Gas Company; ARCO Permian, Unit of Atlantic Richfield Company; and Norit Americas, Inc.. These affected companies agreed to be subject to the implementation of enforceable emission reduction measures of 2,516 tons per year of volatile organic compound (VOC), and 37 tons per year of NO_x. These site-specific voluntary control measures included quantifiable reductions and were made enforceable through the use of signed Agreed Orders. The FAR also called for voluntary measures to be implemented by twenty-three local emission sources in order to reduce ground level ozone. The emission reductions from these voluntary measures totaled 2,793 tons per year in reductions of VOCs, and 1,702 tons per year reductions of NO_x.

During the summer of 1998 the Gregg County monitor recorded five subsequent exceedances of the one-hour ozone NAAQS. In 1999 the Gregg County monitor recorded three additional exceedances of the one-hour ozone NAAQS. On January 5, 1999 the commission formally notified NETAC by letter that as a result of these exceedances, the FAR Agreement required that contingencies under Part B, pages 18-19, Paragraph 1(a) through (d) of the FAR Agreement be implemented. These reductions were made federally enforceable through an Agreed Order Docket No. 2000-0033-SIP on January 26, 2000 and constituted an enforceable reduction of 386 tons per year (tpy) of VOC emissions and a 1671.5 tpy of NO_x reductions by the Eastman Chemical Company, Texas Eastman Division.

In addition to the reductions of 386 tpy of VOC emissions and 1671.5 tpy of NO_x reductions in the Agreed Order Docket No. 2000-0033-SIP effective January 26, 2000, there was also voluntary reductions that same year by the Texas Utilities Electric Company for 3,000 tpy of NO_x, the Central and Southwest Services Company, now (AEP); for 150 tpy of NO_x; and the Eastman Chemical Company, Texas Eastman Division, for 301 tpy of NO_x. These voluntary reductions were not a part of the SIP protocol or the modeling. They resulted in a total additional voluntary savings of 3,451 tpy of NO_x. These additional savings were voluntarily negotiated by NETAC and exceeded the requirements of the FAR agreement.

The Northeast Texas Region has strived to provide a better understanding of the conditions leading to elevated ozone concentrations in their region, and to properly evaluate and avoid the likelihood of future exceedances of the one-hour ozone NAAQS. Through this effort, modeling tools have been developed to evaluate the effects of alternative emission reduction strategies. Significantly, by 1999, NETAC studies demonstrated that Nox,reduction strategies would be far more effective in reducing ozone levels than the VOC reduction strategies initially required under the FAR agreement. In order to accomplish science-based air quality planning activities, the Northeast Texas Region has received and continues to receive biennial funding from the Texas Legislature (see table 1.1-1),to address ozone air quality issues through the 'near non-attainment areas' program. These monetary resources have been used to fund studies through the East Texas Council of Governments (ETCOG) under the technical and policy direction of the North East Texas Air Care (NETAC) organization. In fiscal years 1996/97 ETCOG sponsored studies to provide a better understanding of the conditions leading to high ozone concentrations. These studies examined the emissions inventory for the area as well as carrying out ambient monitoring. In the fiscal years of 1998/99 previous studies were extended through additional emission inventory development and ambient monitoring activities, plus the development of computer models to describe ozone formation in the Northeast Texas region. A Northeast Texas Region 1996 emission inventory was developed and then submitted by the Commission to the EPA's National Emission Trends (NET96) database. Ozone models were developed for two selected high ozone episode periods (June 18-23, 1995 and July 14-18, 1997). A control strategy was developed that demonstrated attainment for the one-hour ozone standard with a future base year of 2007. This modeling was performed with Rider 17 funding by ENVIRON International Corporation (ENVIRON) who was under contract to the ETCOG and the Commission.

In the fiscal years 2000/01 NETAC plans to develop an updated emissions inventory based on 1999 emission rates, to continue air quality monitoring, and to perform additional air quality modeling with emphasis on strategies to demonstrate attainment with the eight hour ozone standard.

Table 1.1-1 Northeast Texas Region Near Nonattainment Funding

Rider/Biennium	Northeast Texas Region Through the ETCOG
Rider 26 1996 - 1997 Biennium	$176,665
Pro Rata Share	17.67%
Rider 17 1998-1999	$470,750
Pro Rata Share	18.07%
Rider 13 2000 - 2001	$935,212.50
Pro Rata Share	23.31%
Rider 13 2002 - 2003	$1,038,600
Pro Rata Share	20.46%
Grand Total Funding	$2,697,897.50

In 2000 the Gregg County Monitor recorded two subsequent exceedances of the one-hour ozone NAAQS on July 15, 2000 and August 11, 2000. The Texas Natural Resource Conservation Commission (Commission) responded by letter on September 5, 2000 to notify NETAC that the ozone exceedances were officially validated and to encourage the NETAC Policy Committee to act as quickly as possible to implement voluntary measure(s) in order to get them in place before the end of the 2000 ozone season. As reflected in the minutes of the November 28, 2000 NETAC policy committee meeting, the City of Longview implemented a contingency measure by voluntarily purchasing electric powered lawn and park maintenance equipment to replace existing equipment that utilized two cycle gasoline engines. Additionally, on September 5, 2000 the NETAC representatives wrote to the EPA to reurge NETAC's proposal for early submittal of a state implementation plan through an amended FAR agreement.

Because of this history of ozone exceedances under the FAR, in 2001 the EPA refused to extend the FAR agreement. Due to NETACs commitment to ongoing implementation of control strategies and its aggressive pursuit of science-based air quality studies which has led to the identification of control strategies demonstrating attainment with the one hour ozone standard theEPA suggested that the NETAC and the commission pursue an early SIP proposal before the expiration of the FAR on September 16, 2001. The commission advised NETAC by letter on June 19, 2001 that it would proceed with the SIP revision for proposal and adoption. NETAC and the commission have worked cooperatively to develop this proposed SIP revision.

The commission and the Northeast Texas Region agree that an early SIP proposal will continue to allow local officials to address air quality issues, while providing benefits for air quality in the Northeast Texas Region. As part of this continuing local effort, NETAC worked with three companies in the Northeast Texas Region (Eastman Chemical Company, Texas Operations; Southwestern Electric Power Company; and TXU Electric Company) to obtain commitments to voluntarily reduce emissions of NO_x. These reductions are proposed to be included in Agreed Orders in order to make the commitments federally enforceable.

PUBLIC HEARING INFORMATION

Public hearings on this proposal will be held in Longview on October 23, 2001 at 7:00 p.m. at the Longview City Hall, City Council Chambers, 300 W. Cotton Street, and in Tyler on October 24, 2001 at 7:00 p.m. at the Tyler Junior College Regional Training and Development Center, Room 104, 1530 SSW Loop 323. The hearings will be structured for the receipt of oral or written comments by interested persons. Individuals may present oral statements when called upon in order of registration. There will be no open discussion during the hearings; however, an agency staff member will be available to discuss the proposal 30 minutes prior to the hearings and will answer questions before and after the hearings.

Written comments will also be accepted via mail or fax. All comments should be submitted to Joyce Spencer, Office of Environmental Policy, Analysis, and Assessment, P.O. Box 13087, MC206, Austin, Texas 78711-3087 or fax number (512) 239-4808. All comments should reference Rule Log Number 2001-026-SIP-AI, and must be received by October 24, 2001. Copies of the SIP revision can be obtained from the commission's web site at *www.tnrcc.state.tx.us/oprd/sips/cover.html*, or by calling Ms. Spencer at (512) 239-5017.

1.3 SOCIAL AND ECONOMIC CONSIDERATIONS

Because the Northeast Texas SIP is a local voluntary initiative, the state has not performed an analysis of social and economic considerations.

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 Federal Clean Air Act (FCAA) and 40 Code of Federal Regulation (CFR); §51.322 require that Emissions Inventories (EI) be prepared statewide and for ozone nonattainment areas. Because ozone is photochemically produced in the atmosphere when volatile organic compounds (VOC) are mixed with NO_x and carbon monoxide[1](CO) in the presence of sunlight, it is important that the 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 tons per year (tpy) of VOC, 25 tpy of NO_x, or 100 tpy of any of the other criteria pollutants which include CO, sulfur compounds (SO_x), particulate matter, (smaller than 10 microns - 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 hazardous air pollutant (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 Emissions Inventory Questionnaires (EIQ) 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 Point Source Data Base (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

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

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 appropriate activity or activity surrogate responsible for generating emissions. Population is the most commonly used activity surrogate for many area source categories, 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_h. 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 Inspection/Maintenance (I/M) program in place (where applicable), 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 vehicle miles of travel (VMT). The level of vehicle travel activity is developed from the federal Highway Performance Monitoring System (HPMS) data compiled by the Texas Department of Transportation for each county. Finally, roadway speeds, which are required for the MOBILE model’s input, were from analysis for several roadway types performed by the Texas Transportation Institute (TTI). The draft guidance on Mobile 6 indicates that with the 1996 EI there are no Tier 2 or conformity issues, therefore Mobile 6 should not be an issue.

2.5 NON-ROAD MOBILE SOURCES

Non-road mobile sources are a subset of the area source category. This subcategory includes aircraft operations, recreational boats, railroad locomotives, and a very broad category of off-highway 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, locomotives, commercial marine vessels, 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. Emissions were originally projected 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 the Emissions & Dispersion Modeling System (EDMS) aircraft emissions model. Locomotive emissions were developed from fuel use and track mileage data obtained from individual railroads.

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. A locally specific biogenic EI was developed for the Northeast Texas Region. This EI was prepared using an updated version of EPA's Biogenic Emissions Inventory System, version 2 (BEIS2) biogenic model called Global Biogenic Emissions Inventory System (GLOBEIS) which allows locally specific data to be used. 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 1996 base case emissions inventory summary for the Northeast Texas Region is shown in Figure 2.7-1. This is the same 1996 base case that the modeling is based on for the Northeast Texas Region. It is evident from the pie charts that for NO_x, the greatest man-made contribution is from point sources, and for VOC, from biogenic sources. Contributions from biogenic emissions are included in the summary, although the SIP control strategies are limited to the reduction of man-made emissions only. The contributions from VOC sources in the 1996 base case inventory include the following: biogenic sources 85%; area sources 8%; non-road sources 3%; on-road mobile sources 2%; and point sources 2%. The contributions from NO_x sources in the 1993 base case inventory are as follows: point sources 54%; on-road mobile sources 21%; area sources 17%, non-road sources 7%; and biogenic sources 1%.

Figure 2.7-1 1996 VOC and NO_x Emissions by Major Category

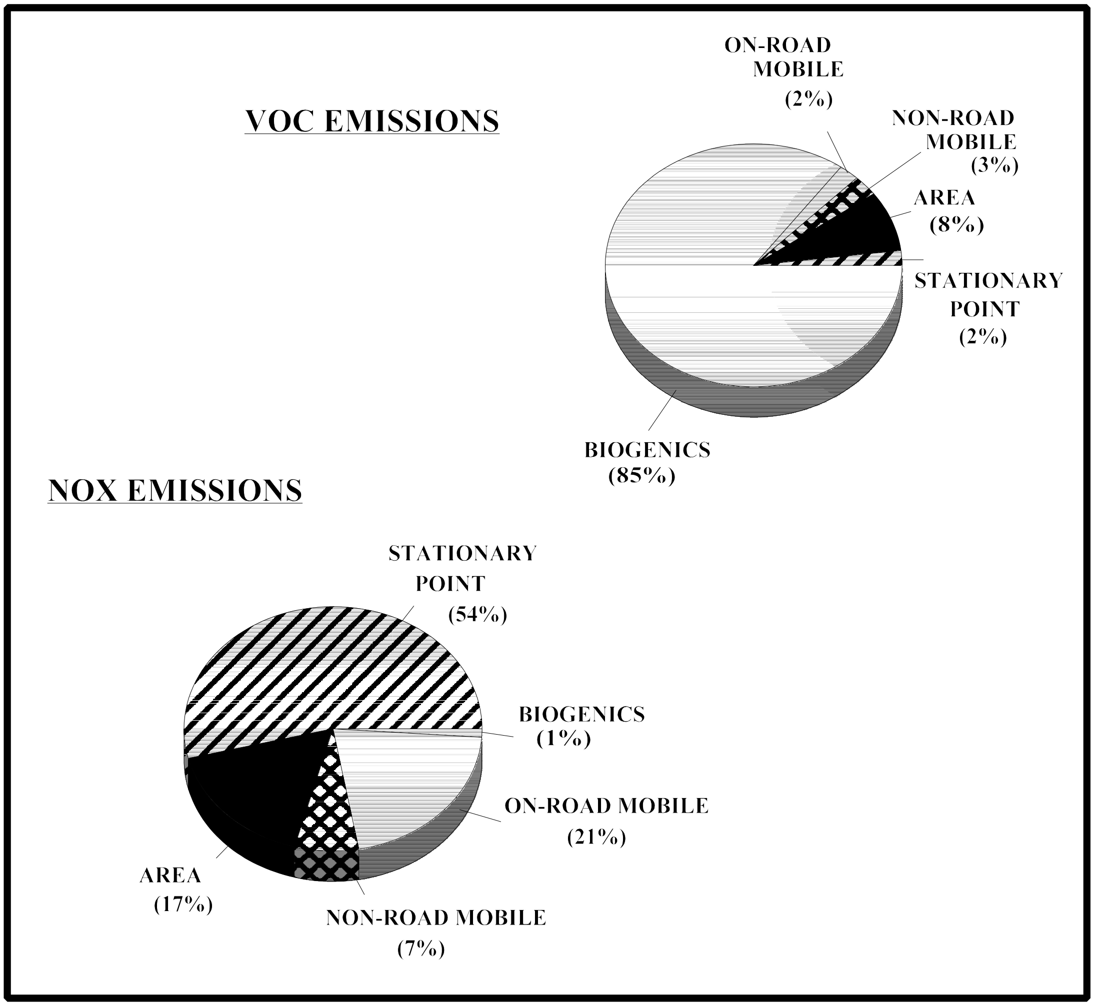


Table 2.7-1 1996 VOC, NO_X, and CO Emissions in Tons per Average Ozone Season Day

Emissions Sources	VOC	**NO_X**	CO
Major Point	29	145	21
Minor Point	2	0.3	0.3
Area	130	40	12
Nonroad Mobile	38	16	228
Onroad Mobile	35	51	311
Biogenics	1350	2	0
Totals	1584	254	623

CHAPTER 3: PHOTOCHEMICAL MODELING

3.1 INTRODUCTION

This chapter briefly describes the photochemical modeling conducted to demonstrate attainment of the one-hour ozone standard in the Northeast Texas Region near nonattainment area. A more detailed description of the photochemical modeling is found in Appendix A. This modeling demonstration used two episodes, June 18-23, 1995 and July 14-18, 1997. This modeling demonstration will include the effects of source specific point source NO_x reductions made enforceable through Agreed Orders, as well as the effects of other local, regional, and national controls. In accordance with earlier agreements between the commission and EPA, a future attainment year of 2007 was used. Although the area has not been formally designated as nonattainment, the reasons for using 2007 as the future/attainment year are (1) 2007 is the attainment date for the Houston-Galveston, Dallas-Ft Worth, and Beaumont-Port Arthur one-hour ozone nonattainment areas, (2) a transport analysis previously conducted for DFW, using the June 30-July 4, 1996 episode, showed a direct impact of the Houston-Galveston plume upon the Northeast Texas Region ; and (3) 2007 has also been used as the future year for modeling associated with the commission's Regional Strategy SIP.

3.2 BACKGROUND

The episodes selected for this attainment demonstration were selected based upon representativeness of ozone episodes that occur in the Northeast Texas Region . June 18-23, 1995 also has the advantage of being an episode Commission used for the DFW attainment demonstration SIP. In addition, an episode previously used for the Ozone Transport Assessment Group (OTAG) July7-12, 1995, was also contemplated. However, it was subsequently scrapped due to performance problems in the TLM domain. The third episode, July 14-18, 1997, was chosen because the Northeast Texas Region design value of 139 ppb (for 1995-97) was set on July 16. In addition, the Baylor aircraft overflew the area on July 17, which could yield important data for evaluating the model performance. A complete discussion of the episode selection process can be found in Appendix B, "Selection of Episodes for East Texas Photochemical Model Development", October 7, 1998 (Environ).

The photochemical model used for this attainment demonstration is the freely-available Comprehensive Air Quality Model with Extensions (CAMx). CAMx is a state of the science photochemical grid model with numerous improvements over the 1990-vintage Urban Airshed Model, version IV. CAMx uses the Carbon Bond Mechanism, version IV (CB-IV) chemistry package, nested grids, plume-in-grid (PiG) for point sources, and three choices for advection schemes: Smolarkiewicz, Bott, or Piece-wise Parabolic Method (PPM). For this modeling exercise, PiG was applied to major point sources, and the Smolarkiewicz advection scheme was used. The modeling domains are shown in Figures 3-1 and 3-2. Figure 3-1 shows the nested domain, while Figure 3-2 shows a zoom in of the TLM 4-km domain, with point source locations overlaid on it.

3.3 METEOROLOGICAL MODELING

CAMx requires gridded meteorological variables of wind speed and direction (vector component), ambient temperature, atmospheric pressure, water vapor mixing ratio, vertical mixing coefficients (Kv), and vertical model layer interface heights. The meteorological parameters are typically developed by either a diagnostic or prognostic meteorological model. For the June 18-23, 1995 episode, the SAI Mesoscale Model (SAIMM) was used, since part of these fields were also developed for DFW. The July 14-18, 1997 episode's meteorological fields were built with the Fifth-Generation Penn State/National Center for Atmospheric Research Mesoscale Meteorological Model (MM5). Since meteorological models may have the same horizontal grid structure as CAMx, but finer vertical resolution, an aggregation/interpolation routine is used to put the meteorological fields into the same grid as that set up for CAMx. Examples include MM5CAMX. A more detailed discussion of the development of the meteorological fields for CAMx may be found in Appendix A.

3.4 EMISSIONS INVENTORY

CAMx requires hourly, gridded values of VOC, NO_x, and CO from source categories of on-road mobile, area and non-road mobile, point (low-level and elevated), and biogenic. VOC emissions must also be speciated. For these modeling exercises, emissions were developed for both a 16km regional grid, plus an urban-scale 4km grid. The regional grid extends west toward Big Spring, Texas; south to Mexico; east to the Alabama/Georgia state line; and north toward the Oklahoma/Kansas state line. The 4km grid covered the Northeast Texas Region core area and extended west toward DFW; east toward north central Louisiana; north toward the Red River; and south toward Lufkin, Texas. The regional inventory was based upon the regional inventory that the commission previously developed for the DFW attainment demonstration SIP. The 4km point, area/nonroad, and on-road inventory was developed by Environ and Pollution Solutions. The anthropogenic emissions inventory was processed by Environ through the Emissions Processing System 2 (EPS2), which spatially and temporally gridded the data, and speciated the VOCs. 2 sets of biogenic emissions were developed by Environ; one built using a combination of the BEIS2 and GLOBEIS models, and the other using GLOBEIS2. The net result was that GLOBEIS2 tended to produce lower biogenic VOC emissions. A complete discussion of the emissions processing for both episodes is in Appendix A.

3.5 BASE CASE PERFORMANCE EVALUATION

Once the emissions inventory and meteorological fields are developed, they are fed into CAMx during the Base Case Performance Evaluation (base case). This exercise is designed to see if CAMx can replicate the actual ozone produced during the episode. EPA guidance requires that model predictions be compared to actual ozone observations within the area of interest (Northeast Texas Region stations in this case) using statistical and graphical methods. Graphical techniques include time series plots (predicted vs observed at a monitoring station) and isopleth maps (lines of constant daily maximum predicted ozone concentration). Statistical methods are unpaired peak accuracy, normalized bias, and gross error. EPA acceptance criteria for each is ±15-20%, ±5-15%, and 30-35%, respectively. Table 3-1 shows the statistical performance evaluation statistics for both episodes. Both episodes met EPA base case performance criteria. A full discussion of the base case model performance evaluation, including statistical measures, isopleth plots, and time series is found in Appendix A.

Table 3-1 Statistical Performance Evaluation

Episode day	Bias (±15%)	Gross error (35%)	Unpaired peak (±20%)
June 22, 1995	-9%	20%	19%
June 23, 1995	-4	20	-3
July 16, 1997	8	30	-10
July 17, 1997	11	20	20

In addition, base case performance evaluation also typically includes diagnostic and sensitivity analyses, which are designed to gauge the model's responsiveness to various input changes. These can include zeroing out all anthropogenic emissions, varying the initial or boundary conditions, increasing or decreasing wind speeds, and varying the biogenic emissions component (a source of uncertainty in the model). Sensitivity tests are used to show what sorts of emission reductions (in type, magnitude, and location) the model responds to. A full discussion of the diagnostic and sensitivity runs is found in Appendix A.

3.6 FUTURE CASE EMISSIONS INVENTORY AND MODELING

After the base case modeling passes all performance evaluation tests, the next step is to grow the base case inventory to the future case or attainment year. As previously noted, the attainment year for this demonstration is 2007. The 2007 inventory consists of the incorporation of emissions due to anticipated growth, plus controls on source categories due to rules that have been promulgated and will be in place by 2007, but were not in effect at the time of the episode(s). The photochemical model is rerun and the model results are compared to the one-hour ozone standard of 125 ppb. If no grid cell concentrations are greater than or equal to 125 ppb, the attainment test is passed. If not, additional control strategies must be developed and modeled. Some control programs, including Houston/Galveston and Dallas/Ft Worth attainment demonstration controls; SB 7; SB 766 (other than those at Texas Eastman); and Stage I vapor recovery and National Low Emission Vehicles for Central and Eastern Texas, were not fully developed or approved when the photochemical grid modeling was conducted and thus are not accounted for in the modeling. In addition, the commission is aware of at least one recently permitted facility (Entergy Power Ventures, L.P., commission air permit number 45360) that has been permitted since the November 12, 1999 Modeling Report was written. Therefore, this source was not included in the future base case modeling, nor was it included in any subsequent diagnostic, sensitivity, or control strategy runs. However, the commission believes that with BACT for this permit (selective catalytic reduction of NO_x), plus impacts of other un-modeled control programs, such as SB 7, the impact of new NO_x emissions will not significantly affect the future base and control cases. A full discussion of the future case inventory development and modeling is found in Appendix A.

3.7 CONTROL STRATEGY MODELING

After completion of the future base case modeling, additional control strategies needed to be tested. This consisted of four phases of control strategy modeling that began with coarse, across the board reductions and was eventually refined to source-specific strategies. The first phase consisted of three runs per episode in which 30% NO_x reductions were modeled in each of major point sources, on-road mobile sources, and other anthropogenic sources (area/non-road mobile and low-level/minor points). These controls were applied equally over all such sources within the 4km domain. The second phase consisted of seven additional simulations (per episode) with varying NO_x control combinations of major points, on-road mobile, and area/nonroad/low-level points. Phase II was designed to try and more accurately determine where emission reductions should be focused. The first 5 runs (II-4 through II-8) also applied controls uniformly over the 4km domain, but II-9 controls were applied only to sources in Gregg, Harrison, Rusk, Smith, and Upshur counties and II-10 was only applied to the same 5 counties plus Camp, Cherokee, Franklin, Henderson, Marion, Morris, Nacogdoches, Panola, Shelby, Titus, Van Zandt, and Wood counties. Table 3-2 shows a summary of the Phase I and II modeling runs.

Table 3-2 Summary of Phase I and Phase II Control Strategy Testing in NO_x Reduction per Source Categories (%)

Phase/Strategy run #	Major point	On-road	Area/nonroad/low-level point
Phase I			
I-1	30	0	0
I-2	0	30	0
I-3	0	0	30
Phase II			
II-4	50	0	0
II-5	70	0	0
II-6	50	30	0
II-7	50	0	30
II-8	50	30	30
II-9	50	30	30
II-10	50	30	30

Phases I and II modeling showed that point source NO_x reductions were effective in reducing ozone. However, reducing ozone from on-road and area/nonroad/low level point sources lowered ozone only marginally, and only showed beneficial effects when coupled with point source NO_x reductions. In addition, none of the scenarios modeled in Phases I or II showed all grid cells below 125 ppb. A full description of Phase I and II modeling, along with tabular and graphical results of the modeling, is found in Appendix A.

3.8 PHASE III CONTROL STRATEGY MODELING

Based on the results of Phases I and II, a third round of control strategy modeling was conducted. Phase III consisted of three additional scenarios that were run for each of the two episodes. Strategy III-11 consisted of first revising the future base case by including federal emission control programs that will be in place by 2007, and lowering over-estimated biogenic VOCs by 30%. The federal control programs are:

– Tier 2 on-road vehicles and fuels (low-sulfur). This begins with a 2004 model year. This reduced NO_x by 12.6% and VOC by 11.5% (fleet average).

– Model year 2004 heavy duty diesel standards. This reduced NO_x by 3.1% (fleet average).

– Beginning 1998, new locomotive standards. NO_x was reduced from diesel locomotives by 36%.

Strategy III-12 included the revised 2007 future base case from Strategy III-11, but also included proposed NO_x reductions for sources operated by Texas Eastman, AEP (formerly Central and Southwest Services (CSW)), and TXU (Texas Utilities). These reduction projects are listed below:

3.8.1 TEXAS EASTMAN

The Texas Eastman reduction projects are associated with the Flexible Attainment Region (FAR) agreement and SB766 grandfathered source permitting.

FAR-based

- Replacement of cooling tower natural gas-fired engine with an electric motor (completed).
- Installation of clean burn technology on compressor engine (completed).

Cogeneration project (anticipated completion 2001)

- Shut down of two coal-fired boilers.
- Switch of two natural gas-fired boilers to back-up service.
- Switch of two auxiliary boilers to back-up.

Olefins Hydration project (Completed January 2000)

- Shut down of three process boilers.
- Shut down of five natural gas compressor engines

Other anticipated projects (Completion anticipated in 2001-2005 time frame)

- Installation of clean burn technology on five compressor engines.
- Installation of clean burn technology on a cooling tower drive.

In total, these amount to a 38% reduction in NO_x from Texas Eastman's 1997 emissions inventory.

3.8.2 AEP (FORMERLY CENTRAL AND SOUTHWEST SERVICES)

AEP developed several NO_x reduction projects at their Wilkes, Knox Lee, and Pirkey power plants.

Wilkes

- Unit #2 - burner project with 25% NO_x reduction from 1997 emissions inventory. (Completed 1999)
- Unit #3 - burner project with 25% NO_x reduction from 1997 inventory (Completed 2000)

Knox Lee

- Unit #5 - burner project with 25% NO_x reduction from 1997 inventory (Completed 2000)

Pirkey

- Burner project - 10% reduction from 1997 emissions inventory (Completed 2000)

The total reductions from these controls are 22% for Wilkes, 12% for Knox Lee, and 10% for Pirkey.

3.8.3 TXU (TEXAS UTILITIES)

TXU controlled NO_x from their Martin Lake, Monticello, and Stryker Creek plants. For Martin Lake and Monticello, the NO_x emission rate dropped to 0.2 pounds/million Btu.

Martin Lake (reductions from 1997 levels)

– Unit 1 - 40% reduction in NO_x
– Unit 2 - 33% NO_x reduction
– Unit 3 - 45% NO_x reduction

<u>Monticello (reductions from 1997 levels)</u>
– Unit 1 - 30% NO_x reduction
– Unit 2 - 32% NO_x reduction
– Unit 3 - 16% NO_x reduction

<u>Stryker Creek</u>
– Unit 1 - 50% NO_x reductions

For each of these plants' total emissions, these reductions amount to 40% from Martin Lake, 26% from Monticello, and 31% from Stryker Creek.

In addition, Strategy III-13 included the effects of the Texas Clean gasoline, rather than the effect of Tier2 and low-sulfur gasoline modeled in III-11. The reductions due to on-road mobile emissions were 0.55% for NO_x, 5.4% for VOC, and 1.1% for CO for this III-13.

3.9 PHASE IV CONTROL STRATEGY TESTING

The final phase of the control strategy testing involved re-estimated biogenic emissions (using the new GloBEIS2 biogenic emissions model), along with addition reductions at the AEP Pirkey plant. A new overfire air project at Pirkey is expected to add another 20% reduction in NO_x from 1997 levels. Taken together with the previously mentioned 10% reduction at Pirkey, total NO_x emission reductions at the plant are 30% from 1997 levels. This is reflected in Strategy IV-14. Table 3-3 shows a summary of the modeling runs including future base case and control strategies. With the reduced biogenic emissions, plus the emission reduction plans from TXU, AEP, and Texas Eastman, the maximum modeled concentration is 118.6 ppb on July 16. This demonstrates attainment of the one-hour ozone standard. A complete description of the future year and control strategy modeling is found in Appendix A.

Table 3-3 Summary of Future Base Case and Control Strategy Modeling of Maximum modeled ozone over entire East Texas domain

Phase/ Strategy Run #	June 22	June 23	July 16	July 17
2007base 1	145	144	121	123
I-1	132	132	122	122

I-2	144	144	120	120
I-3	143	143	120	120
II-4	126	126	120	120
II-5	107	107	131	131
II-6	124	124	120	120
II-7	124	124	126	126
II-8	123	123	126	126
II-9	128	128	127	127
II-10	124	124	127	127
III-11	132	136	111	115
III-12	121	118	114	109
IV-13	145	144	121	123
IV-14	117.6	117.7	118.6	113.7

CHAPTER 4: DATA ANALYSIS

4.1 SUMMARY

There are several influences on ozone levels in Northeast Texas Region. Large air masses can transport ozone long distances and sometimes elevate background levels across the region. These air masses may collect ozone from urban plumes (the fusion of urban area air with major point source plumes) and/or from large rural point source plumes that tend to travel greater distances. Local point sources also have a significant impact on ozone levels in the Northeast Texas Region. Therefore, the movement of air masses, the ozone transported by these air masses, and local point source emissions each factor into this area's ability to meet the one-hour ozone standard.

4.2 REGIONAL CONSIDERATIONS

There are several influences on background level ozone. Plumes from major point sources and urban area air usually merge together to form urban plumes. As a result of night-time shearing, the direct effects of these urban plumes are sometimes limited in distance. However, some plumes may travel to other regions and increase background levels of ozone. In addition, large rural elevated point sources can have direct impacts over long distances, which can also affect background ozone. Monitoring data over the last several years have shown that regional background levels of ozone vary considerably during the high ozone season from March through October.

Data from fixed surface monitoring sites and aircraft monitoring show ranges in ozone background levels are associated with different wind flow patterns. One of the more common transport patterns occurs with persistent south to southeast winds bringing maritime air into Texas. With this flow pattern, the levels of ozone coming into the Texas coast are often as low as 20 to 30 parts per billion (ppb) for daily maximum one-hour averages. As the air moves inland, the ozone levels upwind of San Antonio area are usually about 10 to 20 ppb higher than the coastal measurements, and the ozone levels upwind of the Dallas/Fort Worth (DFW) area are commonly about 20 to 30 ppb higher than the coastal measurements. With lighter winds speeds, this gradient in the background levels is generally stronger than with higher winds. For days with high ozone in the Northeast Texas Region, the most common transport level wind directions are from the east/northeast and from the south, whereas trajectories from the west/northwest are rare. On days when air moves north from the Gulf Coast (from the vicinity of Houston), travel time takes roughly 48 hours to reach the Northeast Texas Region , based on average wind speeds of about 5 miles per hour (mph).

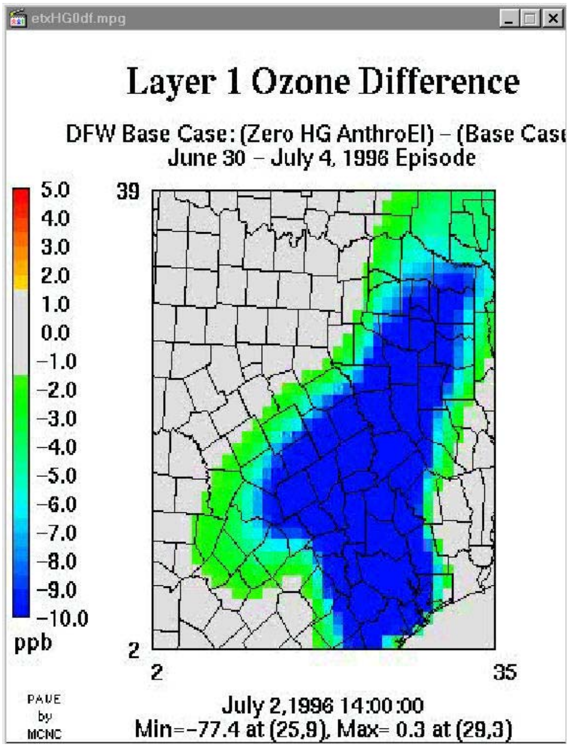
Another case of background ozone influence occurs when slow-moving continental air comes into the Northeast Texas Region. Usually this air comes from the east or northeast, but sometimes it travels from the southeast after sweeping down from the mid-west. Continental air masses may bring background concentrations as high as 60 to 80 ppb.

High ozone in the Northeast Texas Region is most often associated with stagnation (relatively little movement) of air in the region. Regardless of the airflow patterns, addition of local point source emissions to high background concentrations (above 60 ppb) affects the regions ability to attain the one-hour standard. Furthermore, local point sources impact one-hour ozone levels whether or not transported (or regional-scale) ozone is involved. Therefore, in addition to transport, it is important to consider the contribution of local point sources to ozone in the Northeast Texas Region.

4.3 TRANSPORT

Transport of ozone to the Northeast Texas Region was supported by the June 30-July 4, 1996 Houston Zero Out Modeling test. This model run demonstrated a reduction in background ozone levels of 10 ppb or more in the Northeast Texas Region when Houston emissions were eliminated. An image of results for July 2, 1996 (below) shows an area of ozone improvement, extending from Houston to the Northeast Texas Region, that would occur if Houston emissions were substantially reduced.

Figure 4.3-1 Ozone Difference on July 2, 1996 from Houston Zero-Out Modeling Test



The days modeled for the Northeast Texas Region in FY1998/99 (June 22-23, 1995 and July 16-17, 1997) were stagnation days and were useful for developing ozone control strategies because they are representative of the dominant type of high ozone days in this area. During an effort to select other episodes with high 8-hour ozone levels (as part of a new Regional Scale Model under development), commission contractor Environ examined airflow characteristics of several high 8-hour ozone days. Eight-hour findings are relevant to a discussion of one-hour ozone because 8-hour averages describe the background ozone levels that would affect the Northeast Texas Region's ability to meet the one-hour standard. In addition, airflow trajectories are useful when examining one-hour ozone exceedances. Modeling procedures are the same for both 8-hour and one-hour ozone.

Ozone days with a maximum 8-hour ozone of 90 ppb or higher at any CAMS in the Northeast Texas Region from 1995 to 1999 were reviewed in detail. This review resulted in a list of 63 days which would be useful for future 8-hour modeling. Back trajectories and daily weather maps were reviewed to classify the airflow on these days as stagnation, weak transport, or transport. This classification was general, and boundaries between classifications were not rigid. Days when the 32-hour back trajectories stayed within about 150 kilometers (km) of Longview were called stagnation days, especially if the back trajectory meandered and changed direction several times. Days when trajectories were persistent in direction and traveled from more than about 250 km from Longview were called transport days. The remaining days were called weak transport days. The direction of the back trajectory was classified among eight compass points, but on some days no classification was possible. Unclassifiable trajectories meandered through several directions, or else the 500 and 1000 meter (m) trajectories went in very different directions from one another because of wind shear. Finally, five days for which back trajectories were not available from the National Oceanic and Atmospheric Administration (NOAA) could not be classified.

Table 4.3-1 Northeast Texas Transport Breakdown of High 8-hour Ozone Days 1995-99

Stagnation	36	62%
Weak Transport	13	22%
Transport	9	16%
Not Classified	5	0
Total	58 Classifiable Days	100%

Transport comprised 38% of the 58 classifiable days. The wind directions on the 13 weak transport days were east through northerly on seven days and south or southeasterly on five days; one day showed southwesterly flow. The wind directions on six of the nine transport days were from the east/northeast. On the remaining three transport days, directions indicated flow from the northwest, southeast and unclassifiable (because of wind shear). The transport days quite often appeared as isolated events, or near the beginning or end of a stagnation period.

The 68 days examined in this analysis experienced high 8-hour ozone levels, indicating high background concentrations. Some of the transport days also had 1-hour ozone exceedances. In particular, on May 29, 1998 (transport day), September 3, 1998 (weak transport day), and August 4, 1999 (transport day), the Gregg County (Co.) Airport monitor near Longview recorded maximum one-hour ozone averages above 125 ppb. On the latter two days, when trajectories indicated winds were northeasterly, the Cypress River Airport monitor upwind (northeast of Longview) recorded one-hour average levels above 65 ppb. (It should be noted here that daily means in 1998 suggest ozone measurements at Cypress River may have been lower than actual levels that year.) On these days, transport from the northeast may have played a role in the 1-hour exceedances. Also, the stagnation day after August 4, 1999 shows a pattern in ozone levels that supports the possible involvement of regional level transport. Five-minute data show ozone levels at Tyler and Longview (Gregg Co. Airport) monitors on August 5 were similar, which suggests regional influence, rather than a single local source. In addition, a one-hour exceedance that day occurred in Tyler, rather than Longview. No ambient ozone data were available upwind (south) of the major point sources near the Longview area on May 29, 1998.

In 2000, one-hour ozone exceedances were recorded on July 15 (Gregg Co. Airport) and 16 (Cypress River), August 11 (Gregg Co. Airport), and September 1 (Gregg Co. Airport). The first and last of these days are difficult to assess as far as any transport influences because back trajectories indicated clockwise rotation, usually characteristic of stagnation days. In addition, exceedances on July 15, 2000 at Longview occurred during hours when winds were blowing from the northeast, the direction of the Texas Eastman plant. Influences of local point sources will be discussed in Section 4.4 of this chapter.

On July 16, 2000, back trajectories show air traveling from the south and southwest of Longview. Levels at the Gregg Co. Airport monitor (upwind of Cypress River that day) indicate levels of ozone there ranged between 65-86 ppb during five of the mid-day hours. These levels could be the result of regional transport into the area and/or emissions from the Martin Lake Power Plant, southeast of Gregg Co. Airport; no ambient ozone data were available any further south to verify upwind levels. On August 11, 2000, a one-hour exceedance was recorded at the Gregg Co. Airport. Back trajectories indicate air traveled from the north and northeast on this day, and background ozone levels recorded at the Cypress River monitor were elevated between 65-72 ppb. In addition, unusually high five-minute ozone readings registered at Cypress River between 3:00 and 4:00 AM. These readings were associated with relatively high wind speeds, when upper level ozone could have mixed into air layers closer to the ground.

4.4 BAYLOR AIRCRAFT DATA & ANALYSIS

In 1996, the Commission asked Baylor University to undertake a series of air quality measurement flights in and around Texas. The purpose for these flights was to better understand background levels of pollutants like ozone and sulfur dioxide (SO_2), and the impact of large point sources on air quality in rural Texas. Instrumentation aboard the aircraft captures pollution concentration data for ozone, sulfur dioxide, oxides of nitrogen (NO_x), nitric oxide (NO), NO_x plus oxidation products of nitrogen oxides (NO_y), and measures light back scattering (for studying visibility and particulate matter). As of September 1999, over 100 missions had been completed by Baylor aircraft. Data for eighteen of these missions have been validated and analyzed. There are also plans for future flights, as funding permits.

Baylor Flight # 42 flew on August 28, 1997 and investigated background ozone levels south and east of the DFW area, and then traveled to the Northeast Texas Region to study power plant plumes. Background ozone levels south of Dallas generally ranged from 40 ppb to 80 ppb. As the aircraft approached Tyler, there was an indication of higher ozone associated with a sulfur plume. When the aircraft reached Longview, it flew a spiral pattern around Texas Eastman and identified an ozone plume north of the plant. The plume was quite distinct, so winds at mission altitude during this portion of the flight were assumed to be coming from the south. Back trajectories for August 27-28 confirmed winds traveled primarily from the south and southwest during this period. (It should be noted that winds at the 100 m and 500 m altitudes were relatively light and from the northwest and west on August 27). Ozone readings on the south side of the Texas Eastman indicated ozone between 40 and 80 ppb and no identifiable plumes. This observation suggests transport of relatively high levels of background ozone. Sulfur levels north of Texas Eastman ranged from 0 to 6 ppb, indicating low background concentrations. However, on the eastern edge of the spiral pattern, a sulfur plume with levels of 60 ppb and up appeared to be coming from the Martin Lake power plant. Additional evidence linking this plume to Martin Lake was the high levels of NO_y and reduced levels of ozone, reflecting substantial scavenging.

The aircraft flew a second set of spirals around the Martin Lake and HW Pirkey Power Plants. These ozone and sulfur patterns both indicated wind at altitude blowing from the south. It also appeared that there was substantial ozone scavenging near Martin Lake with ozone levels recovering further downstream of the plant. Later, the aircraft flew north/northeast of the Pirkey Power Plant and measured high levels of ozone in that area. If winds at altitude were still from the south, the most likely upstream sources for the ozone plume appear to be the Pirkey Power Plant, the Carthage Compressor Station, and the Northeast Texas Region Gas plant. The Pirkey plume was associated with elevated sulfur readings, whereas the Carthage and Northeast Texas Region Gas ozone plumes were associated with background levels of sulfur.

This mission demonstrates that significant ozone plumes are generated by rural industrial facilities in Northeast Texas Region. Elevated background ozone levels exert influence on these plumes and can affect the magnitude of one-hour ozone levels on some days.

Other Baylor flights have recorded evidence of elevated background ozone levels in the Northeast Texas Region. For example, Flight # 77 on September 18, 1998 recorded background levels of ozone of 60 to 80 ppb while flying between Waco, the Northeast Texas Region, and Shreveport in the early afternoon hours. However, these missions did not fly on days with one-hour ozone exceedances in Northeast Texas Region, and the exact effects of these background levels on short-term exceedances are difficult to quantify.

Baylor flight missions have also recorded high ozone in point source plumes near the Northeast Texas Region when background levels did not necessarily suggest elevated regional ozone. Baylor Flight # 25, for example, encountered ozone as high as 112 ppb while flying arcs around Texas Eastman and the Pirkey Power Plant between 4:00 and 5:00 P.M. on July 20, 1997. NOAA wind trajectories suggest that air in the transport layers at 100 and 500 m altitudes originated from the southeast, and that the 1000 m layer came from the southwest. Rotation was apparent between 6:00 A.M. and 5:00 P.M., which is characteristic of stagnation over the area. There were no wind or ozone data available from the Gregg Co. Airport monitor after 8:00 A.M. that morning. However, the Tyler airport monitor recorded one-hour average ozone levels below or equal to 60 ppb through 3:00 P.M., and concentrations in the flight path to Tyler were 40 to 60 ppb (between 5:30 and 6:00 P.M.). These observations suggest elevated background ozone was not persistent in the region that day.

4.5 Evidence of Local Point Source Impacts

One-hour ozone exceedances have occurred when background ozone levels were not significantly elevated. For example, on August 16, 1998, the Gregg Co. Airport monitor recorded a one-hour ozone average of 127 ppb at 2:00 P.M. Wind trajectories suggest air traveled from the east and northeast on August 16. Wind direction data from Gregg Co. Airport also indicate winds were from the northeast from noon-3:00 P.M that day. Levels recorded upwind at Cypress River and Shreveport monitors were less than 65 ppb all morning and most of the afternoon. There is evidence that the Cypress River data from 1998 were biased low; however, Shreveport monitors had recorded one-hour levels below 65 ppb since 1:00 P.M. on the day before. NOAA back trajectories show 500 m and 1000 m air transport layers traveled near the vicinity of Shreveport around the first hours of August 16. This example suggests impact from point sources nearby the Longview area.

Many one-hour ozone exceedances at the Gregg Co. Airport monitor occur when the wind blows from the direction of the Texas Eastman plant, although other local power plants in the same northeast direction may contribute also. A windrose from the Gregg Co. Airport monitor demonstrates that on high ozone days between 1995-98, the winds from 1:00 - 4:00 P.M. most often come from the northeast.

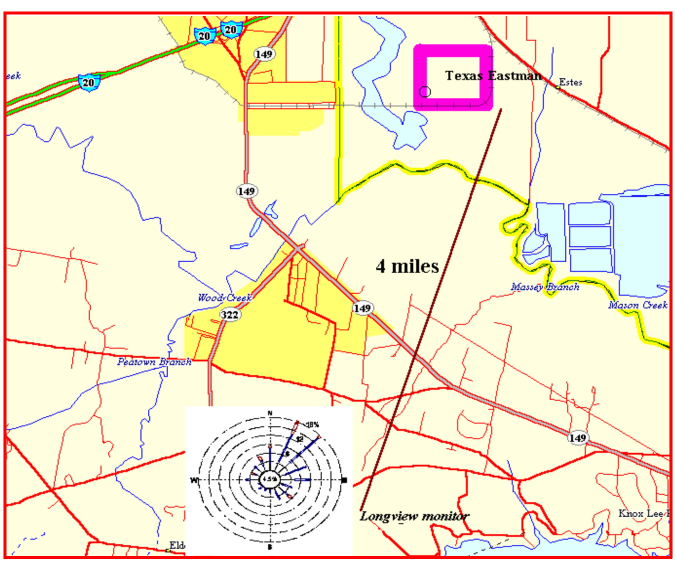


Figure 4.5-1 windrose on high (1-4 P.M. CST)

Longview monitor ozone days 1995-1998

Figure 4.5-2 Illustrates wind distribution during the hour of peak ozone for days from 1994-2000 at the Gregg Co. Airport monitor. On days when ozone is equal to or greater than 105 ppb, the wind direction is most often northerly.

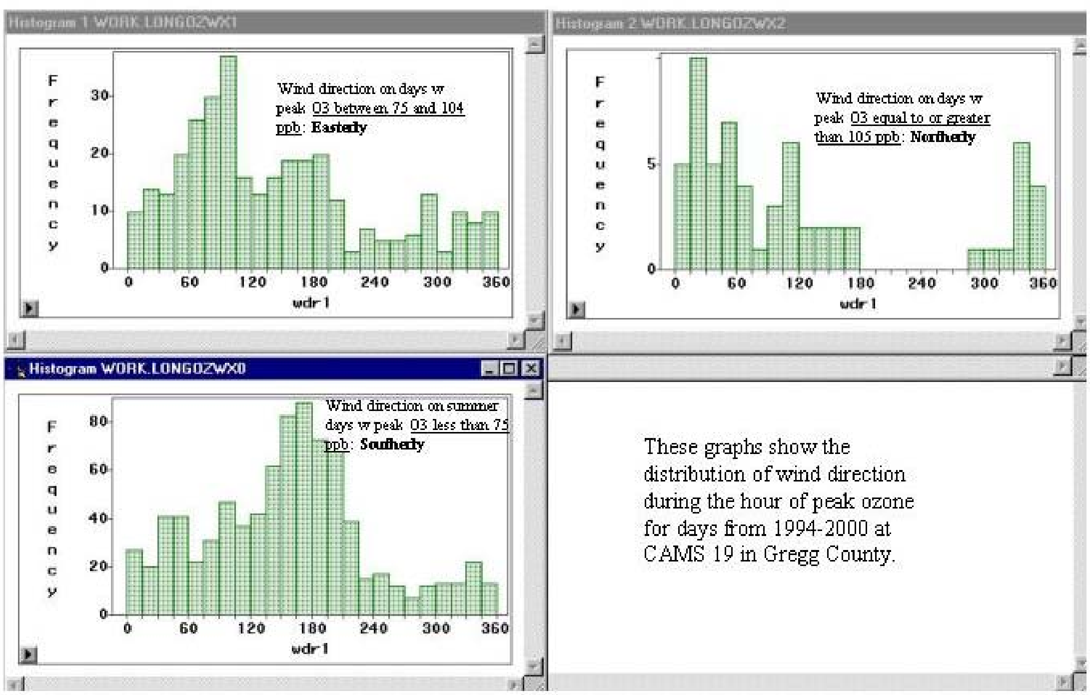
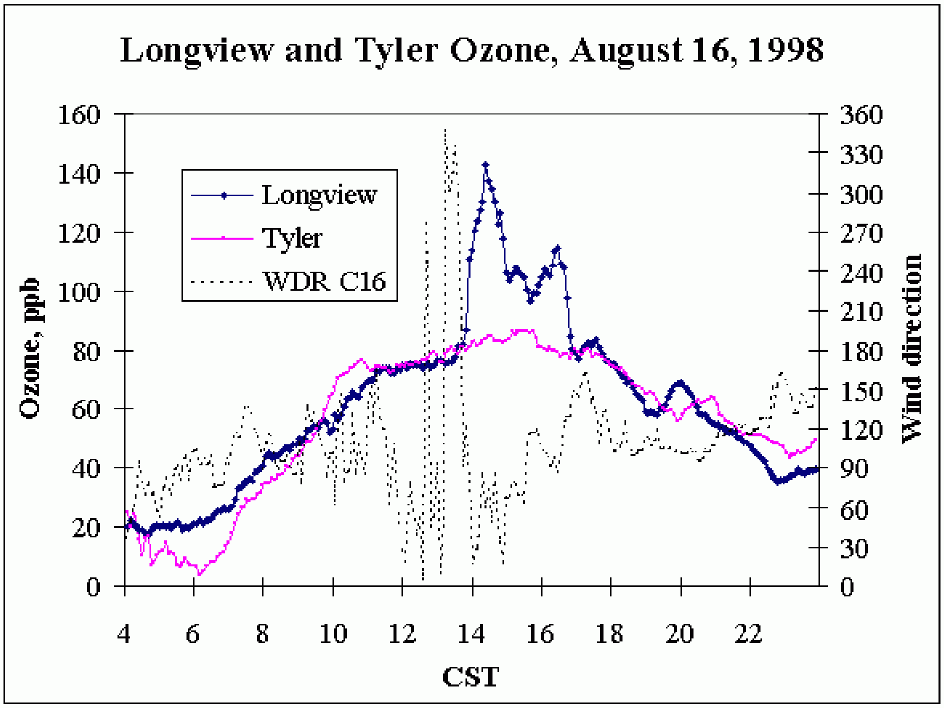


Figure 4.5-3 Ozone at Longview and Tyler, Wind Direction at Longview on August 16, 1998



Further evidence of local sources affecting the Longview (Gregg Co. Airport) monitor can be seen in the time series plots for ozone on exceedance days. A typical pattern is that the Tyler and Longview sites will record similar measurement values throughout the early part of the day, until some point at which ozone levels rise very suddenly at Longview, and then drop quite suddenly later. After that point, Tyler and Longview monitors continue to track similar levels. The recent addition of a sulfur dioxide monitor at Longview has confirmed that ozone and SO_2 "spikes" are often coincident. The working hypothesis is that this phenomenon is the passage of a plume of both SO_2 and NO_x from an upwind industrial source. The reasoning is that this behavior of the data from a static ground monitor in a moving plume resembles the behavior of data from aircraft tracking a plume aloft. The source appears to be local to Longview because similar "spikes" are not observed at Tyler. The preceding Figure 4.4-3 shows a plot of ozone data from Longview and Tyler, as well as the wind direction resultant (WDR) data from Longview, on August 16, 1998.

CHAPTER 5: CONTROL STRATEGIES AND RATE OF PROGRESS

5.1 GENERAL

The Northeast Texas Region is currently focusing on realistic and feasible solutions to high ozone levels by providing enforceable mechanisms for an early SIP Revision submittal and implementation of control strategies sooner than otherwise would occur under Clean Air Act Requirements. This will be accomplished through the use of Agreed Orders, Regional SIP Strategies, and Federal Programs. The Texas Natural Resource Conservation Commission and the Northeast Texas Region believe that early reductions are the key component to a successful attainment plan.

5.2 RATE OF PROGRESS

In September 1999, the Northeast Texas Region air quality modeling and control strategy evaluations demonstrated that the one-hour ozone standard could be attained by 2007. Through the implementation and identification of realistic, innovative, and feasible emission reductions the Northeast Texas Region should complete its reductions by 2003, approximately four years before the modeled attainment date for the NAAQS ozone of 2007. The early reduction schedule has three strong advantages: (1) It will allow the time needed for three years of clean data under the Clean Air Act, (2) it will allow time for the Houston/Galveston reductions to take effect, (3) and it will allow time to invoke contingency measures if they are necessary.

5.3 AGREED ORDERS

In 1997 Agreed Orders were used to require certain actions by the affected companies: Arco Permian, Unit of Atlantic Richfield Company; Eastman Chemical Company, Texas Eastman Division; LaGloria Oil and Gas Company; and Norit Americas, Inc. These Agreed Orders were entered into so the affected companies could make voluntary reductions that reduced VOC emissions by 2,156 tons per year, and NO_x emissions by 37 tons per year. The affected companies voluntarily agreed to implement these controls in order to reduce emissions of ozone precursors. These prior Agreed Orders will expire on September 16, 2001 along with the current FAR. The commission feels that, even though these orders expire, their affects will continue to benefit the Northeast Texas Region in the future
In addition to these prior Agreed Orders, the Eastman Chemical Company, Texas Division entered into an Agreed Order 2000-0033-SIP further reducing NO_x emissions 1,671.5 tpy and VOC emissions by 386 tpy on January 26, 2000. This Agreed Order will remain in effect along with the New Agreed Orders.

New Agreed Orders are being used to require certain actions by the affected companies: American Electric Power (Formerly SWEPCO), TXU (although the Stryker Creek facility was included in the original modeling for TXU, it will not be included in the Agreed Orders due to its lack of impact on controlling ozone in the Northeast Texas area), and Eastman Chemical Company, Texas Operations in order to make voluntary emission reductions enforceable pursuant to the Northeast Texas SIP Revision. The Agreed Orders are being presented to the commission for approval concurrent with this SIP revision. The affected companies voluntarily agreed to implement controls in order to reduce emissions of ozone precursors. These controls should amount to estimated reductions of 23,377.9 tpy of NO_x. A copy of the Agreed Orders will be included in the Appendices.

5.4 REGIONAL STRATEGIES

Due to the significant air quality concerns under the one-hour ozone NAAQS, and the potential challenges imposed by the proposed new 8-hour NAAQS, Texas has developed a regional strategy to provide improved control of ozone air pollution. This strategy has five elements: 1) support of the National Low Emission Vehicle Program (NLEV) program which will bring cleaner cars to Texas by model year 2001; 2) Stage I vapor recovery for larger gas stations; 3) cleaner gasoline; 4) House Bill

(HB) 2912 Grandfathered Facility Provisions; and 5) reduction in NO_x emissions from larger point sources.

5.4.1 NATIONAL LOW EMISSION VEHICLE PROGRAM

Automobile manufacturers made a commitment through the NLEV program to introduce cleaner cars. Along with this commitment, Improvements in gasoline were a tremendous help. These improvements in gasoline quality, combined with the advanced vehicle technology should help areas achieve their overall air quality goals, by showing higher reductions in NO_x. The revised 2007 base case for the Northeast Texas Region included the estimated impacts of Federal control programs that would reasonable be expected to be in place by 2007 instead of the NLEV. Part of the Federal programs that were modeled by the Northeast Texas Region included Tier II vehicles and fuels. The Tier II cars and trucks will have tighter emission standards than NLEVs and will begin to phase-in with the 2004 model year. In addition these vehicles will be accompanied by a low sulfur fuel that will supercede Texas clean gasolines.

5.4.2 STAGE I VAPOR RECOVERY

The commission adopted the Stage I vapor recovery rules on June 30, 1999. These rules already applied to approximately 7,000 gasoline stations in the Beaumont/Port Arthur (BPA), El Paso, Houston/ Galveston (HGA), and DFW ozone nonattainment areas. These rules now also apply in 95 counties in the eastern and central parts of Texas. These rules regulate the filling of gasoline storage tanks at gasoline stations by tank-trucks. To comply with Stage I requirements, a vapor balance system is typically used to capture the vapors from the gasoline storage tanks which would otherwise be displaced to the atmosphere as these tanks are filled with gasoline. The captured vapors are routed to the gasoline tank-truck, and are processed by a vapor control system when the tank-truck is subsequently refilled at a gasoline terminal or gasoline bulk plant. The rules reduce VOC emissions which are precursors to ground-level ozone formation, resulting in ground-level ozone reductions. The effectiveness of Stage I vapor recovery rules depends on the captured vapors being: (1) effectively contained within the gasoline tank-truck during transit; and (2) controlled when the transport vessel is refilled at a gasoline terminal or gasoline bulk plant. Otherwise, the emissions captured at the gasoline station will simply be emitted at a location other than the gasoline station, resulting in no reduction in VOC emissions despite the Stage I requirements.

5.4.3 CLEANER GASOLINE

Texas and other states have used low Reid Vapor Pressure (RVP) fuels for a number of years as an effective program for reducing ozone levels. As the low sulfur fuel adopted by the EPA does not limit RVP, the commission believes it important to implement the low RVP for East Texas.
Starting in late 1997, the commission began to evaluate different types of cleaner burning fuels like gasoline and diesel as part of an overall regional strategy. The commission eventually settled its focus on a cleaner gasoline. Of the cleaner gasolines under consideration, four were evaluated thoroughly: 1) federal Reformulated Gasoline (RFG); 2) a gasoline with equal emissions performance to federal Phase II RFG; 3) a formula-based fuel with low RVP, low sulfur fuel; and 4) California reformulated gasoline. After further discussions the commission completed its analysis on the top two fuels of choice, a performance-based fuel with emissions limits equal to federal phase II RFG, and the formula-based fuel with controls on RVP and sulfur. The low RVP/low sulfur fuel was settled upon for the following reasons: 1) emissions performance; 2) effect on advanced technology cars; 3) impacts on off-road emissions; and 4) low production costs. However, as indicated above, the state low sulfur requirements have been repealed in lieu of the national low sulfur gasoline standards. Therefore, the state rule is requiring a regional lower RVP only fuel.

5.4.4 HB 2912-Grandfathered Facility Provisions

This bill was recently passed by the 77th Texas Legislature with provisions that affects the Northeast Texas Region as well as all of East Texas. It prescribes specific requirements for the permitting or shutdown of Grandfathered facilities. This includes the requirement of permits for existing facilities, pipelines, small business stationary sources, and electric generating facilities. This provision does not include electric generating facilities located at small business stationary sources. Grandfathered facilities in the Northeast Texas Region that do not apply for a permit by the following dates must shut-down by September 1, 2003, and the remaining facilities that fail to fully implement the conditions of their permit relating to reductions or the installation of emissions controls, must shut-down by March 1, 2007. The required control method on Existing Facility Permits is 10-year old Best Available Control Technology (BACT), and a Flexible Permit that must be authorized for the existing facilities at a site. Small Business Stationary Source Permits allows exempt stationary sources from having to report to the emissions inventory and apply for a permit by September 1, 2004. It also prohibits them from emitting air contaminants on or after March 1, 2008. Pipeline Facility Permits applies to Grandfathered reciprocating internal combustion engines that are part of a gathering or transmission pipeline. These reductions can be made at one engine or averaged among more than one, but the averaging may not include reductions achieved since January 1, 2001. In the Northeast Texas Region, these permits must achieve a 50% reduction in the hourly emissions rate of NO_x expressed in terms of grams per brake horsepower hour. Along with this the commission may also require a 50% reduction of VOCs.

5.4.5 Electric Generating Facilities

The commission adopted rules on April 19, 2000 which required NO_x emission reductions from all electric utility boilers and gas turbines located in east and central Texas. For (EGF), the rule sets the NO_x emission limit at 0.165 lb of NO_x /Million British Thermal Unit (MMBtu) for coal or lignite-fired units. Many permitted EGFs are currently authorized to operate at an emission rate in excess of 0.165 lb of NO_x/MMBtu. Specifically, current average emission rates for permitted EGFs in attainment counties in east Texas are estimated at approximately 0.3 lb NO_x/MMBtu. A reduction to 0.165 lb NO_x/MMBtu would accomplish the goal of a 50% reduction generally considered necessary to achieve regional reductions in ambient ozone. For gas-fired electric power boilers the NO_x emission limit is at 0.14 lb NO_x/MMBtu, while for stationary gas turbines, the NO_x emission limit is at 0.15 lb NO_x/MMBtu (or alternatively, 42 ppmv NO_x, adjusted to 15% oxygen). Based upon the significant technical evidence, the commission believes that this level of reduction is a necessary and essential component of the control strategies needed to attain the one-hour ozone NAAQS. The purpose of the strategy is to reduce overall background levels of ozone in order to assist in keeping ozone attainment areas and near-nonattainment areas in compliance with federal ozone standards. The strategy is also necessary to help the BPA, DFW, and HGA ozone nonattainment areas move closer to reaching attainment with the one-hour NAAQS. The strategy takes into account recent science that showed that regional approaches may provide improved control of air pollution. In particular, staff has conducted photochemical grid modeling which indicated that elevated point source NO_x controls in east and central Texas reduced peak one-hour ozone between 14 and 27 ppb at specific locations in the region, depending on the modeling day. The one-hour ozone benefits stretched across the east and central Texas counties and averaged six to seven ppb. Based on a one-hour exceedance design value of 134 ppb, the projected modeled benefits of 50% point source NO_x reductions between 1998-2000 in the attainment counties of east and central Texas showed a 12% reduction in NO_x for the Northeast Texas Region This is equal to a projected reading of 118 ppb, which would be sufficient to keep the area from being reclassified as not attaining the one-hour ozone NAAQS.

5.4.6 Electric Generating Units (SB 7, 76th Legislature, 1999)

SB 7, the electric deregulation bill, included the requirement that EGFs apply to the commission for air quality permits by September 1, 2000, or cease operations by May 1, 2003. Grandfathered EGFs in the

East and Central Texas counties were required to reduce emissions of NO_x by 50% and, for coal-fired EGFs, to reduce SO_2 by 25%.

5.4.7 Permitted Grandfathered Facilities (SB 766, 76th Legislature, 1999)

SB 766 created a voluntary emission reduction permit program for grandfathered facilities, with permit applications required by September 1, 2001. SB 766 also required the commission to impose an emissions fee for all emissions at major sources with grandfathered facilities (for which no application is pending by September 1, 2001), including emissions in excess of 4,000 tons per year, and also required the commission to triple emissions fees every year for emissions from any facility in excess of 4000 tons per year at those sources.

5.4.8 Cement Kilns

The commission adopted rules on April 19, 2000 which required NO_x emission reductions from all cement kilns located in east and central Texas.

For cement kilns, the rule establishes emission limits on the basis of pounds of NO_x per ton of clinker produced. These emission limits are based on the NO_x emissions averaged over each 30 consecutive day period, and vary depending on the type of cement kiln (long wet; long dry; preheater; preheater-precalciner; or precalciner). The emission limits are based on those specified in EPA notice of proposed rulemaking concerning Federal Implementation Plans to Reduce the Regional Transport of Ozone which was published in the October 21, 1998 issue of the *Federal Register* (63 FR 56394). The EPA stated that these limits are designed to achieve a 30% decrease in NO_x emissions from uncontrolled levels.

5.4.9 Low Emissions (Clean) Diesel

The existing low emission diesel fuel rules in Chapter 114 are one element of the control strategies being used for the Northeast Texas Region in order to control ground-level ozone. The existing rules implement a low emission diesel fuel control strategy for on-road fuel and non-road fuel in the four-county Dallas/Fort Worth nonattainment area, the eight-county HGA nonattainment area, the three-county Beaumont/Port Arthur nonattainment area, and the 95-county central and eastern Texas region to be able to demonstrate and maintain attainment with the ozone national ambient air quality standard. The proposed amendments and new section would modify the existing May 1, 2002 program compliance dates so that they occur in 2005.

5.4.10 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.

5.4.11 Voluntary Incentive Program

In May 2001 the 77th Legislature of the State of Texas passed SB 5, which established the Texas Emissions Reduction Program to provide grants and other financial incentives for emission reductions and alternatives to certain components of the SIP.

One of the provisions of SB 5 establishes the Diesel Emissions Reduction Incentive Program, 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.

TABLE 5.4-1 Breakdown of Regional Strategies by Programs

Regional Strategies	Estimated NO_x Reductions in TPD by 2007
Stage I Vapor recovery	8.5 tpd
HB 2912 Grandfathered Facility Provisions	61 tpd
Electric Generating Units (SB 7)	207.3 tpd
Permitted Grandfathered Facilities (SB 766)	.2 tpd
Cement Kilns	14.3 tpd
Low Emissions (Clean) Diesel	16.32 tpd
Gas-Fired Water Heaters, Small Boilers, and Process Heaters	.5 tpd
Voluntary Incentive Program (SB 5)	Reductions are expected by adoption but are not available at this time.

Note: Additional reductions in NO_x emissions are anticipated by Alcoa Inc. in order to meet other SIP requirements for nonattainment and potential nonattainment areas in the future. The Tyler/Longview/Marshall area could possible reserve a future benefit under this order for the 8-hour ozone NAAQS.

TABLE 5.4-2 Summary of Modeled Regional Strategies

Areas	VOC Reductions In % And TPD by 2007	NO_x Reductions In % and TPD By 2007
Dallas/Ft. Worth Four County Area	25% = 122.2 tpd	50% = 298.3 tpd
Houston/Galveston Eight County Area	20% = 135.4 tpd	75% = 940.0 tpd
Beaumont/Port Arthur Three County area	10% = 13.3 tpd	40% = 102.3 tpd

These emission reductions are relevant only to the regional scale model of June 1995), not the urban scale model of July 1997. Since the modeling emission inventories are day specific, the reductions given are averaged over the days of the June 1995 episode.

Federal Measures

The revised 2007 base case included the estimated impacts of Federal control programs that can reasonable be expected to be in place by 2007. The federal programs to be included are (1) Tier II vehicles and fuels. The Tier II cars and trucks will have tighter emission standards than NLEVs and will begin to phase-in with the 2004 model year. these vehicles are expected to be accompanied by a low sulfur fuel that will supercede Texas clean gasolines. (2) The 2004 Heavy Duty Diesel (HDD) standards will have tighter emission standards for heavy duty diesel trucks beginning in 2004. (3) The new locomotive standards that began in 1998 set tighter emission standards for railway locomotives.

TABLE 5.5-1 Summary of Modeled Federal Measures for the Northeast Texas Region

EPA-ISSUED RULES	Estimated VOC Reductions in TPD by 2007	Estimated NO_x Reductions in TPD by 2007
Tier II Vehicle Emission Standards and Federal Low Sulfur Gasoline/ Heavy-Duty Diesel	22 tpd	31.9 tpd
New Locomotive Emission Standards That Began In 1998	30.6 tpd	11.3 tpd

5.6 Summary

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 has been considered when studying air quality in Texas' ozone areas. The commission sees the need to take a regional approach for the Northeast Texas Region to control air pollutants such as that described in the state regional and federal programs listed in this chapter. Through this regional approach, the commission is striving to protect our state's human and natural resources consistent with sustainable economic development through a goal for clean air.

Some control programs, including Houston/Galveston and Dallas/Ft Worth attainment demonstration controls; SB 7; SB 766 (other than those at Texas Eastman); and Stage I vapor recovery and National Low Emission Vehicles for Central and Eastern Texas, were not fully developed or approved when the photochemical grid modeling was conducted and thus are not accounted for in the modeling. In addition, the commission is aware of at least one recently permitted facility (Entergy Power Ventures, L.P., commission air permit number 45360) that has been permitted since the November 12, 1999 Modeling Report was written. Therefore, this source was not included in the future base case modeling, nor was it included in any subsequent diagnostic, sensitivity, or control strategy runs. However, the commission believes that with BACT for this permit (selective catalytic reduction of NO_x), plus impacts of other un-modeled control programs, such as SB 7, the impact of new NO_x emissions will not significantly affect the future base and control cases.