Summary of 2008 NETAC Air Quality Planning Activities

February 1, 2009

Summary of 2008 NETAC Air Quality Activities for Northeast Texas

February 1, 2009

Introduction

The Northeast Texas Near Non-Attainment Area (NNA) has seen large reductions in ozone during the last two decades, achieving the 1996 1-hour National Ambient Air Quality Standard (NAAQS) for ozone and successfully concluding its Early Action Compact (EAC) in 2007 in attainment of the 0.08 ppm 8-hour ozone standard. In March, 2008, the EPA promulgated a new, more stringent 8-hour ozone standard of 0.075 ppm in order to protect public health. Northeast Texas is at a crossroads with the end of the Early Action Compact and a new designation of attainment status slated for 2010. The Northeast Texas NNA is committed to continuing its progress in decreasing ozone levels in order to attain the new 2008 standard while maintaining the economic vitality of the regional area.

The Texas Legislature has provided rider funding to NNAs to enable ozone air quality planning activities. The Northeast Texas NNA has used this funding to:

- Conduct the technical studies needed to understand the ozone problem in Northeast Texas and develop effective control strategies.
- Implement local emission reduction strategies needed to attain the 1-hour ozone standard resulting in the 1-hour ozone SIP revision submitted to EPA in 2002.
- Join EPA's ozone "Early Action Compact" (EAC) program and submit a Clean Air Action Plan (CAAP) demonstrating attainment of the 8-hour ozone standard in 2007 and maintenance of the standard through 2012. The CAAP was incorporated into the SIP submitted to EPA by the State in 2004.
- Implement local emission reduction strategies needed to attain the 0.08 ppm 8-hour ozone standard.
- Perform public outreach and awareness programs to ensure local participation in, and commitment to, ozone air quality planning activities for the region.

These activities have been funded through the East Texas Council of Governments (ETCOG) under the technical direction of Northeast Texas Air Care (NETAC), a local stakeholder group comprised of representatives of local government, business and industry, the general public, and environmental interest groups. In this report, a brief summary of the NETAC's air quality improvement efforts during 2008 is provided.

Ozone Attainment Status

The Northeast Texas ozone monitoring data determine whether the area is in compliance with the National Ambient Air Quality Standards (NAAQS) for ozone. The Texas Commission on Environmental Quality (TCEQ) operates three ozone monitors (Continuous Air Monitoring Stations, CAMS) in Northeast Texas at Longview, Tyler, and Karnack. NETAC has operated a

research ozone monitor that was located at Waskom in 2002-2003 and in Panola County in 2004-2006. The Panola research monitor helped to characterize the concentrations of background ozone in air entering the Northeast Texas regions on high-ozone days. EPA designated all five NETAC counties as being in attainment of the 0.80 ppm 8-hour ozone standard on April 15, 2004 (69 FR 23858).

The annual 4th highest 8-hour ozone values and the resulting design values at monitors in Northeast Texas for recent years are shown in graphical form in Figures 1 and 2, respectively, and are listed in Tables 1 and 2. Note that all the ozone data have been validated by the TCEQ and that the research monitor at Panola was not active in 2007 or 2008, so a design value cannot be calculated for 2006-2008 for this monitor. Figures 1 and 2 show dramatic declines in design values and 4th high ozone levels at all three monitors over the last decade. The ozone data indicate that 2005 was a relatively high ozone year in Northeast Texas; the 2005 data increased the three year averages used to calculate the 2004-2006 design values to the point where the Longview monitor was out of compliance with the 8-hour standard at the end of 2006. The 2007-2008 period, on the other hand, saw the lowest 4th high ozone values in the last decade at the Northeast Texas monitors. The 2005-2007 design values were all 84 ppb or less, which means that all Northeast Texas monitors were in attainment of the 0.08 ppm 8-hour ozone standard at the end of the Early Action Compact in December, 2007. The 2006-2008 design values show a further reduction in ozone levels such that Northeast Texas design values are at their lowest levels in ten years at all three monitors.

Table 1. Annual 4th highest 8-hour ozone values (ppb) and 2006-2008 8-hour ozone design values for Northeast Texas

Year	Longview	Tyler	Karnack	Panola
2004	83	81	77	75
2005	88	83	84	79
2006	84	82	78	79
2007	81	77	69	N/A
2008	71	72	68	N/A

Table 2. Recent trends in 8-hour ozone design values (ppb) for Northeast Texas

Design Value for Years	Longview	Tyler	Karnack	Panola
2002-2004	83	81	81	N/A
2003-2005	84	81	80	77
2004-2006	85	82	79	77
2005-2007	84	80	77	N/A
2006-2008	78	77	71	N/A

Although the last 3 years have seen declines in the 4th high 8-hour ozone values and resulting design values for all three monitors, it is likely that this reduction is due in part to weather conditions during these three years that were less conducive to ozone formation than in previous years. Figure 2 shows that there is a strong relationship between weather conditions favorable for producing high ozone in Northeast Texas and ozone values over the last six years. Ozone formation in Northeast Texas peaks on hot, sunny days with winds ranging from northerly to

southeasterly. Figure 2 shows that years with a large number of days with these meteorological conditions tended to have a large number of high ozone days. TCEQ data show that NOx levels in the Tyler-Longview-Marshall area have been either flat (Tyler and Karnack monitors) or increasing slightly (Longview) in recent years ("2008 in Review", presentation by Jonathan Steets, TCEQ Air Quality Division, December 16, 2008). NETAC's conceptual model of ozone formation indicates that ozone levels in Northeast Texas are critically dependent on the amount of NOx available. Considering the flat or increasing NOx levels in Northeast Texas, the data in Figure 2 suggest that the favorable weather conditions played a role in the ozone decreases seen over the last few years in Northeast Texas.

In March of 2009, the State of Texas must recommend attainment designations to the EPA in reference to the new 2008 ozone standard. The TCEQ has used 2006-2008 ozone data to make recommendations to Governor Perry regarding the attainment status of all Texas counties. The Karnack monitor has a 2006-2008 design value of 71 ppb, which is in attainment of the new 0.075 ppm (75 ppb) ozone standard promulgated in 2008. The Tyler and Longview monitors have design values of 78 ppb and 77 ppb, respectively, and do not currently attain the 75 ppb standard. Accordingly, the TCEQ has recommended that Gregg, Rusk, and Smith counties be designated as nonattainment (letter from TCEQ Chairman Buddy Garcia to Governor Perry, December 11, 2008). In their recommendation letter, TCEQ notes that 2009 data may be considered by EPA in making attainment designations. In order to achieve a 2007-2009 design value of 75 ppb or less, the Longview, Tyler, and Karnack monitors would need to record 2009 annual 4th high 8-hour ozone values no higher than 75 ppb, 78 ppb, and 90 ppb, respectively.

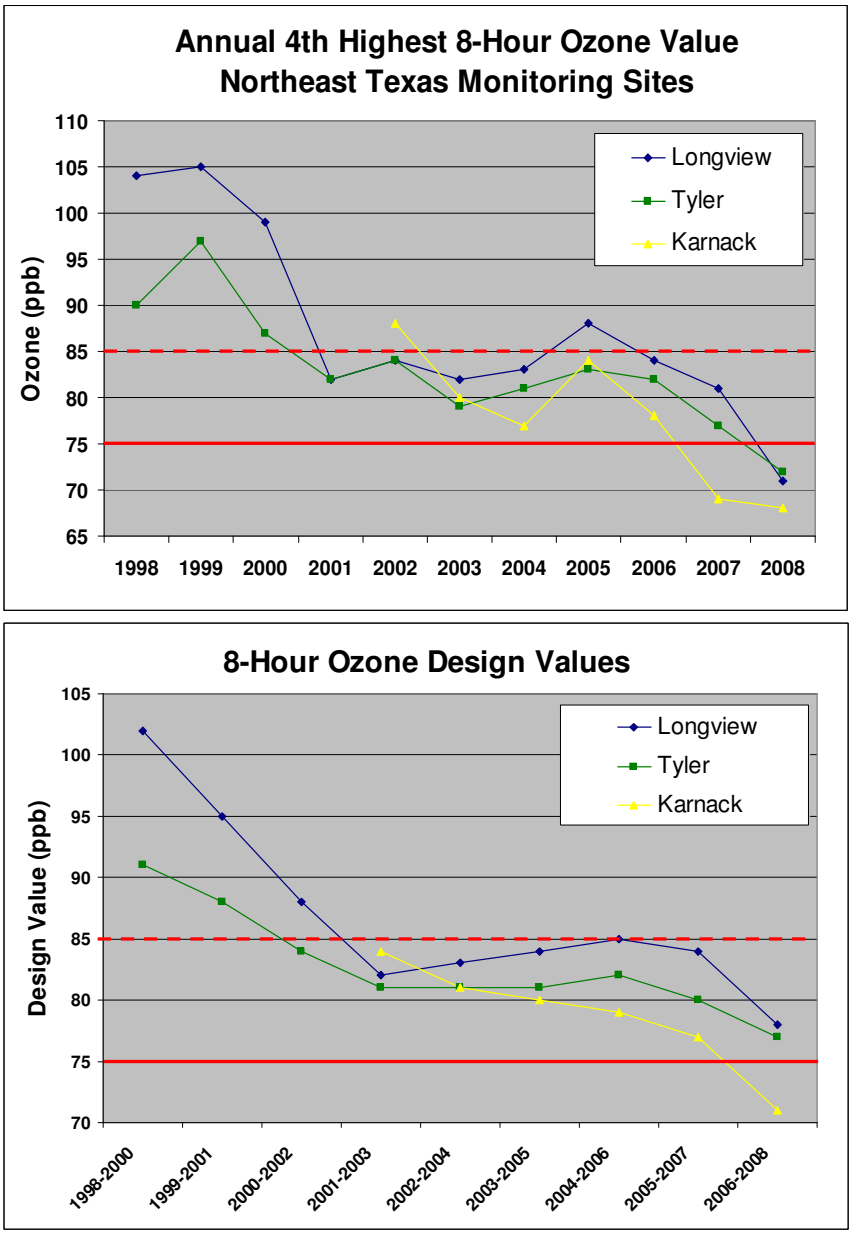

Figure 1. Trends in annual 4th highest 8-hour ozone values (upper panel) and design values (lower panel) at the Longview, Tyler, and Karnack monitors in Northeast Texas

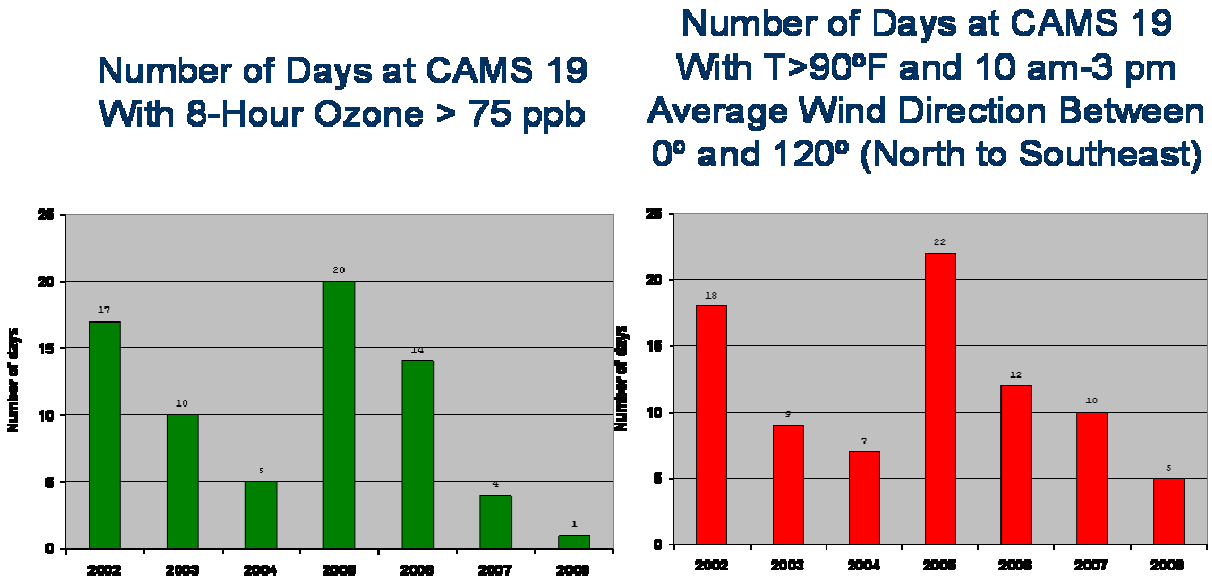

Figure 2. Right panel: Number of days in each year on which 8-hour ozone at CAMS 19 was greater than 75 ppb. Left panel: number of days in each year on which conditions typical of high ozone days in Northeast Texas occurred.

Analysis of 2008 Ozone Data

NETAC has reviewed 2008 ozone concentrations recorded at the Longview, Karnack, and Tyler ozone monitors. For the purposes of the analysis presented below, we define a high ozone day to be one on which the daily maximum 8-hour average ozone concentration was greater than 75 ppb or the daily maximum 1-hour average ozone concentration was greater than 85 ppb at one or more of the three Northeast Texas monitors. There were six such days in 2008.

Each high ozone day was analyzed using data for ozone, sulfur dioxide, NOx, and wind from the TCEQ CAMS ground-level monitors at Longview, Tyler and Karnack. For the period August 1-October 6, 2008, a Reactive Alkene Detector (RAD) instrument was deployed at the CAMS 19 monitor in Longview; this instrument detects highly reactive VOCs (HRVOCs) such as ethylene and isoprene that contribute to rapid, efficient ozone formation. Back trajectories were prepared for air arriving at each monitor that measured high ozone. The back trajectories were calculated using NOAA's HYSPLIT (Hybrid Single-Particle Lagrangian Integrated Trajectory) model and TCEQ's AQplot model. Back trajectories are a qualitative tool subject to theoretical and data limitations and were used only to investigate possible source regions for pollutants transported to the monitor.

Here follows an analysis of the high ozone days in Northeast Texas in 2008 based on the available data described in the previous paragraph:

- Three high ozone days at Longview were associated with calm or northerly winds and a rapid early morning rise in ozone. These sharp ozone increases during times of northerly winds are consistent with the impact of a plume containing highly reactive volatile organic compounds (HRVOCs) from the chemical plant complex owned by Eastman, Westlake, and Flint Hills (formerly Huntsman).
- On two of these three high ozone days at Longview, HRVOC data from the RAD instrument was available and confirmed the presence of HRVOCs during the rapid ozone rise.
- On several high ozone days at Longview, elevated sulfur dioxide was observed at the same time as the ozone peak, indicative of plume impacts from nearby coal-fired power plants. On one of these days, winds were southeasterly, suggesting possible impacts from the Martin Lake power plant in Rusk County. On two of these days, winds were northeasterly, consistent with possible plume impacts from the Pirkey Power Plant.
- Regional 8-hour ozone levels in air entering the region were 70 ppb or higher on August 4, when the Tyler and Longview monitors recorded peak 8-hour ozone values of 101 and 82 ppb, respectively.
- Four high ozone days at Longview and two at Tyler were associated with ozone production from local sources superimposed on a regional 8-hour ozone background of 60 ppb or greater.
- The highest 8-hour ozone measurement during 2008 was 101 ppb at the Tyler on August 4. This was likely due to an impact at the monitor from a source to its southeast and a second, later impact by the City of Tyler urban plume on a day with high (~70 ppb) regional background ozone. The high 8-hour value was due to the sustained high ozone levels caused by two separate plume impacts.

The surface monitoring data from the 2008 ozone season are consistent with the conceptual understanding of the factors leading to ozone levels exceeding the 8-hour ozone standard in Northeast Texas. In 2008, high ozone in Northeast Texas was caused by emissions from sources within Northeast Texas superimposed on a high regional ozone background.

Status of Emission Reduction Measures at the End of 2008

NETAC has played a key role in identifying and facilitating important local emission reductions. NETAC has carried out emission inventory development supplemented by local surveys as well as aircraft- and surface-based ambient air quality monitoring that indicated that Northeast Texas ozone levels can be most effectively lowered by reducing emissions of nitrogen oxides (NOx). This finding was confirmed through ozone modeling of the area. NETAC then secured agreements for local NOx reductions from key major sources such as the Eastman Chemical Complex in Longview and several facilities operated by American Electric Power (AEP) and Luminant (formerly TXU) in Northeast Texas. For example, NETAC has worked with Luminant to make installation of NOx-reducing selective catalytic reduction (SCR) technology at the Martin Lake Power Plant a priority.

Luminant has made a commitment to reduce NOx emissions from coal-fired power plants in Eastern Texas by 20% below 2005 annual emissions. To implement this commitment,

Luminant has filed with TCEQ applications for the installation of selective catalytic reduction (SCR) technology on the three electric generating units at the Martin Lake station. During TCEQ's June 13, 2007, consideration of a Luminant permit application for a new generating unit, TCEQ commissioner Larry Soward asked for clarification concerning the Luminant commitment. Luminant's legal counsel advised Commissioner Soward and the commission that the commitment was evidenced by the applications to install SCR controls on the Martin Lake units and the Sandow-4 unit. Luminant's legal counsel reaffirmed that these emission reductions will occur.

On July 17, 2007, the NETAC Policy Committee adopted a resolution urging TXU (now Luminant), Kohlberg Kravis Roberts, and Texas Pacific Group to cooperate with NETAC and TCEQ in making its proposed emission reductions legally enforceable. NETAC's co-chairs met with Luminant in 2007 to discuss plans for additional controls at the Martin Lake units. At the NETAC Technical Committee meeting held on November 7, 2008, David Duncan of Luminant reported that Luminant had applied to TCEQ for SCR permits for the Martin Lake plant, but that approval of the SCR permits was being contested.

Another focus of NETAC's emission reduction efforts has been gas compressor engines associated with natural gas production. Emission inventory and survey data compiled by NETAC showed that NOx emissions from these compressor engines taken together are comparable to NOx emissions from a large power plant. In 2005, NETAC implemented a pilot project to demonstrate the effectiveness of retrofitting small (< 500 hp), spark-ignited, rich-burn compressor engines used in natural gas production with exhaust catalysts and electronic air/fuel ratio controllers. At the end of a year-long test period, these controls were achieving an estimated emission reduction efficiency of greater than 90%, or 0.1 ton/day NOx per engine. NETAC then vigorously pursued funding for a catalyst retrofit program for compressor engines. In 2010, emissions from larger (>240 hp) gas compressor engines will be regulated by the East Texas Combustion Rule.

In June 2007, the TCEQ adopted an East Texas Combustion Rule as part of the Dallas-Fort Worth 8-Hour Ozone SIP Revision. The rulemaking will subject owners or operators of stationary sources of NOx in the Dallas-Fort Worth eight-hour ozone nonattainment area, as well as in specified counties in the northeast Texas area, to more stringent emission control, monitoring, testing, recordkeeping, and reporting requirements. The Rule applies to rich-burn engines with horsepower greater than 240 hp. The preamble to the proposed rule published in December 2006 noted that catalyst technology is expected to be the primary control technology for rich-burn, gas-fired engines. The rule applies in 33 East Texas Counties, and the compliance deadline is March 1, 2010. An analysis performed by the TCEQ suggests that NOx reductions from the East Texas Combustion Rule for the 5-county Tyler-Longview area would be approximately 7 tons per day.

Other emissions reductions supported by NETAC include energy efficiency programs adopted by the cities of Longview, Marshall, and Tyler. Voluntary on-road vehicle emission reductions were made through funding for clean-fueled propane vans for local transit agencies under the DOE "Clean Cities Program". The East Texas Council of Governments runs public awareness

programs that are funded by the State of Texas through Rider funding for near-nonattainment areas (NNAs). These programs include:

- ozone watch and warning communications network between local government and industries to communicate ozone action day forecasts issued by TCEQ;
- NETAC website;
- public service announcements; school programs and teacher training workshops; distribution of public information and educational materials;
- Annual Ozone Season kick-off meeting for the NETAC area.

NETAC's Stakeholder Process and Committee Activities During 2008

In 1995, local elected officials and other leaders in local government, business and industry created Northeast Texas Air Care (NETAC) in order to provide leadership and guidance in addressing ozone air quality issues in a five county area consisting of Gregg, Harrison, Rusk, Smith, and Upshur counties. A policy committee consisting of representatives of local government, business and industry, the general public and environmental interest groups governs NETAC. (Attachment 1)

From its inception, NETAC has emphasized the need to ensure that air quality planning activities are developed using scientifically sound techniques. In order to achieve this objective NETAC created a Technical Advisory Committee to undertake, supervise, and guide technical studies such as emission inventory development, air quality modeling and control strategy development, and specialized monitoring studies. The Technical Advisory Committee reports to the policy committee. The Technical Advisory Committee consists of representatives from local government, local business and industry, EPA technical staff, TCEQ technical staff, Texas Department of Transportation planning staff, and the general public and environmental interest groups (Attachment 1).

NETAC is actively involved in public education and outreach programs concerning ozone air quality issues. This work is guided by NETAC's Public Education/Outreach Committee, which consists of representatives from local government, local business and industry, TCEQ staff, and environmental interest groups (Attachment 1). The Public Education/Outreach Committee reports to the NETAC Policy Committee.

NETAC receives staff support for its activities from the East Texas Council of Governments (ETCOG), which receives and administers grant funds provided by the Texas Legislature for air quality planning activities. NETAC and its subcommittees meet on an as-needed basis. All meetings are open to the public and are posted at the East Texas Council of Governments and advertised through the distribution of information packets to local media outlets. During 2008, the NETAC Technical and Policy Advisory Committees held meetings on May 15 and November 7.

During the May 15 and November 7 meetings, the Technical Committee discussed: (a) the status of EPA's proposed revisions to the ozone NAAQS; (b) potential VOC monitoring activities at CAMS 19 for 2008; (c) a potential project to improve the TCEQ emission inventory for

construction equipment in Northeast Texas; (d) emission inventory improvements in the 2005 ozone model; (e) NETAC emission reduction strategies and sensitivity analyses of ozone to Northeast Texas emissions; (f) a summary of the 2008 ozone season with a preliminary analysis of high ozone days; (g) Luminant's plans for SCR control on its Martin Lake power plant units; (h) TCEQ's gas compressor engine emissions reduction rule; (i) research monitoring of HRVOCs at CAMS 19 during August-October, 2008; and (j) ozone planning activities during FY 2008-2009.

During the May 15 and November 7 meetings, the Policy committee discussed: (a) the status of EPA's proposed revisions to the ozone NAAQS; (b) NETAC studies to improve the Northeast Texas gas compressor engine emission inventory; (c) NETAC emission reduction strategies; (d) the 2005 ozone model and sensitivity analyses of ozone to Northeast Texas emissions; (e) air quality planning strategies for the revised ozone standard; (f) the 2008 ozone season and attainment status of Northeast Texas; (g) EPA's implementation of the 75 ppb ozone standard; (h) Luminant's plans for SCR control on its Martin Lake power plant units; (i) TCEQ's gas compressor engine emissions reduction rule; (j) research monitoring of HRVOCs at CAMS 19 during August-October, 2008; (k) legislative funding for near nonattainment areas; and (m) the Texas State Energy Conservation Office and Texas A&M's Rebuild America-Rural Community Building Initiative. The Policy Committee also (l) elected a new co-chair, Tyler Mayor Barbara Bass, and (k) presented a Clean Air Achievement award to Mayor Joey Seeber.

Public Outreach Activities During 2008

NETAC is actively engaged in public education and outreach activities concerning ozone air quality issues. The public outreach committee organized an ozone season awareness kickoff event for May 15, 2008. The purpose of the kickoff event was to raise public awareness of ozone air quality issues and encourage public support for programs designed to minimize ozone formation.

NETAC Public Education/Outreach activities for 2008 included the following:

- Hosting the NETAC website (www.netac.org). The website is regularly updated with meeting dates, associated agendas and enclosures for Committee meetings. The public can also find minutes of past meetings, various air quality reports, and a directory of all participants in NETAC.

- In cooperation with the Texas Commission on Environmental Quality, NETAC and local governments in the area provide "ozone action alerts" for the public on days when TCEQ predicts meteorological conditions are favorable for high ozone formation. Notification is provided through the NETAC website, local government public access channels, and the display of ozone alert flags.

- The Annual Ozone Season Awareness Event was held in Kilgore at the Kilgore City Hall on May 15, 2008. Speakers at the event included Tom Diggs of the EPA, who discussed the revised 8-hour ozone standard and Ramon Alvarez of the Environmental Defense

Fund who discussed air quality planning. Other speakers included Jim Mathews, NETAC's Legal Counsel, who gave the NETAC Progress Report for 2008.

- NETAC sponsored a series of public service announcements (PSAs) that ran on several local radio stations from May through September 2008, including a PSA that ran on the local NBC affiliate for two weeks during the Olympics. These PSAs sought to educate the public about what they can do at both work and home during the ozone season to reduce their impact on air quality readings.

- The NETAC Public Education/Outreach Committee approved the purchase of book covers for school districts in the five county area for the 2008-2009 school year. The book covers have an informational theme as well as including information on where to learn more about air quality. This is one of the most well received activities as ETCOG receives numerous thank you letters from students and school administrations.

Technical Activities

NETAC technical activities during 2005 and 2006 emphasized ambient air monitoring. During 2007 and 2008, there was a shift in emphasis towards emission inventory development and ozone modeling and with the goal of understanding the causes of episodes of elevated ozone concentrations at the Longview monitor and developing a plan for maintaining attainment through 2012 and supporting possible SIP development. Below is a description of technical activities NETAC carried out in 2008:

Air Monitoring

Enhanced Monitoring at CAMS 19

For several years, NETAC has collected canister VOC samples at CAMS 19 to augment the TCEQ's monitoring activities at Longview. NETAC continued to collect VOC data at CAMS 19 in 2008. During August-October, NETAC carried out a successful monitoring program which confirmed the presence of intermittent plumes containing very high concentrations of highly reactive VOCs at CAMS 19. HRVOCs were analyzed using a reactive alkene detector (RAD) which made a measurement once every second, 24 hours a day, providing a nearly continuous record of HRVOCs at CAMS 19. The high resolution RAD data confirmed the intermittent character of anthropogenic HRVOC impacts suggested by 2006 VOC monitoring data from CAMS 19, and showed that HRVOCs are present on a significant fraction of days, with 10 of 64 days showing strong RAD signals above 30 ppb. The natural background for HRVOCs (i.e. biogenic HRVOCs whose primary constituent is isoprene) may be expected to be approximately 10 ppb at midday. NETAC has investigated the relationship between periods of high ozone and high HRVOC levels at CAMS 19. Many periods of high HRVOC levels were not associated with high ozone at CAMS 19; most of these occurred at night. Some days with strong HRVOC signals may not have been conducive to ozone formation (lower temperatures, clouds). However, high 1-hour ozone values coincided with HRVOC spikes under northerly winds on 3 days in September, suggesting Eastman Complex impacts.

In 2008, NETAC drafted a letter to the Eastman, Westlake, and Flint Hills (all of which have facilities at the Eastman Complex) asking for their cooperation in understanding the origin of these HRVOC plumes that are implicated in ozone spikes at CAMS 19. The RAD data was used in the analysis of 2008 high ozone days, and was also used to determine the biogenic HRVOC contribution from periods between spikes for evaluation of CAMx modeling of biogenic VOCs.

Aircraft Monitoring

During 2006, Northeast Texas Air Care (NETAC) sponsored seven science flights between August 9 and November 3, 2006. The purpose of these flights was to characterize ozone and precursors from local sources and regional transport. The November 3, 2006 Baylor aircraft flight measured ozone precursors including HRVOCs (alkenes) and NOy in a plume extending downwind of the Eastman Complex. NOy is the sum of NOx and compounds that result from atmospheric reactions of NOx. By measuring NOy, it is possible to follow a plume of NOx emissions from the source downwind and to continue to track the plume even as NOx is transformed into other species. The aircraft measurements of alkenes and NOy were used to estimate emissions from the Eastman Complex, and were compared with reported emissions appearing in the TCEQ 2005 Emission Inventory. The total ethene emissions estimated from the aircraft data agreed within experimental uncertainty with the TCEQ inventory estimate and the spatial distribution of the emissions estimates with latitude was similar. The emissions estimate of NOy derived from the aircraft data was much lower than the TCEQ NOx estimate by an amount that exceeded the uncertainty in the measurements.

The Eastman Complex is one of several large point sources of emissions in the 5-county area, and the aircraft data suggest that ethene emissions from the Complex are well-characterized in the emission inventory, and therefore, in NETAC's conceptual model of ozone formation in Northeast Texas. The discrepancy between the NOx and NOy emissions estimates suggests that further work is required to refine our understanding of Eastman's NOx emissions. It is important to resolve this issue so that Eastman's NOx emissions and its contribution to ozone formation are well-characterized in the conceptual model and also in the emission inventory to be used in future ozone modeling of Northeast Texas.

NETAC has emission inventory data that indicate where the main sources of ozone precursor emissions are located within the Eastman Complex. Previous NETAC ozone modeling has been performed at a grid resolution of 4 km and does not resolve sources within the Complex, so high resolution ozone modeling at 1 km resolution is currently being carried out, and the data from the aircraft flight and the TCEQ inventory will serve as a first step toward understanding the distribution of emissions within the Eastman Complex.

Conceptual Model Update

During 2008, NETAC updated its conceptual model of ozone formation. Since the last conceptual model update in 2004, NETAC has carried out surface-based and aircraft measurements in Northeast Texas, revised and refined the local and regional emission inventories, and developed ozone models for the years 2002 and 2005. This wealth of new

information lends additional detail to the 2008 conceptual model, but does not change the overall picture of the factors leading to high ozone in Northeast Texas. High ozone days in Northeast Texas are usually the result of a local point source plume impact at a Northeast Texas monitor on a day when regional background ozone levels are high. High ozone days occur most often between June and September when the area is under the influence of a semi-permanent subtropical high-pressure system, vertical mixing of pollutants in the atmosphere is restricted, skies are clear to partly cloudy, temperatures are high, and winds are light. Most episodes are associated with near-surface winds from either the east/northeast or south/southwest with the latter direction appearing less consistently on the highest days and with greater variability in direction.

On a regional scale, emissions of ozone precursors in Northeast Texas are dominated by highly reactive biogenic VOCs such as isoprene and pinenes; anthropogenic sources account for a much smaller fraction of total daily VOC emissions in the NETAC area. The overall VOC/NOx emission ratio in the five county area is well within the regime associated with NOx-limited ozone formation. As a result, reductions in NOx will be generally more effective in controlling ozone on a regional basis than reductions in anthropogenic VOC. Sensitivity tests using NETAC's 2005 ozone model confirm that NOx reductions are more effective than VOC reductions in controlling ozone in Northeast Texas.

Local Emission Inventory Development

Gas Compressor Engine Inventory

Emissions from gas compressor engines used in natural gas gathering systems are an important component of the Northeast Texas emission inventory. Discussions between NETAC and TCEQ identified engine load factor as an uncertain parameter in NETAC's existing emission inventory for gas compressor engines. Engine load factor is the ratio of the engine's operating horsepower to the engine's rated horsepower. During 2008, NETAC carried out a field study to determine the appropriate load factor for compressor engines used in natural gas production in the five NETAC counties and Panola County. Previous studies had assumed load factor of 100% consistent with normal emission inventory techniques. Applying the load factors determined in the present study reduced the estimated 2005 emissions of NOx by 34%. Similar reductions are seen for engine exhaust emissions of VOC and CO.

Biogenic Emissions

A new land use/land cover database developed by the University of Texas (UT) was used to calculate biogenic emissions in Northeast Texas. The database that has been used in biogenic emissions modeling in previous ozone modeling for Northeast Texas was derived from the 1998-1999 ENVIRON/UT field surveys and GIS LULC data from the Texas Parks and Wildlife Service. In calculating the biogenic emissions for the May-June 2005 ozone model episode, Texas Parks and Wildlife Service GIS data was replaced with satellite data from the UT Center for Space Research (CSR). This data set was developed in 2006-2007 and has a spatial resolution of 25 meters. In general, the biogenic VOC emissions are lower using the CSR LULC data. This is because of the greater heterogeneity in the CSR data revealed by the high spatial

resolution. The CSR database has less area designated as high-emitting forest and more area designated as open pasture/grassland.

The revised biogenic emission inventory and updated gas compressor engine inventory were tested in NETAC's 2005 ozone model, and the results are described below.

Ozone Modeling

NETAC has developed a SIP-quality seasonal ozone model for the period May-June, 2005. This model is being used to understand conditions leading to 8-hour ozone problems in Northeast Texas (at the Longview monitor in particular) through an examination of the influences of regional transport, local sources and meteorological variability on Northeast Texas ozone levels. The modeling extends previous NETAC Northeast Texas modeling work by updating the emissions inventories and meteorological database, incorporating additional ambient monitoring, and bringing all the information together through the development and application of a photochemical ozone modeling system. The model is being used to evaluate the likelihood of future exceedances of the ozone NAAQS and develop emissions reduction strategies to ensure that the area does not exceed the ozone NAAQS in the future.

Meteorological Sensitivity Tests

NETAC's 2005 ozone model performs well on most days during the May-June 2005 period, achieving performance statistics that compare favorably with those of similar regional ozone modeling applications, but underestimates peak ozone at Longview on 3 of 5 8-hour ozone exceedance days. Detailed analysis for the three ozone exceedance days on which the peak ozone values at CAMS 19 were underestimated by the model showed that the high values of observed ozone at Longview were the result of power plant plume impacts and that the most likely reason that the peak ozone values were not accurately simulated at CAMS 19 is errors in wind speed and direction modeled by MM5. The MM5 sensitivity to changes in the treatment of clouds (i.e. cumulus parameterization) and nudging strength was investigated, and it was determined that increasing the nudging strength slightly and using the Grell cumulus parameterization caused a reduction in wind speeds and general increase in peak ozone, with a 6-10 ppb increase on one of the exceedance days. Further efforts to improve the meteorological fields through integration of additional wind profiler data are underway in 2009.

Emission Inventory Updates

In 2008, a series of emission inventory updates were integrated into the model, and their impacts were assessed. During November of 2007, TCEQ made available a revised emission inventory for 2005. The incorporation of this inventory into the May-June 2005 ozone model was initiated during the second half of 2007 and completed in 2008. Local emission improvements were made as well.

NETAC's 2005 gas compressor engine emission inventory (discussed above) was integrated into the model using improved information for the spatial distribution of wells (and emissions) obtained from the Texas Railroad Commission.

The new biogenic emission inventory based in the CSR landcover data (discussed above) was tested in the 2005 ozone model and its effect on surface ozone was assessed. In general, going to the CSR database reduced ozone, but the effect is not large. Further review of this data set is planned to determine whether the revised biogenic inventory containing the CSR landcover data should be permanently integrated into the 2005 ozone model.

Dry Deposition Algorithm

Dry deposition refers to the direct removal of air contaminants through contact with various terrestrial surfaces and uptake into biota. Dry deposition is an important process that removes ozone from the atmosphere and limits buildup of unhealthy ozone concentrations. The treatment of dry deposition in a regional air quality model can therefore have a significant effect on model performance. The scheme used in the standard version of CAMx is the Wesely algorithm, which was developed in 1989 (W89). W89 was the most comprehensive algorithm at the time for regional-scale air quality modeling, but no longer represents the current state of the science. Furthermore, the W89 algorithm is defined for a limited number of land cover types that are in turn characterized by typical eastern U.S. vegetation types, density, and seasonal conditions. The deposition velocities calculated with W89 may not be sufficiently accurate outside the east or for atypical conditions (e.g., seasonal transitions, drought stress).

It is desirable to implement a dry deposition algorithm in CAMx that incorporates updates in theory as well as measurements made since the development of W89. One of the most important aspects of newer dry deposition schemes is the use of "leaf area index" (LAI) to scale pollutant uptake into biota. The leaf area index is the ratio of the one-sided green leaf area to a unit area of the ground and can be measured by satellites. The LAI characterizes the amount of vegetation present and is a critical parameter in the calculation of the latent heat flux and, therefore, the surface energy budget.

During the spring of 2008, ENVIRON implemented the AERMOD dry deposition algorithm in CAMx as an alternative to the W89 scheme. AERMOD is EPA's regulatory guideline model for assessing impacts of a nearby source of pollutants. The AERMOD scheme is based on W89 but has updates to the surface resistance calculation and includes vegetation density scaling via a highly simplified parameter that is related to, but not identical to, the LAI. The use of the AERMOD scheme in CAMx produced slight improvements in model performance that were most noticeable at the Karnack monitor, which is the best measure of regional ozone performance. Although the AERMOD scheme represented an improvement over the W89 algorithm, it was desirable to employ a scheme that uses LAI derived from satellite measurements rather than the simple parameter in the AERMOD scheme that is related to the LAI; it is not possible to determine this parameter objectively from observed data.

A recent LAI-based algorithm is used in Environment Canada's AURAMS air quality model. This scheme is a state-of-the-science algorithm that has an improved representation of non-stomatal deposition pathways and has been tested extensively through its use in daily air quality forecasting and has been shown to reproduce observed fluxes of ozone and SO_2 with reasonable accuracy. In 2008, NETAC tested the Environment Canada scheme in a simplified model and

compared it to the AERMOD and W89 schemes. Testing of the Environment Canada algorithm in CAMx is underway in 2009, including a comparison against the AERMOD and W89 ozone performance in CAMx.

VOC Emission Inventory Reconciliation

NETAC collected VOC data at CAMS 19 in 2005 and analyzed these data to understand the contribution of oil and gas sources to ambient VOC concentrations. The 2005 ozone model was used to perform a reconciliation of the VOC emission inventory for Northeast Texas oil and gas sources with ambient VOC data from CAMS 19. This reconciliation suggested that VOC emissions from oil and gas sources are understated. However, VOC emissions from oil and gas sources are dominated by alkanes with relatively low ozone-forming potential and therefore are much less important than biogenic VOC emissions in Northeast Texas. Nevertheless, the results of this investigation showed of VOC emissions from oil and gas sources are not well understood and that further study is warranted.

Emissions Reduction Sensitivity Tests

The 2005 ozone model was used to evaluate the relative importance of several categories of local emissions. The model's sensitivity to 30% across-the-board reductions in emissions of VOCs and NOx was tested, and the model ozone levels were found to be far more sensitive to NOx reductions than to VOC reductions. This is consistent with NETAC's conceptual model of ozone formation, which states that ozone formation in Northeast Texas is NOx-limited due to the presence of large amounts of highly reactive biogenic VOCs. A series of sensitivity tests were performed to see which category of NOx reductions caused the largest reductions in surface layer ozone. Reductions in power plant NOx had the largest effect on ozone, followed by reductions in area source NOx and on-road mobile source NOx. Reductions in off-road mobile source NOx emissions had the smallest effect.

Attachment 1

NETAC TECHNICAL ADVISORY COMMITTEE (14)

- City of Longview
  - Robert Ray, Assistant City Attorney
  - Karen Owen, Longview MPO
- City of Marshall
  - Winston Robinson
- City of Tyler
  - Greg Morgan
  - Angela Choy
- EPA
  - Carrie Page
  - Erik Sndyer
- TCEQ
  - Kathy Singleton

    - Doug Boyer
    - Michelle Baetz
- NETAC General Counsel,
    - Jim Mathews, Mathews and Freeland
- TxDOT
    - Dale Spitz
- AEP/SWEPCO
    - Kelly Spencer
    - Kimberly Hughes
    - N. N. Dharmarajan
- CenterPoint Energy
    - Laura Guthrie
    - Gary Thiemann
- Eastman Chemical Company
    - Sharon Wellman
- Huntsman Chemical Company
    - Dennis Leahy
- Luminant
    - David Duncan
    - Dick Robertson
    - Rick Hanning
- Caddo Lake Institute, Inc.
    - Rick Lowerre, Lowere & Frederick
- Environmental Defense Fund
    - Mr. Ramon Alvarez, Ph.D.

NETAC POLICY COMMITTEE (18)

- Gregg County
    - Judge Bill Stoudt, Co-Chair
- Harrison County
    - Judge Richard Anderson
- Rusk County
    - Judge Sandra Hodges
- Smith County
    - Judge Joel Baker
- Upshur County
    - Judge Dean Fowler
- City of Gilmer
    - Jeff Ellington
- City of Henderson
    - Mayor Buzz Fullen
- City of Kilgore
    - Jeff Howell, City Manager
- City of Longview
    - Mayor Jay Dean
    - Councilman Daryl Williams

- City of Marshall
  - Mayor Ed Smith
  - Winston Robinson
- City of Tyler
  - Mayor Barbara Bass, Co-Chair
  - Greg Morgan
- Longview Economic Development Corp. (LEDCO)
  - John Stroud
- Marshall Economic Development Corp. (MEDCO)
  - Cliff Todd
- Tyler Economic Development Corporation (TEDCO)
  - Tom Mullins
- WE CAN
  - Ms. Tammy Campbell
- AEP/SWEPCO
  - Keith Honey
- Eastman Chemical Company
  - Darrell Rachels
- Luminant
  - David Duncan

NETAC Public Education/Outreach Committee

- Robert Ray, Assistant City Attorney, City of Longview
- Greg Morgan, Project Coordinator, City of Tyler
- Winston Robinson, City of Marshall
- Sharon Wellman, Eastman Chemical Company
- Rick Hanning, Luminant
- Ray Luce, TCEQ-Region 5 Air Program
- Leigh Ann Brunson, TCEQ-Austin
- Kelly Spencer, AEP/SWEPCO
- Scott McCloud, AEP/SWEPCO