HGB Attainment Demonstration SIP Revision for the 1997 Eight-Hour Ozone Standard (2009-017-SIP-NR)

Executive Director's Recommendation for Proposal

September 23, 2009

EXECUTIVE SUMMARY

EPA changed HGB 1997 8 hour ozone designation from moderate to severe on Oct. 1, 2008, effective Oct. 31, 2008. The deadline for submission of the revised SIP is April 15, 2010. Deadline for compliance to the .08 ppm standard is June 15, 2019 or as soon as expeditiously possible.

The existing measures to control ozone formation in the HGB area that have been adopted in previous SIP revisions center on:

- approximately 80 percent NOX emission reductions from point sources through the Mass Emission Cap and Trade (MECT) program;
- NOX emission reductions from on-road and non-road sources through the vehicle inspection and maintenance (I/M) program, the Texas Emission Reduction Plan (TERP), and the Texas Low Emission Diesel (TxLED) program;
- highly reactive volatile organic compounds (HRVOC) controls through the associated HRVOC Emission Cap and Trade (HECT) program; and
- VOC controls.

This proposed SIP for HGB uses photochemical modeling and weight of evidence.

Photochemical modeling includes federal, state and local controls including the HRVOC Emissions Cap and Trade program (HECT) and Voluntary Emissions Reduction Program (VMEP) and accounts for population and economic growth. Weight of evidence covers all items that provide reductions but are not covered by photochemical modeling.

The H-GAC's commitment for NO_x emissions reductions from the Voluntary Mobile Emission Reduction Program (VMEP) is 2.25 tons per day (tpd). The H-GAC has also identified transportations control measures (TCMs) that have been or will be implemented in the nonattainment area. By the start of the 2018 ozone season, these TCMs will reduce NO_x emissions in the HGB area by 0.015 tpd.

Photochemical modeling analysis demonstrates that a 25 percent reduction of the HECT cap on the total Harris County HRVOC allocation would contribute to attainment at all HGB monitors. Accordingly, this SIP revision contains a proposed 25 percent reduction in the total HRVOC allowance cap and revision to the HRVOC allocation methodology. The HECT program will continue to be applicable only in Harris County.

CHAPTER 1: GENERAL

The history of the Texas State Implementation Plan can be found at this url: http://www.tceq.state.tx.us/implementation/air/sip/sipintro.html#History.

EPA established the one hour ozone standard of 0.08 ppm on 4/30/71.
EPA revised the one hour ozone standard to 0.12 ppm on 2/8/79.
The 8-county HGB area was designated as non-attainment by EPA on 11/6/91.
EPA established the eight hour standard of 0.08 ppm effective on 9/16/97, but it did not become law until 2004.
HGB was classified as Severe-17 for the one-hour standard, requiring a compliance date of 11/15/07.
EPA designated HGB as moderate non-attainment for the eight hour standard on 6/15/04, requiring a demonstration of attainment by 6/15/10.
EPA revoked the one hour standard on 6/15/05.
EPA granted the governor of Texas's request to reclassify HGB from moderate to severe on 10/1/08. The new classification required compliance to the eight hour standard as expeditiously as practicable, but no later than 6/15/19. The revised SIP must be submitted by 4/15/10.

The one hour ozone design value has dropped from 220 in 1991 to 147 in 2008.
The eight hour ozone design value has dropped from 119 in 1991 to 91 in 2008.

In this SIP revisions are proposed to three rules:
2009-019-101-EN - MECT Program Cap Integrity for the HGB Eight-Hour Ozone Nonattainment Area
2009-006-101-EN - HECT Program Cap Reduction and Allowance Reallocation
2008-019-115-EN - VOC Control Technique Guidelines (CTG) Update
Details of the revisions are provided in Chapter 4.
Several stakeholder meetings have been held in the development of this SIP proposal.

CHAPTER 2: ANTHROPOGENIC EMISSIONS INVENTORY (EI) DESCRIPTION

This chapter discusses general EI improvements and development for each of the source categories. Chapter 3, *Photochemical Modeling* details specific emissions inventories and emissions inputs developed for the Houston-Galveston-Brazoria (HGB) ozone photochemical modeling.

1. EI improvements

Significant changes that have improved the emissions inventory include the following:
a. rule 115 requiring monitoring of HRVOCs in cooling water towers, flares and vents;
b. HARC Project H51C which identified thousands of tons of VOC flash emissions from upstream oil and gas operations in the HGB area;
c. a TCEQ study on tank emissions due to landing loss and the special inventory exercise performed during one month of the TexAQS II campaign in which facilities provided hourly emissions, and

d. a comprehensive guidance document, updated annually, to identify means for calculating emissions to point sources. It is located at: http://www.tceq.state.tx.us/implementation/air/industei/psei/psei.html

2. Point Sources
Stationary point source emissions data are collected annually from sites that meet the reporting requirements of 30 TAC § 101.10. These sites include, but are not limited to, refineries, chemical plants, bulk terminals, and utilities. To collect the data, the TCEQ mails EI questionnaires (EIQ) to all sites identified as meeting the reporting requirements.

3. Area sources
All stationary emission sources that are not included in the point source EI.

4. Non-road mobile sources
Includes vehicles, engines, and equipment used for construction, agriculture, transportation, recreation, and many other purposes.

5. On-road mobile sources
Consists of automobiles, trucks, motorcycles, and other motor vehicles traveling on public roadways.

CHAPTER 3: PHOTOCHEMICAL MODELING

1. Introduction, overview, ozone modeling, base case modeling and future year modeling.

Modeling guidance recommends:

- Using model results in a relative sense and applying the model response to the observed ozone data.
- Using available air quality, meteorology, and emissions data to develop a conceptual model for eight-hour ozone formation and to use that analysis in episode selection.
- Using other analyses (weight of evidence) to corroborate the model results and support the adequacy of a proposed control strategy package.

This attainment demonstration uses photochemical modeling in combination with corroborative analyses primarily associated with the 2000 and 2006 Texas Air Quality Studies (TexAQS 2000 and TexAQS II, respectively) to support a conclusion that the HGB eight-county nonattainment area will attain the 0.08 parts per million (ppm) 1997 eight-hour ozone standard by June 15, 2019.

The modeling system is composed of a meteorological model, several emissions processing models, and a photochemical air quality model. Due to chemical reaction complexity, the modeling guidance strongly recommends using photochemical computer models to simulate ozone formation and evaluate the effectiveness of future control strategies.

Ozone modeling involves two major phases, the base case modeling phase and the future year modeling phase (with sub-steps in each phase).

2. Episode Selection

The modeling guidance sets forth the primary criteria for selecting ozone episodes for eight hour ozone attainment demonstration modeling:

• Select a mix of episodes reflecting a variety of meteorological conditions that frequently correspond with observed eight-hour daily maximum ozone concentrations greater than 84 ppb at different monitoring sites;

• Select periods where eight hour ozone concentrations are close to the eight-hour ozone design value at each key monitor.

• Select periods for which extensive air quality/meteorological databases exist; and

• Model a sufficient number of days so that the modeled attainment test can be applied at all of the ozone monitoring sites that are in violation of the ozone NAAQS.

3. Meteorological Modeling

The TCEQ is using the Fifth Generation Meteorological Model (MM5, version 3.7.3) developed jointly by the National Center for Atmospheric Research (NCAR) and Pennsylvania State University. The wind speed and direction are deemed to be the most important meteorological parameters input to the air quality model. A detailed performance evaluation for each of the 2005 and 2006 meteorological modeling episodes is included in Appendix A.

4. Modeling Emissions

For the stationary emission source types, which consist of point and area sources, routine emission inventories provided the major inputs for the emissions modeling processing. Area source modeling emissions were developed using the EPA NEI and the TCEQ TexAER. Emissions from mobile and biogenic sources were derived from relevant emission models. Specifically, link-based on-road mobile source emissions were derived from a travel demand model coupled with the EPA MOBILE6.2 emission factor model, and non-road mobile source emissions were derived from the EPA's National Mobile Inventory Model (NMIM), or the Texas NONROAD (TexN) mobile source models. The on- and non-road emissions were processed to air quality model-ready using version three of the Emissions Processing System (EPS3; Environ, 2007). Biogenic emissions were derived from the Global Biosphere Emissions and Interactions System (GloBEIS) model, which outputs air quality model-ready emissions.

In general, the baseline modeling emissions are based on typical ozone season emissions, whereas the base case modeling emissions are episode day-specific.

Considerations are given to emissions within Texas and from outside of Texas.

More details of the development of baseline emissions and tables containing values are provided in the HGB SIP. The following chart summarizes the findings.

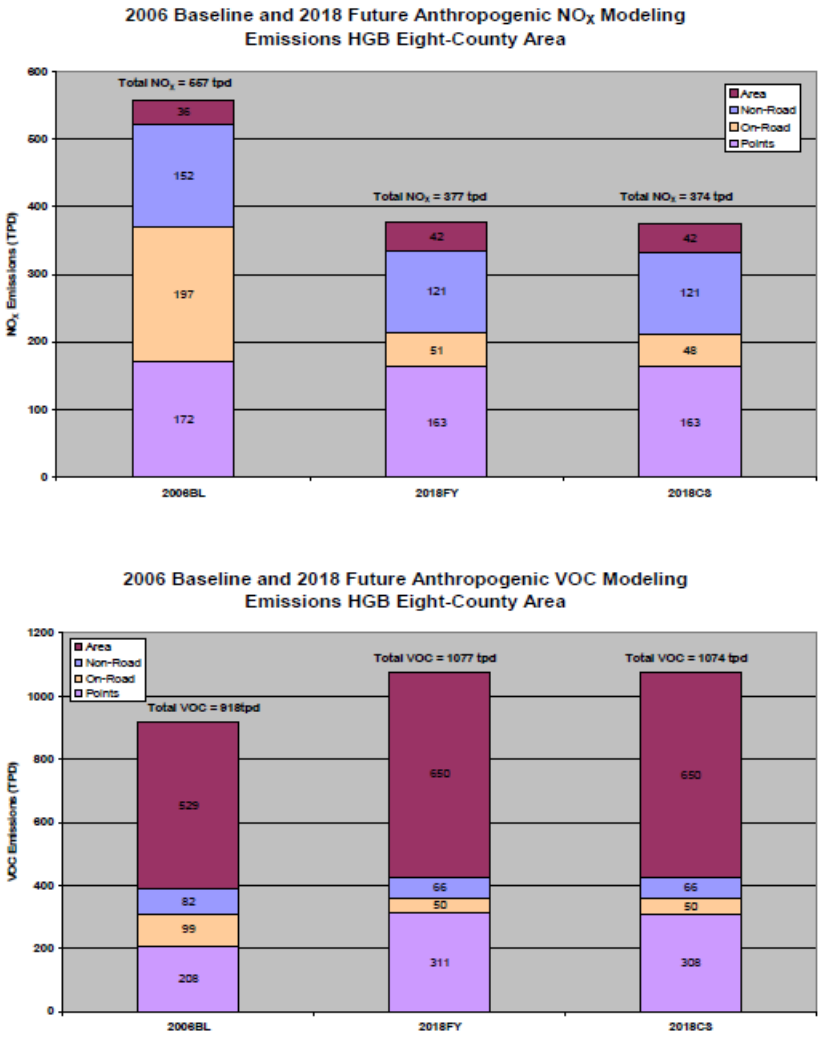

Figure 3-10: 2006 Baseline and 2018 Future Base, and 2018 Control Strategy Anthropogenic NO_X and VOC Modeling Emissions for HGB

Notes: 2006BL = 2006 Baseline
2018FY = 2018 Future Year or Future Base
2018CS = 2018 Control Strategy

5. Photochemical Modeling

The following three prerequisites were identified for selecting the air quality model to be used in the HGB attainment demonstration:

a. must have a reasonably current, peer-reviewed, scientific formulation;

b. must be available at no or low cost to stakeholders; and

c. must be consistent with air quality models being used for other Texas nonattainment or near nonattainment areas.

The only model to meet all three of these criteria is CAMx.

Descriptions are provided in the SIP regarding the modeling domain and horizontal grid cell size, the vertical layer structure, model configuration and a number of model performance evaluations.

Evaluations included data from TexAQS II including the Rural Monitoring Network, NOAA WP3-3D Orion aircraft, NOAA Twin Otter TOPAZ, The Research Vessel Ron H. Brown, Ozone Sondes, Moody Tower Research and other TexAQS II data including formaldehyde monitored at Lynchburg Ferry and HRM-3 monitoring sites.

Some additional TexAQS II data have not yet been used for model performance evaluation because they were not yet available in a usable form, but may be useful in the future. These data sources include the Houston Triangle project, the Baylor Aztec flights, the Solar Occultation Flux (SOF) measurements, "smart" balloon data, Differential Optical Absorption Spectroscopy (DOAS) observations, and satellite observations.

Diagnostic testing was performed using flare sensitivity modeling, retrospective modeling/2000 backcast, and weekday vs. weekend modeling.

6. Baseline (2006) and Future Case (2018) Modeling

The TCEQ selected 2006 as the baseline year for conducting the attainment modeling.
The 2018 baseline attainment modeling projects two regulatory monitors (Houston Bayland Park (CAMS 53) and Deer Park (CAMS 35)) and one non-regulatory monitor (Wallisville Road (CAMS 617)) to have DV_{FS} greater than 84 ppb.
In sensitivity analyses, model response plots indicate that NOx reductions have the greatest impact on reducing ozone, especially at Bayland Park. A combination of NOx and VOC reductions has the most significant benefit for the Deer Park site.

The TCEQ applied the Ozone Source Apportionment Tool and Anthropogenic Precursor Culpability Analysis of CAMx to 2018 baseline modeling. Lower-level local emission sources, including non-road mobile, area, on-road mobile, and low-level points, make a greater contribution to ozone at Houston Bayland Park (CAMS 53) than Deer Park (CAMS 35), although Ship Channel sources make a noticeable contribution at Houston Bayland Park (CAMS 53). Conversely, local elevated sources, including HGB elevated points, ships, HECT, and MECT, make a greater contribution at Deer Park (CAMS 35) than Houston Bayland Park (CAMS 53). Wallisville ozone origins are more like Deer Park (CAMS 35) than Houston Bayland Park (CAMS 53).

Future case modeling with controls was also performed for:
a. 25% HECT Cap Reduction (reduces HRVOCs in HECT program from point sources by 25%)
b. Voluntary emission reductions of NO_X and VOC from on- and non-road mobile sources within the eight-county HGB area.
In all cases the Deer Park, Bayland Park and Wallisville monitor design values drop between 0.07-0.28 ppb with these controls.

The TCEQ has archived all modeling documentation and modeling input/output files generated as part of the HGB SIP modeling analysis.

CHAPTER 4: CONTROL STRATEGIES AND REQUIRED ELEMENTS

1. Introduction

This chapter describes existing and proposed ozone control measures for the HGB area, as well as how Texas meets the following severe ozone nonattainment area state implementation plan (SIP) requirements: reasonably available control technology (RACT), reasonably available control measures (RACM), motor vehicle emission budgets (MVEBs), and contingency measures.

2. Existing Control Measures

Point Sources

a. NOx Mass Emissions Cap and Trade (MECT) program yielding overall 80% reductions in NOx from point sources. 4/1/03

b. HRVOC rules and HRVOC Emissions Cap and Trade (HECT) program impacting process vents, cooling water towers and flares. 1/31/06

c. HRVOC fugitive rules provide more stringent leak detection and repair (LDAR) and add more components to be leak tested. 3/31/04

d. VOC rules on storage and degassing operations addresses leaks through fittings on floating roof tanks, eliminates exemption for crude oil and natural gas condensate storage, and more stringent rules for degassing tanks. 1/1/09

e. NOx emissions standards for nitric acid/adipic acid manufacturing facilities. 11/15/99

f. NOx controls on utility power generation in East and Central Texas. 5/1/03

g. VOC control measures for batch processes, bakeries and lithographic printers.12/31/02

Area/Non-Road

a. Refueling Stage I vapor recovery - 1990

b. Refueling Stage II vapor recovery – 1992

c. Federal Area/Non-Road measures (e.g. standards relating to locomotive engines and leaf blowers) – through 2007

d. TERP grants – January 2002

e. California standards for non-road engines 25 hp and greater. 5/1/04

f. Stationary diesel engines prohibition on testing and maintenance between 6:00 am and noon. 4/1/02

g. NOx emission limits on small scale residential and industrial boilers, process heaters, and water heaters. 2002

h. NOx emission limits on boilers, process heaters, stationary engines and turbines at minor sites not included in the MECT program. 3/31/05

i. Additional VOC control technology requirements for batch processes, bakeries, and offset lithographic printers. 12/31/02

j. TxLED - Requires all diesel for both on-road and non-road use to have a lower aromatic content and a higher cetane number. 10/31/05

k. TxLED for Marine fuels. 6/24/07

l. Texas low RVP gasoline - Requires all gasoline for both on-road and non-road use to have a RVP of 7.8 pounds per square inch (psi) or less from May 1 through October 1 each year. April 2000

m. Voluntary Mobile Emissions Reduction Program (VMEP) administered by HGAC. Through 2007

On-road Measures
a. Federal On-road Measures – Through 2007
b. TERP grants. January 2002
c. Vehicle Inspection/Maintenance. 5/1/02
d. Speed limit reductions. September 2003
e. TxLED. 10/31/05
f. Texas low RVP gasoline. May 2000
g. VMEP. Through 2007
h. Transportation control measures. Through 2007.

Other
a. Portable Fuel Containers Rule
b. Voluntary energy efficiency/renewable energy. December 2000
c. Automotive Windshield Washer Fluid. 1/1/95

3. Updates to Existing Control Measures
a. The existing NOx cap trade program (MECT) allows for additional allowances to be granted. In this proposed SIP no additional NOx allowances will be granted, preventing the NOx cap from growing.
b. Repeal of State Portable Fuel Container Rule. EPA has issued a more stringent rule on portable fuel containers, which will supersede the state rule.
c. Clean Fuel Fleet Requirement – the Texas regulation has been replaced new federal standards.

4. Reasonably Available Control Technology (RACT) Analysis
RACT is defined as the lowest emissions limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility. RACT requirements for nonattainment areas classified as moderate and higher are included in the FCAA to assure that significant source categories at major sources of ozone precursor emissions are controlled to a reasonable extent, but not necessarily to best expected of new sources or to maximum achievable control technology (MACT) levels required for major sources of hazardous air pollutants. While RACT and RACM have similar consideration factors like technological and economic feasibility, there is a significant distinction between RACT and RACM. To be considered RACM, a control measure must advance attainment of the area towards meeting the NAAQS for that measure. Advancing attainment of the area is not a factor of consideration when evaluating RACT because the benefit of implementing RACT is presumed under the FCAA.

Under the current state rules, the HGB area is subject to some of the most stringent NOX and VOC emission control requirements in the country, and for many source categories, the existing rules are more stringent than recommended RACT standards for those categories.

The TCEQ's analysis demonstrates that the current VOC rules and controls for the HGB area satisfy the FCAA requirements for RACT for all Control Technique Guidelines

(CTG) or Alternative Control Techniques (ACT) VOC source categories specific to any CTG or ACT documents issued prior to 2006.

The TCEQ has determined that portions of the Offset Lithographic and Letterpress Printing CTG recommendations represent RACT for the HGB area. However, for other CTG which the EPA has provided for a number of coatings, etc. TCEQ has determined that they are either not used in Texas, do not meet RACT standards, or TCEQ has not made a determination on them yet.

5. Reasonably Available Control Measures Analysis

States are required by the FCAA to "provide for implementation of all reasonably available control measures as expeditiously as practicable" and to include RACM analyses in the SIP. However, regions are only obligated to adopt those measures that are reasonably available for implementation in light of local circumstances.

Based on the RACM analysis, the TCEQ determined that only one potential control measure met the criteria to be considered RACM. A reduction in the HRVOC cap for Harris County under the HECT program was determined to help advance attainment of the HGB area and to meet the other RACM criteria. Reported HRVOC emissions from sources in the HECT program during the first two years of the HECT program, calendar years 2007 and 2008, averaged approximately 56 percent of the total allocated HRVOC allowances for Harris County. Because there is a demonstrated substantial surplus in the HRVOC cap, a 25 percent reduction in the cap for Harris County is technologically feasible and should have minimal economic impact. Modeling demonstrates that a 25 percent reduction in the HRVOC cap for Harris County will help the HGB area make progress toward attainment of the 1997 eight-hour ozone NAAQS. Based on 2007-2008 emissions, a 25 percent reduction would leave a buffer of approximately 600 tpy, or more, in the cap that should be sufficient to account for any significant variations in HRVOC emissions in future years due to emission events and scheduled startup, shutdown, and maintenance events as well as allow for future economic growth.

6. New Control Measures

a. Stationary Sources

HECT Cap Reduction and Allowance Reallocation The proposed revisions to the HECT Program Cap rule would result in a 25 percent reduction in the total HECT allowance cap and revise the HRVOC allocation methodology.

Following the initial allocation of allowances, companies participating in the HECT program commented that the allocation was not equitably distributed and that some sites did not receive enough allocations while other sites received allocations greater than necessary. Monitoring data supports the assertion of an inequitable distribution of allowances. Revisions to the rule are anticipated to result in a more equitable allocation.

b. Local Programs

The H-GAC worked with HGB area local governments and business stakeholders to develop appropriate control strategies to meet the SIP requirements and to recruit

stakeholders who would take legal responsibility for implementing these strategies through the establishment of memoranda of agreement. As a result, six projects were identified as Transportation Control Measures (TCMs), and numerous strategies were agreed upon with local governments as voluntary measures. For more information regarding the development of local control strategies, see Appendix F. In addition the Voluntary Mobile Emissions Reduction Program (VMEP) provides voluntary mobile source measures have the potential to contribute, in a cost-effective manner. The H-GAC identified three voluntary measures that will aid in the improvement of the HGB region's air quality. The H-GAC's commitment for NOX from VMEP is 2.25 tpd.

7. Motor Vehicle Emissions Budget (MVEB)

The MVEB refers to the maximum allowable emissions from on-road mobile sources for each applicable criteria pollutant or precursor as defined in the SIP. The budget must be used in transportation conformity analyses. Areas must demonstrate that the estimated emissions from transportation plans, programs, and projects do not exceed the MVEB. The attainment budget represents the on-road mobile source emissions that have been modeled for the attainment demonstration. The budget reflects all of the on-road control measures reflected in that demonstration.

8. Monitoring Network

States are required to submit an annual monitoring network review to the EPA by July 1 of each year. This network review is required to provide the framework for establishment and maintenance of an air quality surveillance system. The reclassification of the Houston ozone nonattainment area to severe requires one major change in the HGB area PAMS plan. The TCEQ will conduct intensive carbonyl sampling at the Clinton PAMS Type 2 Site (AQS ID 48-201-1035) each year. As agreed upon with the EPA, Region 6, the TCEQ will collect a total of 240 carbonyl samples at this site at a sampling frequency of eight 3-hour samples per day every three days during July-September. Carbonyl sampling will be terminated at the Houston Channelview site to offset this increased sampling schedule at the Clinton site.

9. Contingency Plan

SIP revisions for nonattainment areas are required to provide for specific measures to be implemented should a nonattainment area fail to meet reasonable further progress (RFP) requirements or attain the applicable NAAQS by the attainment date set by the EPA.

To meet the contingency requirement, the TCEQ will evaluate potential control measures to be implemented at the state level that require more study before emissions reductions can be quantified and federal measures that are not yet final. Potential measures include but are not limited to the following:

Potential State Measures

- Gas Imaging "Find and Fix" Rule
  Contingency measure rule to require the use of gas imaging camera technology for periodic inspection of sources of VOC emissions such as storage tanks,

barges, etc., that are not currently subject to leak detection monitoring programs and set reasonable time periods for companies to address possible problems found (e.g., leaking seals).

- Enhanced LDAR for Difficult-to-Monitor Components
  Contingency measure rule to require the use of gas imaging camera technology for more frequent monitoring on difficult-to-monitor and unsafe-to-monitor components that would normally have very long monitoring frequencies under traditional LDAR monitoring rules.

Potential Federal Measures

- International Maritime Engine Emission Standards for Oceangoing Vessels
  If implemented by the EPA this measure would result in annual emission reductions from fleet turnover.

- Potential Enhanced Corporate Average Fuel Economy (CAFÉ) standards for cars and trucks.
  The original federal measure increased the fuel economy of vehicles starting with model year 2011 to approximately 35 miles per gallon. (mpg) in 2020. The CAFÉ rules are part of a larger federal energy bill, H.R. 6, signed into law December 19, 2007. The administration is proposing to move the requirement to begin in 2016, allowing for observable reductions by 2019.

- EPA Proposed Rule to Reduce Air Toxics from Stationary Diesel and Gas-Fired Engines.
  If finalized, this rule would become effective in 2013.

- EPA Proposed Rule to Reduce Air Toxics Emissions from Area Source Asphalt Refining and Asphalt Roofing Manufacturing Facilities.
  If finalized, this rule would likely go into effect before 2019.

- EPA Final Rule for National Volatile Organic Compound (VOC) Emission Standards for Aerosol Coatings
  Final rule amendments to add compounds and reactivity factors go into effect July 2009.

Any measure used to meet the contingency requirement will be included in the SIP for the 1997 eight hour ozone standard in the HGB area before 2019.

CHAPTER 5: WEIGHT OF EVIDENCE

The corroborative analysis presented in this chapter demonstrates the progress that the Houston-Galveston-Brazoria (HGB) area is making towards attainment of the 1997 eight-hour ozone National Ambient Air Quality Standard (NAAQS) of 0.08 parts per million

(ppm). This document will present the supplemental evidence, i.e., the corroborative analyses, for the current modeling demonstration. The guidance also states that a weight of evidence demonstration is allowed when the future design value is at or below 87.9 parts per billion (ppb).

The weight of evidence issues are divided into three categories: modeling issues, observational trends of ozone and ozone precursors in the HGB area and control measures which cannot yet be quantified but none-the-less will lead to tangible reductions.

The problems with the model have been identified as follows:

• Emissions inventories must be reconciled to some extent with observational data before the model can accurately depict the ozone formation processes in the HGB area, especially for HRVOC.
• Adding HRVOC to modeling emissions inventories generally increases ozone concentrations and alleviates a portion of the ozone and HRVOC under-prediction problems found by every modeling group who has attempted to model the HGB area.
• Reactivities of the TCEQ-defined HRVOC are high regardless of which chemical mechanism is used to evaluate their effects. In addition to the TCEQ list of HRVOC, formaldehyde also displays high reactivity.
• There are also a number of concerns regarding accurately addressing complex meteorological issues.

Both field studies sponsored by the TCEQ, TexAQS 2000 and TexAQS II, have indicated that there are substantial discrepancies in the reported emissions of HRVOC, especially ethene and propylene. The TCEQ remote sensing studies of flares, storage tanks, cooling towers, and other sources have shown that large quantities of VOC emissions have gone unreported. In addition, solar occultation flux measurements have shown that 30-minute variations in industrial HRVOC emissions can be an order of magnitude or more.

A number of researchers studying urban photochemistry in the HGB area and other cities have found that available mechanisms for simulating radical production are unable to replicate the observed radical formation and propagation rates. The TCEQ modeling is consistent with the findings that there is apparently something missing in the current mechanisms. The atmospheric chemistry community as a whole has not yet resolved the problem or problems with the current mechanisms. Several hypotheses for the missing radical formation mechanism exist. The TCEQ continues to support investigations for improving chemical mechanisms, and is prepared to adopt an improved mechanism when it becomes sufficiently mature.

The HGB SIP describes how well the model predicts ozone concentrations, ozone precursors, meteorological parameters, and responses to emission changes. A list of the strengths and weaknesses of the model are presented in section 5.2.2.

Conclusion
The photochemical grid model performed by the TCEQ for this SIP revision has been rigorously evaluated against observational data. While there are a number of shortcomings that this modeling has in common with other modeling exercises in the HGB area, modeling for many of the simulated ozone days appears to behave in a manner consistent with most of the atmospheric phenomena of interest. Evaluation of the modeling response to emission changes appears to show that the modeled ozone is slightly less responsive to emission changes than the observed ozone. Thus, modeling of 2018 emissions with the proposed control package in place may over-predict the future ozone concentrations.

Ozone Trends
While the HGB area continues to exceed both the one-hour and eight-hour ozone standards, one-hour ozone design values have generally decreased over the past 17 years, and eight-hour ozone design values have decreased over at least the past nine years. The eight-hour ozone design value in 2008 was 91 ppb, a 24 percent decrease from the 1991 design value of 119 ppb. The 2008 value is approaching the 1997 eight-hour ozone NAAQS of 85 ppb. If this trend were to continue at that rate, attainment of the 1997 eight-hour standard could be reached in five years, though if the pace of recent years were maintained, it could occur even sooner.

NOx Trends
Daily peak one-hour NOX from all monitors in the HGB area has declined from 1991 through 2008. The increasing density of NOX data points shows that the number of NOX monitors in the HGB area has greatly increased since 1991. Annual 90th percentile and annual average NOX values have been calculated. Both of these measures have decreased markedly over the 1991 to 2008 period, falling 64 percent and 68 percent, respectively. Even more remarkable may be the 53 percent and 48 percent declines since 1999.

VOC Trends
Trends at each of the eight Houston Ship Channel auto-GC monitors were examined. Data from the four other auto-GC monitors were analyzed only for trend slope and possible statistical significance of trends. Though measured ethylene and propylene concentrations show a large degree of variability at all auto-GC monitors, downward trends are apparent at seven of the eight; only Wallisville Road 5-48 (CAMS 617) appears to show no decrease.

Correcting for Meteorology
The number of high ozone days and 8 hour ozone values are dependent on the weather conditions. However, analysis shows that, after adjusting for meteorology, concentrations of ozone has declined substantially in the HGB area. All else held equal, daily maximum eight-hour ozone concentrations in the HGB area should be around 9 ppb lower in 2007 compared to 1996.

Background Ozone Concentrations: Transport of Ozone into the HGB Area

- The seasonal variability in eight-hour maximum ozone in eastern Texas is primarily associated with background ozone. Local contributions tend to be highest during the summer when background ozone reaches a minimum.
- The late spring peak in eight-hour maximum ozone in eastern Texas is primarily associated with "tropospheric background" ozone. This ozone maximum has been observed at rural sites elsewhere and is associated with variations in the lifetime of ozone, the concentrations of NOx, and enhanced transport from the stratosphere.
- The midsummer minimum in background ozone in eastern Texas leads to a minimum in eight-hour peak ozone that is strongest in southeastern Texas and barely noticeable in northeastern Texas. The primary cause of the summertime minimum is a decline in the tropospheric background ozone.
- When easterly and northeasterly winds become more frequent in late summer, background ozone and total ozone in eastern Texas begin rising. Winds are also less steady than in the middle of summer, so continental transport becomes increasingly frequent.
- Research on the meteorology of the HGB area has found that the highest background ozone transported into the HGB area predominately originates from the north and northeast.

Air Quality Trends Conclusions

Ozone concentrations have decreased dramatically in the HGB area since the 1990s. Examination of trends in one-hour ozone, eight-hour ozone, the number of exceedances, the spatial distribution of ozone, the seasonal distribution of ozone, and the strength of ozone gradients all show substantial downward trends. The causes of the trends were investigated by examining the meteorological variations that have occurred over the years, by evaluating the local changes in ozone precursor concentrations, and by examining trends in background ozone. The analyses found that the inter-annual meteorological variations cannot explain the observed decreases in ozone, and that the ozone precursors are on statistically significant downward trends. In addition, the analyses have found that background ozone has not dropped substantially since 2000, suggesting that the significant ozone reductions in the HGB area are due to local emission controls, not due to background ozone decreases.

Qualitative Corroborative Analysis

Because photochemical modeling is an evaluation tool and not an absolute prediction of future ozone concentrations, additional data must be considered in order to draw conclusions about the validity of the final predicted design value and whether the attainment demonstration satisfies the requirements of the Federal Clean Air Act. Additional measures that will be implemented but have not been entirely quantified in the current HGB SIP proposal include:

a. New international marine diesel engine and fuel standards.

b. The SmartWay Transport Partnership is a voluntary EPA program for the freight transport industry that promotes strategies and technologies to help improve fleet efficiency while also reducing air emissions.
c. Blue Skyways has similar objectives to SmartWay, but also focuses on promoting emissions reduction strategies for other on-road sources, non-road sources, and highway fueling and idling reduction infrastructure, while also promoting renewable, efficient, and alternative energy sources.
d. Control of VOC Emissions from Flash Emissions from Upstream Oil and Gas Storage Tanks.
e. Energy Efficiency and Renewable Energy Measures
f. Clean Air Interstate Rule (CAIR)
g. Texas Emission Reduction Plan (TERP)
h. Low Income Vehicle Repair Assistance, Retrofit, and Accelerated Vehicle Retirement Program (LIRAP)
i. Clean School Bus Program
j. American Waterways Operators Tank Barge Emissions Best Management Practices
k. Other Local Programs (listed in detail in the HGB SIP).

Conclusions

- First, the photochemical grid modeling performs relatively well. Problems observed with the modeling are those that are known to exist in all photochemical modeling exercises. In spite of the known shortcomings, the model can be used carefully to predict ozone concentrations. The photochemical grid modeling predicts that the control strategy package chosen by the TCEQ can lower the ozone design values in the HGB area down to a value very near the 0.08 ppm eight-hour ozone standard. The model response to emission decreases is less than the response observed in the atmosphere, suggesting that the proposed emission controls are more likely to yield attainment of the eight-hour 0.08 ppm ozone standard than the absolute modeled design values indicate.
- Second, the ozone trend analyses show that ozone has decreased significantly since the late 1990s. Meteorological variations alone cannot explain the significant downward trend. Decreases in background ozone cannot explain the downward trend either. Significant decreases in ozone precursors, however, coincide with the decreases in ozone, indicating that the ozone decreases observed in the HGB area are due to local emission controls.
- Third, many additional air quality improvement measures are being adopted in the HGB area that cannot be included in the photochemical modeling analysis because they cannot be accurately quantified. These additional measures can provide additional assurance that the HGB area is on the path toward attainment.

Based upon the photochemical grid modeling results and these corroborative analyses, the weight of evidence indicates that the HGB area will attain the 1997 eight-hour ozone standard by June 15, 2019.

CHAPTER 6: ONGOING AND FUTURE INITIATIVES

Flare Task Force

In November 2008, the TCEQ formed an agency-wide task force to comprehensively evaluate all aspects of flares in Texas. The Flare Task Force is evaluating how flares factor into air quality challenges with an emphasis on air toxics and ozone. Some of the specific issues under evaluation include: different factors affecting flare performance, such as waste gas flow rates, turndown ratio, and waste gas to steam assist ratios; the adequacy of existing monitoring requirements for flares; and alternatives to flaring routine emissions. A stakeholder group associated with the Flare Task Force has been formed to solicit comment on these issues related to flares.

IR Camera Work (Optical Gas Imaging)

The system also has the potential to advance leak detection and repair (LDAR) work practices and enable monitoring of components that are difficult to monitor with traditional LDAR methods. However, the commission has technical and enforcement concerns associated with the potential regulatory implementation of this technology. A standardized method or performance specification is necessary to ensure consistent and reliable application of optical gas imaging instrumentation.

Open Path Sensing Technologies

SOF, DIAL, I-DOAS all provide specific information for pollutant monitoring at ground level and at some point in the sky. However there are a number of concerns that TCEQ has with these techniques.

DIAL at Texas City

TCEQ was the first regulatory organization in the U.S. to implement DIAL. They employed NPL to take several measurements in Texas City. The contractor, NPL, submitted a draft report in February 2008, which is expected to be finalized in fall 2009. An independent third party is currently comparing remote sensing measurements to conventionally determined emissions. Although these results are still being analyzed, preliminary total VOC measurements indicate that flare emissions may be underreported when emissions are determined using conventional material balance calculation methods. Additionally, preliminary results as well as other research indicate flare destruction and removal efficiency (DRE) may be reduced during certain operating conditions, such as combusting small volumes of waste gas and during flare air- or steam-assist operations.

Helicopter DIAL looking for Benzene

The TCEQ completed field work in June 2009 to demonstrate the capabilities of a helicopter-mounted DIAL. The study's major focus will be using the DIAL to locate sources of benzene emissions from industrial facilities in the Houston Ship Channel area. The DIAL system used was developed to detect methane leaks during flyovers of gas pipelines. A final report is due to the agency by August 2009 and the agency final evaluation of the technology should be completed by the fall of 2009.

SHARP study findings

An extensive field study of ozone precursors and formation was conducted in the HGB area in April, May, and June 2009 using cutting-edge measurement technology. Approximately $2 million of air quality research funds for this project were provided by the state legislature. The goal of the SHARP study is to investigate the:

- contribution of direct emissions of formaldehyde and nitrous acid from flares, stacks, and
  other point and mobile sources;
- importance of secondary formation of formaldehyde from the ozonolysis of olefins;
- identification of formation pathways of nitrous acid;
- ambient levels of nitryl chloride and potential impact as a ozone precursor; and
- spring and early summer ozone formation mechanisms in the HGB area.

The data from this study will be analyzed in 2009 and 2010 and used to better understand HGB area emissions and chemistry, enhance model inputs and mechanisms, and aid in the evaluation of control strategy development.

Mid Course Review Question

The commission is soliciting comments on whether it is appropriate to perform a 1997 eight-hour ozone standard MCR analysis for the HGB area, and, if so, what elements should be contained in the analysis. The commission is also seeking input on the appropriate date to submit the MCR.

NAAQS for ozone is dropping to 0.075 ppm.

On March 12, 2008, the EPA strengthened its NAAQS for ground-level ozone from 0.08 parts per million (ppm) to 0.075 ppm. Governor Rick Perry submitted the state's recommendation to the EPA on March 10, 2009. The HGB area was included in the governor’s recommended nonattainment areas.