

REVISION TO THE STATE IMPLEMENTATION PLAN FOR
THE CONTROL OF OZONE AIR POLLUTION

HOUSTON-GALVESTON-BRAZORIA 1997 EIGHT-HOUR
OZONE STANDARD NONATTAINMENT AREA



TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
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Houston-Galveston-Brazoria Reasonable Further Progress State
Implementation Plan Revision for the 1997 Eight-Hour Ozone Standard

PROJECT NO. 2009-018-SIP-NR

Adopted
March 10, 2010

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EXECUTIVE SUMMARY

The 1990 Federal Clean Air Act Amendments (FCAA), §182, require ozone nonattainment areas with air quality classified as moderate or higher to submit plans showing reasonable further progress (RFP) toward attainment of the ozone National Ambient Air Quality Standard (NAAQS). The Houston-Galveston-Brazoria (HGB) area (Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties) is classified as a severe nonattainment area for the 1997 eight-hour ozone standard, with an attainment date of June 15, 2019. This state implementation plan (SIP) revision is not required or intended to demonstrate attainment of the ozone NAAQS but rather to demonstrate that ozone precursor emissions will be reduced in accordance with the guidelines set forth in the second phase of the United States Environmental Protection Agency's (EPA) 1997 Eight-Hour Ozone Implementation Rule (40 Code of Federal Regulations §51.910).

This SIP revision demonstrates that the RFP emissions reduction requirement will be met for the six-year period (2003 through 2008) beginning January 1 of the year following the year used for the baseline emissions inventory (2002) and all remaining three-year periods after the first six-year period (2009 through 2011, 2012 through 2014, and 2015 through 2017) out to the area's attainment date (2019). Target year inventories include the latest information available to estimate emissions growth. Target levels for the attainment year (2018) also account for RFP corrections and non-creditable reductions. All of the RFP inventories are based upon an ozone season weekday analysis.

The RFP methodology involves development of the base year and milestone year inventories, emissions reductions for nitrogen oxides (NO_x) and volatile organic compounds (VOC) in each milestone year, and an estimate of the effects of non-creditable reductions and pre-1990 FCAA rules. Through this methodology, the reduction amount is determined. Once these values have been calculated, the milestone target levels and emissions inventories can be compared to determine if the forecasted controlled emissions inventories are less than the target level. The results, which demonstrate that the HGB area meets the FCAA RFP requirements for each of the milestone years, are displayed in Chapter 3: *TARGET EMISSIONS LEVELS AND REASONABLE FURTHER PROGRESS DEMONSTRATION*, Table 3-3: *Calculation of Required 3 Percent Per Year NO_x and VOC Reductions*.

This SIP revision also sets the NO_x and VOC motor vehicle emissions budgets (MVEB) for transportation conformity purposes for the milestone years 2008, 2011, 2014, 2017, and 2018. An MVEB is the on-road mobile source allocation of the total allowable emissions for each applicable criteria pollutant or precursor, as defined in the SIP. Transportation conformity determinations must be performed using the budget test once the EPA determines the budget adequate for transportation conformity purposes. To pass the budget test, areas must demonstrate that the estimated emissions from transportation plans, programs, and projects do not exceed the MVEB for the established year.

Because the HGB area has been reclassified as a severe nonattainment area for the 1997 eight-hour ozone NAAQS, the RFP milestone years adopted in the previous (May 23, 2007) HGB RFP SIP revision have been revised to reflect the area's extended attainment date. Chapter 5: *MOTOR VEHICLE EMISSIONS BUDGETS* documents the development of the revised RFP MVEB for each of these milestone years for the eight-county HGB ozone nonattainment area.

SECTION V: LEGAL AUTHORITY

A. General

The Texas Commission on Environmental Quality (TCEQ) has the legal authority to implement, maintain, and enforce the National Ambient Air Quality Standards (NAAQS) and to control the quality of the state's air, including maintaining adequate visibility.

The first air pollution control act, known as the Clean Air Act of Texas, was passed by the Texas Legislature in 1965. In 1967, the Clean Air Act of Texas was superseded by a more comprehensive statute, the Texas Clean Air Act (TCAA), found in Article 4477-5, Vernon's Texas Civil Statutes. The legislature amended the TCAA in 1969, 1971, 1973, 1979, 1985, 1987, 1989, 1991, 1993, 1995, 1997, 1999, 2001, 2003, 2005, 2007, and 2009. In 1989, the TCAA was codified as Chapter 382 of the Texas Health & Safety Code.

Originally, the TCAA stated that the Texas Air Control Board (TACB) is the state air pollution control agency and is principal authority in the state on matters relating to the quality of air resources. In 1991, the legislature abolished the TACB effective September 1, 1993, and its powers, duties, responsibilities, and functions were transferred to the Texas Natural Resource Conservation Commission (TNRCC). With the creation of the TNRCC, the authority over air quality is found in both the Texas Water Code and the TCAA. Specifically, the authority of the TNRCC is found in Chapters 5 and 7. Chapter 5, Subchapters A - F, H - J, and L, include the general provisions, organization, and general powers and duties of the TNRCC, and the responsibilities and authority of the executive director. This chapter also authorizes the TNRCC to implement action when emergency conditions arise, and to conduct hearings. Chapter 7 gives the TNRCC enforcement authority. In 2001, the 77th Texas Legislature continued the existence of the TNRCC until September 1, 2013, and changed the name of the TNRCC to the TCEQ. In 2009, the 81st Texas Legislature, during a special session, amended §5.014 of the Texas Water Code, changing the expiration date of the TCEQ to September 1, 2011, unless continued in existence by the Texas Sunset Act.

The TCAA specifically authorizes the TCEQ to establish the level of quality to be maintained in the state's air and to control the quality of the state's air by preparing and developing a general, comprehensive plan. The TCAA, Subchapters A - D, also authorize the TCEQ to collect information to enable the commission to develop an inventory of emissions; to conduct research and investigations; to enter property and examine records; to prescribe monitoring requirements; to institute enforcement proceedings; to enter into contracts and execute instruments; to formulate rules; to issue orders taking into consideration factors bearing upon health, welfare, social and economic factors, and practicability and reasonableness; to conduct hearings; to establish air quality control regions; to encourage cooperation with citizens' groups and other agencies and political subdivisions of the state as well as with industries and the federal government; and to establish and operate a system of permits for construction or modification of facilities.

Local government authority is found in Subchapter E of the TCAA. Local governments have the same power as the TCEQ to enter property and make inspections. They also may make recommendations to the commission concerning any action of the TCEQ that affects their territorial jurisdiction, may bring enforcement actions, and may execute cooperative agreements with the TCEQ or other local governments. In addition, a city or town may enact and enforce ordinances for the control and abatement of air pollution not inconsistent with the provisions of the TCAA and the rules or orders of the commission.

Subchapters G and H of the TCAA authorize the TCEQ to establish vehicle inspection and maintenance programs in certain areas of the state, consistent with the requirements of the Federal Clean Air Act; coordinate with federal, state, and local transportation planning agencies to develop and implement transportation programs and measures necessary to attain and maintain the NAAQS;

establish gasoline volatility and low emission diesel standards; and fund and authorize participating counties to implement vehicle repair assistance, retrofit, and accelerated vehicle retirement programs.

B. Applicable Law

The following statutes and rules provide necessary authority to adopt and implement the State Implementation Plan (SIP). The rules listed below have previously been submitted as part of the SIP.

Statutes

TEXAS HEALTH & SAFETY CODE, Chapter 382 September 1, 2009

TEXAS WATER CODE September 1, 2009

All sections of each subchapter are included, unless otherwise noted.

Chapter 5: Texas Natural Resource Conservation Commission
Subchapter A: General Provisions
Subchapter B: Organization of the Texas Natural Resource Conservation Commission
Subchapter C: Texas Natural Resource Conservation Commission
Subchapter D: General Powers and Duties of the Commission
Subchapter E: Administrative Provisions for Commission
Subchapter F: Executive Director (except §§5.225, 5.226, 5.227, 5.2275, 5.231, 5.232, and 5.236)
Subchapter H: Delegation of Hearings
Subchapter I: Judicial Review
Subchapter J: Consolidated Permit Processing
Subchapter L: Emergency and Temporary Orders (§§5.514, 5.5145 and 5.515 only)
Subchapter M: Environmental Permitting Procedures (§5.558 only)

Chapter 7: Enforcement
Subchapter A: General Provisions (§§7.001, 7.002, 7.00251, 7.0025, 7.004, 7.005 only)
Subchapter B: Corrective Action and Injunctive Relief (§7.032 only)
Subchapter C: Administrative Penalties
Subchapter D: Civil Penalties (except §7.109)
Subchapter E: Criminal Offenses and Penalties: §§ 7.177, 7.179-7.183

Rules

All of the following rules are found in Title 30 Texas Administrative Code, as of the following effective dates:

Chapter 7, Memoranda of Understanding, §§7.110 and 7.119 May 2, 2002

Chapter 19, Electronic Reporting March 1, 2007

Chapter 35, Subchapters A-C, K: Emergency and Temporary Orders and Permits; Temporary Suspension or Amendment of Permit Conditions July 20, 2006

Chapter 39, Public Notice, §§39.201; 39.401; 39.403(a) and (b)(8)-(10); 39.405(f)(1) and (g);39.409; 39.411 (a), (b)(1)-(6) and (8)-(10) and (c)(1)-(6) and (d); 39.413(9), (11), (12) and (14); 39.418(a) and (b)(3) and (4); 39.419(a), (b),(d) and (e); 39.420(a), (b) and (c)(3) and (4); 39.423 (a) and (b); 39.601; 39.602; 39.603; 39.604; and 39.605 March 29, 2006

Chapter 55: Requests for Reconsideration and Contested Case Hearings; Public Comment, §§55.1; 55.21(a) - (d), (e)(2), (3), and (12), (f) and (g); 55.101(a), (b), and (c)(6) - (8); 55.103; 55.150; 55.152(a)(1), (2), and (6) and (b); 55.154; 55.156; 55.200; 55.201(a) - (h); 55.203; 55.205; 55.209, and 55.211	March 29, 2006
Chapter 101: General Air Quality Rules	January 1, 2009
Chapter 106: Permits by Rule, Subchapter A	June 30, 2004
Chapter 111: Control of Air Pollution from Visible Emissions and Particulate Matter	July 19, 2006
Chapter 112: Control of Air Pollution from Sulfur Compounds	July 16, 1997
Chapter 113: Standards of Performance for Hazardous Air Pollutants and for Designated Facilities and Pollutants	May 14, 2009
Chapter 114: Control of Air Pollution from Motor Vehicles	June 26, 2008
Chapter 115: Control of Air Pollution from Volatile Organic Compounds	July 19, 2007
Chapter 116: Permits for New Construction or Modification	May 29, 2008
Chapter 117: Control of Air Pollution from Nitrogen Compounds	March 4, 2009
Chapter 118: Control of Air Pollution Episodes	March 5, 2000
Chapter 122, §122.122: Potential to Emit	December 11, 2002
Chapter 122, §122.215: Minor Permit Revisions	June 3, 2001
Chapter 122, §122.216: Applications for Minor Permit Revisions	June 3, 2001
Chapter 122, §122.217: Procedures for Minor Permit Revisions	December 11, 2002
Chapter 122, §122.218: Minor Permit Revision Procedures for Permit Revisions Involving the Use of Economic Incentives, Marketable Permits, and Emissions Trading	June 3, 2001

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 - 3. *Beaumont-Port Arthur* (No change)
 - 4. *El Paso* (No change)
 - 5. *Regional Strategies* (No change)
 - 6. *Northeast Texas* (No change)
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 - 8. *San Antonio Area* (No change)
- C. Particulate Matter (No change)
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- F. Oxides of Nitrogen (No change)
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- J. Mobile Sources Strategies (No change)
- K. Clean Air Interstate Rule (No change)
- L. Transport (No change)
- M. Regional Haze (No change)

LIST OF ACRONYMS

ABY	Adjusted Base Year
APU	Auxiliary Power Units
ATP	Anti-Tampering Programs
DERC	Discrete Emissions Reduction Credits
DFW	Dallas-Fort Worth
DV	Design Value
EBT	Emissions Banking and Trading
EDMS	Emissions and Dispersion Model System
EDMS	Environmental Data Management System
EGAS	Economic Growth Analysis System
EGUs	Electric Generating Units
EI	Emissions Inventory
EIQ	Emissions Inventory Questionnaires
EPA	United States Environmental Protection Agency
ERC	Emission Reduction Credits
ERG	Eastern Research Group, Inc.
ESAD	Emission Specifications for Attainment Demonstration
FAA	Federal Aviation Administration
FCAA	1990 Federal Clean Air Act Amendments
FMVCP	Federal Motor Vehicle Control Program
GSE	Ground Support Equipment
HAS	Houston Airport System
HDDV	Heavy-Duty Diesel Vehicles
HECT	Highly Reactive Volatile Organic Compounds Emissions Cap and Trade Program
HGB	Houston-Galveston-Brazoria
H-GAC	Houston-Galveston Area Council
HRVOC	Highly Reactive Volatile Organic Compounds
I/M	Inspection and Maintenance
MECT	Mass Emissions Cap and Trade Program
MSY	Milestone Year
MVEB	Motor Vehicle Emissions Budgets
NAAQS	National Ambient Air Quality Standards
NLEV	National Low Emission Vehicle
NO _x	Nitrogen Oxides
PFC	Portable Fuel Container
PN	Percent of NO _x
PV	Percent of VOC
REMI	Regional Economic Modeling, Inc.
RFG	Reformulated Gasoline
RFP	Reasonable Further Progress
ROP	Rate of Progress
RVP	Reid Vapor Pressure
SI	Spark Ignition
SIC	Standard Industrial Classification
SIP	State Implementation Plan
STARS	State of Texas Air Reporting System
TAC	Texas Administrative Code
TAF	Terminal Area Forecast
TCAA	Texas Clean Air Act
TCEQ	Texas Commission on Environmental Quality
TCM	Transportation Control Measures
TDM	Travel Demand Models

TexAER	Texas Air Emissions Repository
TexAQS 2000	Texas Air Quality Study 2000
TexN	Texas NONROAD Model
TIPI	Texas Industrial Production Index
TNRCC	Texas Natural Resource Conservation Commission
tpd	Tons Per Day
TxLED	Texas Low Emission Diesel
USC	United States Code
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds

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CHAPTER 1: GENERAL

1.1 HOUSTON-GALVESTON-BRAZORIA AREA REASONABLE FURTHER PROGRESS BACKGROUND

On April 30, 2004, nonattainment area designations were published as part of the first phase of the United States Environmental Protection Agency's (EPA) implementation rule for the 1997 eight-hour ozone standard (69 FR 23936). This notice defined the Houston-Galveston-Brazoria (HGB) nonattainment area as Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties. Based on the area's 1997 eight-hour ozone design value (DV), the area was classified as moderate nonattainment.

As part of the first phase of the EPA's implementation rule for the 1997 eight-hour ozone standard (69 FR 23951), the Texas Commission on Environmental Quality (TCEQ) was required to submit an attainment demonstration state implementation plan (SIP) revision for a moderate nonattainment area to the EPA by June 15, 2007. In addition to an attainment demonstration, a reasonable further progress (RFP) SIP revision that demonstrated a 15 percent reduction in anthropogenic ozone precursors, nitrogen oxides (NO_x) and volatile organic compounds (VOC), between 2002 and 2008 was also required to be submitted by the June 15, 2007, deadline. On May 23, 2007, the commission adopted the required RFP SIP revision, which was submitted to the EPA on June 13, 2007.

On June 15, 2007, the TCEQ submitted a letter from the Governor of Texas to the EPA requesting that the HGB area be reclassified from a moderate to a severe nonattainment area for the 1997 eight-hour ozone standard. The EPA granted the governor's request on September 18, 2008. The effective date of this reclassification was October 31, 2008. As a result of the reclassification, the EPA set April 15, 2010, as the deadline for the state to submit an attainment demonstration SIP revision for the HGB area that addresses the severe ozone nonattainment area requirements, including RFP. The HGB area's new attainment date for the 1997 ozone standard is as expeditiously as practicable, but no later than June 15, 2019.

"The History of the Texas State Implementation Plan (SIP)," a comprehensive overview of the SIP revisions submitted to the EPA by the State of Texas is available at the following Web site: <http://www.tceq.state.tx.us/implementation/air/sip/sipintro.html#History>.

1.2 REASONABLE FURTHER PROGRESS REQUIREMENTS

The 1990 Federal Clean Air Act Amendments (FCAA), 42 United States Code (USC) §7410, require states to submit SIP revisions that contain enforceable measures to achieve the National Ambient Air Quality Standards (NAAQS). The FCAA also requires states with nonattainment areas classified as moderate or above to submit plans showing reasonable further progress toward attainment of the ozone standard. This RFP SIP revision is neither required for, nor intended to, demonstrate attainment of the ozone NAAQS but rather to demonstrate that ozone precursor emissions will be reduced by 18 percent between 2002 and 2008, 9 percent between 2009 and 2011, 9 percent between 2012 and 2014, 9 percent between 2015 and 2017, 3 percent in 2018, and 3 percent in 2019 for contingency purposes.

In addition to the RFP analyses, this SIP revision provides updated RFP on-road mobile vehicle emissions budgets (MVEB) and updated 2002 emissions inventories for point, area, on-road mobile, and non-road mobile sources. This SIP revision also includes existing contingency measure requirements to be implemented if the area fails to achieve the RFP milestones.

A summary of how this plan meets RFP requirements can be found in Appendix 1: *HGB Reasonable Further Progress Demonstration Calculations Spreadsheet*.

1.3 PUBLIC HEARING AND COMMENT INFORMATION

The commission held public hearings at the times and locations listed below.

CITY	DATE	TIME	LOCATION
Houston	October 28, 2009	2:00 P.M.	Houston-Galveston Area Council 3555 Timmons Lane Houston, TX 77027 Conference Room A
Houston	October 28, 2009	6:00 P.M.	Houston-Galveston Area Council 3555 Timmons Lane Houston, TX 77027 Conference Room A
Austin	October 29, 2009	3:00 P.M.	TCEQ 12100 Park 35 Circle Austin, TX 78753 Building E, Room 201S

Question and answer sessions were held 30 minutes prior to the hearings. Neither the October 28, 2009, hearing scheduled for 6:00 p.m. nor the October 29, 2009, hearing was officially opened because no party indicated a desire to provide comment. The public comment period opened on October 9, 2009, and closed on November 9, 2009. Written comments were accepted via mail, fax, and through the eComments system. There were five comments. Summaries of public comments and TCEQ responses are included as part of this SIP revision.

1.4 SOCIAL AND ECONOMIC CONSIDERATIONS

Because no new control strategies are associated with this SIP revision, there are no changes that would require an analysis of social and economic considerations.

1.5 FISCAL AND MANPOWER RESOURCES

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

CHAPTER 2: EMISSIONS INVENTORIES

2.1 INTRODUCTION

The 1990 Federal Clean Air Act Amendments (FCAA) require that reasonable further progress (RFP) emissions inventories (EI) be prepared for ozone nonattainment areas. Ozone is photochemically produced in the atmosphere when volatile organic compounds (VOC) are mixed with nitrogen oxides (NO_x) in the presence of sunlight. The Texas Commission on Environmental Quality (TCEQ) maintains an EI of up-to-date information on NO_x and VOC sources. The EI identifies the types of emissions sources 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 inventory provides data for a variety of air quality planning tasks, including establishing baseline emission levels, calculating reduction targets, developing control strategies to achieve the emissions reductions, developing emission inputs for air quality models, and tracking actual emission reductions against established emissions growth and control budgets. The total inventory of VOC and NO_x emissions for an area is summarized from the estimates developed for the five general categories of emission sources: point, area, non-road mobile, on-road mobile, and biogenic.

The TCEQ submitted a Houston-Galveston-Brazoria (HGB) RFP SIP revision to the United States Environmental Protection Agency (EPA) in 2007 for a moderate nonattainment area. On October 31, 2008, the HGB area was reclassified as a severe nonattainment area for the 1997 eight-hour ozone NAAQS. States are required by §172(e) of the FCAA to demonstrate an average of 3 percent annual reductions of VOC and/or NO_x emissions the first six years after the baseline year (2002) and every subsequent three year period, out to a severe area's attainment date. In accordance with this requirement, this SIP revision includes anthropogenic EI from the 2002 base year as well as projected anthropogenic EI for the milestone years 2008, 2011, 2014, 2017, and 2018 to provide a basis for demonstrating how the required emissions reductions will be met.

2.1.1 Updated Uncontrolled Milestone Year Inventories

The uncontrolled milestone year EIs represent the inventory for the milestone year if no further action to control emissions is taken beyond the controls already accounted for in the 2002 base year inventory. Inventories are first calculated for each source category using EPA-approved methodologies and then combined to obtain the total uncontrolled milestone year inventory for VOC and NO_x. The uncontrolled milestone inventories include pre-2002 FCAA controls and growth in activity from 2002 to the milestone years, but do not include post-2002 FCAA controls.

2.1.2 Updated Controlled Milestone Year Inventories

The controlled milestone year EIs represent the inventory for the milestone year with growth from the 2002 base year and with all RFP controls taken into account. Inventories are first calculated for each major source category using EPA-approved methodologies and then combined to obtain the total controlled milestone year inventories for VOC and NO_x. The controlled milestone year inventories include pre-2002 FCAA controls, growth in activity from 1990 to the milestone year, and post-2002 FCAA controls used to meet the RFP target emissions level, but it does not include post-2002 FCAA controls that are not used to meet the RFP target emissions level.

2.2 POINT SOURCES

2.2.1 Emissions Inventory Development

Stationary point source emissions data are collected annually from sites that meet the reporting requirements of 30 Texas Administrative Code (TAC) §101.10. To collect the data, the TCEQ mails emissions inventory questionnaires (EIQ) to all sites identified as meeting the reporting requirements. Companies are required to report emissions data and to provide samples of calculations used to determine the emissions. Information characterizing the process equipment, the abatement units, and the emission points is also required. All data submitted in the EIQ are reviewed for quality assurance purposes and then stored in the State of Texas Air Reporting System (STARS) database.

2.2.2 Updated 2002 Base Year Inventory

The 2002 base year inventory data were extracted from STARS on February 4, 2009. The extracted data contained ozone season daily emissions of NO_x and VOC from each site in the HGB area that submitted an EIQ for 2002 and reflected revisions made on or before the extract date. County-level reported VOC emissions were adjusted to account for unreported VOC emissions discovered in the Texas Air Quality Study 2000 (TexAQS 2000).

2.2.3 Updated Uncontrolled Milestone Year Inventories

The uncontrolled milestone year inventories were developed from the 2002 inventory was projected using the following approaches: applying projection factors to 2002 emissions, refining the VOC emission estimates to reflect unreported emissions, and adding emissions credits.

First, emissions were projected by applying growth factors to the 2002 actual emissions. The Economic Growth Analysis System (EGAS) 5.0 was used to derive growth factors from the following data sets: the Regional Economic Modeling, Inc., (REMI) 5.5 factor set at the county-wide level for Texas; the REMI 6.0 factor set at the state-wide level; and the Moody's Economy, Inc., factor set at the county-wide level for Texas. Growth factors were compared to actual growth in emissions from 2002 to 2005 for each contaminant and each industrial category at the county level, and the factors that most closely corresponded to historical growth were selected.

County-level reported VOC emissions were then revised to account for unreported VOC emissions discovered in the TexAQS 2000. Based on TexAQS 2000 measurements ambient VOC concentrations in the Houston Ship Channel were determined to be several times greater than the estimates reported in the TCEQ's emissions inventories.

Finally, the inventories were adjusted to account for emissions credits. Emissions credits are emissions reductions that may return to the air shed in the future. To account for the possible use of these banked NO_x and VOC emissions, unused emissions reduction credits (ERCs) and discrete emissions reduction credits (DERCs) as of October 2008, were applied to the inventory.

2.2.4 Updated Controlled Milestone Year Inventories

The controlled milestone year inventories were developed from the 2005 inventory using the following approaches: applying projection factors to 2005 emissions, applying Emissions Banking and Trading program allocations, applying rules that limit emissions from tank landings, refining VOC emission estimates to reflect unreported emissions, and adding emissions credits. The 2005 inventory was designated as the baseline year for controlled projections because it was the most recent National Emissions Inventory year available. The 2005 inventory was extracted from STARS on February 4, 2009. The extracted data were reported ozone season daily emissions of NO_x and VOC from each site in the HGB area that submitted a 2005 EIQ and reflected revisions made on or before the extract date.

Industrial source NO_x controls are reflected in the Mass Emissions Cap and Trade program (MECT) 2008 NO_x cap. The MECT NO_x emissions allocations account for NO_x controls, including controls applied to electric generating units (EGU) and large stationary engines as defined by 30 TAC Chapter 117, Subchapters C: *Combustion Control at Major Utility Electric Generation Sources in Ozone Nonattainment Areas* and D: *Combustion Control at Minor Sources in Ozone Nonattainment Areas*. The controlled milestone year NO_x inventories were developed by applying projection factors to baseline year emissions and then applying the unit-specific allocations from the MECT for regulated sources. Emissions were then added to account for unused NO_x emissions credits.

The VOC controls are reflected in the highly reactive volatile organic compounds emissions cap and trade program (HECT) and 30 TAC Chapter 115 changes that limit tank landings. The HECT cap is an annual cap on sitewide highly reactive volatile organic compounds (HRVOC) emissions from

equipment that are subject to the HRVOC control requirements of 30 TAC Chapter 115, Subchapter H, Division 1: *Vent Gas Control* or Division 2: *Cooling Tower Heat Exchange Systems* for applicable sites listed in the cap. Other 30 TAC Chapter 115 changes limit convenience landings unless an abatement device is used to control the VOC emissions or landing loss emissions are authorized under an emission limit or cap in a permit issued under 30 TAC Chapter 116. The controlled milestone year VOC inventories were developed by applying projection factors to baseline year emissions and then applying the HECT allocations to HRVOC emissions from applicable units at regulated sites. Reductions were then applied for 30 TAC Chapter 115, Subchapter B, Division 1: *Storage of Volatile Organic Compounds*. County-level VOC emissions were then adjusted to account for unused credits and unreported VOC emissions determined from ambient monitoring data.

A summary of the point source RFP inventories is presented in Table 2-1: *HGB Eight-County RFP Point Source NO_x Emissions* and Table 2-2: *HGB Eight-County RFP Point Source VOC Emissions*.

Table 2-1: HGB Eight-County RFP Point Source NO_x Emissions

RFP Analysis Year	NO _x (tons per day)	
	Uncontrolled	Controlled
2002	339.29	339.29
2008	375.56	155.73
2011	383.85	156.21
2014	401.05	157.17
2017	421.57	158.33
2018	428.69	158.75

Table 2-2: HGB Eight-County RFP Point Source VOC Emissions

RFP Analysis Year	VOC (tons per day)	
	Uncontrolled	Controlled
2002	316.62	316.62
2008	333.14	170.05
2011	338.75	164.33
2014	347.70	172.31
2017	358.79	181.86
2018	362.90	185.38

For more details on the point source projection method, please refer to Appendix 2: *Development of Reasonable Further Progress Point Source Inventories*.

2.3 AREA SOURCES

2.3.1 Emissions Inventory Development

Area sources are commercial, small-scale industrial, and residential sources that use materials or perform processes that generate emissions. Area sources are too small to meet the emissions reporting criteria for major point sources, so emissions are calculated as county-wide totals rather than as individual facilities. Area sources can be divided into two groups characterized by the emission mechanism: hydrocarbon evaporative emissions and fuel combustion emissions. Examples of evaporative sources include printing operations, industrial coatings, degreasing solvents, house paints, leaking underground storage tanks, gasoline service station underground tank filling, and vehicle refueling operations. Fuel combustion sources include oil and gas production sources, stationary source fossil fuel combustion at residences and businesses, outdoor refuse burning,

structural fires, and wildfires. With some exceptions, these emissions may be calculated by multiplying an established emission factor (emissions per unit of activity) by the appropriate activity or activity surrogate responsible for generating emissions. Population is the most commonly used activity surrogate for many area sources. Other activity data include the amount of gasoline sold in an area, employment by industry type, and acres of cropland.

2.3.2 Updated 2002 Base Year Inventory

The 2002 base year EI was developed in 2003. Because the TCEQ was required to submit this inventory to the EPA as the Periodic Emissions Inventory, considerable effort went into its development. Since that time, there have been additional updates to the 2002 area source EI. Improvements resulted from bottom-up surveys for some categories, such as gasoline stations. Surveys produce data that more accurately depict facility activity levels than do top-down methodologies that usually rely on default surrogates such as county populations and numbers of employees associated with appropriate EPA emission factors. Activity data for other categories were available from various sources. The Energy Information Administration maintains state level fuel use data for the residential, industrial, and commercial sectors for fuels ranging from coal to natural gas. This data is useful in calculating emissions from home cooking, water heating, and similar use at the industrial and commercial levels. Actual oil and gas production data are available from the Railroad Commission of Texas, which were used in these updated 2002 inventories. State and local governments also provided data on asphalt usage in road paving projects. The EPA's Emissions Inventory Improvement Program produced approved methodologies for several area source categories. The latest version of the EPA's growth factor system, EGAS 5.0, was used to grow emissions from the 1999 area source emissions inventory for some sources.

2.3.3 Updated Uncontrolled Milestone Year Inventories

For most area source categories, the 2002 base year EI was projected to 2008, 2011, 2014, 2017, and 2018 using improved growth factors. A contractor project developed a complete set of updated EGAS growth factors using REMI and other economic data.¹ For a few categories, census populations were used to project the future emissions.

2.3.4 Updated Controlled Milestone Year Inventories

The controlled 2008, 2011, 2014, 2017, and 2018 inventories were developed by first projecting the 2002 base year inventory to specific years and then applying controls. The only rule affecting area sources in the HGB area that came into effect after 2002 is the federal portable fuel container (PFC) rule (72 FR 8428, published February 26, 2007). Controlled emissions based on the federal PFC rule do not take effect until 2010, so there were no emissions reductions from the federal rule in the 2008 inventories (i.e., no emissions reductions credits were taken in 2008 for PFC). Many rules concerning industrial coatings and gasoline station underground tank filling (Stage I) and vehicle refueling (Stage II) were accounted for in the base year numbers.

A summary of the area source RFP inventories is presented in Table 2-3: *HGB Eight-County RFP Area Source NO_x Emissions*, and Table 2-4: *HGB Eight-County RFP Area Source VOC Emissions*. Please note that there is no difference between the uncontrolled and controlled NO_x emissions for the base and all milestone years and the VOC emissions for the base year and 2008 because there were no controls applied to the projected area source inventories.

¹ Eastern Research Group, Inc., "Development of County Level Growth Factors from 1990 through 2020," TCEQ Contract No. 582-04-65564, Work Order No. 65564-05-18, August 2005.

Table 2-3: HGB Eight-County RFP Area Source NO_x Emissions

RFP Analysis Year	NO _x (tons per day)	
	Uncontrolled	Controlled
2002	89.11	89.11
2008	89.63	89.63
2011	93.90	93.90
2014	96.01	96.01
2017	98.23	98.23
2018	99.38	99.38

Table 2-4: HGB Eight-County RFP Area Source VOC Emissions

RFP Analysis Year	VOC (tons per day)	
	Uncontrolled	Controlled
2002	407.61	407.61
2008	371.82	371.82
2011	382.72	379.04
2014	393.07	383.42
2017	404.84	394.74
2018	408.82	398.57

For more details on the area source projection method, please refer to Appendix 3: *Development of Reasonable Further Progress Area Source Inventories*.

2.4 NON-ROAD MOBILE SOURCES

2.4.1 Emissions Inventory Development

Non-road sources include vehicles, engines, and equipment used for construction, agriculture, transportation, recreation, and many other purposes. Non-road vehicles are also referred to as "off-road" or "off-highway" vehicles since they do not normally operate on roads or highways. This broad category is comprised of a diverse collection of machines, many of which are powered by diesel engines. Non-road emissions sources include, but are not limited to: agricultural equipment; commercial and industrial equipment; construction and mining equipment; lawn and garden equipment; aircraft and airport equipment; locomotives; and commercial marine vessels and equipment.

A Texas specific version of the EPA's NONROAD 2005 model, called the Texas NONROAD (TexN) model, was used to calculate emissions from all non-road mobile equipment and recreational vehicles except aircraft, locomotives, commercial marine, and oilfield drilling rigs. The TexN model does not include commercial marine vessel, locomotive, or airport emissions. Emissions for these three source categories are estimated using other EPA methods and guidance documents. However, support equipment for aircraft, locomotive, and commercial marine operations and facilities are included in the NONROAD model. Although oilfield drilling rigs are included in the NONROAD model, emissions from this category were developed separately to provide more accurate inventories.² For this reason, equipment populations for oilfield drilling rigs were set to zero in the TexN model.

² Eastern Research Group, Inc., "Emissions from Oil and Gas Production Facilities," TCEQ Contract No. 582-07-84003-01, August 31, 2007.

2.4.1.1 TexN Model Source Categories Emissions Estimation Methodology

Emissions for all non-road mobile categories except aircraft, locomotives, and commercial marine vessels were calculated using the TexN model. Modeling emissions from the non-road sector is especially challenging because of difficulties in determining in-use population, activity, load, and emission rates. Although operating the EPA's model with all of the default surrogates is acceptable, the EPA encourages states to update the model with local, county-level data based on surveys and other relevant information. In order to facilitate the development of non-road emissions inventories with locality specific inputs, TexN was developed to estimate emissions from all sources included in the EPA's NONROAD model for Texas. The TexN model is a software tool for developing emissions estimates for non-road mobile sources in Texas using county specific activity data. The model allows air quality planners to replace EPA's default data with local bottom-up data. Local, county-level data is incorporated into the TexN model as it becomes available to the TCEQ. Several emission inventory studies have been conducted in Texas in recent years to improve upon the default data available in the EPA's NONROAD 2005 model. These studies have focused on various equipment categories operating in different areas of the state, including diesel construction equipments, liquid propane gas powered forklifts, transportation refrigeration units, commercial lawn and garden, and recreational marine vessels. A detailed listing of the non-road equipment studies and surveys conducted in Texas and documentation of procedures used in developing the non-road RFP emissions inventories can be found in Appendix 4: *Development of Reasonable Further Progress Non-Road Mobile Source Emissions Inventories for Source Categories in the EPA's NONROAD 2005 Model*.

2.4.1.2 Airport Emissions Estimation Methodology

Emissions from airport activities in the HGB area were estimated for Ellington Field, George Bush Intercontinental Airport, and William P. Hobby Airport. Emissions were calculated using the Federal Aviation Administration (FAA) Emissions and Dispersion Modeling System (EDMS), version 5.1. The airport emissions categories considered for this RFP analysis were aircraft (commercial air carriers, air taxis, general aviation, and military), auxiliary power units (APU), and ground support equipment (GSE) operations. The 2005 through 2018 aircraft, APU, and GSE (George Bush Intercontinental and Hobby Airports) emissions were obtained from the Houston Airport System (HAS) emissions inventory, which was submitted to the TCEQ on January 9, 2009, by Jacobs Consultancy. GSE emissions from Continental Airlines was prepared by Landrum and Brown, Inc., and submitted to the TCEQ, January 21, 2009, and GSE emissions from Southwest Airlines were prepared using EDMS version 5.02. Since there were no emissions inventory data available for 2008, the 2008 emissions were estimated using an interpolation method between the years 2005 and 2011. The documentation of procedures used in developing the airport emissions inventories can be found in Appendix 5: *Development of RFP Non-Road Mobile Source Emissions Inventories for Airports*.

2.4.1.3 Locomotive Emissions Estimation Methodology

Emissions for locomotive activities were obtained from the Texas Air Emissions Repository (TexAER) database. Controlled estimated emissions for calendar years 2008, 2011, 2014, 2017, and 2018 were determined from data extrapolated from the Tier-Specific Locomotive Engine Update, August 31, 2007, conducted for the TCEQ by Eastern Research Group, Inc., (ERG) and contained in TexAER. The study was developed to ascertain emissions activity in the Dallas-Fort Worth area, the Houston-Galveston-Brazoria area, and Texas. The growth rate was developed using reports from railway companies and regulatory controls data.

Uncontrolled estimated emissions for calendar years 2008, 2011, 2014, 2017, and 2018 were developed and extrapolated using emissions trends data from the 1997 EPA *Technical Highlights* document.³ In this document, Tier I and II emission standards for manufactured and remanufactured

³ United States Environmental Protection Agency, "Emission Factors for Locomotives," Technical Highlights, EPA-420-F-97-051, December 1997.

diesel-powered locomotives and locomotive engines were established. The documentation of procedures used in developing the locomotive emissions inventories can be found in Appendix 6: *Development of RFP Non-Road Mobile Source Emissions Inventories for Locomotives*.

2.4.1.4 Commercial Marine Emissions Estimation Methodology

Commercial marine activities were obtained from the 2000 and 2007 emissions projections provided to TCEQ via contract with Starcrest and ERG.^{4,5} Emission growth factors provided by ERG were considered in obtaining 2008, 2011, 2014, 2017, and 2018 emission estimates.⁶ The documentation of procedures used in developing the commercial marine emissions inventories can be found in Appendix 7: *Development of RFP Non-Road Mobile Source Emissions Inventories for Commercial Marine Vessels*.

2.4.1.5 Drilling Rigs Diesel Engines Emissions Estimation Methodology

Oilfield drilling rig diesel engines are included in the NONROAD model category “Other Oilfield Equipment” which includes various types of equipment. Due to the significant growth in the oil and gas exploration and production industry, the emissions inventory for diesel drilling rigs was included in a contract with ERG.⁷ Emission trends were developed using oil and gas production data trends for 2008, 2011, 2014, 2017, and 2018 emission estimates. The documentation of procedures used in developing the drilling rig emissions inventories can be found in Appendix 8: *Development of RFP Non-Road Mobile Source Emissions Inventories for Drilling Rigs*.

2.4.2 Updated 2002 Base Year Inventory

Since the 2002 base year EI was originally developed in 2003, input data in the NONROAD model were updated using the results of several contracted projects. Since the TexN model incorporated all of the recently updated input data, revised 2002 non-road EI for the NONROAD model categories were developed using the TexN model. The 2002 aircraft and GSE as well as locomotive emissions were obtained from the TexAER database. The 2002 base year EI for commercial marine vessels was obtained from the 2000 and 2007 emissions projections provided to TCEQ via contract with Starcrest and ERG (see footnotes 4 and 5). The 2002 base year EI for drilling rigs was developed from data provided by ERG (see footnote 7).

2.4.3 Updated Uncontrolled Milestone Year Inventories

The uncontrolled emissions per analysis year (2002, 2008, 2011, 2014, 2017, and 2018) were calculated by adding the controlled emissions for that year with the sum of all of the individual controls used to demonstrate RFP for that year. The locomotive uncontrolled emission inventories were obtained from the EPA’s December 1997 Emission Factors for Locomotives document. Emissions for commercial marine vessels were developed from two surveys of vessel types and activities in the Port of Houston and surrounding ports. The Railroad Commission of Texas provided actual annual oil and gas production data for each county, from which diesel drilling rig emissions trends were developed.

2.4.4 Updated Controlled Milestone Year Inventories

The effects of federal and state control programs were evaluated. The TexN model was executed for ozone season daily emission for years 2002, 2008, 2011, 2014, 2017, 2018, and 2019. To evaluate

⁴ Starcrest Consulting Group, LLC, “2007 Goods Movement Air Emissions Inventory at the Port of Houston,” provided by the Port of Houston Authority, January 2009.

⁵ Eastern Research Group, Inc., “Development of Emission Estimates for Offshore Non-road Mobile Sources in Texas State Waters,” TCEQ Contract No. 582-04-65564, Work Order No. 65564-05-13, August 31, 2005.

⁶ ERG, “Commercial Marine Vessel, Locomotive, and Aircraft Growth Factors,” TCEQ Contract No. 582-07-84003-02, August 31, 2007.

⁷ ERG, “Emissions from Oil and Gas Production Facilities,” TCEQ Contract No. 582-07-84003-01, August 31, 2007.

individual control measure emission reductions for the RFP requirements, a series of TexN model runs were executed for both controlled and uncontrolled scenarios for each federal and state control program. Airport emissions were projected for future years 2008, 2011, 2014, 2017, and 2018 using the growth factors from the Terminal Area Forecast (TAF) summary for fiscal year 2008 – 2025.⁸ Locomotive controlled emission estimates were developed from the TexAER data extrapolated from data obtained through a contract conducted for the TCEQ by ERG and contained in TexAER.⁹ The growth rate was developed using reports from railway companies and regulatory controls data. The controlled emission inventories for commercial marine vessels were developed from two surveys of vessel types and activities in the Port of Houston and surrounding ports (see footnotes 4 and 5). Based on 2002 data from the Railroad Commission of Texas, diesel-drilling rig emissions trends were developed for 2008, 2011, 2014, 2017, and 2018. No controlled emissions reductions apply to drilling rigs.

Summaries of all the non-road mobile source RFP inventories are presented in Table 2-5: *HGB Eight-County RFP Non-Road Mobile Source NO_x Emissions (Tons/Day)* and Table 2-6: *HGB Eight-County RFP Non-Road Mobile Source VOC Emissions (Tons/Day)*. Because there are no controls applied to airport and drilling rigs, these columns display only uncontrolled emissions.

Table 2-5: HGB Eight-County RFP Non-Road Mobile Source NO_x Emissions (Tons/Day)

RFP Analysis Year	NONROAD Model Categories		Locomotive		Commercial Marine		Airport	Drilling Rig
	Uncontrolled	Controlled	Uncontrolled	Controlled	Uncontrolled	Controlled	Uncontrolled	
2002	88.63	79.01	34.58	34.58	28.01	27.63	6.35	9.41
2008	105.39	65.80	49.6	37.86	30.97	29.01	9.90	6.86
2011	111.18	54.97	49.17	36.42	32.45	29.22	10.43	6.79
2014	117.09	43.88	51.19	37.10	33.93	29.20	11.53	6.74
2017	124.33	35.94	52.42	37.18	35.41	29.20	12.12	6.71
2018	128.14	33.68	54.23	38.19	35.90	29.00	12.32	6.69

Table 2-6: HGB Eight-County RFP Non-Road Mobile Source VOC Emissions (Tons/Day)

RFP Analysis Year	NONROAD Model Categories		Locomotive		Commercial Marine		Airport	Drilling Rig
	Uncontrolled	Controlled	Uncontrolled	Controlled	Uncontrolled	Controlled	Uncontrolled	
2002	96.70	79.05	2.28	2.28	1.08	1.06	1.68	0.25
2008	109.00	63.01	2.56	2.29	1.20	1.12	2.62	0.18
2011	115.34	57.76	2.59	2.25	1.25	1.13	2.71	0.18
2014	121.33	55.02	2.71	2.28	1.31	1.13	2.81	0.18
2017	126.24	53.78	2.85	2.32	1.37	1.13	2.64	0.18
2018	129.34	53.58	2.94	2.35	1.39	1.13	2.60	0.18

⁸ United States Department of Transportation, Federal Aviation Administration, “Terminal Area Forecast Summary, Fiscal Years 2008-2025,” FAA-APO-06-1, January 2009.

⁹ Eastern Research Group, Inc., “Tier-Specific Locomotive Engine Updated,” TCEQ Contract No. 582-07-84003-04, August 31, 2007.

2.5 ON-ROAD MOBILE SOURCES

2.5.1 Emissions Inventory Development

On-road mobile emissions sources consist of automobiles, trucks, motorcycles, and other motor vehicles traveling on public roadways. On-road mobile source emissions are usually categorized as either combustion-related emissions or evaporative hydrocarbon emissions. 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. To calculate emissions, both the rate of emissions per unit of activity (emission factors) and the number of units of activity must be determined.

Emission factors are developed using EPA's mobile emission factor model MOBILE. The model may be run using national default information or input may be provided to modify the model calculations to simulate the driving behavior, meteorological conditions, and vehicle characteristics specific to the HGB area. Because inputs influence the emission factors calculated by the MOBILE model, every effort is made to input parameters reflecting local conditions, rather than national default values. The localized inputs used for the HGB RFP on-road mobile EI development include vehicle speeds for each roadway link, temperature, humidity, vehicle age distributions for each vehicle type, percentage of miles traveled for each vehicle type, type of inspection-maintenance program, fuel control programs, and gasoline vapor pressure controls.

To estimate on-road mobile emissions, emission factors calculated by the MOBILE model described above must be multiplied by the level of vehicle activity. On-road mobile source emission factors are expressed in units of grams per mile. Therefore, the activity information that is required to complete the inventory calculation is vehicle miles traveled (VMT) in units of miles per day. The level of vehicle travel activity is developed using travel demand models (TDM) run by the Texas Department of Transportation or the local metropolitan planning organizations. TDM are validated against a large number of ground counts, i.e., traffic passing over counters placed in various locations throughout a county or area. VMT estimates are often calibrated against outputs from the federal Highway Performance Monitoring System, a federal model built from a different set of traffic counters.

In addition to the number of miles traveled on each roadway link, the speed on each roadway type or segment is also needed to complete an on-road emissions inventory. Roadway speeds, required inputs for the MOBILE model, are calculated by using the activity volumes from the TDM and a post-processor speed model.

In order to perform the RFP calculations, a state must determine the base inventory from which the calculations begin, the amount of reductions achieved from controls that were implemented prior to the FCAA and therefore not creditable toward FCAA RFP requirements, the uncontrolled milestone year inventory, and the emission reduction controls to demonstrate that RFP is met for each milestone year. To determine all of the information required for RFP calculations, a set of on-road mobile source inventories and control measure reduction estimates are required to complete the RFP calculations.

- The 2002 base year is the starting point for the 1997 eight-hour ozone RFP demonstration. This starting point establishes the inventory as it existed in 2002, the RFP base year established by the EPA for areas designated as nonattainment for the 1997 eight-hour ozone standard.

- The adjusted base year (ABY) inventories are the basis for calculating the percent reductions, as required in the RFP guidance, and as a basis for determining the non-creditable reductions due to control programs implemented prior to the FCAA.¹⁰ Because the ABY inventory adjusts the 2002 base year inventory for the fleet turnover effects of the pre-1990 Federal Motor Vehicle Control Program (FMVCP) and the 1992 Reid Vapor Pressure (RVP) control, only the emission rates are different than the 2002 base year. Speed and VMT activity levels for both the 2002 base year and ABY inventories are consistent with both the TDM output for the 2002 roadway network and demographic demands.
- An on-road mobile ABY inventory is required for each milestone year and for any year for which a percent reduction requirement calculation must be completed. The ABY inventory is used to determine the level of non-creditable reductions for each RFP milestone year.
- The RFP analysis also requires an uncontrolled inventory with growth between the base year and the milestone year. These uncontrolled inventories serve as the basis for determining how much emissions reduction is required to meet the RFP target.
- The RFP analysis requires the calculation of a controlled inventory to subtract from the uncontrolled inventory to determine the effectiveness of control strategies. RFP requires direct calculation of the emission reductions from control strategies that are then subtracted from the uncontrolled emissions to determine the controlled inventory value. Both the total from on-road mobile control strategies and the emission reductions from each individual control strategy are calculated.

A summary of the on-road mobile source vehicle miles traveled used to develop the various NO_x and VOC emissions levels in subsequent tables is presented in Table 2-7: *HGB Eight-County RFP Ozone Season Weekday On-Road Mobile Source VMT*, Table 2-8: *HGB Eight-County RFP Ozone Season Weekday On-Road Mobile Source NO_x Emissions*, and Table 2-9: *HGB Eight-County RFP Ozone Season Weekday On-Road Mobile Source VOC Emissions*. For complete documentation of the development of the on-road mobile source inventories for the HGB RFP demonstration, refer to Appendix 9: *Houston-Galveston-Brazoria 1997 Eight-Hour Ozone Nonattainment Area Reasonable Further Progress On-Road Mobile Source Emissions Inventories*. The complete set of input and output files are available upon request from the TCEQ’s Air Quality Division.

Table 2-7: HGB Eight-County RFP Ozone Season Weekday On-Road Mobile Source VMT

RFP Analysis Year	Inventory Scenario (vehicle miles traveled per day)		
	Adjusted Base Year	Uncontrolled	Controlled
2002	135,716,461	135,716,461	135,716,461
2008	135,716,461	146,039,120	146,039,120
2011	135,716,461	154,332,688	154,332,688
2014	135,716,461	168,390,202	168,390,202
2017	135,716,461	180,067,224	180,067,224
2018	135,716,461	184,010,300	184,010,300

¹⁰ United States Environmental Protection Agency, “Final Rule to Implement the 8-Hour Ozone National Ambient Air Quality Standard; Final Rule,” *Federal Register* (70 FR 71631), November 29, 2005.

Table 2-8: HGB Eight-County RFP Ozone Season Weekday On-Road Mobile Source NOx Emissions

RFP Analysis Year	Inventory Scenario (tons per day)		
	Adjusted Base Year	Uncontrolled	Controlled
2002	387.09	387.09	326.72
2008	346.01	363.05	175.80
2011	335.20	372.46	123.41
2014	334.08	407.05	86.61
2017	333.24	432.04	61.78
2018	333.17	443.70	55.39

Table 2-9: HGB Eight-County RFP Ozone Season Weekday On-Road Mobile Source VOC Emissions

RFP Analysis Year	Inventory Scenario (tons per day)		
	Adjusted Base Year	Uncontrolled	Controlled
2002	189.08	189.08	132.64
2008	185.46	194.89	86.15
2011	184.23	205.03	68.35
2014	183.60	222.41	56.21
2017	183.50	237.86	48.39
2018	183.46	242.84	46.68

2.5.2 Updated 2002 Base Year Inventory

The 2002 base year EI for on-road mobile sources was updated using emission factors calculated using the latest version of the MOBILE model, MOBILE6.2.03. Additional updates were made to incorporate the latest activity estimates from the HGB travel demand model 2002 network. Only control strategies implemented prior to 2002 were included in the input to the inventory development for the 2002 on-road mobile source base year inventory. These controls include: pre-1990 FMVCP, fleet turnover to Tier 1 FMVCP, reformulated gasoline, and the HGB vehicle inspection and maintenance (I/M) program. The activity levels used to calculate the inventory reflect the 2002 roadway network with 2002 VMT and speeds. A summary of the inventory is presented in Table 2-10: *Summary of HGB Non-Creditable Reductions, Ozone Season Weekday On-Road Mobile Source VMT, and Emissions*. For complete documentation of the development of the inventory and details on MOBILE model inputs, refer to Appendix 9: *Houston-Galveston-Brazoria 1997 Eight-Hour Ozone Nonattainment Area Reasonable Further Progress On-Road Mobile Source Emissions Inventories*.

2.5.3 Updated 2002 Adjusted Base Year Inventories for the Base and Milestone Years

The RFP planning process includes calculating the adjusted base year EI, from which required percent emission reductions are calculated. As specified by the FCAA, certain on-road mobile source emissions reductions are not creditable toward these required percentage reductions. The non-creditable reductions include reductions from controls that were promulgated prior to the 1990 FCAA. The two rules that are non-creditable for this HGB 1997 eight-hour ozone RFP SIP revision are pre-1990 FMVCP and pre-1990 promulgated federal fuel volatility regulations (summertime gasoline RVP limits beginning in 1992). Because the defeat device for heavy-duty diesel vehicles (HDDV) was affecting a FMVCP that was implemented prior to the 1990 FCAA, the HDDV NO_x off-cycle emissions effects and associated mitigation program effects are also considered non-

creditable. For this HGB RFP demonstration, pre-1990 non-creditable emission reductions include pre-1990 FCAA FMVCP, 1992 summertime RVP limits, and HDDV NO_x off-cycle emissions and mitigation programs.

An adjusted base year EI for on-road mobile sources is developed for each milestone year using emissions factors from the MOBILE model, which reflect only control strategies implemented prior to 1990. By projecting the pre-1990 FMVCP into future years, the effects of additional fleet turnover benefit due to the new standards is reflected in the emission factors. The controls included in the ABY inventory development include pre-1990 FCAA FMVCP and the 1992 summertime RVP control. The activity levels used to calculate the ABY inventories reflect the 2002 roadway network with 2002 VMT and speeds. The estimated non-creditable emissions reductions due to pre-1990 controls are calculated by subtracting the 2002 ABY inventory, relative to the target year, from the actual 2002 base year inventory. A summary of the inventories and associated non-creditable emissions reductions is presented in Table 2-10: *Summary of HGB Non-Creditable Reductions, Ozone Season Weekday On-Road Mobile Source VMT, and Adjusted Base Year Inventories*. Creditable controls are discussed in Section 2.5.5: *Updated Controlled Milestone Year Emissions Inventories*. For complete documentation of the development of the inventory and details on MOBILE model inputs, refer to Appendix 9: *Houston-Galveston-Brazoria 1997 Eight-Hour Ozone Nonattainment Area Reasonable Further Progress On-Road Mobile Source Emissions Inventories*.

Table 2-10: Summary of HGB Non-Creditable Reductions, Ozone Season Weekday On-Road Mobile Source VMT, and Adjusted Base Year Inventories

Calendar Year	VMT	Inventories		Non-Creditable Emissions Reductions	
		NO _x	VOC	NO _x	VOC
2002 Base Year	135,716,461	326.72	132.64	N/A	N/A
2002 Adjusted Base Year (ABY)	135,716,461	387.09	189.08	N/A	N/A
2008 ABY	135,716,461	346.01	185.46	41.08	3.62
2011 ABY	135,716,461	335.20	184.23	10.81	1.23
2014 ABY	135,716,461	334.08	183.60	1.12	0.63
2017 ABY	135,716,461	333.24	183.50	0.84	0.10
2018 ABY	135,716,461	333.17	183.46	0.07	0.04

Note: VMT is presented in miles per day and NO_x and VOC emissions are presented in tons per day.

2.5.4 Updated Uncontrolled Milestone Year Emissions Inventories

The uncontrolled on-road mobile emissions inventories for each RFP milestone year were developed using emission factors that reflect only control strategies implemented prior to 2002. The latest version of MOBILE, MOBILE6.2.03, was used to develop the inventories for this SIP revision. The activity levels were updated to include the latest output from the HGB transportation demand model. These controls include Pre-1990 FMVCP, the 1992 RVP control, fleet turnover to Tier 1 FMVCP, reformulated gasoline, and the HGB vehicle I/M program. The activity levels used to calculate the inventory reflect the milestone roadway network, with milestone year VMT and speeds. A summary of the inventories is presented in Tables 2-8: *HGB Eight-County RFP Ozone Season Weekday On-Road Mobile Source NO_x Emissions* and 2-9: *HGB Eight-County RFP Ozone Season Weekday On-Road Mobile Source VOC Emissions*. For complete documentation of the development of the inventory and details on MOBILE model inputs, refer to Appendix 9: *Houston-Galveston-Brazoria 1997 Eight-Hour Ozone Nonattainment Area Reasonable Further Progress On-Road Mobile Source Emissions Inventories*.

2.5.5 Updated Controlled Milestone Year Emissions Inventories

The controlled on-road mobile emissions inventories for each RFP milestone year were developed using emission factors that reflect both control strategies implemented prior to 2002 and the control strategies used to demonstrate compliance with RFP requirements. These controls include pre-1990 FMVCP, fleet turnover to Tier 1 of the FMVCP, fleet turnover to Tier 2 of the FMVCP, the 2007 heavy-duty diesel FMVCP standards, summer reformulated gasoline, the HGB vehicle I/M program, the anti-tampering program, and Texas Low Emission Diesel (TxLED). control scenario inventory values include both the controlled inventory and the level of reductions for each control strategy. A summary of the uncontrolled on-road mobile inventory, the individual on-road mobile control reductions, and the resulting controlled on-road mobile inventory for each milestone year are summarized in Table 2-11: *HGB RFP Ozone Season Weekday On-Road Mobile Source NO_x Emissions and Control Strategy Reductions* and Table 2-12: *HGB RFP Ozone Season Weekday On-Road Mobile Source VOC Emissions and Control Strategy Reductions*.

Table 2-11: HGB RFP Ozone Season Weekday On-Road Mobile Source NO_x Emissions and Control Strategy Reductions

Emissions Inventory and Control Strategy Description	NO _x (tons per day)				
	2008	2011	2014	2017	2018
Uncontrolled (see Table 2-8)	363.05	372.46	407.05	432.04	443.70
Tier 1 Federal Motor Vehicle Control Program (FMVCP)	68.11	62.24	56.88	49.05	49.28
Federal Reformulated Gasoline (RFG)	46.75	72.94	104.41	128.94	135.65
I/M in Harris County	13.65	16.07	20.82	25.11	26.48
National Low Emission Vehicle Program (NLEV)	9.12	9.31	6.16	3.42	2.66
Expanded I/M	7.06	5.12	10.15	8.63	9.16
Tier 2 FMVCP	24.98	51.95	53.79	91.98	96.36
2007 Heavy-Duty Diesel FMVCP	8.70	28.22	66.13	61.69	67.54
On-road TxLED	8.87	3.21	2.11	1.45	1.19
Controlled	175.80	123.41	86.61	61.78	55.39

Table 2-12: HGB RFP Ozone Season Weekday On-Road Mobile Source VOC Emissions and Control Strategy Reductions

Emissions Inventory and Control Strategy Description	VOC (tons per day)				
	2008	2011	2014	2017	2018
Uncontrolled (see Table 2-9)	194.89	205.03	222.41	237.86	242.84
Tier 1 Federal Motor Vehicle Control Program (FMVCP)	45.57	63.02	79.36	91.17	94.52
Federal Reformulated Gasoline (RFG)	34.24	34.51	37.17	39.99	40.97
I/M in Harris County	10.42	11.35	12.43	13.49	13.90
National Low Emission Vehicle Program (NLEV)	5.33	4.81	3.27	1.97	1.59
Expanded I/M	3.09	3.30	4.44	4.32	4.50
Tier 2 FMVCP	9.91	19.19	16.87	37.20	39.39
2007 Heavy-Duty Diesel FMVCP	0.15	0.45	12.53	1.00	1.08
On-road TxLED	0.04	0.06	0.12	0.33	0.21
Controlled	86.15	68.35	56.21	48.39	46.68

The MVEB calculations for each milestone year are documented in Chapter 5: *MOTOR VEHICLE EMISSIONS BUDGETS*.

The activity levels used to calculate the inventory reflect the milestone roadway network, with milestone year VMT and speeds. A summary of the inventories is presented in Table 2-8: *HGB Eight-County RFP Ozone Season, Weekday On-Road Mobile Source NO_x Emissions* and Table 2-9: *HGB Eight-County RFP Ozone Season Weekday On-Road Mobile Source VOC Emissions*. For complete documentation of the development of the inventory and details on MOBILE model inputs, refer to Appendix 9: *Houston-Galveston-Brazoria 1997 Eight-Hour Ozone Nonattainment Area Reasonable Further Progress On-Road Mobile Source Emissions Inventories*.

2.6 BIOGENIC SOURCES

Biogenic sources include hydrocarbon emissions from crops, lawn grass, and trees as well as a small amount of NO_x emissions from soils. Plants are sources of VOC such as isoprene, monoterpene, and alpha-pinene. The tool for estimating biogenic emissions is the EPA Biogenic Emissions Inventory System. The biogenic emissions are important in determining the overall emissions profile of an area and therefore are required for regional air quality modeling and to meet periodic EPA reporting requirements. Since the 2002 base year EI is based upon the inventory developed to meet EPA periodic reporting requirements, the 2002 base year EI includes biogenic emissions.

The RFP methodology does not include biogenic emissions. Therefore, the first step in the RFP methodology subtracts the biogenic emissions from the 2002 base year EI. The resulting 2002 total anthropogenic EI is called the 2002 RFP base year EI. The calculation of the 2002 HGB RFP base year EI is documented in Sheet 16 of Appendix 1: *HGB RFP Demonstration Calculations Spreadsheet*.

Since the RFP methodology excludes biogenic emissions, biogenic RFP EI are not developed for RFP milestone years.

2.7 EMISSIONS SUMMARY

Uncontrolled base and milestone year NO_x and VOC emissions in the HGB area for each RFP source category are summarized in Tables 2-13: *HGB Eight-County RFP Uncontrolled Ozone Season Weekday NO_x Emissions* and 2-15: *HGB Eight-County RFP Uncontrolled Ozone Season Weekday VOC Emissions*. Controlled base and milestone year NO_x and VOC emissions in the HGB area for each RFP source category are summarized in Tables 2-14: *HGB Eight-County RFP Controlled Ozone Season Weekday NO_x Emissions* and 2-16: *HGB Eight-County RFP Controlled Ozone Season Weekday VOC Emissions*. Please note that there is no difference between the uncontrolled and controlled area source NO_x emissions for the base and all milestone years and the VOC emissions for the base year and 2008 because there were no controls applied to the projected area source inventories.

Table 2-13: HGB Eight-County RFP Uncontrolled Ozone Season Weekday NO_x Emissions

Year	Point Sources	Area Sources	Non-Road Mobile Sources	On-Road Mobile Sources	Total
2002	339.29	89.11	166.98	387.09	982.47
2008	375.56	89.63	202.72	363.05	1030.96
2011	383.85	93.90	210.01	372.46	1060.22
2014	401.05	96.01	220.48	407.05	1124.59
2017	421.57	98.23	230.99	432.04	1182.82
2018	428.69	99.38	237.25	443.70	1209.02

Table 2-14: HGB Eight-County RFP Controlled Ozone Season Weekday NO_x Emissions

Year	Point Sources	Area Sources	Non-Road Mobile Sources	On-Road Mobile Sources	Total
2002	339.29	89.11	156.98	326.72	912.10
2008	155.73	89.63	149.44	175.80	570.60
2011	156.21	93.90	138.83	123.41	512.35
2014	157.17	96.01	128.45	86.61	468.25
2017	158.33	98.23	121.15	61.78	439.49
2018	158.75	99.38	119.88	55.39	433.40

Table 2-15: HGB Eight-County RFP Uncontrolled Ozone Season Weekday VOC Emissions

Year	Point Sources	Area Sources	Non-Road Mobile Sources	On-Road Mobile Sources	Total
2002	316.62	407.61	100.15	189.08	1013.46
2008	333.14	371.82	113.68	194.89	1013.53
2011	338.75	382.72	120.10	205.03	1046.60
2014	347.70	393.07	126.28	222.41	1089.46
2017	358.79	404.84	132.38	237.86	1133.87
2018	362.90	408.82	134.29	242.84	1148.85

Table 2-16: HGB Eight-County RFP Controlled Ozone Season Weekday VOC Emissions

Year	Point Sources	Area Sources	Non-Road Mobile Sources	On-Road Mobile Sources	Total
2002	316.62	407.61	84.32	132.64	941.19
2008	170.05	371.82	69.23	86.15	697.24
2011	164.33	379.04	64.03	68.35	675.75
2014	172.31	383.42	61.42	56.21	673.35
2017	181.86	394.74	60.05	48.39	685.05
2018	185.38	398.57	59.84	46.68	690.47

CHAPTER 3: TARGET EMISSIONS LEVELS AND REASONABLE FURTHER PROGRESS DEMONSTRATION

3.1 INTRODUCTION

This chapter describes how the elements of the Houston-Galveston-Brazoria (HGB) 2018 reasonable further progress (RFP) demonstration are calculated, documents the RFP calculations, and provides a summary of the HGB RFP demonstration for all RFP milestone years. The RFP guidance requires an average 3 percent reduction between the RFP base year and an area's attainment year. The United States Environmental Protection Agency (EPA) guidance requires demonstration of RFP six years from the base year and then every third year after that year until the attainment year. With an RFP base year of 2002 and an attainment date in 2019, the HGB RFP analysis has five RFP milestone years, 2008, 2011, 2014, 2017, and 2018. The RFP milestone year requirements for HGB are:

- an 18 percent emission reduction for the six year period between the 2002 base year and the first RFP milestone year 2008;
- a 9 percent emission reduction for each three year period ending in 2011, 2014, and 2017; and
- a 3 percent emission reduction for the one year period from 2017 to the attainment year, 2018.

Compliance with the 2008, 2011, 2014, 2017, and 2018 milestone emission reduction requirements are demonstrated using EPA methodologies first to calculate the elements of the RFP demonstration and then to use these elements to complete the RFP analyses. First the inventories, control reductions, and non-creditable emission reductions are developed for each milestone year. Second, the target level of emissions for each milestone year is calculated. Third, the RFP control reductions for each milestone year are subtracted from the uncontrolled milestone year emissions inventory (EI) that includes growth between 2002 and each milestone year. When the uncontrolled projected inventory for each milestone year, minus the RFP controls, is less than or equal to the target level of emissions for volatile organic compounds (VOC) and/or nitrogen oxides (NO_x), the RFP requirement has been met. The required RFP elements are:

- 2002 base year emissions;
- non-creditable reductions for 2008, 2011, 2014, 2017, and 2018;
- 2008, 2011, 2014, 2017, and 2018 target levels of emissions;
- 2008, 2011, 2014, 2017, and 2018 projected emissions with growth; and
- individually quantified control strategy emissions reductions for 2008, 2011, 2014, 2017, and 2018.

3.2 TARGET LEVEL METHODOLOGY

EPA guidance specifies the method states should use to calculate the maximum amount of emissions a nonattainment area can emit for each RFP milestone year. These RFP target levels of emissions are calculated with a six-step process. The following six step process was used for the HGB RFP state implementation plan (SIP) revision for the 1997 eight-hour ozone standard.

1. Develop the 2002 base year inventory.
2. Develop the 2002 RFP base year inventory.
3. Develop the adjusted base year inventories for 2002, 2008, 2011, 2014, 2017, and 2018.
4. Calculate the non-creditable fleet turnover correction for each RFP milestone year.
5. Calculate the required 3 percent per year emission reduction amount.

6. Calculate the 2008, 2011, 2014, 2017, and 2018 target levels of emissions for VOC and NO_x.

3.3 CALCULATION OF TARGET EMISSIONS LEVELS

A step by step summary of the six-step process described above for target calculations for 2008, which serves as an example of how all target levels for each milestone year is calculated, is presented in Tables 3-1: *Step by Step Summary of Calculation of 2008 Target Levels for HGB*. A summary of all target levels can be found in Tables 3-4: *RFP Post-2002 Target Level of NO_x Emissions* and 3-5: *RFP Post-2002 Target Level of VOC Emissions*.

Table 3-1: Step by Step Summary of Calculation of 2008 Target Levels for HGB

Description	NO _x	VOC
① Step 1: 2002 Base Year Inventory (see Tables 2-14 and 2-16)	912.10	941.19
② Step 2: Add or subtract emissions that are to be added from outside the nonattainment area	0.00	0.00
③ 2002 RFP Base Year Inventory (see Tables 2-14 and 2-16)	912.10	941.19
④ Step 3: 2002 On-road Adjusted Base Year Inventory (see Table 2-10)	387.09	189.08
⑤ 2008 On-road Adjusted Base Year Inventory (see Table 2-10)	346.01	185.46
⑥ Step 4: Calculate Non-creditable reductions (see Table 2-10)	41.08	3.62
⑦ 2008 Adjusted Base Year Inventory	871.02	937.57
⑧ Percent of NO _x (PN) and VOC (PV) to meet 18% Reduction Requirement PN + PV = 18	17%	1%
⑨ Step 5: Calculate the 2002 to 2008 18% Reduction Requirement (⑦ x ⑧)	148.07	9.38
⑩ Step 6: Calculate the Target Level of Emissions (③ minus ⑥ minus ⑨)	722.94	928.19

Note: Emissions are represented in tons per day.

Step one of the RFP target calculation is development of the 2002 base year EI. EPA guidance specifies the method states must use to develop the base year and all other SIP EI. Details of the development of the 2002 HGB base year inventory are discussed in Chapter 2: *EMISSIONS INVENTORIES*. Summaries of the 2002 HGB base year NO_x and VOC emissions inventories are presented in; Table 2-14: *HGB Eight-County RFP Controlled Ozone Season Weekday NO_x Emission*, and Table 2-16: *HGB Eight-County RFP Controlled Ozone Season Weekday VOC Emission*.

The second step of the RFP target calculation methodology adds or subtracts any emissions from outside the nonattainment area that need to be included with or excluded from the nonattainment area inventory. The resulting inventory is called the 2002 RFP base year inventory, which represents the total anthropogenic emissions for the area and is the same as the 2002 base year inventory.

Step three of the target calculation methodology is development of the on-road adjusted base year (ABY) inventories for 2002, 2008, 2011, 2014, 2017, and 2018. These inventories are an algebraic representation of the effects of the pre-1990 Federal Clean Air Act Amendments (FCAA) controls projected to the RFP base and milestone years. As such, these inventories can be used to estimate the effects of the pre-1990 FCAA controls between milestone years. This estimation allows for the calculation of the non-creditable control reduction that is done as step four. The emission rates for an ABY inventory are developed using the latest version of EPA's emission factor model, MOBILE6.2.03. The model input file is set up to turn off all 1990 FCAA effects and the model evaluation year is set to the RFP base or milestone year. The model is run to determine emission factors for each base or milestone year with only pre-1990 FCAA controls. The emission factors for all years are then multiplied by the 2002 base year VMT. Since all of the inventories use the base year VMT, these inventories are referred to as RFP ABY inventories. Details of the development of the HGB RFP ABY inventories are documented in Chapter 2: *EMISSIONS INVENTORIES* and

Appendix 9: *Houston-Galveston-Brazoria 1997 Eight-Hour Ozone Nonattainment Area Reasonable Further Progress On-road Mobile Source Emissions Inventories.*

Step four, calculating the non-creditable fleet turnover correction, is accomplished by subtracting the ABY inventory for each RFP milestone year from the adjusted base inventory for the previous RFP milestone year. Since the ABY inventories estimate the effects of the non-creditable pre-1990 FCAA controls, the difference between ABY inventories represent an estimate of the non-creditable RFP emission reductions, also referred to as the fleet turnover correction. Table 3-2: *Summary Non-creditable Fleet Turnover Reduction* provides a summary of the fleet turnover corrections for all RFP milestone years. The equations for calculating the fleet turnover correction are shown below:

Equation 3-1A: $FTC_{MSY, VOC} = ABY_{(MSY-1), VOC} - ABY_{MSY, VOC}$

and

Equation 3-1B: $FTC_{MSY, NOx} = ABY_{(MSY-1), NOx} - ABY_{MSY, NOx}$

where:

- $FTC_{MSY, VOC}$ = VOC fleet turnover correction for year MSY
- $FTC_{MSY, NOx}$ = NO_x fleet turnover correction for year MSY
- $ABY_{MSY, VOC}$ = MSY adjusted base year inventory for VOC
- $ABY_{MSY, NOx}$ = MSY adjusted base year inventory for NO_x
- $ABY_{(MSY-1), VOC}$ = previous MSY adjusted base year inventory for VOC
- $ABY_{(MSY-1), NOx}$ = previous MSY adjusted base year inventory for NO_x
- MSY = RFP milestone year
- MSY – 1 = previous RFP milestone year

Table 3-2: Summary Non-creditable Fleet Turnover Reduction

RFP Analysis Year	On-road Mobile ABY EI		Non-creditable Fleet Turnover Reductions		Non-creditable Pre-1990 CAA Fleet Turnover Reduction Years
	NO _x	VOC	NO _x	VOC	
2002	387.09	189.08	N/A	N/A	N/A
2008	346.01	185.46	41.08	3.62	2002-2008
2011	335.20	184.23	10.81	1.23	2008-2011
2014	334.08	183.60	1.12	0.63	2011-2014
2017	333.24	183.50	0.84	0.10	2014-2017
2018	333.17	183.46	0.07	0.04	2017-2018

Step five, calculating the required 3 percent per year emission reduction amount, is accomplished by multiplying the RFP milestone year ABY inventory values by the percent reduction needed to meet RFP requirements. For HGB, the requirement is to reduce emissions by 3 percent per year from the base year to the attainment year. The second phase of the EPA’s Eight-Hour Ozone Implementation Rule allows ozone nonattainment areas to substitute NO_x reductions for VOC reductions, but use of NO_x emissions reductions must meet the criteria in §182(c)(2)(C) in the FCAA. For the eight HGB counties, an equivalent percentage of NO_x reduction may be substituted for VOC reduction

requirements for all RFP milestone years. The total of the percent NO_x and VOC reductions must equal the total emission reduction requirement for each milestone year. The RFP reduction requirement for this SIP revision is satisfied with a 1 percent reduction in VOC for each milestone year and the remaining percent reduction in NO_x emissions. Equation 3-2 describes the method to calculate the percentage of NO_x emissions substituted for VOC emissions:

Equation 3-2:
$$N_{MSY} = [3 \times (CY_{MSY} - CY_{MSY-1})] - V_{MSY}$$

where:

- N_{MSY} = percentage NO_x reductions for year MSY
- CY = calendar year
- MSY = RFP milestone year
- $MSY - 1$ = previous RFP milestone year
- V_{MSY} = percentage VOC reductions for year MSY

The VOC and NO_x percentages are multiplied by the milestone year ABY inventories for VOC and NO_x, respectively, to calculate the required VOC and NO_x emission reductions for each milestone year. Table 3-3: *Calculation of Required 3 Percent Per Year NO_x and VOC Reduction* provides a summary of the NO_x and VOC reductions needed to satisfy the 3 percent per year requirement for all RFP milestone years. The equations for calculating the required percent reductions for VOC and NO_x are shown in Equations 3-3A and 3-3B.

Equation 3-3A:
$$RQ_{VOC} = [BY_{2002VOC} - (ABY_{2002VOC} - ABY_{MSY, VOC})] \times PV_{MSY}$$

and

Equation 3-3B:
$$RQ_{NOx} = [BY_{2002NOx} - (ABY_{2002NOx} - ABY_{MSY, NOx})] \times PN_{MSY}$$

where:

- RQ_{VOC} = required percent VOC emission reductions by 2008
- RQ_{NOx} = required percent NO_x emission reductions by 2008
- $BY_{2002VOC}$ = 2002 base year inventory for VOC
- $BY_{2002NOx}$ = 2002 base year inventory for NO_x
- $ABY_{2002VOC}$ = 2002 adjusted base year inventory for VOC
- $ABY_{2002NOx}$ = 2002 adjusted base year inventory for NO_x
- $ABY_{MSY, VOC}$ = MSY adjusted base year inventory for VOC
- $ABY_{MSY, NOx}$ = MSY adjusted base year inventory for NO_x
- PV_{MSY} = percentage VOC reductions for year MSY
- PN_{MSY} = percentage NO_x reductions for year MSY
- MSY = RFP milestone year

Table 3-3: Calculation of Required 3 Percent Per Year NO_x and VOC Reduction

RFP Analysis Year	Total Percent Reduction Requirement	Percent NO _x	Percent VOC	tons per day			
				ABY EI NO _x	ABY EI VOC	Required Reductions NO _x	Required Reductions VOC
2002	N/A	N/A	N/A	912.10	941.19	N/A	N/A
2008	18.0	17.0	1.0	871.02	937.57	148.07	9.38
2011	9.0	8.0	1.0	860.21	936.34	68.82	9.36
2014	9.0	8.0	1.0	859.09	935.71	68.73	9.36
2017	9.0	8.5	0.5	858.25	935.61	72.95	4.68
2018	3.0	2.5	0.5	858.18	935.57	21.45	4.68
2019	3.0	2.5	0.5	858.18	935.57	21.45	4.68

Step six, calculating 2008 target levels of emissions, is accomplished by subtracting the required emission reductions calculated in step five and the fleet turnover correction factor calculated in step four from the 2002 base year inventory. This target level represents the level of emissions for each RFP milestone year for the HGB area to meet its eight-hour ozone RFP requirements. Because the fleet turnover correction affects both NO_x and VOC emissions, target levels are calculated for both pollutants even when the entire reduction requirement is taken from one pollutant or the other. The method for calculating the target levels of emissions for the RFP milestone years is shown in Equation 3-4.

$$\text{Equation 3-4: } TL_{MSY, X} = TL_{(MSY-1), X} - RQ_{MSY, X} - FTC_{MSY, X}$$

where:

- TL_{MSY, X} = target level of emissions for MSY
- TL_{(MSY-1), X} = target level of emissions for the previous RFP milestone year (Note: For 2008 the target level of emissions for the previous RFP milestone year is equal to the 2002 base year inventory.)
- RQ_{MSY, X} = emission reduction requirement for MSY for pollutant X
- FTC_{MSY, X} = fleet turnover correction term for MSY for pollutant X
- X = either VOC or NO_x
- MSY = RFP milestone year
- MSY - 1 = previous RFP milestone year

Appendix 1: *HGB RFP Demonstration Calculations Spreadsheet* documents the calculation of the target values for all RFP milestone years. Table 3-1: *Step by Step Summary of Calculation of 2008 Target Levels for HGB* provides a step by step summary of the calculation of the target levels for 2008 for the HGB area. Tables 3-4: *RFP Post-2002 Target Level of NO_x Emissions* and 3-5: *RFP Post-2002 Target Level of VOC Emissions* summarize the calculation of the target levels of VOC and NO_x for all RFP milestone years and provide the Federal Motor Vehicle Control Program (FMVCP) non-creditable emissions reductions. The following sections describe how the target levels are integrated into the RFP demonstration.

Table 3-4: RFP Post-2002 Target Level of NO_x Emissions

RFP Milestone Year	tons per day			
	Previous Target	FMVCP Non-Creditable Reduction	Post-2002 Percent Reduction Requirement NO _x	NO _x Target
2002 Base Year	N/A	N/A	N/A	912.10*
2008	912.10	41.08	148.07	722.94
2011	722.94	10.81	68.82	643.32
2014	643.32	1.12	68.73	573.47
2017	573.47	0.84	72.95	499.68
2018	499.68	0.07	21.45	478.15

* This is the base year inventory, which is the starting point for calculating target values

Table 3-5: RFP Post-2002 Target Level of VOC Emissions

RFP Milestone Year	tons per day			
	Previous Target	FMVCP Non-Creditable Reduction	Post-2002 Percent Reduction Requirement VOC	VOC Target
2002 Base Year	N/A	N/A	N/A	941.19*
2008	941.19	3.62	9.38	928.19
2011	928.19	1.23	9.36	917.60
2014	917.60	0.63	9.36	907.61
2017	907.61	0.10	4.68	902.84
2018	902.84	0.04	4.68	898.12

* This is the base year inventory, which is the starting point for calculating target values

3.4 GROWTH

The HGB RFP SIP revision demonstration must also account for any growth in emissions between 2002 and each RFP milestone year; 2008, 2011, 2014, 2017, and 2018. The VOC and NO_x uncontrolled projected year EI are derived by applying the appropriate projection methodologies to the 2002 base year EI, to emission factor development, and/or to activity level estimates. The resulting inventories include any growth between 2002 and each projection year. The projection methodology for the uncontrolled RFP EI excludes changes in the emission factors due to control strategies so that the projections represent the total growth in emissions. When the creditable RFP control reductions are subtracted from uncontrolled projected inventories that include growth, the result will be the forecast controlled RFP emissions. The controlled RFP emissions are compared to the target levels to determine if a nonattainment area meets the RFP requirements. This method for accounting for growth is based on the EPA guidance for performing RFP calculations.¹¹ The development of the uncontrolled projected EI is documented in Chapter 2: *EMISSIONS*

¹¹ United States Environmental Protection Agency, “Final Rule to Implement the 8-Hour Ozone National Ambient Air Quality Standard; Final Rule,” *Federal Register* (70 FR 71631), November 29, 2005.

INVENTORIES. The development of the projected control reductions are documented in Chapter 4: *CONTROL MEASURES TO ACHIEVE TARGET LEVELS*.

3.5 RFP DEMONSTRATION

The second phase of the EPA’s 1997 Eight-Hour Ozone Implementation Rule (40 Code of Federal Regulations §51.910) requires the RFP control strategy plan to show emission reductions that will reduce the controlled RFP milestone year EI to a value less than the emissions target value. The creditable RFP control reductions are subtracted from the uncontrolled forecast inventory for each RFP milestone year. For milestone years 2011 through 2018, the controls that are reserved to demonstrate 2009 to 2018 contingency are added to the controlled RFP inventory because the creditable reductions for those years include the reductions reserved for contingency. The RFP milestone requirement is met for 2008 if the controlled RFP emissions forecast is less than the target level of emissions. The RFP milestone requirement is met for all other years if the controlled RFP emissions forecast without reductions reserved for contingency is less than the target level of emissions. Tables 3-6: *Summary of RFP Demonstration for Eight HGB Counties for 2008*, 3-7: *Summary of RFP Demonstration for Eight HGB Counties for 2011*, 3-8: *Summary of RFP Demonstration for Eight HGB Counties for 2014*, 3-9: *Summary of RFP Demonstration for Eight HGB Counties for 2017*, and 3-10: *Summary of RFP Demonstration for Eight HGB Counties for 2018* summarize the demonstration of the RFP plan for HGB for the 2008, 2011, 2014, 2017, and 2018 milestone years. As concluded in the final row of each of these tables, the HGB area demonstrates the required RFP emission reductions for each milestone year. All RFP calculations, including the required reductions, the fleet turnover correction factor, and the target emission levels are calculated and shown in Appendix 1: *HGB RFP Demonstration Calculations Spreadsheet*. Details of the emission reductions used to calculate the creditable RFP control reduction for each milestone year are documented in Chapter 4: *CONTROL MEASURES TO ACHIEVE TARGET LEVELS* and summarized in Tables 4-1: *Summary of HGB RFP NO_x Emission Reductions Represent Post-2002 Cumulative Totals* and 4-2: *Summary of HGB RFP VOC Emission Reductions Represent Post-2002 Cumulative Totals*.

Table 3-6: Summary of RFP Demonstration for Eight HGB Counties for 2008

Line #	Description	tons per day	
		NO _x	VOC
Line 1	Uncontrolled Emissions Forecast With Growth	1030.96	1013.53
Line 2	Creditable RFP Control Reductions for 2008	450.74	137.44
Line 3	Controlled RFP Emissions Forecast (Line 1 minus Line 2)	580.22	876.09
Line 4	RFP Target Level of Emissions	722.94	928.19
Line 5	Excess (+) / Shortfall (-) (Line 4 minus Line 3)	+142.72	+52.10
Line 6	Is Controlled RFP EI Less Than Target Level of Emissions?	Yes	Yes

Table 3-7: Summary of RFP Demonstration for Eight HGB Counties for 2011

Line #	Description	tons per day	
		NO _x	VOC
Line 1	Uncontrolled Emissions Forecast With Growth	1060.22	1046.60
Line 2	Creditable RFP Control Reductions for 2008	450.74	137.44
Line 3	Creditable RFP Control Reductions 2008 to 2011	88.54	54.82
Line 4	Controlled RFP Emissions Forecast (Line 1 minus Line 2 minus Line 3)	520.94	854.34
Line 5	Amount of Creditable Reductions Reserved for 2009 to 2018 Contingency	21.78	4.69
Line 6	Controlled RFP Forecast Without Reductions Reserved for Contingency (Line 4 plus Line 5)	542.71	859.03
Line 7	RFP Target Level of Emissions	643.32	917.60
Line 8	Excess (+) / Shortfall (-) (Line 7 minus Line 6)	+100.60	+58.57
Line 9	Is Controlled RFP EI Less Than Target Level of Emissions?	Yes	Yes

Table 3-8: Summary of RFP Demonstration for Eight HGB Counties for 2014

Line #	Description	tons per day	
		NO _x	VOC
Line 1	Uncontrolled Emissions Forecast With Growth	1124.59	1089.46
Line 2	Creditable RFP Control Reductions for 2008, 2011	539.28	181.78
Line 3	Creditable RFP Control Reductions 2011 to 2014	107.44	44.35
Line 4	Controlled RFP Emissions Forecast (Line 1 minus Line 2 minus Line 3)	477.86	863.33
Line 5	Amount of Creditable Reductions Reserved for 2009 to 2018 Contingency	21.78	4.69
Line 6	Controlled RFP Forecast Without Reductions Reserved for Contingency (Line 4 plus Line 5)	499.64	868.02
Line 7	RFP Target Level of Emissions	573.47	907.61
Line 8	Excess (+) / Shortfall (-) (Line 7 minus Line 6)	+73.83	+39.59
Line 9	Is Controlled RFP EI Less Than Target Level of Emissions?	Yes	Yes

Table 3-9: Summary of RFP Demonstration for Eight HGB Counties for 2017

Line #	Description	tons per day	
		NO _x	VOC
Line 1	Uncontrolled Emissions Forecast With Growth	1182.82	1133.87
Line 2	Creditable RFP Control Reductions for 2008, 2011, 2014	646.72	226.13
Line 3	Creditable RFP Control Reductions 2014 to 2017	88.72	31.28
Line 4	Controlled RFP Emissions Forecast (Line 1 minus Line 2 minus Line 3)	447.38	876.46
Line 5	Amount of Creditable Reductions Reserved for 2009 to 2018 Contingency	21.78	4.69
Line 6	Controlled RFP Forecast Without Reductions Reserved for Contingency (Line 4 plus Line 5)	469.15	881.15
Line 7	RFP Target Level of Emissions	499.68	902.84
Line 8	Excess (+) / Shortfall (-) (Line 7 minus Line 6)	+30.53	+21.68
Line 9	Is Controlled RFP EI Less Than Target Level of Emissions?	Yes	Yes

Table 3-10: Summary of RFP Demonstration for Eight HGB Counties for 2018

Line #	Description	tons per day	
		NO _x	VOC
Line 1	Uncontrolled Emissions Forecast With Growth	1209.02	1148.85
Line 2	Creditable RFP Control Reductions for 2008, 2011, 2014, 2017	735.45	257.40
Line 3	Creditable RFP Control Reductions 2017 to 2018	30.60	8.99
Line 4	Controlled RFP Emissions Forecast (Line 1 minus Line 2 minus Line 3)	442.98	882.45
Line 5	Amount of Creditable Reductions Reserved for 2009 to 2018 Contingency	21.78	4.69
Line 6	Controlled RFP Forecast Without Reductions Reserved for Contingency (Line 4 plus Line 5)	464.76	887.14
Line 7	RFP Target Level of Emissions	478.15	898.12
Line 8	Excess (+) / Shortfall (-) (Line 7 minus Line 6)	+13.40	+10.98
Line 9	Is Controlled RFP EI Less Than Target Level of Emissions?	Yes	Yes

CHAPTER 4: CONTROL MEASURES TO ACHIEVE TARGET LEVELS

4.1 OVERVIEW OF CONTROL MEASURES

This section briefly describes the control measures used to achieve the necessary emission reductions to meet the reasonable further progress (RFP) requirements. The methodologies used to estimate reduced emission levels are described in Sections 4.2 through 4.5. The projected emission reductions reflect the identified federal and state emission controls. All state control measures are codified in Texas state regulations. The list of controls does not include all emission reduction programs for the Houston-Galveston-Brazoria (HGB) area. The summary of emission reductions from the control measures used to meet the RFP targets is presented in Tables 4-1: *Summary of HGB RFP NO_x Emission Reductions* and 4-2: *Summary of HGB RFP VOC Emission Reductions*. Individual and total values shown in these summary tables have been extracted from the spreadsheet in Appendix 1: *HGB Reasonable Further Progress Demonstration Calculations Spreadsheet*. All values represent the numbers rounded to two significant figures. Since the totals in the tables are taken directly from the spreadsheet and rounded rather than summed from the rounded values in the table, there may be rounding discrepancies for the total values.

Table 4-1: Summary of HGB RFP NO_x Emission Reductions

Control Strategy Description	<i>tons per day</i>				
	2008	2011	2014	2017	2018
Mass Emissions Cap and Trade Program (MECT)	219.83	227.65	243.87	263.23	269.94
Tank Landing Loss Rule	0.00	0.00	0.00	0.00	0.00
Federal Portable Fuel Container (PFC) Rule	0.00	0.00	0.00	0.00	0.00
Tier 1 Federal Motor Vehicle Control Program (FMVCP)	68.11	62.24	56.88	49.05	49.28
Federal Reformulated Gasoline (RFG)	46.75	72.94	104.41	128.94	135.65
Inspection and Maintenance (I/M) in Harris County	13.65	16.07	20.82	25.11	26.48
National Low Emission Vehicle program (NLEV)	9.12	9.31	6.16	3.42	2.66
Expanded I/M (Brazoria, Fort Bend, Galveston, and Montgomery Counties)	7.06	5.12	10.15	8.63	9.16
Tier 2 FMVCP	24.98	51.95	53.79	91.98	96.36
2007 Heavy-Duty FMVCP	8.70	28.22	66.13	61.69	67.54
On-road Texas Low Emission Diesel (TxLED)	8.87	3.21	2.11	1.45	1.19
Tier I and II Locomotive NO _x standards	11.74	12.75	14.09	15.24	16.04
Small Non-Road Spark Ignition (SI) Phase I	-0.30	-0.39	-0.47	-0.56	-0.58
Federal Standards for New Heavy-Duty Non-Road Engines	5.76	7.91	9.64	12.02	12.56
Tier 2 and 3 Federal Standards for New Non-Road Diesel Engines	8.13	14.01	18.76	23.25	24.29
Federal Standards for New Small Non-Road Spark Ignition (SI) Engines (Phase II)	1.25	1.65	1.85	1.99	2.04
Federal Standards for New Large Non-Road SI and Recreational Marine	12.27	20.30	27.01	31.10	32.13
Non-road TxLED	2.87	2.59	2.14	1.73	1.59
Non-road RFG	0.00	0.00	0.00	0.00	0.00
Tier 4 Federal Standards for Diesel Engines	0.00	0.52	4.67	10.96	12.82
Federal Marine Diesel Tier 2	1.96	3.23	4.72	6.20	6.90
Sum of Control Reductions	450.74	539.28	646.72	735.45	766.04

Note: The Small Non-road Spark Ignition Phase I rule is designed to reduce hydrocarbon emissions. The technology that is used achieve the reduction in hydrocarbon emissions also causes a slight increase in NO_x emission rates. See Table 4-2 for information regarding VOC reductions

Table 4-2: Summary of HGB RFP VOC Emission Reductions

Control Strategy Description	tons per day				
	2008	2011	2014	2017	2018
Mass Emissions Cap and Trade Program (MECT)	0.00	0.00	0.00	0.00	0.00
Tank Landing Loss Rule	0.00	11.50	11.50	11.50	11.50
Federal Portable Fuel Container (PFC) Rule	0.00	3.68	9.65	10.10	10.25
Tier 1 Federal Motor Vehicle Control Program (FMVCP)	45.57	63.02	79.36	91.17	94.52
Federal Reformulated Gasoline (RFG)	34.24	34.51	37.17	39.99	40.97
Inspection and Maintenance (I/M) in Harris County	10.42	11.35	12.43	13.49	13.90
National Low Emission Vehicle program (NLEV)	5.33	4.81	3.27	1.97	1.59
Expanded I/M (Brazoria, Fort Bend, Galveston, and Montgomery Counties)	3.09	3.30	4.44	4.32	4.50
Tier 2 FMVCP	9.91	19.19	16.87	37.20	39.39
2007 Heavy-Duty FMVCP	0.15	0.45	12.53	1.00	1.08
On-road Texas Low Emission Diesel (TxLED)	0.04	0.06	0.12	0.33	0.21
Tier I and II Locomotive NO _x standards	0.27	0.34	0.43	0.53	0.59
Small Non-Road Spark Ignition (SI) Phase I	1.77	2.50	3.23	3.95	4.19
Federal Standards for New Heavy-Duty Non-Road Engines	4.73	6.82	8.54	10.17	10.58
Tier 2 and 3 Federal Standards for New Non-Road Diesel Engines	0.95	1.68	2.32	2.95	3.10
Federal Standards for New Small Non-Road Spark Ignition (SI) Engines (Phase II)	16.70	20.81	22.72	24.13	24.57
Federal Standards for New Large Non-Road SI and Recreational Marine	4.14	7.96	11.37	14.03	14.76
Non-road TxLED	0.00	0.00	0.00	0.00	0.00
Non-road RFG	0.04	0.13	0.22	0.30	0.33
Tier 4 Federal Standards for Diesel Engines	0.00	0.03	0.26	0.52	0.59
Federal Marine Diesel Tier 2	0.08	0.12	0.18	0.24	0.26
Sum of Control Reductions	137.44	192.26	236.61	267.88	276.87

4.2 POINT SOURCE CONTROLS

The point source controls were calculated using several sources of data, including but not limited to the point source emissions inventory and the Mass Emissions Cap and Trade Program (MECT). Emission reductions required by state rules were incorporated into the future projections for controlled inventories. Point source controls are detailed in Sheets 30-34 of Appendix 1: *HGB RFP Demonstration Calculations Spreadsheet*. The most significant NO_x reduction strategies are the 30 Texas Administrative Code (TAC) Chapter 117 rules and the MECT Program. Some of the affected source categories are utility boilers, turbines and duct burners, heaters and furnaces, internal combustion engines, and industrial boilers. The reductions in point source VOC emissions were determined from the tank landing loss rules in 30 TAC Chapter 115, Subchapter B.

4.3 AREA SOURCE CONTROLS

The only area source control in the HGB area used in this RFP demonstration is the federal portable fuel container (PFC) rule. Controlled VOC emissions resulting from this rule will begin in 2010.

Therefore, the first year of this HGB RFP State Implementation Plan (SIP) revision for PFC controls will be 2011. The EI forecast used EPA approved Economic Growth Analysis System (EGAS) growth factors to develop the corresponding controlled EI for milestone and attainment years. To develop the controlled emissions, rule effectiveness factors were applied for source categories with applicable rules. The summary of uncontrolled and controlled emissions for area sources in the HGB area may be found in Tables 2-3: *HGB Eight-County Area Source NO_x Emissions* and 2-4: *HGB Eight-County RFP Area Source VOC Emissions*.

4.4 NON-ROAD MOBILE SOURCE CONTROLS

Most non-road mobile source emissions were calculated using a Texas specific version of the EPA's NONROAD 2005 model, called the Texas NONROAD (TexN) model. Although operating the EPA's model with all of the default surrogates is acceptable, the EPA encourages states to update the model with local, county-level data based on surveys and other relevant information. The TexN model is a software tool for developing emissions estimates for non-road mobile sources in Texas using county specific activity data. The model allows air quality planning staff to replace EPA's default data with local bottom-up data. Local, county-level data is incorporated into the TexN model as it becomes available.

Emissions from the remaining non-road mobile sources not included in the NONROAD model, locomotives, aircraft and ground support equipment, commercial marine vessels, and oilfield drilling rigs, were calculated outside of the NONROAD 2005 model using EPA-approved methodologies.

4.4.1 NONROAD Model Categories

For the RFP plan, the TexN model was executed using county specific population and activity files where available. In some cases, custom allocation and technology type data files were also used. The technology type file identifies what percent of an equipment population is expected to use federal non-road equipment controls for the year of interest. The effects of federal and state control programs were evaluated. The TexN model was executed for ozone season daily emission for years 2002, 2008, 2011, 2014, 2017, 2018, and 2019. In order to evaluate RFP requirements, a series of TexN model runs were executed for both controlled and uncontrolled scenario for each federal and state control program for each analysis year. The documentation and procedure of applicable federal and state rules modeled is in Appendix 4: *Development of RFP Non-Road Mobile Source Emissions Inventories for Source Categories in the EPA's NONROAD2005 Model*. The inventories developed include county level ozone season day controlled and uncontrolled emissions estimates for years 2002, 2008, 2011, 2014, 2017, 2018, and 2019 for the eight counties in the HGB area.

Once the individual uncontrolled and controlled emissions estimates were generated by the TexN model, the effectiveness of control strategies for each year of interest was evaluated. Emissions reductions from individual federal and state controls on non-road equipment was calculated by subtracting the controlled emissions estimates from the uncontrolled emissions estimates.

4.4.2 Non-Road Categories not in the NONROAD Model

Locomotive controlled emissions were calculated using data extrapolated from a contractor report drafted by Eastern Research Group, Inc., (ERG) and contained in the Texas Air Emissions Repository (TexAER) database.¹² The uncontrolled emissions were developed using the EPA Fleet Average Emission Factors for Locomotives document.¹³ Commercial marine vessel emissions were developed based on emission inventory completed in 2005 and 2007 by the contractor.^{14,15} Emissions were

¹² ERG, "Tier-Specific Locomotive Engine Updated," TCEQ Contract No. 582-07-84003-04, August 31, 2007.

¹³ EPA, "Emission Factors for Locomotives," December 1997.

¹⁴ ERG, "Development of Emission Estimates for Offshore Non-road Mobile Sources in Texas State Waters," August 2005.

¹⁵ ERG, "Commercial Marine Vessel, Locomotive, and Aircraft Growth Factors," August 2007.

developed from surveys to determine vessel types and shipping activities within the Houston Ship Channel. Oilfield drilling rig emissions were developed by contractor using drilling permit data from the Railroad Commission of Texas.¹⁶

The reductions for each control strategy for each milestone year are summarized in Tables 4-1: *Summary of HGB RFP NO_x Emission Reductions* and 4-2: *Summary of HGB RFP VOC Emission Reductions*. Details of the non-road control strategy emission reductions are documented in Appendix 4: *Development of RFP Non-Road Mobile Source Emissions Inventories for Source Categories in the EPA's NONROAD2005 Model*.

4.5 ON-ROAD MOBILE SOURCE CONTROLS

The projected mobile source emissions inventories documented in Appendix 9: *Houston-Galveston-Brazoria 1997 Eight-Hour Ozone Nonattainment Area Reasonable Further Progress On-Road Mobile Source Emissions Inventories* includes quantification of emission reductions for all federal and state on-road mobile source control rules for each RFP milestone year for the eight-county HGB area. Not all available on-road mobile source controls are needed to demonstrate RFP for the HGB area. A summary of the on-road mobile controls included in the 2002, 2008, 2011, 2014, 2017, and 2018 RFP inventories is presented in Table 4-3: *Control Programs Modeled in MOBILE6 Emissions Factors for the Base and Milestone Years RFP Controlled Emissions Inventories*. The reductions for each control strategy for each milestone year are summarized Tables 4-1: *Summary of HGB RFP NO_x Emission Reductions* and 4-2: *Summary of HGB RFP VOC Emission Reductions*.

Table 4-3: Control Programs Modeled in MOBILE6 Emissions Factors for the Base and Milestone Years RFP Controlled Emissions Inventories

Control Program	2002	2008	2011	2014	2017	2018
Tier 1 Federal Motor Vehicle Control Program (FMVCP)	X	X	X	X	X	X
I/M in Harris County	X	X	X	X	X	X
Federal Reformulated Gasoline (RFG)	X	X	X	X	X	X
National Low Emission Vehicle Program (NLEV)	X	X	X	X	X	X
Tier 2 FMVCP		X	X	X	X	X
2007 Heavy-Duty Diesel FMVCP		X	X	X	X	X
Expanded I/M		X	X	X	X	X
TxLED		X	X	X	X	X

4.6 VMT, ON-ROAD EMISSIONS, AND TRANSPORTATION CONTROL MEASURES

Transportation control measures (TCM) are required to offset growth in vehicle miles traveled (VMT) that results in an increase in vehicle emissions for nonattainment areas classified as serious under the National Ambient Air Quality Standards (NAAQS). TCMs are therefore part of the overall control strategy for the HGB area and are documented in the HGB Attainment Demonstration SIP Revision for the 1997 Eight-Hour Ozone Standard (Project No. 2009-017-SIP-NR). There is growth in VMT for the HGB area for the years between the RFP base year of 2002 and the attainment year, 2018, as illustrated in Figure 4-1: *RFP VMT Trends*. However, the growth in VMT for the area is more than offset by control measures that reduce the per mile emission rates, resulting in a decrease in emissions of both VOC and NO_x for the same time period as shown in Figure 4-2: *RFP Controlled On-Road NO_x and VOC Emissions Trends*. The increase in VMT and decrease in vehicle emissions for the RFP time period are summarized in Table 4-4: *RFP Controlled NO_x Emissions, VOC Emissions, and VMT* and may also be found in Table 1: *HGB RFP Ozone Season Weekday On-Road Mobile Source*

¹⁶ ERG, "Emissions from Oil and Gas Production Facilities," August 2007.

VMT, Average Speed (mph), and Emissions (tpd) of Appendix 9: *Houston-Galveston-Brazoria 1997 Eight-Hour Ozone Nonattainment Area Reasonable Further Progress On-Road Mobile Source Emissions Inventories*. The control measures used to achieve the on-road mobile RFP emission reductions and to demonstrate RFP requirements do not include TCMs. TCMs are not needed to meet RFP requirements for the area and are therefore included as part of the control strategy for the HGB Attainment Demonstration SIP Revision for the 1997 Eight-Hour Ozone Standard only.

Table 4-4: RFP Controlled NO_x Emissions, VOC Emissions, and VMT

RFP Milestone Year	NO _x	VOC	VMT
	tons per day		miles per day
2002 Base Year	326.72	132.64	135,716,461
2008	175.80	86.15	146,039,120
2011	123.41	68.35	154,332,688
2014	86.61	56.21	168,390,202
2017	61.78	48.39	180,067,224
2018	55.39	46.68	184,010,300

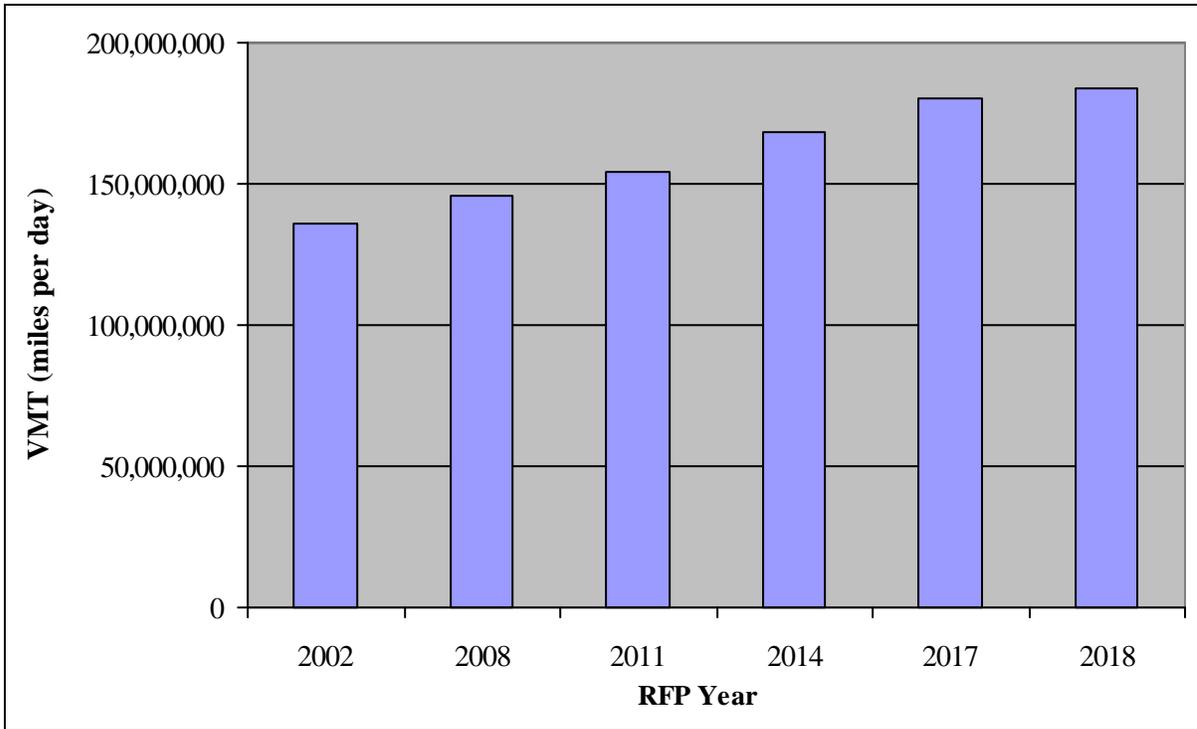


Figure 4-1: RFP VMT Trends

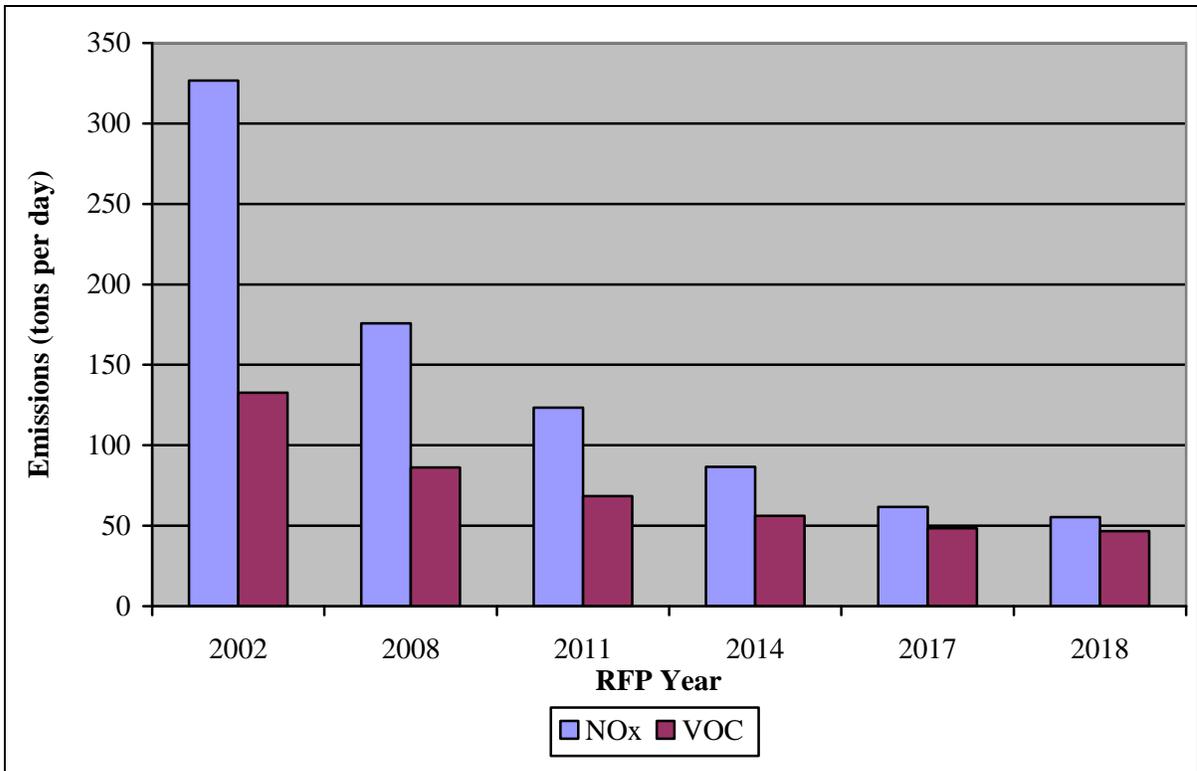


Figure 4-2: RFP Controlled On-Road NO_x and VOC Emissions Trends

4.7 CONTINGENCY MEASURES

In case of a milestone failure, contingency control measures estimated to reduce emissions by an additional 3 percent between each milestone year and the next calendar year are required. As with the 3 percent per year reduction requirement, the 3 percent contingency requirement is based upon the adjusted base year and may be met using either VOC or NO_x reductions. As shown in Table 4-5: *2009 RFP Contingency Demonstration for the HGB Area* the 3 percent contingency analysis for 2009 and subsequent milestone years to 2018 is based upon a 2.5 percent reduction in NO_x and a 0.5 percent reduction in VOC to be achieved between 2008 and 2009. The excess emission reductions from the RFP milestone year 2008 were used to demonstrate the 2009 contingency. The 2009 contingency reductions are subtracted from creditable control reductions for milestone years 2011, 2014, 2017, and 2018 to account for the contingency requirements for each of those years. If the RFP milestone requirement is met for 2008, the contingency reductions designated for 2009 will be available to be used as contingency reductions for each following milestone where the RFP emissions requirement is met.

Table 4-5: 2009 RFP Contingency Demonstration for HGB Area

Description	2009	
	NO _x	VOC
Adjusted 2008 Base Year EI	871.02	937.57
Percent for Contingency Calculation (total of 3 percent)	2.50	0.50
2008 to 2009 Required Contingency Reductions	21.78	4.69
Excess From 2008 RFP Demonstration (see Appendix 1 Sheet 2)	142.72	52.10
Subtract 2008 MVEB Safety Margin From Excess Reductions from 2008 RFP Demonstration	-17.58	-8.61
Total Contingency Reductions	125.14	43.49
Contingency Excess (+) or Shortfall (-)	+103.37	+38.80
Are contingency reductions greater than required contingency reduction?	Yes	Yes

Note: Emissions are represented in tons per day.

Since 2018 is the attainment year, there is no corresponding continuing 3 percent per year analysis for 2019. The 3 percent contingency analysis for 2019 was based upon a 2 percent reduction in NO_x and a 1 percent reduction in VOC to be achieved between 2018 and 2019. Inventory analyses were performed on the fleet turn over effects for the federal emission certification programs for on-road and non-road vehicles. The emission reductions for the year from 2018 to 2019 were estimated for these programs. Controlled emission reductions not previously used in the 2018 milestone demonstration may also be used to satisfy contingency requirements, so the excess emission reductions from the 2018 RFP demonstration are included in the contingency analysis. Because this SIP revision provided for a 10 percent MVEB safety margin using some of the excess emissions reductions from the 2018 RFP demonstration, those emissions are subtracted from the amount available to demonstrate 2019 contingency. A summary of the 2019 contingency analysis is provided in Table 4-6: *2019 RFP Contingency Demonstration for HGB Area*. The analysis demonstrates that the 2019 contingency reductions exceed the 3 percent reduction requirement; therefore, the RFP contingency requirement is fulfilled for the HGB area.

Table 4-6: 2019 RFP Contingency Demonstration for HGB Area

Description	2019	
	NO _x	VOC
Adjusted 2018 Base Year EI	858.18	935.57
Percent for Contingency Calculation (total of 3 percent)	2.50	0.50
2018 to 2019 Required Contingency Reductions	21.45	4.68
Excess From 2018 RFP Demonstration (see Appendix 1 Sheet 7)	13.40	10.98
Subtract 2018 MVEB Safety Margin From Excess Reductions from 2018 RFP Demonstration	-5.54	-4.67
Tier 1 FMVCP	-1.93	1.40
Federal RFG	5.09	0.70
I/M and ATP in Harris County	0.88	0.20
NLEV	-0.60	-0.31
Expand I/M to Brazoria, Fort Bend, Galveston, and Montgomery Counties	0.35	0.11
Tier 2 FMVCP	2.92	1.60
2007 Heavy Duty Diesel FMVCP	3.58	0.04
On-road Texas Low Emission Diesel	0.00	0.00
TERP	0.00	0.00
VMEP	0.00	0.00
TCM	0.00	0.00
Tier I and II Locomotive NO _x Standards	0.68	0.01
Small Non-Road Spark Ignition Phase I	-0.03	0.24
Heavy Duty Non-road Engines	0.30	0.32
Tier 2, and 3 Non-road Diesel Engines	0.72	0.11
Small Non-road SI Engines (Phase II)	0.04	0.43
Large Non-road SI & Recreational Marine	0.95	0.62
Non-road Texas Low Emission Diesel	0.00	0.00
Non-road Reformulated Gasoline	0.00	0.03
Tier 4 Diesel Rule	1.58	0.06
Federal Marine Diesel Tier 2	0.55	0.02
Total Contingency Reductions	22.94	11.89
Contingency Excess (+) or Shortfall (-)	+1.49	+7.21
Are contingency reductions greater than required contingency reduction?	Yes	Yes

Note: Emissions are represented in tons per day.

CHAPTER 5: MOTOR VEHICLE EMISSIONS BUDGETS

5.1 INTRODUCTION

This Houston-Galveston-Brazoria (HGB) reasonable further progress (RFP) state implementation plan (SIP) revision establishes motor vehicle emissions budgets (MVEB), which set the allowable HGB area on-road mobile emissions. The HGB RFP SIP revision MVEB are calculated by subtracting the on-road mobile control strategy emission reductions that are necessary to demonstrate RFP from the uncontrolled, projected on-road mobile source emissions for each RFP milestone year. Local transportation planning organizations use the MVEB to demonstrate that projected emissions from transportation plans, programs, and projects are equal to, or less than the budget, as required by the federal transportation conformity rule.

5.2 OVERVIEW OF METHODOLOGIES AND ASSUMPTIONS

The Texas Commission on Environmental Quality (TCEQ) developed updated on-road mobile source emissions inventories (EI) and control strategy reduction estimates that use the latest planning assumptions and the newest version of the United States Environmental Protection Agency's (EPA) emission factor model. Updated inventory development included development of: a 2002 base year inventory; adjusted base year inventories for 2002, 2008, 2011, 2014, 2017, and 2018; 2008, 2011, 2014, 2017, and 2018 milestone year inventories; and control strategy reduction estimates for 2008, 2011, 2014, 2017, and 2018. The TCEQ worked with the Houston-Galveston Area Council (H-GAC) to develop these inventories. Appendix 9: *Houston-Galveston-Brazoria 1997 Eight-Hour Ozone Nonattainment Area Reasonable Further Progress On-Road Mobile Source Emissions Inventories* is a copy of the H-GAC contractor (ENVIRON International Corporation) report, which provides detailed documentation of the on-road mobile inventory development.

5.3 MOTOR VEHICLE EMISSIONS BUDGETS FOR RFP MILESTONE YEARS

The RFP MVEB reflect the on-road mobile EI for each RFP milestone year, the on-road mobile reduction strategies used to demonstrate RFP, and a 10 percent transportation conformity safety margin. A transportation conformity safety margin is allowed when there is an excess in emission reductions required to demonstrate RFP for a milestone year. The amount of the safety margin is less than the total in excess emission reductions for nitrogen oxides (NO_x) and volatile organic compounds (VOC) and, therefore, even if the safety margin is used for a transportation conformity determination, the HGB area will still meet the 1997 eight-hour ozone standard RFP requirements for all milestone years. Summaries of the calculation of the MVEB for each RFP milestone year are presented in Tables 5-1: *2008 RFP Motor Vehicle Emissions Budgets for the HGB Area*, 5-2: *2011 RFP Motor Vehicle Emissions Budgets for the HGB Area*, 5-3: *2014 RFP Motor Vehicle Emissions Budgets for the HGB Area*, 5-4: *2017 RFP Motor Vehicle Emissions Budgets for the HGB Area*, 5-5: *2018 RFP Motor Vehicle Emissions Budgets for the HGB Area*. The details of the calculation of the MVEB is documented in Sheets 10 through 14 of Appendix 1: *HGB RFP Demonstration Calculations Spreadsheet*. The RFP control strategy produces more than the required emissions reductions for each milestone year. Some of the excess in emissions reductions for each milestone year is used to provide a safety margin. This safety margin is less than the total emissions reductions needed for the RFP demonstration; therefore, even if this safety margin is used, the HGB area will still demonstrate RFP for each milestone.

Table 5-1: 2008 RFP Motor Vehicle Emissions Budgets for the HGB Eight-County Ozone Nonattainment Area

Description	NO _x tons per day	VOC tons per day
2008 On-Road Emissions Projection Without Post-1990 FCAA Controls	363.05	194.89
2008 On-Road Mobile Reasonable Further Progress Controls		
Tier 1 Federal Motor Vehicle Control Program (Tier 1 FMVCP)	68.11	45.57
Federal Reformulated Gasoline (All 8 Counties)	46.75	34.24
I/M in Harris County	13.65	10.42
National Low Emission Vehicle Program (NLEV)	9.12	5.33
Expanded I/M (Brazoria, Fort Bend, Galveston, and Montgomery)	7.06	3.09
Tier 2 Federal Motor Vehicle Control Program (Tier 2 FMVCP)	24.98	9.91
2007 Heavy-Duty Diesel FMVCP	8.7	0.15
On-Road TxLED	8.87	0.04
2008 On-Road Emissions Projection With Post-1990 FCAA Controls (Uncontrolled inventory minus control reductions)	175.81	86.14
Add Transportation Conformity Safety Margin ¹	17.58	8.61
2008 RFP Motor Vehicle Emissions Budgets	193.39	94.75

¹ The 2008 RFP reductions exceed the required emissions reductions. Excess emissions equaling 10 percent of the 2008 on-road emissions projection with post-1990 FCAA controls for each NO_x and VOC is used to provide a safety margin for 2008.

Table 5-2: 2011 RFP Motor Vehicle Emissions Budgets for the HGB Eight-County Ozone Nonattainment Area

Description	NO _x tons per day	VOC tons per day
2011 On-Road Emissions Projection Without Post-1990 FCAA Controls	372.46	205.03
2011 On-Road Mobile Reasonable Further Progress Controls		
Tier 1 Federal Motor Vehicle Control Program (Tier 1 FMVCP)	62.24	63.02
Federal Reformulated Gasoline (All 8 Counties)	72.94	34.51
I/M in Harris County	16.07	11.35
National Low Emission Vehicle Program (NLEV)	9.31	4.81
Expanded I/M (Brazoria, Fort Bend, Galveston, and Montgomery)	5.12	3.3
Tier 2 Federal Motor Vehicle Control Program (Tier 2 FMVCP)	51.95	19.19
2007 Heavy-Duty Diesel FMVCP	28.22	0.45
On-Road TxLED	3.21	0.06
2011 On-Road Emissions Projection With Post-1990 FCAA Controls (Uncontrolled inventory minus control reductions)	123.40	68.34
Add Transportation Conformity Safety Margin ¹	12.34	6.83
2011 RFP Motor Vehicle Emissions Budgets	135.74	75.17

¹ The 2011 RFP reductions exceed the required emissions reductions. Excess emissions equaling 10 percent of the 2011 on-road emissions projection with post-1990 FCAA controls for each NO_x and VOC is used to provide a safety margin for 2011.

Table 5-3: 2014 RFP Motor Vehicle Emissions Budgets for the HGB Eight-County Ozone Nonattainment Area

Description	NO _x tons per day	VOC tons per day
2014 On-Road Emissions Projection Without Post-1990 FCAA Controls	407.05	222.41
2014 On-Road Mobile Reasonable Further Progress Controls		
Tier 1 Federal Motor Vehicle Control Program (Tier 1 FMVCP)	56.88	79.36
Federal Reformulated Gasoline (All 8 Counties)	104.41	37.17
I/M in Harris County	20.82	12.43
National Low Emission Vehicle Program (NLEV)	6.16	3.27
Expanded I/M (Brazoria, Fort Bend, Galveston, and Montgomery)	10.15	4.44
Tier 2 Federal Motor Vehicle Control Program (Tier 2 FMVCP)	53.79	16.87
2007 Heavy-Duty Diesel FMVCP	66.13	12.53
On-Road TxLED	2.11	0.12
2014 On-Road Emissions Projection With Post-1990 FCAA Controls (Uncontrolled inventory minus control reductions)	86.60	56.22
Add Transportation Conformity Safety Margin ¹	8.66	5.62
2014 RFP Motor Vehicle Emissions Budgets	95.26	61.84

¹ The 2014 RFP reductions exceed the required emissions reductions. Excess emissions equaling 10 percent of the 2014 on-road emissions projection with post-1990 FCAA controls for each NO_x and VOC is used to provide a safety margin for 2014.

Table 5-4: 2017 RFP Motor Vehicle Emissions Budgets for the HGB Eight-County Ozone Nonattainment Area

Description	NO _x tons per day	VOC tons per day
2017 On-Road Emissions Projection Without Post-1990 FCAA Controls	432.04	237.86
2017 On-Road Mobile Reasonable Further Progress Controls		
Tier 1 Federal Motor Vehicle Control Program (Tier 1 FMVCP)	49.05	91.17
Federal Reformulated Gasoline (All 8 Counties)	128.94	39.99
I/M in Harris County	25.11	13.49
National Low Emission Vehicle Program (NLEV)	3.42	1.97
Expanded I/M (Brazoria, Fort Bend, Galveston, and Montgomery)	8.63	4.32
Tier 2 Federal Motor Vehicle Control Program (Tier 2 FMVCP)	91.98	37.20
2007 Heavy-Duty Diesel FMVCP	61.69	1.00
On-Road TxLED	1.45	0.33
2017 On-Road Emissions Projection With Post-1990 FCAA Controls (Uncontrolled inventory minus control reductions)	61.77	48.39
Add Transportation Conformity Safety Margin ¹	6.18	4.84
2017 RFP Motor Vehicle Emissions Budgets	67.95	53.23

¹ The 2017 RFP reductions exceed the required emissions reductions. Excess emissions equaling 10 percent of the 2017 on-road emissions projection with post-1990 FCAA controls for each NO_x and VOC is used to provide a safety margin for 2017.

Table 5-5: 2018 RFP Motor Vehicle Emissions Budgets for the HGB Eight-County Ozone Nonattainment Area

Description	NO _x tons per day	VOC tons per day
2018 On-Road Emissions Projection Without Post-1990 FCAA Controls	443.70	242.84
2018 On-Road Mobile Reasonable Further Progress Controls		
Tier 1 Federal Motor Vehicle Control Program (Tier 1 FMVCP)	49.28	94.52
Federal Reformulated Gasoline (All 8 Counties)	135.65	40.97
I/M in Harris County	26.48	13.90
National Low Emission Vehicle Program (NLEV)	2.66	1.59
Expanded I/M (Brazoria, Fort Bend, Galveston, and Montgomery)	9.16	4.50
Tier 2 Federal Motor Vehicle Control Program (Tier 2 FMVCP)	96.36	39.39
2007 Heavy-Duty Diesel FMVCP	67.54	1.08
On-Road TxLED	1.19	0.21
2018 On-Road Emissions Projection With Post-1990 FCAA Controls (Uncontrolled inventory minus control reductions)	55.38	46.68
Add Transportation Conformity Safety Margin ¹	5.54	4.67
2018 RFP Motor Vehicle Emissions Budgets	60.92	51.35

¹ The 2018 RFP reductions exceed the required emissions reductions. Excess emissions equaling 10 percent of the 2018 on-road emissions projection with post-1990 FCAA controls for each NO_x and VOC is used to provide a safety margin for 2018.