TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
AGENDA ITEM REQUEST
for Proposed State Implementation Plan Revision

AGENDA REQUESTED: 05/31/2023

DATE OF REQUEST: 05/12/2023

INDIVIDUAL TO CONTACT REGARDING CHANGES TO THIS REQUEST, IF NEEDED: Jamie Zech, Agenda Coordinator, (512) 239-3935

CAPTION: **Docket No. 2023-0306-SIP.** Consideration for publication of, and hearing on, the proposed Houston-Galveston-Brazoria Moderate Area Attainment Demonstration State Implementation Plan (SIP) Revision for the 2015 Eight-Hour Ozone National Ambient Air Quality Standard.

To meet federal Clean Air Act requirements, the proposed SIP revision would include a photochemical modeling analysis, a weight of evidence analysis, a reasonably available control technology analysis, a reasonably available control measures analysis, motor vehicle emissions budgets for 2023, and a contingency plan. (Vanessa T. De Arman, John Minter; Project No. 2022-022-SIP-NR)

Richard C. Chism
Director

Donna F. Huff
Division Deputy Director

Jamie Zech
Agenda Coordinator

Copy to CCC Secretary? **NO** ☒ **YES** ☐

Texas Commission on Environmental Quality
Interoffice Memorandum

To: Commissioners **Date:** May 12, 2023

Thru: Laurie Gharis, Chief Clerk
Erin E. Chancellor, Interim Executive Director

From: Richard Chism, Director *RCC*
Office of Air

Docket No.: 2022-0306-SIP

Subject: Commission Approval for Proposal of the Houston-Galveston-Brazoria (HGB) Moderate Area Attainment Demonstration (AD) State Implementation Plan (SIP) Revision for the 2015 Eight-Hour Ozone National Ambient Air Quality Standard (NAAQS)

HGB 2015 Ozone NAAQS Moderate AD SIP Revision
Non-Rule Project No. 2022-022-SIP-NR

Background and reason(s) for the SIP revision:
Six counties comprise the HGB 2015 ozone NAAQS (0.070 parts per million) nonattainment area: Brazoria, Chambers, Fort Bend, Galveston, Harris, and Montgomery Counties. Based on monitoring data from 2018, 2019, and 2020, the area did not attain the 2015 eight-hour ozone NAAQS by the attainment date of August 3, 2021 for areas classified as marginal, and did not qualify for a one-year attainment date extension in accordance with federal Clean Air Act (FCAA), §181(a)(5).[1] On October 7, 2022, the United States Environmental Protection Agency (EPA) published a final notice reclassifying the area from marginal to moderate, effective November 7, 2022 (87 *Federal Register* (FR) 60897).

The HGB 2015 ozone NAAQS nonattainment area is now subject to the moderate nonattainment area requirements in FCAA, §182(b), and the Texas Commission on Environmental Quality (TCEQ) is required to submit moderate area AD and reasonable further progress (RFP) SIP revisions to EPA. The attainment date for the moderate classification is August 3, 2024 with a 2023 attainment year (87 FR 60897).[2] EPA set a January 1, 2023 deadline for states to submit AD and RFP SIP revisions to address the 2015 eight-hour ozone standard moderate nonattainment area requirements.

Scope of the SIP revision:
As a result of reclassification, the TCEQ is required to submit to EPA an AD SIP revision consistent with FCAA requirements for areas classified as moderate nonattainment for the 2015 eight-hour ozone NAAQS.

A.) Summary of what the SIP revision would do:
This SIP revision includes a photochemical modeling analysis and a weight-of-evidence (WoE) analysis that evaluates the attainment status of the area. This proposed SIP revision also includes a reasonably available control measures (RACM) analysis, a reasonably available control technology (RACT) analysis, and a contingency plan that would provide additional emissions reductions if the area fails to attain the standard by the moderate attainment date. To ensure that federal transportation funding conforms to the SIP, this proposed HGB AD SIP revision contains nitrogen

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[1] An area that fails to attain the 2015 eight-hour ozone NAAQS by its attainment date would be eligible for the first one-year extension if, for the attainment year, the area's fourth highest daily maximum eight-hour average is at or below the level of the standard (70 parts per billion (ppb)); the HGB area's fourth highest daily maximum eight-hour average for 2020 was 75 ppb as measured at the Conroe Relocated monitor (C78/A321). The HGB area's design value for 2020 was 79 ppb.
[2] The attainment year ozone season is the ozone season immediately preceding a nonattainment area's attainment date.

oxides and volatile organic compounds motor vehicle emissions budgets (MVEB) for the 2023 attainment year. No control measures were identified as RACM for this SIP revision because any such measures would have had to be implemented by January 1, 2023, to be considered as even potentially advancing attainment. This proposed SIP revision also includes a RACT analysis from the 2008 Ozone NAAQS Serious AD SIP Revision for the HGB area, adopted March 4, 2020. The 2020 SIP revision for the 2008 ozone NAAQS was performed at a more stringent classification than the current proposed SIP revision. Additionally, the 2020 RACT analysis for the HGB area used a 2017 base year, which is only two years prior to the 2019 base year used for the current proposed SIP revision. Therefore, the RACT analysis performed for the 2008 Ozone NAAQS Serious AD SIP Revision is adequate for the purposes of this proposed 2015 Ozone NAAQS Moderate AD SIP Revision.

B.) Scope required by federal regulations or state statutes:
If adopted, this SIP revision would be submitted to EPA in response to the requirements of FCAA, §182(b)(1) and EPA's *Implementation of the 2015 National Ambient Air Quality Standards for Ozone: State Implementation Plan Requirements; Final Rule* (2015 eight-hour ozone standard SIP requirements rule). The FCAA-required SIP elements include analyses for RACT and RACM, MVEBs, and a contingency plan. Consistent with EPA's November 2018 modeling guidance, this proposed SIP revision includes a modeled attainment demonstration and a WoE analysis.[3] This SIP revision also includes performance standard modeling for the existing vehicle inspection and maintenance (I/M) program and certification statements to confirm that I/M, nonattainment new source review, and Stage I gasoline vapor recovery program requirements have been met for the HGB 2015 ozone NAAQS nonattainment area.

C.) Additional staff recommendations that are not required by federal rule or state statute:
None.

Statutory authority:
The authority to propose and adopt SIP revisions is derived from the following sections of Texas Health and Safety Code, Chapter 382, Texas Clean Air Act (TCAA), §382.002, which provides that the policy and purpose of the TCAA is to safeguard the state's air resources from pollution; TCAA, §382.011, which authorizes the commission to control the quality of the state's air; and TCAA, §382.012, which authorizes the commission to prepare and develop a general, comprehensive plan for the control of the state's air. This revision is required by FCAA, §110(a)(1) and is proposed under the commission's general authority under Texas Water Code, §5.102, General Powers and §5.105, General Policy. The SIP revision is also proposed under 42 United States Code, §§7420 *et seq.*, and implementing rules in 40 Code of Federal Regulations Part 51, which requires states to submit SIP revisions that specify the manner in which the NAAQS will be achieved and maintained within each air quality control region of the state.

Effect on the:

A.) Regulated community:
This SIP revision will impact the regulated community by changing the SIP base emissions year for emissions banking and trading credit generation for the HGB 2015 ozone NAAQS nonattainment area to 2019. On April 9, 2021, TCEQ communicated this change to regulated entities.

[3] EPA. *Modeling Guidance for Demonstrating Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze.* November 29, 2018. https://www.epa.gov/sites/default/files/2020-10/documents/o3-pm-rh-modeling_guidance-2018.pdf.

B.) Public:
The general public in the HGB ozone nonattainment area may benefit from the area ultimately meeting the ozone NAAQS and the area being redesignated as attainment for the 2015 eight-hour ozone NAAQS.

C.) Agency programs:
No additional burden on agency programs is anticipated as a result of this SIP revision.

Stakeholder meetings:
The TCEQ hosted and attended multiple meetings for the HGB area related to the proposed SIP revision. Agenda topics included the status of HGB photochemical modeling development, emissions inventories and trends, ozone design values, and planning activities for the HGB 2015 Eight-Hour Ozone Moderate Classification AD SIP Revision. Attendees included representatives from industry, county and city government, environmental groups, and the public.

If this proposed SIP revision is approved by the commission for public comment and public hearing, then a formal public comment period will be opened, and a public hearing will be offered.

Public Involvement Plan
Yes.

Alternative Language Requirements
Yes. Spanish.

Potential controversial concerns and legislative interest:
The current project timeline allows for submission to EPA by the end of 2023, after EPA's January 1, 2023 SIP submittal deadline. Missing the submittal deadline could lead to EPA issuing a finding of failure to submit prior to TCEQ's planned submittal, which would start sanctions and federal implementation plan (FIP) clocks. EPA would be required to promulgate a FIP any time within two years after finding TCEQ failed to make the required submission unless TCEQ submits, and EPA approves, a plan revision correcting the deficiency prior to promulgating the FIP. Sanctions could include transportation funding restrictions, grant withholdings, and 2-to-1 emissions offset requirements for new construction and major modifications of stationary sources in the HGB 2015 ozone NAAQS nonattainment area. Based on the TCEQ's modeling and available data, the HGB area is not expected to attain the 2015 ozone NAAQS by the August 3, 2024 attainment date.

A 2021 court ruling on the 2015 eight-hour ozone standard SIP requirements rule vacated provisions in the rule allowing for the use of previously implemented measures as contingency measures (*Sierra Club v. EPA*, 21 F.4th 815, D.C. Cir. 2021). EPA published draft guidance on contingency measures in the *Federal Register* for public comment on March 23, 2023. Since EPA had not issued guidance to states regarding contingency measures at the time it was developed, this SIP revision relies on the historically approved approach of using surplus mobile source emissions reductions to fulfill the contingency measure requirements.

Would this proposed revision affect any current policies or require development of new policies?
No.

What are the consequences if this SIP revision does not go forward? Are there alternatives to revision?
The commission could choose to not comply with requirements to develop and submit an AD SIP revision to EPA. However, if the SIP revision is not submitted to EPA, EPA could issue a finding of

failure to submit, requiring that TCEQ submit the required SIP revision within a specified time period, and impose sanctions on the state. EPA would be required to promulgate a FIP anytime within two years after finding TCEQ failed to make the required submission. Sanctions could include transportation funding restrictions, grant withholdings, and 2-to-1 emissions offsets requirements for new construction and major modifications of stationary sources in the HGB 2015 ozone NAAQS nonattainment area. EPA could impose such sanctions and implement a FIP until the state submitted, and EPA approved, an AD SIP revision for the area.

Key points in the proposal SIP revision schedule:

Anticipated proposal date: May 31, 2023
Anticipated public hearing date: July 11, 2023
Anticipated public comment period: June 2, 2023 through July 17, 2023
Anticipated adoption date: November 8, 2023

Agency contacts:
Vanessa T. De Arman, SIP Project Manager, Air Quality Division, (512) 239-5609
John Minter, Staff Attorney, Environment Law Division, (512) 239-0663
Jamie Zech, Agenda Coordinator, Air Quality Division, (512) 239-3935

cc: Chief Clerk, 2 copies
Executive Director's Office
Jim Rizk
Morgan Johnson
Krista Kyle
Office of General Counsel
Vanessa T. De Arman
John Minter
Terry Salem
Jamie Zech

REVISIONS TO THE STATE OF TEXAS AIR QUALITY IMPLEMENTATION PLAN FOR THE CONTROL OF OZONE AIR POLLUTION

HOUSTON-GALVESTON-BRAZORIA 2015 EIGHT-HOUR OZONE STANDARD NONATTAINMENT AREA

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
P.O. BOX 13087
AUSTIN, TEXAS 78711-3087

HOUSTON-GALVESTON-BRAZORIA MODERATE AREA ATTAINMENT DEMONSTRATION STATE IMPLEMENTATION PLAN REVISION FOR THE 2015 EIGHT-HOUR OZONE NATIONAL AMBIENT AIR QUALITY STANDARD

PROJECT NUMBER 2022-022-SIP-NR

Proposal
May 31, 2023

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EXECUTIVE SUMMARY

Six counties comprise the Houston-Galveston-Brazoria (HGB) 2015 ozone National Ambient Air Quality Standard (NAAQS) (0.070 parts per million) nonattainment area: Brazoria, Chambers, Fort Bend, Galveston, Harris, and Montgomery Counties. Based on monitoring data from 2018, 2019, and 2020, the area did not attain the 2015 eight-hour ozone NAAQS by the attainment date for areas classified as marginal, August 3, 2021, and did not qualify for a one-year attainment date extension in accordance with federal Clean Air Act (FCAA), §181(a)(5).[1] On October 7, 2022, the United States Environmental Protection Agency (EPA) published a final notice reclassifying the area from marginal to moderate, effective November 7, 2022 (87 *Federal Register* (FR) 60897).

The HGB 2015 ozone NAAQS nonattainment area is now subject to the requirements in FCAA, §182(b) for moderate nonattainment areas. The Texas Commission on Environmental Quality (TCEQ) is required to submit moderate ozone classification attainment demonstration (AD) and reasonable further progress (RFP) state implementation plan (SIP) revisions to the EPA. The attainment date for areas classified as moderate is August 3, 2024 with a 2023 attainment year (87 FR 60897).[2] The EPA set a January 1, 2023 deadline for states to submit AD and RFP SIP revisions to address the 2015 eight-hour ozone standard moderate nonattainment area requirements.

This proposed HGB AD SIP revision includes the following required SIP elements for moderate ozone nonattainment areas: photochemical modeling, a reasonably available control technology (RACT) analysis, a reasonably available control measures (RACM) analysis, a weight-of-evidence (WoE) analysis, a contingency plan, attainment year motor vehicle emissions budgets (MVEB) for transportation conformity purposes, performance standard modeling for the existing vehicle inspection and maintenance (I/M) program, and certification statements to confirm that I/M, nonattainment new source review, and Stage I gasoline vapor recovery program requirements have been met for the HGB 2015 ozone NAAQS nonattainment area.

This HGB AD SIP revision is scheduled to be proposed in conjunction with the Dallas-Fort Worth (DFW) and HGB 2015 Eight-Hour Ozone Moderate Classification RFP SIP Revision (Project No. 2022-023-SIP-NR).

This proposed HGB AD SIP revision includes a photochemical modeling analysis of reductions in nitrogen oxides (NO_x) and volatile organic compounds (VOC) emissions from existing control strategies and a WoE analysis. The peak ozone design value for the HGB 2015 ozone NAAQS nonattainment area is estimated to be 76 parts per billion (ppb) in 2023.The quantitative and qualitative analyses in Chapter 5: *Weight of*

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[1] An area that fails to attain the 2015 eight-hour ozone NAAQS by its attainment date would be eligible for the first one-year extension if, for the attainment year, the area's fourth-highest daily maximum eight-hour average is at or below the level of the standard (70 parts per billion (ppb)); the HGB area's fourth-highest daily maximum eight-hour average for 2020 was 75 ppb as measured at the Conroe Relocated monitor (C78/A321). The HGB area's design value for 2020 was 79 ppb.

[2] The attainment year ozone season is the ozone season immediately preceding a nonattainment area's attainment date.

Evidence supplement the photochemical modeling analysis presented in Chapter 3: *Photochemical Modeling* to characterize 2023 future year ozone conditions.

For the photochemical modeling analysis, this proposed SIP revision includes a base case modeling episode of April through October of 2019. This modeling episode was chosen because the period is representative of the times of the year that eight-hour ozone levels above 70 ppb have historically been monitored within the nonattainment area. The model performance evaluation of the 2019 base case indicates the modeling is suitable for use in conducting the modeling attainment test. The modeling attainment test was applied by modeling a 2019 base year and 2023 future year to estimate 2023 eight-hour ozone design values.

Table ES-1: *Summary of 2019 Base and 2023 Future Case Anthropogenic Modeling Emissions for HGB 2015 Ozone NAAQS Nonattainment Area for June 12 Episode Day* lists the anthropogenic modeling emissions of NO_x and VOC in tons per day (tpd) by source category for a sample episode day of June 12 in the 2019 base and 2023 future case ozone modeling. The differences in modeling emissions between the 2019 base case and the 2023 future case reflect the net of economic growth and reductions from existing controls. The existing controls include both state and federal measures that have already been adopted.

Table ES-1: Summary of 2019 Base and 2023 Future Case Anthropogenic Modeling Emissions for HGB 2015 Ozone NAAQS Nonattainment Area for June 12 Episode Day

Emission Source Category	2019 NO_x (tpd)	2023 NO_x (tpd)	2019 VOC (tpd)	2023 VOC (tpd)
On-Road	77.64	54.85	39.06	31.09
Non-Road	36.13	30.26	36.65	36.78
Off-Road – Airports	9.20	7.44	2.77	2.54
Off-Road – Locomotives	10.48	7.93	0.54	0.39
Off-Road – Commercial Marine	63.41	55.11	3.62	3.62
Area	35.16	36.27	255.86	270.05
Oil and Gas – Drilling	0.29	0.25	0.03	0.02
Oil and Gas – Production	1.01	1.01	35.25	16.98
Point – EGU	30.82	42.41	1.17	6.86
Point – Non-EGU	71.46	93.42	96.44	101.55
HGB Nonattainment Area Total	**335.60**	**328.95**	**471.39**	**469.88**

The future year on-road mobile source emission inventories for this proposed SIP revision were developed using the version 3 of the EPA Motor Vehicle Emission Simulator (MOVES3) model. These 2023 attainment year inventories establish the NO_x and VOC MVEB that, once found adequate or approved by the EPA, must be used in transportation conformity analyses. The attainment MVEBs represent the updated future year on-road mobile source emissions that have been modeled for the AD and include all of the on-road control measures. The MVEBs are provided in Table 4-2: *2023 Attainment Demonstration MVEB for the HGB 2015 Ozone NAAQS Nonattainment Area.*

The eight-hour ozone design values for the 2019 base case design value (DVB) and modeled 2023 future case design value (DVF) for the regulatory ozone monitors in the HGB 2015 ozone NAAQS nonattainment area are shown in Table ES-2: *Summary of 2019 DVBs and Modeled 2023 DVF for HGB 2015 Ozone NAAQS Nonattainment Area Regulatory Monitors*. In accordance with the EPA's November 2018 *Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze*,[3] the 2023 DVF presented have been rounded to one decimal place and then truncated. Based on the TCEQ's modeling and available data, the HGB area is not expected to attain the 2015 ozone NAAQS by the August 3, 2024 attainment date.

Table ES-2: Summary of 2019 DVBs and Modeled 2023 DVF for HGB 2015 Ozone NAAQS Nonattainment Area Regulatory Monitors

Monitor Name	CAMS Number	2019 DVB (ppb)	Relative Response Factor	2023 DVF (ppb)
Houston Aldine	0008	78.00	0.985	76
Houston Bayland Park	0053	76.67	0.974	74
Channelview	0015	68.00	0.996	67
Clinton	0403	71.00	0.990	70
Conroe Relocated	0078	74.33	0.994	73
Houston Croquet	0409	71.33	0.981	69
Houston Deer Park #2	0035	75.67	0.996	75
Galveston 99th St.	1034	74.00	0.989	73
Baytown Garth	1017	71.33	0.999	71
Houston East	0001	72.67	0.996	72
Lake Jackson	1016	65.00	0.993	64
Lang	0408	72.00	0.981	70
Lynchburg Ferry	1015	64.33	0.996	64
Manvel Croix Park	0084	74.33	0.981	72
Houston Monroe	0406	66.67	0.987	65
Houston North Wayside	0405	65.00	0.989	64
Northwest Harris Co.	0026	72.67	0.990	71
Park Place	4016	73.00	0.990	72
Seabrook Friendship Park	0045	67.67	1.000	67
Houston Westhollow	0410	70.00	0.973	68

This proposed HGB AD SIP revision documents a photochemical modeling analysis and a WoE assessment that meets EPA modeling guidance.

[3] https://www.epa.gov/sites/default/files/2020-10/documents/o3-pm-rh-modeling_guidance-2018.pdf

SECTION V-A: LEGAL AUTHORITY

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. In 1989, the TCAA was codified as Chapter 382 of the Texas Health and Safety Code. The TCAA is frequently amended for various purposes during the biennial legislative sessions.

Originally, the TCAA stated that the Texas Air Control Board (TACB) was the state air pollution control agency and was the 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). 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 section 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. In 2011, the 82nd Texas Legislature continued the existence of the TCEQ until 2023.

With the creation of the TNRCC (and its successor the TCEQ), the authority over air quality is found in both the Texas Water Code (TWC) and the TCAA. The general authority of the TCEQ is found in TWC, Chapter 5 and enforcement authority is provided by TWC, Chapter 7. TWC, Chapter 5, Subchapters A - F, H - J, and L, include the general provisions, organization, and general powers and duties of the TCEQ, and the responsibilities and authority of the executive director. TWC, Chapter 5 also authorizes the TCEQ to implement action when emergency conditions arise and to conduct hearings. 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.

In addition, 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.

<u>Applicable Law</u>
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.

<u>Statutes</u>
All sections of each subchapter are included with the most recent effective date, unless otherwise noted.

TEXAS HEALTH & SAFETY CODE, Chapter 382	September 1, 2021
TEXAS WATER CODE	September 1, 2021

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, 5.231, 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, 7.0025, 7.004, and 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, 7.178-7.183 only)

Rules

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

Chapter 7: Memoranda of Understanding, §§7.110 and 7.119
December 13, 1996 and May 2, 2002, respectively

Chapter 19: Electronic Reporting — March 15, 2007
Subchapter A: General Provisions
Subchapter B: Electronic Reporting Requirements

Chapter 39: Public Notice
Subchapter H: Applicability and General Provisions, §§39.402(a)(1) – (a)(6), (a)(8), and (a)(10) – (a)(12); §§39.405(f)(3) and (g), (h)(1)(A), (h)(2) – (h)(4), (h)(6), (h)(8) – (h)(11), (i) and (j), §39.407, §39.409;§§39.411(a), (e)(1) – (4)(A)(i) and (iii), (4)(B), (e)(5) introductory paragraph, (e)(5)(A),(e)(5)(B), (e)(6) – (e)(10), (e)(11)(A)(i), (e)(11)(A)(iii) – (vi), (e)(11)(B) – (F), (e)(13) and (e)(15), (e)(16), (f) introductory paragraph, (f)(1) – (8), (g) and (h);39.418(a), (b)(2)(A), (b)(3), and (c); §39.419(e);39.420 (c)(1)(A) – (D)(i)(I) and (II), (c)(1)(D)(ii), (c)(2), (d) – (e), and (h), and Subchapter K: Public Notice of Air Quality Permit Applications, §§39.601 – 39.605 — September 16, 2021

Chapter 55: Requests for Reconsideration and Contested Case Hearings; Public Comment, all of the chapter, except §55.125(a)(5) and (a)(6) — September 16, 2021

Chapter 101: General Air Quality Rules — May 14, 2020

Chapter 106: Permits by Rule, Subchapter A — April 17, 2014

Chapter 111: Control of Air Pollution from Visible Emissions and Particulate Matter — November 12, 2020

Chapter 112: Control of Air Pollution from Sulfur Compounds — October 27, 2022

Chapter 114: Control of Air Pollution from Motor Vehicles — April 21, 2022

Chapter 115: Control of Air Pollution from Volatile Organic Compounds — July 22, 2021

Chapter 116: Control of Air Pollution by Permits for New Construction or Modification — July 1, 2021

Chapter 117: Control of Air Pollution from Nitrogen Compounds — March 26, 2020

Chapter 118: Control of Air Pollution Episodes — March 5, 2000

Chapter 122: Federal Operating Permits Program

SECTION VI: CONTROL STRATEGY

A. Introduction (No change)
B. Ozone (Revised)
   1. Dallas-Fort Worth (No change)
   2. Houston-Galveston-Brazoria (Revised)
   3. Beaumont-Port Arthur (No change)
   4. El Paso (No change)
   5. Regional Strategies (No change)
   6. Northeast Texas (No change)
   7. Austin Area (No change)
   8. San Antonio Area (No change)
   9. Victoria Area (No change)
C. Particulate Matter (No change)
D. Carbon Monoxide (No change)
E. Lead (No change)
F. Oxides of Nitrogen (No change)
G. Sulfur Dioxide (No change)
H. Conformity with the National Ambient Air Quality Standards (No change)
I. Site Specific (No change)
J. Mobile Sources Strategies (No change)
K. Clean Air Interstate Rule (No change)
L. Transport (No change)
M. Regional Haze (No change)

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LIST OF ACRONYMS

ACT	Alternative Control Techniques
AD	attainment demonstration
AEDT	Aviation Environmental Design Tool
AMPD	Air Markets Program Data
APU	auxiliary power unit
AQRP	Air Quality Research Program
AQS	Air Quality System
auto-GC	Automated Gas Chromatograph
$(BC)^2$	Black and Brown Carbon
BACT	best available control technology
BEIS	Biogenic Emissions Inventory System
BELD5	Biogenic Emissions Landuse Data
CAMS	continuous air monitoring station
CAMx	Comprehensive Air Model with Extensions
CFR	Code of Federal Regulations
CMV	commercial marine vessel
CSAPR	Cross-State Air Pollution Rule
CTG	Control Technique Guidelines
D.C.	District of Columbia
DERA	Diesel Emissions Reduction Act
DERI	Diesel Emissions Reduction Incentive
DMA	Marine Distillate fuel A
DMX	Marine Distillate fuel X
DTIP	Drayage Truck Incentive Program
DV	design value
DVB	base case design value
DVF	future case design value
EE/RE	energy efficiency/renewable energy
EGF	electric generating facility
EGU	electric generating unit
EI	emissions inventory
EPA	United States Environmental Protection Agency

ERC	emission reduction credits
ESL	Energy Systems Laboratory
FAA	Federal Aviation Administration
FCAA	federal Clean Air Act
FIP	federal implementation plan
FR	*Federal Register*
GEOS-Chem	Goddard Earth Observing System—Chemistry model
GSE	ground support equipment
HB	House Bill
HECT	Highly Reactive Volatile Organic Compound Emissions Cap and Trade
H-GAC	Houston-Galveston Area Council
HGB	Houston-Galveston-Brazoria
HPMS	Highway Performance Monitoring System
HRVOC	highly reactive volatile organic compounds
I/M	inspection and maintenance
IC/BC	Initial and boundary conditions
km	kilometer
LDAR	leak detection and repair
m	meter
MACT	maximum achievable control technology
MCR	mid-course review
MDA8	maximum daily average eight-hour
MECT	Mass Emissions Cap and Trade
MODIS	Moderate-Resolution Imaging Spectroradiometer
MOVES	Motor Vehicle Emissions Simulator
MPE	model performance evaluation
MVEB	motor vehicle emissions budget
MW	megawatt
MWh	megawatt-hour
NAAQS	National Ambient Air Quality Standard
NASA	National Aeronautics and Space Administration
NMB	normalized mean bias
NME	normalized mean error
NO_2	nitrogen dioxide

NO_X	nitrogen oxides
NSR	new source review
NTIG	New Technology Implementation Grants
PAMS	Photochemical Assessment Monitoring Station
PEI	periodic emissions inventory
PHA	Port of Houston Authority
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers
ppb	parts per billion
ppbC	parts per billion by carbon
ppbv	parts per billion by volume
ppm	parts per million
PSM	performance standard modeling
RACM	reasonably available control measures
RACT	reasonably available control technology
RAQPAC	Regional Air Quality Planning Advisory Committee
RFP	reasonable further progress
ROP	rate of progress
RRF	relative response factor
RS	redesignation substitute
SB	Senate Bill
SIP	State Implementation Plan
SMOKE	Sparse Matrix Operation Kernel Emissions
SO2	sulfur dioxide
SPRY	Seaport and Rail Yard Areas Emissions Reduction
STARS	State of Texas Air Reporting System
TAC	Texas Administrative Code
TACB	Texas Air Control Board
TAMIS	Texas Air Monitoring Information System
TCAA	Texas Clean Air Act
TCEQ	Texas Commission on Environmental Quality (commission)
TCFP	Texas Clean Fleet Program
TCM	transportation control measure
TDM	travel demand model

TERP	Texas Emissions Reduction Plan
TexN2	Texas NONROAD utility version 2
TIM	Technical Information Meeting
THSC	Texas Health and Safety Code
TNGVGP	Texas Natural Gas Vehicle Grant Program
TNMOC	total non-methane organic compounds
TNRCC	Texas Natural Resource Conservation Commission
tpd	tons per day
tpy	tons per year
TSD	technical support document
TTI	Texas Transportation Institute
TWC	Texas Water Code
TxDOT	Texas Department of Transportation
TxLED	Texas Low Emission Diesel
U.S.	United States
VMT	vehicle miles traveled
VOC	volatile organic compounds
WoE	weight of evidence
WRF	Weather Research and Forecasting

LIST OF PREVIOUS STATE IMPLEMENTATION PLAN (SIP) REVISIONS AND REPORTS

The following list references SIP revisions and reports that were previously adopted by the commission and submitted to the United States Environmental Protection Agency (EPA). The list identifies how these SIP revisions are referenced in this document and contains the project number, adoption date, and full title. Copies of these SIP revisions are located on the Texas SIP Revisions webpage (https://www.tceq.texas.gov/airquality/sip/sipplans.html).

2000 HGB One-Hour Ozone Attainment Demonstration (AD) and Post-1999 Rate of Progress (ROP) SIP Revision (TCEQ Project No. 2000-011-SIP-AI, adopted December 6, 2000) HGB One-Hour Ozone Post-1999 ROP and Attainment Demonstration SIP Revision

2001 HGB Follow-Up One-Hour Ozone AD and ROP SIP Revision (TCEQ Project No. 2001-007-SIP-AI, adopted September 26, 2001) HGB One-Hour Ozone Post-1999 ROP and Attainment Demonstration Follow-Up SIP Revision

2002 HGB One-Hour Ozone AD Follow-Up SIP Revision (TCEQ Project No. 2002-046a-SIP-AI, adopted December 13, 2002) HGB One-Hour Ozone Post-1999 ROP and Attainment Demonstration SIP Revision

2004 HGB One-Hour Ozone Post-1999 ROP SIP Revision (TCEQ Project No. 2004-049b-SIP-NR, adopted October 27, 2004) HGB One-Hour Ozone Post-1999 ROP SIP Revision

2004 HGB One-Hour Ozone AD Mid-Course Review (MCR) SIP Revision (TCEQ Project No. 2004-042-SIP-NR, adopted December 1, 2004) HGB Mid-Course Review of the One-Hour Ozone Attainment Demonstration SIP Revision

2007 HGB 1997 Eight-Hour Ozone SIP Revision (TCEQ Project No. 2006-027-SIP-NR, adopted May 23, 2007) Houston-Galveston-Brazoria (HGB) 1997 Eight-Hour Ozone Nonattainment Area SIP Revision

2007 HGB 1997 Eight-Hour Ozone Reasonable Further Progress (RFP) SIP Revision (TCEQ Project No. 2006-030-SIP-NR, adopted May 23, 2007) Houston-Galveston-Brazoria (HGB) 1997 Eight-Hour Ozone Nonattainment Area Reasonable Further Progress (RFP) SIP Revision

2010 HGB 1997 Eight-Hour Ozone AD SIP Revision (TCEQ Project No. 2009-017-SIP-NR, adopted March 10, 2010) Houston-Galveston-Brazoria (HGB) 1997 Eight-Hour Ozone Attainment Demonstration SIP Revision

2010 HGB 1997 Eight-Hour Ozone RFP SIP Revision (TCEQ Project No. 2009-018-SIP-NR, adopted March 10, 2010) Houston-Galveston-Brazoria (HGB) 1997 Eight-Hour Ozone Reasonable Further Progress (RFP) SIP Revision

2011 HGB 1997 Eight-Hour Ozone Reasonably Available Control Technology (RACT) Update SIP Revision (TCEQ Project No. 2010-028-SIP-NR, adopted December 7, 2011)

Houston-Galveston-Brazoria (HGB) Reasonably Available Control Technology (RACT) Analysis SIP Revision

2013 HGB 1997 Eight-Hour Ozone Motor Vehicle Emissions Budget (MVEB) Update SIP Revision (TCEQ Project Number 2012-002-SIP-NR, adopted April 23, 2013) Houston-Galveston-Brazoria (HGB) Motor Vehicle Emissions Budget (MVEB) Update SIP Revision

2014 HGB/Dallas-Fort Worth (DFW) 2008 Eight-Hour Ozone Emissions Inventory (EI) SIP Revision (TCEQ Project No. 2013-016-SIP-NR, adopted July 2, 2014) Emissions Inventory (EI) for the 2008 Eight-Hour Ozone Standard for the Houston-Galveston-Brazoria (HGB) and Dallas-Fort Worth (DFW) Areas SIP Revision

2014 HGB One-Hour Ozone Redesignation Substitute (RS) Report (Submitted to the EPA on July 22, 2014) Redesignation Substitute Report for the Houston-Galveston-Brazoria (HGB) One-Hour Ozone Standard Nonattainment Area

2015 HGB One-Hour Ozone National Ambient Air Quality Standard (NAAQS) SIP Revision (TCEQ Project No. 2014-011-SIP-NR, adopted July 1, 2015) Houston-Galveston-Brazoria (HGB) Area Redesignation Substitute for the One-Hour Ozone National Ambient Air Quality Standard (NAAQS) State Implementation Plan (SIP) Revision

2015 HGB 1997 Eight-Hour Ozone RS Report (Submitted to the EPA on August 18, 2015) Redesignation Substitute Reports for the Houston-Galveston-Brazoria (HGB) 1997 Eight-Hour Ozone Standard Nonattainment Area and the Dallas-Fort Worth (DFW) One-Hour and 1997 Eight-Hour Ozone Standard Nonattainment Areas

2016 HGB 1997 Eight-Hour Ozone Standard RS SIP Revision (TCEQ Project No. 2015-001-SIP-NR, adopted April 27, 2016) Houston-Galveston-Brazoria (HGB) Area Redesignation Substitute (RS) for the 1997 Eight-Hour Ozone National Ambient Air Quality Standard (NAAQS) State Implementation Plan (SIP) Revision

2016 HGB 2008 Eight-Hour Ozone AD Moderate Classification SIP Revision (TCEQ Project No. 2016-016-SIP-NR, adopted December 15, 2016) Houston-Galveston-Brazoria Attainment Demonstration State Implementation Plan Revision for the 2008 Eight-Hour Ozone Standard Nonattainment Area

2016 HGB 2008 Eight-Hour Ozone RFP Moderate Classification SIP Revision (TCEQ Project No. 2016-017-SIP-NR, adopted December 15, 2016) Houston-Galveston-Brazoria (HGB) Reasonable Further Progress (RFP) State Implementation Plan (SIP) Revision for the 2008 Eight-Hour Ozone Standard Nonattainment Area

2018 HGB One-Hour and 1997 Eight-Hour Ozone Redesignation and Maintenance Plan SIP Revision (TCEQ Project No. 2018-026-SIP-NR, adopted December 12, 2018) Houston-Galveston-Brazoria (HGB) Redesignation Request and Maintenance Plan for the One-Hour and 1997 Eight-Hour Ozone Standards SIP Revision

2020 HGB 2008 Eight-Hour Ozone Serious Classification AD SIP Revision (TCEQ Project No. 2019-077-SIP-NR, adopted March 4, 2020) Houston-Galveston-Brazoria

(HGB) Serious Classification Attainment Demonstration (AD) State Implementation Plan (SIP) Revision for the 2008 Eight-Hour Ozone National Ambient Air Quality Standard (NAAQS)

2020 DFW and HGB 2008 Eight-Hour Ozone Serious Classification RFP SIP Revision (TCEQ Project No. 2019-079-SIP-NR, adopted March 4, 2020) Dallas-Fort Worth (DFW) and Houston-Galveston-Brazoria (HGB) Serious Classification Reasonable Further Progress (RFP) State Implementation Plan (SIP) Revision for the 2008 Eight-Hour Ozone Standard Nonattainment Area

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CHAPTER 1: GENERAL

1.1 BACKGROUND

Information on the Texas State Implementation Plan (SIP) and a list of SIP revisions and other air quality plans adopted by the commission can be found on the Texas State Implementation Plan webpage (https://www.tceq.texas.gov/airquality/sip) on the Texas Commission on Environmental Quality's (TCEQ) website (https://www.tceq.texas.gov).

1.2 INTRODUCTION

The following history of the one-hour and eight-hour ozone National Ambient Air Quality Standards (NAAQS) and summaries of the Houston-Galveston-Brazoria (HGB) area one-hour and eight-hour ozone SIP revisions is provided to give context and greater understanding of the complex issues involved in the area's ozone challenge.

1.2.1 One-Hour Ozone NAAQS History (No change)

No change from the 2020 HGB Serious Classification Attainment Demonstration (AD) SIP for 2008 Eight-Hour Ozone NAAQS (Project Number: 2019-077-SIP-NR).

1.2.1.1 December 2000 (No change)

No change from the 2020 HGB Serious Classification AD SIP for 2008 Eight-Hour Ozone NAAQS (Project Number: 2019-077-SIP-NR).

1.2.1.2 September 2001 (No change)

No change from 2020 HGB Serious Classification AD SIP for 2008 Eight-Hour Ozone NAAQS.

1.2.1.3 December 2002 (No change)

No change from 2020 HGB Serious Classification AD SIP for 2008 Eight-Hour Ozone NAAQS.

1.2.1.4 October 2004 (No change)

No change from 2020 HGB Serious Classification AD SIP for 2008 Eight-Hour Ozone NAAQS.

1.2.1.5 December 2004 (No change)

No change from 2020 HGB Serious Classification AD SIP for 2008 Eight-Hour Ozone NAAQS.

1.2.1.6 Redesignation Substitute (RS) for the One-Hour Ozone NAAQS (No change)

No change from 2020 HGB Serious Classification AD SIP for 2008 Eight-Hour Ozone NAAQS.

1.2.1.7 Redesignation Request and Maintenance Plan SIP Revision for the One-Hour Ozone NAAQS

On February 16, 2018, the United States Court of Appeals for the District of Columbia Circuit (D.C. Circuit Court) issued an opinion in the case *South Coast Air Quality Management District v. EPA, 882 F.3d 1138 (D.C. Cir. 2018)*. The case was a challenge to the United States Environmental Protection Agency's (EPA) 2008 eight-hour ozone standard SIP requirements rule (80 *Federal Register* (FR) 12264), which revoked the 1997 eight-hour ozone NAAQS as part of the implementation of the more stringent 2008 eight-hour ozone NAAQS. The court's decision vacated parts of the EPA's 2008 eight-hour ozone standard SIP requirements rule, including the RS, removal of anti-backsliding requirements for areas designated nonattainment under the 1997 eight-hour ozone NAAQS, waiver of requirements for transportation conformity for maintenance areas under the revoked 1997 eight-hour ozone NAAQS, and elimination of the requirement to submit a second 10-year maintenance plan. The court's vacatur of removal of anti-backsliding requirements for areas designated nonattainment under the 1997 eight-hour ozone NAAQS may also apply to areas that were designated nonattainment under the one-hour ozone NAAQS.

To address the D.C. Circuit Court's ruling, the commission adopted a formal redesignation request and maintenance plan SIP revision for the one-hour and the 1997 eight-hour ozone NAAQS on December 12, 2018. The 2018 HGB One-Hour and 1997 Eight-Hour Ozone Redesignation and Maintenance Plan SIP Revision includes a request that the HGB area be redesignated to attainment for the revoked one-hour NAAQS as well as the 1997 eight-hour ozone NAAQS and a maintenance plan that ensures the area remains in attainment of both standards through 2032. The maintenance plan uses a 2014 base year inventory and includes interim year inventories for 2020 and 2026, establishes motor vehicle emissions budgets (MVEB) for 2032, and includes a contingency plan. The TCEQ submitted this SIP revision to the EPA on December 14, 2018. On February 14, 2020, the EPA published a final approval of the HGB redesignation request and maintenance plan, terminating anti-backsliding obligations, and approving the federal Clean Air Act (FCAA), §185 fee program (85 FR 8411). On November 13, 2020, the Sierra Club filed a petition to review the EPA's final action on the HGB redesignation request and maintenance plan and the FCAA, §185 fee program. On August 26, 2022, the D.C. Circuit Court determined that it was not the proper venue for the matter and granted the EPA's requests to transfer the petition to the Fifth Circuit Court of Appeals and the voluntary remand of its approval of the HGB FCAA, §185 fee program. On December 1, 2022, the petitioners filed, and the court granted, a motion to voluntarily dismiss the petition.

1.2.2 1997 Eight-Hour Ozone NAAQS History (No change)

No change from 2020 HGB Serious Classification AD SIP for 2008 Eight-Hour Ozone NAAQS.

1.2.3 2008 Eight-Hour Ozone NAAQS History

On March 12, 2008, the EPA lowered the primary and secondary eight-hour ozone NAAQS to 0.075 parts per million (73 (FR) 16436). Attainment of this standard is achieved when an area's design value does not exceed 75 parts per billion (ppb). On May 21, 2012, the HGB eight-county area, consisting of Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties, was designated nonattainment and classified as marginal under the 2008 eight-hour ozone NAAQS, effective July 20, 2012. On May 21, 2012, the EPA published the implementation rule for the 2008 eight-hour ozone standard which set the attainment date for the HGB marginal nonattainment area as December 31, 2015 (77 FR 30160).

On December 23, 2014, the D.C. Circuit Court ruled on a lawsuit filed by the Natural Resources Defense Council, which resulted in vacatur of the EPA December 31 attainment date for the 2008 eight-hour ozone NAAQS. As part of the EPA's final 2008 eight-hour ozone standard SIP requirements rule, the EPA modified 40 Code of Federal Regulations (CFR) §51.1103 consistent with the D.C. Circuit Court decision to establish attainment dates that run from the effective date of designation, i.e., July 20, 2012, rather than the end of the 2012 calendar year. As a result, the attainment date for the HGB marginal nonattainment area changed from December 31, 2015 to July 20, 2015. In addition, because the attainment year ozone season is the ozone season immediately preceding a nonattainment area's attainment date, the attainment year for the HGB marginal nonattainment area changed from 2015 to 2014.

On July 2, 2014, the commission adopted the 2014 HGB/Dallas-Fort Worth (DFW) 2008 Eight-Hour Ozone Emissions Inventory (EI) SIP Revision to satisfy the FCAA, §172(c)(3) and §182(a)(1) emissions inventory reporting requirements for the HGB marginal nonattainment area under the 2008 eight-hour ozone NAAQS. The EPA published direct final approval of this EI SIP revision on February 20, 2015 (80 FR 9204).

1.2.3.1 Reclassification to Moderate for the 2008 Eight-Hour NAAQS

The HGB area did not attain the 2008 eight-hour ozone standard in 2014 but qualified for a one-year attainment date extension in accordance with FCAA, §181(a)(5). On May 4, 2016, the EPA published final approval of the one-year attainment date extension for the HGB 2008 eight-hour ozone marginal nonattainment area to July 20, 2016 with a 2015 attainment year (81 FR 26697).

Because the HGB area's 2015 design value of 80 ppb exceeded the 2008 eight-hour ozone NAAQS, the EPA published a final determination of nonattainment and reclassification of the HGB 2008 eight-hour ozone nonattainment area from marginal to moderate nonattainment on December 14, 2016 (81 FR 90207). The EPA set a January 1, 2017 deadline for the state to submit an attainment demonstration that addressed the 2008 eight-hour ozone NAAQS moderate nonattainment area requirements, including reasonable further progress (RFP). As indicated in the EPA's 2008 eight-hour ozone standard SIP requirements rule, the attainment date for moderate classification was July 20, 2018 with an attainment year of 2017.

1.2.3.2 December 2016

On December 15, 2016, the commission adopted two revisions to the Texas SIP for the HGB ozone nonattainment area. The 2016 HGB 2008 Eight-Hour Ozone AD Moderate Classification SIP Revision included a photochemical modeling analysis of reductions in nitrogen oxides (NO_x) and volatile organic compounds (VOC) emissions from existing control strategies and a weight of evidence (WoE) analysis, which met the requirements to demonstrate attainment of the 2008 eight-hour ozone NAAQS. Consistent with the requirements of FCAA, 182(b)(1) and the EPA's 2008 eight-hour ozone standard SIP requirements rule, the AD SIP revision also included a reasonably available control technology (RACT) analysis, a reasonably available control measures (RACM) analysis, MVEBs for the 2017 attainment year, and a contingency plan. The AD SIP revision also incorporated a rulemaking to 30 Texas Administrative Code (TAC) Chapter 115 to implement RACT for VOC storage tanks in the HGB area (Rule Project No. 2016-039-115-AI).

The 2016 HGB 2008 Eight-Hour Ozone RFP Moderate Classification SIP Revision demonstrated a 15% emissions reduction in ozone precursors from the 2011 base year through the 2017 attainment year and a 3% reduction for contingency in 2018. The RFP SIP revision also set NO_X and VOC MVEBs for the 2017 attainment year.

1.2.3.3 Reclassification to Serious for the 2008 Eight-Hour Ozone NAAQS

Based on monitoring data from 2015, 2016, and 2017, the HGB area did not attain the 2008 eight-hour ozone NAAQS in 2017[4] and did not qualify for a one-year attainment date extension in accordance with FCAA, §181(a)(5).[5] On August 23, 2019, the EPA published the final notice reclassifying the HGB nonattainment area from moderate to serious for the 2008 eight-hour ozone NAAQS, effective September 23, 2019 (84 FR 44238). As indicated in the EPA's 2008 eight-hour ozone standard SIP requirements rule, the attainment date for a serious classification was July 20, 2021 with a 2020 attainment year. The EPA set an August 3, 2020 deadline for states to submit AD and RFP SIP revisions to address the 2008 eight-hour ozone standard serious nonattainment area requirements.

On March 4, 2020, the commission adopted the 2020 HGB 2008 Eight-Hour Ozone AD Serious Classification SIP Revision. Consistent with the requirements of FCAA, 182(b)(1) and the EPA's 2008 eight-hour ozone standard SIP requirements rule, the AD SIP revision included photochemical modeling, corroborative WoE analysis, an analysis of RACM, including RACT, and contingency measures that provided additional emissions reductions. To ensure that federal transportation funding conforms to the SIP, the HGB AD SIP revision also contained 2020 attainment year MVEBs.

1.2.3.4 Reclassification to Severe for the 2008 Eight-Hour Ozone NAAQS

Based on monitoring data from 2018, 2019, and 2020, the HGB area did not attain the 2008 eight-hour ozone NAAQS in the 2020 attainment year, but did qualify for a one-year attainment date extension in accordance with FCAA, §181(a)(5).[6] On April 5, 2021, the TCEQ submitted a one-year attainment date extension request to the EPA. On October 7, 2022, the EPA published a final notice denying the one-year attainment date extension request and reclassifying the HGB nonattainment area from serious to severe for the 2008 eight-hour ozone NAAQS, effective November 7, 2022 (87 FR 60926). The attainment date for the severe classification is July 20, 2027, with a 2026 attainment year. States must submit AD and RFP SIP revisions to the EPA by May 7, 2024, 18 months from the effective date of the reclassification, to address the 2008 eight-hour ozone standard severe nonattainment area requirements.

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[4] The attainment year ozone season is the ozone season immediately preceding a nonattainment area's attainment date.

[5] An area that fails to attain the 2008 eight-hour ozone NAAQS by its attainment date would be eligible for the first one-year extension if, for the attainment year, the area's fourth-highest daily maximum eight-hour average is at or below the level of the standard (75 ppb); the HGB area's fourth-highest daily maximum eight-hour average for 2017 was 79 ppb as measured at the Conroe Relocated monitor (C78/A321). The HGB area's design value for 2017 was 81 ppb.

[6]The HGB area's fourth-highest daily maximum eight-hour average for 2020 was 75 ppb as measured at the Conroe Relocated monitor (C78/A321). The HGB area's design value for 2020 was 79 ppb.

1.2.4 2015 Eight-Hour Ozone NAAQS History

On October 1, 2015, the EPA lowered the primary and secondary eight-hour ozone NAAQS to 0.070 ppm (80 FR 65292), effective December 28, 2015. On June 4, 2018 the EPA published final designations for areas under the 2015 eight-hour ozone NAAQS. A six-county HGB area including Brazoria, Chambers, Fort Bend, Galveston, Harris, and Montgomery Counties was designated nonattainment and classified as marginal under the 2015 eight-hour ozone NAAQS, effective August 3, 2018 (83 FR 25776).

1.2.4.1 Marginal Classification for the 2015 Eight-Hour Ozone NAAQS

Under a marginal classification, the HGB area was required to attain the 2015 eight-hour ozone standard by the end of 2020 to meet an August 3, 2021 attainment date. On June 10, 2020, the commission adopted the 2015 Eight-Hour Ozone NAAQS EI SIP Revision for the HGB, DFW, and Bexar County Nonattainment Areas (Non-Rule Project No. 2019-111-SIP-NR). The SIP revision satisfies FCAA, §172(c)(3) and §182(a)(1) EI reporting requirements for nonattainment areas under the 2015 eight-hour ozone NAAQS, including the HGB area. The revision also includes certification statements to confirm that the emissions statement and nonattainment new source review requirements have been met for the HGB, DFW, and Bexar County 2015 eight-hour ozone nonattainment areas. On June 29, 2021, the EPA published final approval of the EI for the HGB 2015 ozone nonattainment area (86 FR 34139). On September 9, 2021, the EPA published final approval of the nonattainment new source review and emissions statement portions of the SIP revision (86 FR 50456).

1.2.4.2 Reclassification to Moderate for the 2015 Eight-Hour Ozone NAAQS

Based on monitoring data from 2018, 2019, and 2020, the HGB area did not attain the 2015 eight-hour ozone NAAQS in the 2020 attainment year and did not qualify for a one-year attainment date extension in accordance with FCAA, §181(a)(5).[7] On October 7, 2022, the EPA published final notice reclassifying the six-county HGB area from marginal to moderate nonattainment for the 2015 eight-hour ozone NAAQS, effective November 7, 2022 (87 FR 60897). The attainment date for the moderate classification is August 3, 2024, with a 2023 attainment year. The EPA set a January 1, 2023 deadline for states to submit AD and RFP SIP revisions to address the 2015 eight-hour ozone standard moderate nonattainment area requirements.

1.2.5 Existing Ozone Control Strategies

Existing control strategies implemented to address the one-hour, 1997 eight-hour, and 2008 eight-hour ozone standards are expected to continue to reduce emissions of ozone precursors in the HGB 2015 ozone NAAQS nonattainment area and positively impact progress toward attainment of the ozone NAAQS. The one-hour and eight-hour ozone design values for the HGB area from 1991 through 2022 are illustrated in Figure 1-1: *Ozone Design Values and Population in the HGB Area*. Both one-hour and eight-hour ozone design values have decreased over the past 31 years. The 2022 one-hour ozone design value of 113 ppb decreased by 49%, almost half the 1991 design value of 220 ppb. The 2022 eight-hour ozone design value of 78 ppb represents a 37% decrease

[7] The HGB area's fourth-highest daily maximum eight-hour average for 2020 was 75 ppb as measured at the Conroe Relocated monitor (C78/A321). The HGB area's design value for 2020 was 79 ppb.

from the 1991 value of 124 ppb. These decreases in design values occurred despite an 86% increase in area population from 1991 through 2021.

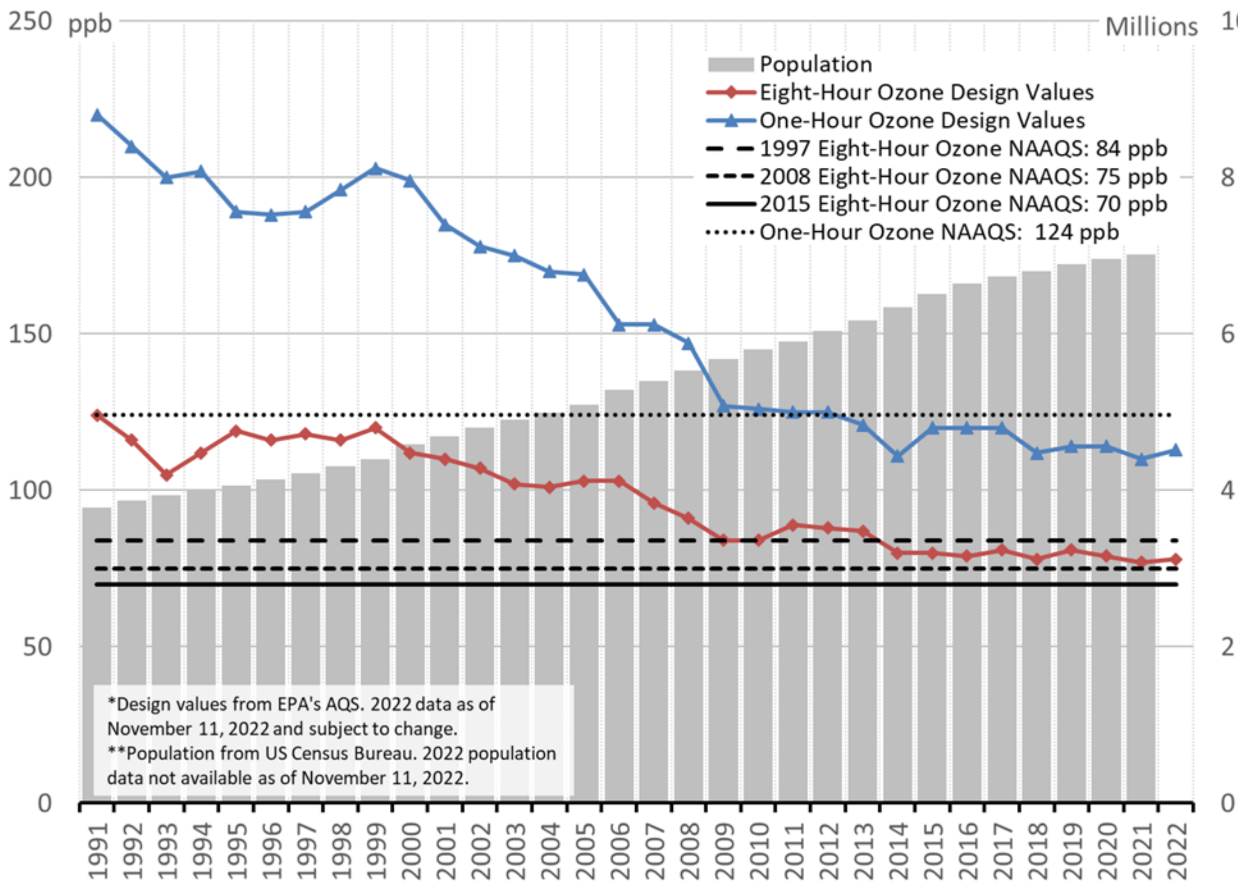

Figure 1-1: Ozone Design Values and Population in the HGB Area

1.3 HEALTH EFFECTS

In 2015, the EPA revised the primary eight-hour ozone NAAQS to 0.070 ppm (70 ppb). To support the 2015 eight-hour primary ozone standard, the EPA provided information that suggested that health effects may potentially occur at levels lower than the previous 0.075 ppm (75 ppb) standard. Breathing relatively high levels of ground-level ozone can cause acute respiratory problems like cough and decreases in lung function and can aggravate the symptoms of asthma. Repeated exposures to high levels of ozone can potentially make people more susceptible to allergic responses and lung inflammation.

Children are at a relatively higher risk from exposure to ozone when compared to adults since they breathe more air per pound of body weight than adults and because children's respiratory systems are still developing. Children also spend a considerable amount of time outdoors during summer and during the start of the school year (August through October) when elevated ozone levels are typically measured. Adults most at risk from exposures to elevated ozone levels are people working or exercising outdoors and individuals with preexisting respiratory diseases.

1.4 STAKEHOLDER PARTICIPATION AND PUBLIC MEETINGS

1.4.1 Regional Air Quality Planning Advisory Committee Meetings

The Regional Air Quality Planning Advisory Committee (RAQPAC) is appointed by the Houston-Galveston Area Council (H-GAC) Board of Directors and includes representatives of local government, public health, transportation, industry, business, environmental organizations, and citizens from the HGB area. The committee assists and advises H-GAC, regional and local governments, transportation organizations and other agencies on air quality issues. TCEQ SIP Team staff provide air quality planning updates at the RAQPAC monthly meetings. More information about this committee is available on the RAQPAC webpage (http://www.h-gac.com/board-of-directors/advisory-committees/regional-air-quality-planning-advisory-committee/default.aspx).

1.4.2 HGB Air Quality Technical Information Meeting (TIM)

The HGB Air Quality TIM is provided to present technical and scientific information related to air quality modeling and analysis in the HGB nonattainment area. The TCEQ hosted a virtual TIM on July 28, 2022 and included presentations on ozone planning, conformity analysis, ozone design values, modeling platform updates, marine emissions inventory development, Tracking Aerosol Convection Experiment – Air Quality field study, Section 185 fees, and an update from the EPA. More information is available on the HGB Air Quality TIM webpage (https://www.tceq.texas.gov/airquality/airmod/meetings/aqtim-hgb.html).

1.4.3 HGB Virtual Outreach Meetings

The TCEQ hosted virtual stakeholder outreach meetings on September 7, 2022 and September 8, 2022 to provide an update on planning for the development of the 2008 and 2015 ozone NAAQS SIP submissions. These meetings provided a brief overview of the HGB area's air quality status, the plan requirements for moderate and severe ozone nonattainment areas, and also provided an opportunity for input on existing and potential NO_X and VOC emission reduction measures being implemented within the point, area, and mobile emissions source sectors in the region. Presentation topics included ozone planning, ozone design values, emissions inventories and trends, emission control strategies, contingency measures, Section 185 fees, and RACT.

1.5 PUBLIC HEARING AND COMMENT INFORMATION

The commission will offer a public hearing for this proposed SIP revision at the following time and location:

Table 1-1: Public Hearing Information

City	Date	Time	Location
Houston	July 11, 2023	7:00pm	Houston-Galveston Area Council 3555 Timmons Ln #100 Houston, TX 77027

The public comment period will open on June 2, 2023 and close on July 17, 2023. Written comments will be accepted via mail, fax, or through the TCEQ Public Comment system (https://tceq.commentinput.com/). File size restrictions may apply to comments being submitted via the TCEQ Public Comment system. All comments should reference the "HGB 2015 Ozone NAAQS Moderate AD SIP Revision" and should reference Project Number 2022-022-SIP-NR. Comments submitted via hard copy may be mailed to Vanessa T. De Arman, MC 206, State Implementation Plan Team, Air Quality Division, Texas Commission on Environmental Quality, P.O. Box 13087, Austin, Texas 78711-3087 or faxed to (512) 239-4808. Comments submitted electronically must be submitted through the TCEQ Public Comment system. File size restrictions may apply to comments being submitted via the TCEQ Public Comment system. Comments must be received by 11:59 CDT on July 17, 2023.

An electronic version of the HGB 2015 Ozone NAAQS Moderate AD SIP Revision and appendices can be found at the TCEQ's HGB: Latest Ozone Planning Activities webpage (https://www.tceq.texas.gov/airquality/sip/hgb/hgb-latest-ozone). An electronic version of the public hearing notice will be available on the Texas SIP Revisions webpage (https://www.tceq.texas.gov/airquality/sip/sipplans.html).

1.6 SOCIAL AND ECONOMIC CONSIDERATIONS

No new control strategies have been incorporated into this proposed HGB AD SIP revision. Therefore, there are no additional social or economic costs associated with this revision.

1.7 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: ANTHROPOGENIC EMISSIONS INVENTORY DESCRIPTION

2.1 INTRODUCTION

The federal Clean Air Act (FCAA) requires that attainment demonstration (AD) emissions inventories (EI) be prepared for ozone nonattainment areas (April 16, 1992, 57 *Federal Register* (FR) 13498). Ground-level (tropospheric) ozone is produced when ozone precursors, volatile organic compounds (VOC) and nitrogen oxides (NO_X), undergo photochemical reactions in the presence of sunlight.

The Texas Commission on Environmental Quality (TCEQ) maintains an inventory of current information for anthropogenic sources of NO_X and VOC emissions that identifies the types of emissions sources present in an area, the amount of each pollutant emitted, and the types of processes and emissions control devices at each facility or source category. The total anthropogenic inventory of NO_X and VOC emissions for an area is derived from estimates developed for three general categories of emissions sources: point, area, and mobile (both non-road and on-road).

The EI also provides data for a variety of air quality planning tasks, including establishing baseline emissions levels, calculating emission reduction targets, developing control strategies to achieve emissions reductions, developing emissions inputs for air quality models, and tracking actual emissions reductions against established emissions growth and control budgets.

This chapter discusses general EI development for each of the anthropogenic source categories. Chapter 3: *Photochemical Modeling* details specific EIs and emissions inputs developed for the Houston-Galveston-Brazoria (HGB) 2015 ozone National Ambient Air Quality Standard (NAAQS) nonattainment area photochemical modeling.

2.2 POINT SOURCES

Stationary point source emissions data are collected annually from sites that meet the reporting requirements of 30 Texas Administrative Code (TAC) §101.10. This rule establishes EI reporting thresholds in ozone nonattainment areas that are currently at or less than major source thresholds in the HGB 2015 NAAQS ozone nonattainment area. Therefore, some minor sources in the area report to the point source EI.

To collect the data, the TCEQ provides detailed reporting instructions and tools for completing and submitting an EI. Companies submit EI data using a web-based system called the State of Texas Environmental Electronic Reporting System. Companies are required to report emissions data and to provide sample calculations used to determine the emissions. Information characterizing the process equipment, the emissions control devices, and the emission points is also required. As required by FCAA, §182(a)(3)(B), company representatives certify that reported emissions are true, accurate, and fully represent emissions that occurred during the calendar year to the best of the representative's knowledge.

All data submitted in the EI are reviewed for quality assurance purposes and then stored in the State of Texas Air Reporting System (STARS) database. The TCEQ's Point Source Emissions Inventory webpage (https://www.tceq.texas.gov/airquality/point-source-ei/psei.html) contains guidance documents and historical point source emissions data. Additional information is available upon request from the TCEQ's Air Quality Division.

Stationary sources must have state implementation plan (SIP) emissions and meet other requirements to be able generate emissions credits. SIP emissions are site- or facility-specific values based on the calendar year EI data used to develop the AD SIP revision's projection-base year inventory. The projection-base year is defined in 30 TAC §101.300(23) and refers to the EI year used to forecast future year emissions for modeling point sources.

For this proposed AD SIP revision, the TCEQ has designated the projection-base year for point sources as 2019 for electric generating units (EGU) with emissions recorded in the United States Environmental Protection Agency's (EPA) database for Air Markets Program Data and 2019 for all other stationary point sources (non-EGUs) with emissions recorded in the TCEQ STARS database. For more details on the projection-base year for point sources, please see Chapter 3, Section 3.4.2: *Emissions Inputs* and Section 3.3: *Point Sources* of Appendix A: *Modeling Technical Support Document (TSD).*

On April 9, 2021, the TCEQ requested regulated entities submit revisions to the 2019 point source EI by July 9, 2021. The point source emissions in this proposed SIP revision reflects updates submitted by the due date. The TCEQ provided notification to regulated entities and the public through its email distribution system and by posting the notice on the TCEQ website.[8]

2.3 AREA SOURCES

Stationary emissions sources that do not meet the reporting requirements of 30 TAC §101.10 for point sources are classified as area sources. Area sources are small-scale stationary industrial, commercial, and residential sources that use materials or perform processes that generate emissions of air pollutants. Examples of typical sources of VOC emissions include oil and gas production sources, printing operations, industrial coatings, degreasing solvents, house paints, gasoline service station underground tank filling, and vehicle refueling operations. Examples of typical fuel combustion sources that emit NO_X include oil and gas production sources, stationary source fossil fuel combustion at residences and businesses, outdoor refuse burning, and structure fires.

Area source emissions are estimated and calculated as county-wide totals rather than as individual sources. Area source emissions are typically calculated by applying EPA- or TCEQ-developed emissions factor (emissions per unit of activity) by the appropriate activity or activity surrogate responsible for generating emissions. Population is one of the more commonly used activity surrogates for area source calculations. Other activity data commonly used include the amount of gasoline sold in an area, employment by industry type, and crude oil and natural gas production.

The emissions data for the different area source categories are developed, reviewed for quality assurance, stored in the Texas Air Emissions Repository database, and

[8] https://wayback.archive-it.org/414/20220309051946/https://www.tceq.texas.gov/assets/public/implementation/air/ie/pseiforms/OzoneBumpUps_HGB-DFW-SAN.pdf

compiled to develop the statewide area source EI. The area source periodic emissions inventory (PEI) is reported every third year (triennially) to the EPA for inclusion in the National Emissions Inventory. The TCEQ submitted the most recent PEI for calendar year 2020.

2.4 NON-ROAD MOBILE SOURCES

Non-road vehicles (non-road sources) do not normally operate on roads or highways and are often referred to as off-road or off-highway vehicles. Non-road sources include agricultural equipment, commercial and industrial equipment, construction and mining equipment, lawn and garden equipment, aircraft and airport equipment, locomotives, drilling rigs, and commercial marine vessels (CMV).

For this proposed AD SIP revision, EIs for non-road sources were developed for the following subcategories: NONROAD model categories (as described further below), airports, locomotives, CMVs, and drilling rigs used in upstream oil and gas exploration activities. The airport subcategory includes estimates for emissions from the aircraft, auxiliary power units (APU), and ground support equipment (GSE) subcategories relevant for airports. The following sections describe the emissions estimates methodologies used for the non-road mobile source subcategories discussed below.

2.4.1 NONROAD Model Categories Emissions Estimation Methodology

The Motor Vehicle Emission Simulator 3 (MOVES3) model is the EPA's latest mobile source emissions model for estimating non-road source category emissions. The TCEQ has invested significant time and resources to develop a Texas-specific version of the non-road component of the MOVES model called Texas NONROAD utility version 2 (TexN2) that replaces EPA defaults used to determine emissions with county-specific activity data.[9] The TCEQ uses TexN2 to calculate emissions from all non-road mobile source equipment and recreational vehicles, with the exception of airports, locomotives, CMVs, and drilling rigs used in upstream oil and gas exploration activities. Because emissions for airports, CMVs, and locomotives are not included in either the MOVES3 model or TexN2 utility, the emissions for these categories are estimated using other EPA-approved methods and guidance. Although emissions for drilling rigs are included in the MOVES3 model and TexN2 utility, alternate emissions estimates were developed for that source category in order to develop more accurate county-level inventories. The equipment populations for drilling rigs were set to zero in the TexN2 utility to avoid double counting emissions from these sources.

2.4.2 Drilling Rig Diesel Engines Emissions Estimation Methodology

Drilling rig diesel engines used in upstream oil and gas exploration activities are included in the MOVES3 model category "Other Oilfield Equipment," which includes various types of equipment; however, due to significant growth in the oil and gas exploration and production industry, a 2015 survey of oil and gas exploration and production companies was used to develop updated drilling rig emissions

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[9] https://www.tceq.texas.gov/downloads/air-quality/research/reports/emissions-inventory/5822111300fy2021-20210423-erg-texn2-update.pdf

characterization profiles.[10] The drilling rig emissions characterization profiles from this study were combined with drilling activity data obtained from the Railroad Commission of Texas to develop the EI for this source category.

2.4.3 CMV and Locomotive Emissions Estimation Methodology

The locomotive EI was developed from a TCEQ-commissioned study using EPA-accepted EI development methods.[11] The locomotive EI includes line haul and yard emissions activity data from all Class I and Class III (currently, there are no Class II operators in Texas) locomotive activity and emissions by rail segment.

The CMV EI was developed from a TCEQ-commissioned study using EPA-accepted EI development methods.[12] The CMV EI includes at-port and underway emissions activity data from Category I, II, and III CMVs by county.

2.4.4 Airport Emissions Estimation Methodology

The airport EI was developed from a TCEQ-commissioned study using the Federal Aviation Administration's (FAA) Aviation Environmental Design Tool (AEDT) model.[13] AEDT is the most recent FAA model for estimating airport emissions and has replaced the FAA's Emissions and Dispersion Modeling System. The airport emissions categories used for this AD SIP revision included aircraft (commercial air carriers, air taxis, general aviation, and military), APU, and GSE operations.

2.5 ON-ROAD MOBILE SOURCES

On-road mobile emissions sources consist of automobiles, trucks, motorcycles, and other motor vehicles traveling on public roadways. On-road mobile source ozone precursor emissions are usually categorized as 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 from the vehicle. To calculate emissions, both the rate of emissions per unit of activity (emissions factors) and the number of units of activity must be determined.

This proposed SIP revision includes preliminary on-road EIs developed using MOVES3. Updated on-road EIs and emissions factors were developed using the EPA's mobile emissions factor model, MOVES3. The MOVES3 model may be run using national default information or the default information may be modified to simulate data specific to the HGB 2015 ozone NAAQS nonattainment area, such as the control programs, driving behavior, meteorological conditions, and vehicle characteristics. The TCEQ parameters reflect local conditions to the extent that local values are available;

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[10] https://wayback.archive-it.org/414/20210527185246/https://www.tceq.texas.gov/assets/public/implementation/air/am/contracts/reports/ei/5821552832FY1505-20150731-erg-drilling_rig_2014_inventory.pdf

[11] https://www.tceq.texas.gov/downloads/air-quality/research/reports/emissions-inventory/5822111027-20211015-tti-texas-locomotive-railyard-2020-aerr-trend-ei.pdf

[12] https://web.archive.org/web/20220122014359/https://www.tceq.texas.gov/downloads/air-quality/research/reports/emissions-inventory/5822111294fy2021-20210730-ramboll-2020-cmv-ei-trends.pdf

[13] https://www.tceq.texas.gov/downloads/air-quality/research/reports/emissions-inventory/5822111196-20211015-tti-texas-airport-2020-aerr-trend-ei.pdf

these local values are reflected in the emissions factors calculated by the MOVES3 model. The localized inputs used for the on-road mobile EI development include vehicle speeds for each roadway link, vehicle populations, vehicle hours idling, temperature, humidity, vehicle age distributions for each vehicle type, percentage of miles traveled for each vehicle type, type of inspection and maintenance program, fuel control programs, and gasoline vapor pressure controls.

To estimate on-road mobile source emissions, emissions factors calculated by the MOVES3 model must be multiplied by the level of vehicle activity. On-road mobile source emissions factors are expressed in units of grams per mile, grams per vehicle (evaporative), and grams per hour (extended idle); therefore, the activity data required to complete the inventory calculation are vehicle miles traveled (VMT) in units of miles per day, vehicle populations, and source hours idling. The level of vehicle travel activity is developed using travel demand models (TDM) run by the Texas Department of Transportation or by the local metropolitan planning organizations. The TDMs are validated against a large number of ground counts, i.e., traffic passing over counters placed in various locations throughout a county or area. For SIP EIs, VMT estimates are calibrated against outputs from the federal Highway Performance Monitoring System, a model built from a different set of traffic counters. Vehicle populations by source type are derived from the Texas Department of Motor Vehicles' registration database and, as needed, national estimates for vehicle source type population.

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 EI. Roadway speeds, required inputs for the MOVES3 model, are calculated by using the activity volumes from the TDMs and a post-processor speed model.

2.6 EI IMPROVEMENT

The TCEQ EI reflects years of emissions data improvement, including extensive point and area source inventory reconciliation with ambient emissions monitoring data. Reports detailing recent TCEQ EI improvement projects can be found at the TCEQ's Air Quality Research and Contract Projects webpage (https://www.tceq.texas.gov/airquality/airmod/project/pj.html).

CHAPTER 3: PHOTOCHEMICAL MODELING

3.1 INTRODUCTION

This chapter describes attainment demonstration (AD) modeling conducted in support of this proposed state implementation plan (SIP) revision. The Texas Commission on Environmental Quality (TCEQ) followed procedures recommended for AD modeling for the eight-hour ozone National Ambient Air Quality Standard (NAAQS) in the United States Environmental Protection Agency's (EPA) November 2018 *Modeling Guidance for Demonstrating Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze* (EPA, 2018; referred to as the EPA modeling guidance).[14]

Results of the 2019 base case and the 2023 future case photochemical modeling runs are presented, which were used to estimate the 2023 attainment year design value. Base case modeling was used to evaluate the photochemical model's ability to replicate measured ozone and precursor concentrations for a past timeframe with monitored high-ozone concentrations. Future case modeling estimates the change in ozone concentrations due to changes in anthropogenic emissions in a future year while keeping the meteorological and natural emissions (biogenic and wildfires) inputs from the base case constant. Future case modeling answers the question: what would the ozone concentrations be in the future if the same meteorological conditions (that resulted in a high ozone episode in the past) were to repeat?

This chapter summarizes the components of AD modeling, such as episode selection, modeling domain, and model inputs. A detailed description of the various modeling elements can be found in Appendix A: *Modeling Technical Support Document (TSD).*

3.2 MODELING EPISODE

The AD modeling uses the TCEQ's 2019 modeling platform, which has a modeling episode of April 1 through October 31, 2019. The EPA modeling guidance provides recommendations for choosing a modeling episode that will be appropriate to use for the modeling attainment test for eight-hour ozone AD SIP revisions. The recommendations are intended to ensure that the selected episode is representative of area-specific conditions that lead to exceedances of the eight-hour ozone NAAQS. This section provides an overview of the April through October 2019 ozone season in the Houston-Galveston-Brazoria (HGB) 2015 eight-hour ozone NAAQS moderate nonattainment area (HGB 2015 ozone NAAQS nonattainment area).

One of the recommended criteria for selecting a modeling episode is that the episode be in the recent past and contains a sufficient number of exceedance days. Exceedance days are defined as days when at least one regulatory monitor in the area had a Maximum Daily Eight-Hour Average (MDA8) ozone concentration that exceeded the 2015 ozone NAAQS of 70 parts per billion (ppb). Figure 3-1: *Exceedance Days in the HGB 2015 Ozone NAAQS Nonattainment Area by Year from 2012 through 2022* shows the number of HGB area exceedance days for the 2015 ozone NAAQS over a 10-year period. The year 2019 had 29 days with MDA8 ozone above 70 ppb, which is a sufficient number of exceedance days for a modeling episode.

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[14] https://www.epa.gov/sites/default/files/2020-10/documents/o3-pm-rh-modeling_guidance-2018.pdf

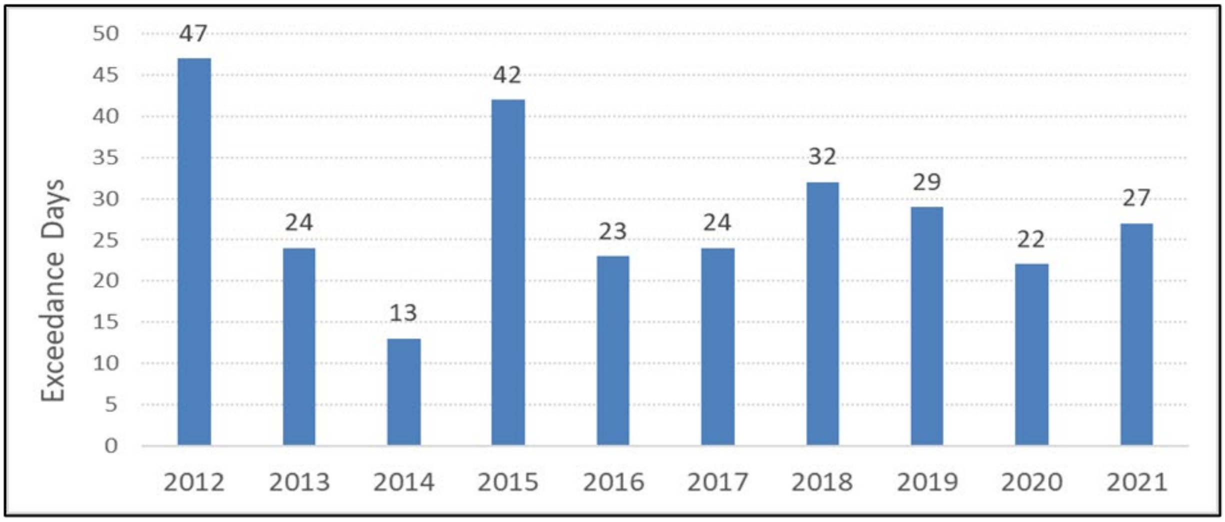

Figure 3-1: Exceedance Days in the HGB 2015 Ozone NAAQS Nonattainment Area by Year from 2012 through 2021

In selecting a modeling episode, the EPA recommends that the exceedance days follow historically observed temporal trends. Figure 3-2: *Exceedance Days by Month from 2012 through 2021 in the HGB 2015 Ozone NAAQS Nonattainment Area* shows that ozone exhibits two peaks, one in late spring and another in summer, with the mid-summer minimum occurring in July. High MDA8 ozone values at all three eight-hour ozone standard levels occurred from March through October with a few exceedances in March. Most exceedances occur between April and October, peaking in August.

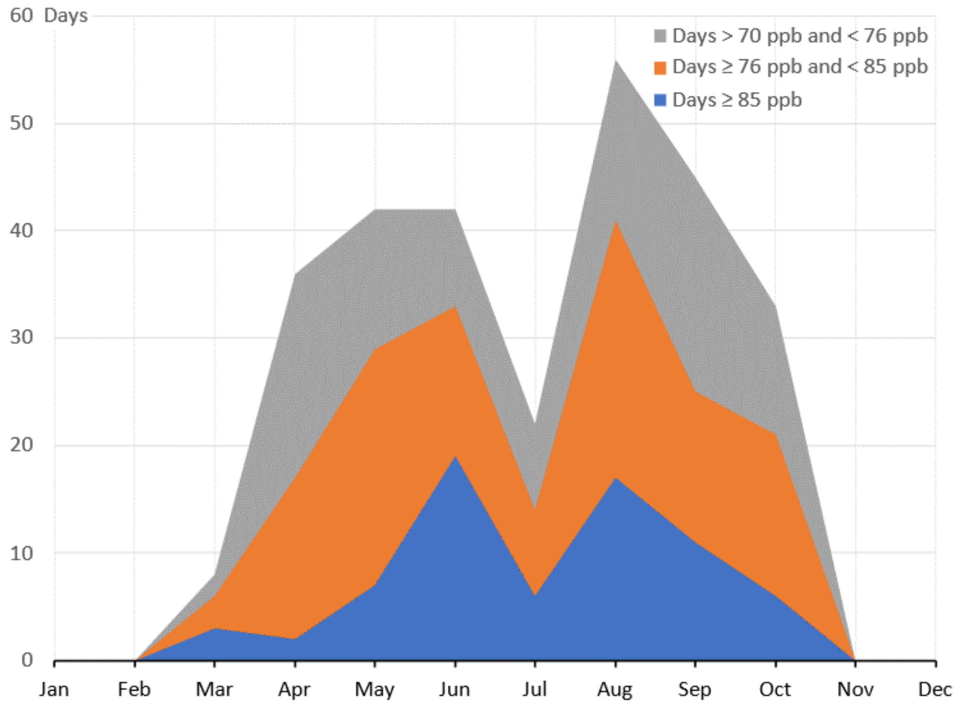

Figure 3-2: Exceedance Days by Month from 2012 through 2021 in the HGB 2015 Ozone NAAQS Nonattainment Area

Another recommendation from the EPA modeling guidance is to choose an episode when each regulatory monitor within the nonattainment area has at least five days during the episode when the MDA8 ozone concentration exceeded 60 ppb, which is the threshold for being included in the future year attainment test. There are 20 regulatory monitors within the six counties of the HGB 2015 nonattainment area. The regulatory monitors are shown in Figure 3-3: *Map of Ozone Monitoring Sites in the HGB 2015 Ozone NAAQS Nonattainment Area* as blue circles and are labeled with the monitor's short name and continuous air monitoring station (CAMS) number.[15]

[15] Maps in this document were generated by the Air Quality Division of the Texas Commission on Environmental Quality. The products are for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. They do not represent an on-the-ground survey and represent only the approximate relative location of property boundaries. For more information concerning these maps, contact the Air Quality Division at 512-239-1459.

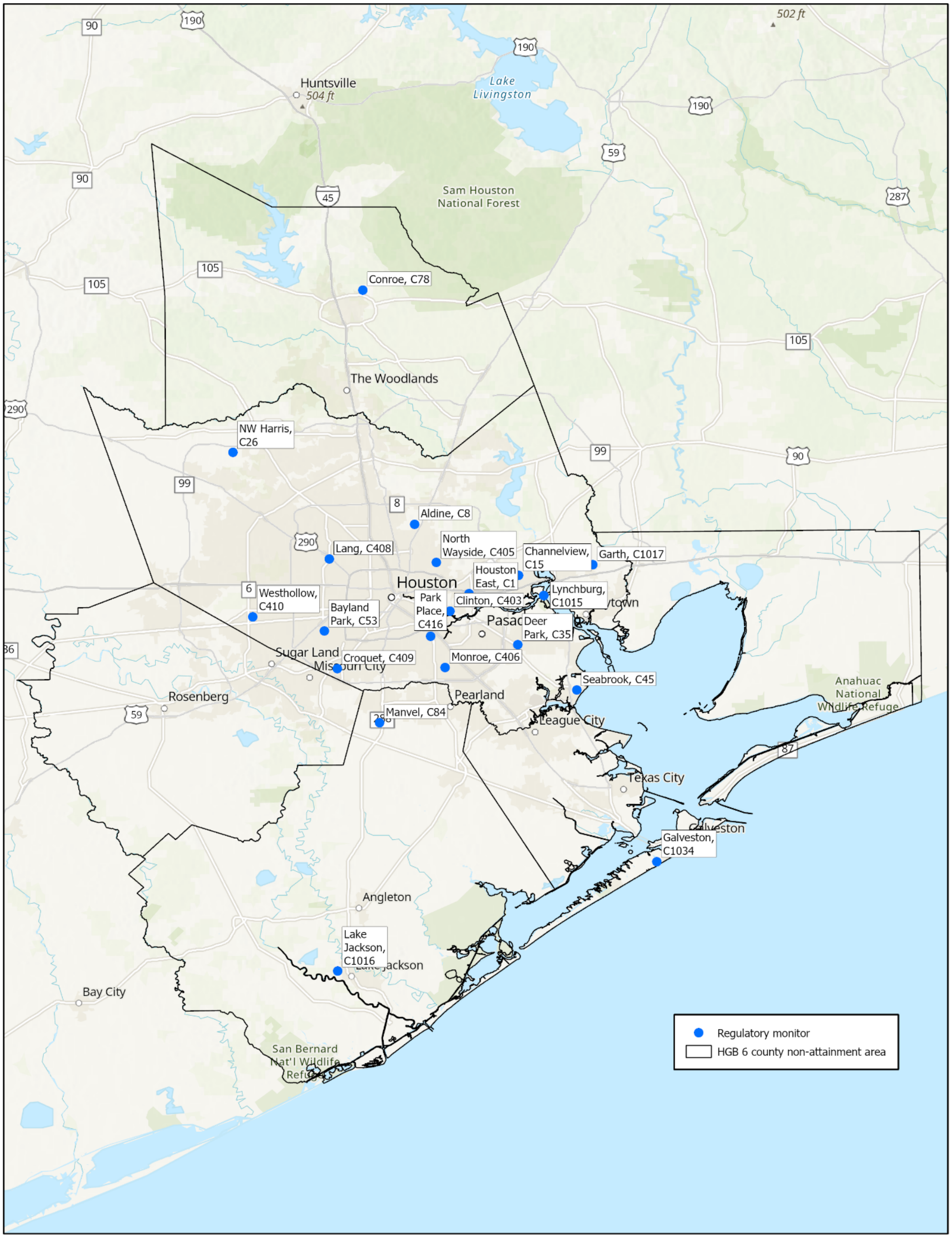

Figure 3-3: Map of Ozone Monitoring Sites in the HGB 2015 Ozone NAAQS Nonattainment Area

Table 3-1: *Exceedance Days and Ozone Conditions During from April through October 2019 Modeling Episode at Regulatory Monitors* summarizes ozone exceedances and ozone conditions at each regulatory monitor during the modeling episode. All regulatory monitors in the HGB 2015 ozone NAAQS nonattainment area meet the criterion of having at least five days with MDA8 ozone above 60 ppb. The monitor with the highest number of days with MDA8 ozone above 70 ppb is the Houston Bayland Park monitor with 16 ozone exceedance days. The monitor with the highest design value is the Houston Aldine monitor with the design value of 81 ppb. That monitor had eight ozone exceedance days. The 2019 design value for the Lynchburg Ferry monitor does not meet the validity requirement and therefore it is not listed in the table.

Table 3-1: Exceedance Days and Ozone Conditions from April through October 2019 Modeling Episode at Regulatory Monitors

Monitor Short Name	Monitor Name	CAMS Number	Episode Maximum Eight-Hour Ozone (ppb)	Number of Days Above 60 ppb	Number of Days Above 70 ppb	2019 Regulatory Ozone Design Value (ppb)
Aldine	Houston Aldine	0008	93	30	8	81
Bayland Park	Houston Bayland Park	0053	91	28	16	77
Channelview	Channelview	0015	76	10	3	70
Clinton	Clinton	0403	92	7	3	72
Conroe	Conroe Relocated	0078	83	18	4	76
Croquet	Houston Croquet	0409	84	13	5	70
Deer Park	Houston Deer Park #2	0035	107	19	5	75
Galveston	Galveston 99th St.	1034	81	16	6	76
Garth	Baytown Garth	1017	76	12	2	74
Houston East	Houston East	0001	88	11	3	74
Lake Jackson	Lake Jackson	1016	68	5	0	65
Lang	Lang	0408	88	17	6	73
Lynchburg	Lynchburg Ferry	1015	77	7	1	N/A
Manvel	Manvel Croix Park	0084	90	11	6	75
Monroe	Houston Monroe	0406	82	9	4	66
North Wayside	Houston North Wayside	0405	74	7	3	67

Monitor Short Name	Monitor Name	CAMS Number	Episode Maximum Eight-Hour Ozone (ppb)	Number of Days Above 60 ppb	Number of Days Above 70 ppb	2019 Regulatory Ozone Design Value (ppb)
NW Harris	Northwest Harris Co.	0026	86	11	4	74
Park Place	Park Place	4016	88	20	5	73
Seabrook	Seabrook Friendship Park	0045	90	7	2	71
Westhollow	Houston Westhollow	0410	77	23	6	71

The EPA modeling guidance also recommends that the episode includes meteorological patterns that represent a variety of conditions that correspond to high ozone. An assessment of the meteorological conditions in the HGB area in 2019 showed that the year was not atypical, and therefore was reasonable for modeling ozone. Details of the episode selection process for the TCEQ's 2019 modeling platform are provided in Section 1.2: *Modeling Episode* of Appendix A.

3.3 PHOTOCHEMICAL MODELING

The TCEQ used the Comprehensive Air Model with Extensions (CAMx) version 7.20 for this AD modeling. The model software and the CAMx user's guide are publicly available (Ramboll, 2022). The TCEQ's choice of CAMx is in line with the criteria specified in the EPA modeling guidance for model selection.

3.3.1 Modeling Domains

CAMx was configured with three nested domains: a 36-kilometer (km) grid resolution domain (named na_36km) covering most of North America, a 12 km grid resolution domain (named us_12km) covering continental United States (U.S.), and a four km grid resolution domain (named txs_4km) covering central and east Texas. Dimensions of the CAMx domains are shown in Table 3-2: *CAMx Horizontal Domain Parameters*. The geographical extent of each domain is shown in Figure 3-4: *CAMx Modeling Domains*. The HGB 2015 ozone NAAQS nonattainment area is contained within tx_4km, the finest resolution domain, as shown in Figure 3-5: *HGB 2015 Ozone NAAQS Nonattainment Area and CAMx 4 km Modeling Domain*. In the vertical direction, each CAMx domain reaches up to over 18 km from the Earth's surface and is divided into 30 layers. The resolution of layers decreases with increasing distance from the surface, details of which are presented in Section 3.4.1: *Meteorological Inputs* of this chapter.

Table 3-2: CAMx Horizontal Domain Parameters

Domain Name	Range West to East (km)	Range South to North (km)	Number of Cells West to East	Number of Cells South to North	Cell Size (km)
na_36km	-2,952 to 3,240	-2,772 to 2,556	172	148	36

Domain Name	Range West to East (km)	Range South to North (km)	Number of Cells West to East	Number of Cells South to North	Cell Size (km)
us_12km	-2,412 to 2,340	-1,620 to 1,332	396	246	12
txs_4km	-324 to 432	-1,584 to -648	189	234	4

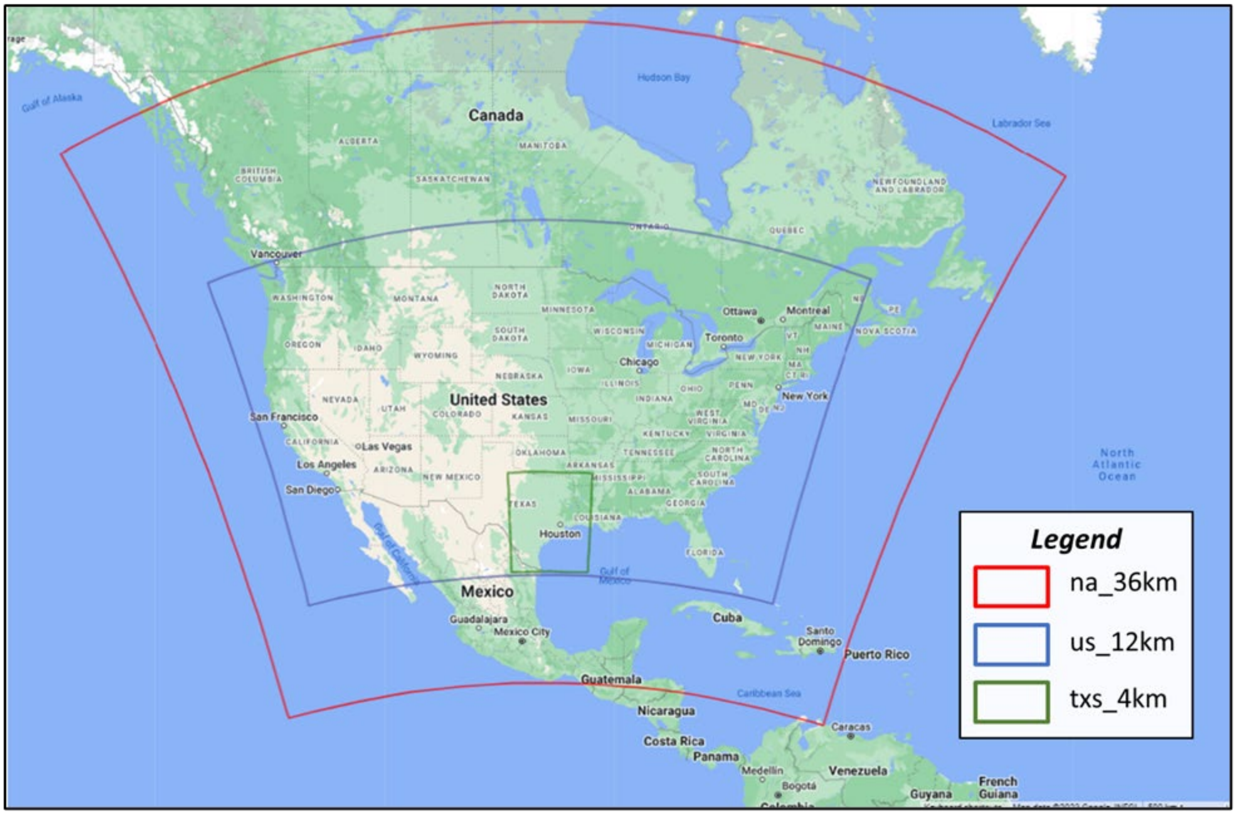

Figure 3-4: CAMx Modeling Domains

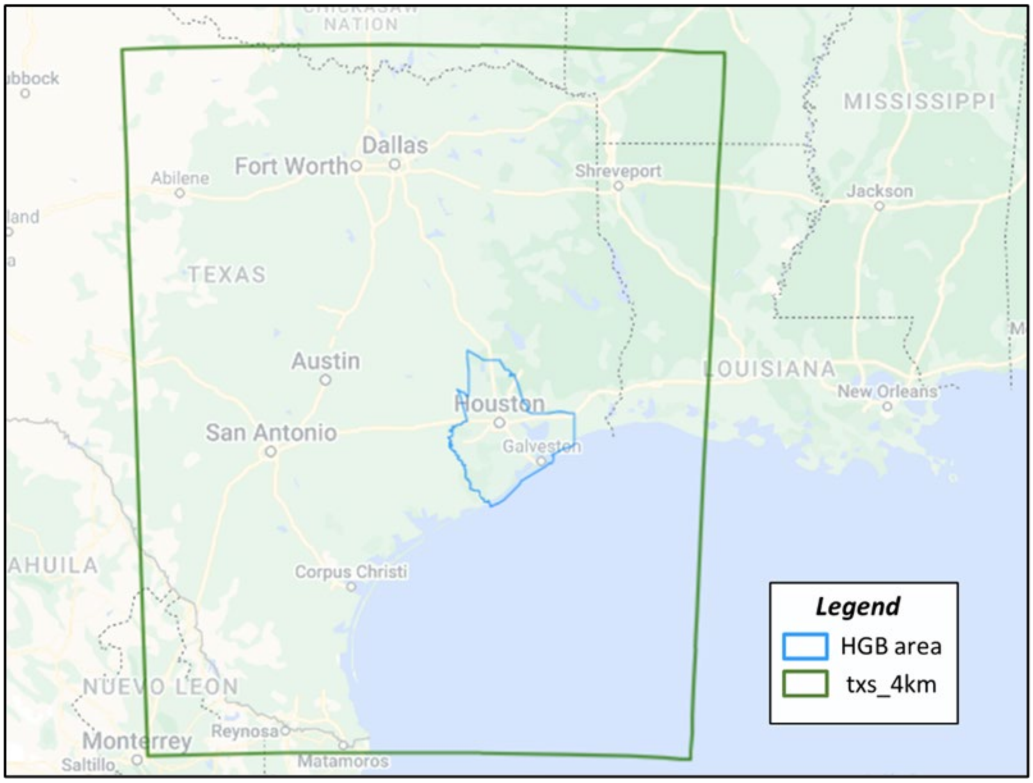

Figure 3-5: HGB 2015 Ozone NAAQS Nonattainment Area and CAMx 4 km Modeling Domain

3.3.2 CAMx Options

The TCEQ used the CAMx options summarized in Table 3-3: *CAMx Configuration Options* for this SIP revision. Details regarding the configuration testing conducted by the TCEQ to determine the dry deposition and vertical diffusion schemes is provided in Section 5.1.4: *Evaluation of CAMx Configuration Options* of Appendix A.

Table 3-3: CAMx Configuration Options

CAMx Option	Option Selected
Version	Version 7.20
Time Zone	Coordinated Universal Time
Chemistry Mechanism	Carbon Bond version 6 revision 5 gas-phase mechanism (CB6r5)
Photolysis Mechanism	Tropospheric Ultraviolet and Visible radiative transfer model, version 4.8, with Total Ozone Mapping Spectrometer ozone column data
Chemistry Solver	Euler-Backward Iterative
Dry Deposition Scheme	Zhang03
Vertical Diffusion	K-theory
Iodine Emissions	Oceanic iodine emission computed from saltwater masks

3.4 MODELING INPUTS

A photochemical air quality model requires several inputs to be able to simulate chemical and physical processes leading to ozone formation. The main inputs are meteorological parameters, emission inputs, and initial and boundary conditions (IC/BC). The sections below provide an overview of the inputs used in this modeling; more details are provided in Section 2: *Meteorological Modeling* and Section 3: *Emissions Modeling* of Appendix A.

3.4.1 Meteorological Inputs

The TCEQ used the Weather Research and Forecasting (WRF) model, version 4.1.5, to generate the meteorological inputs for the photochemical modeling supporting this SIP revision. The WRF modeling was conducted for March 15 to November 1, 2019 to cover ramp-up and ramp-down days needed by CAMx.

WRF was configured with a 12 km horizontal grid resolution domain that covered most of North America, as depicted in Figure 3-6: *CAMx and WRF Domains*. A second 4 km fine grid domain covering the eastern half of Texas includes the 2015 ozone NAAQS nonattainment areas of Bexar County, Dallas-Fort Worth, and HGB was also modeled. Each WRF domain embeds a corresponding CAMx domain of the same horizontal resolution. The WRF domains are larger than the corresponding CAMx domains as seen in Figure 3-6, to ensure that the effects of boundary conditions are minimized and large-scale meteorological conditions are better captured. The na_36km and us_12km CAMx domains are centered at the same location as the 12 km WRF domain. The txs_4km CAMx domain is centered at the same point as the 4 km WRF domain. All domains use the Lambert Conformal map projection.

Figure 3-6: CAMx and WRF Domains

The WRF domains have 42 vertical layers extending to over 20 km from the Earth's surface to better capture tropospheric meteorological conditions and vertical mixing that are essential for chemical transport mechanisms. The lowest CAMx layer corresponds to the first two WRF layers. CAMx layers 2 through 21 align with the WRF domain. Layers 22 through 30 of the CAMx domain encompass multiple WRF layers as displayed in Figure 3-7: *WRF and CAMx Vertical Layers for the txs_4km Domain*.

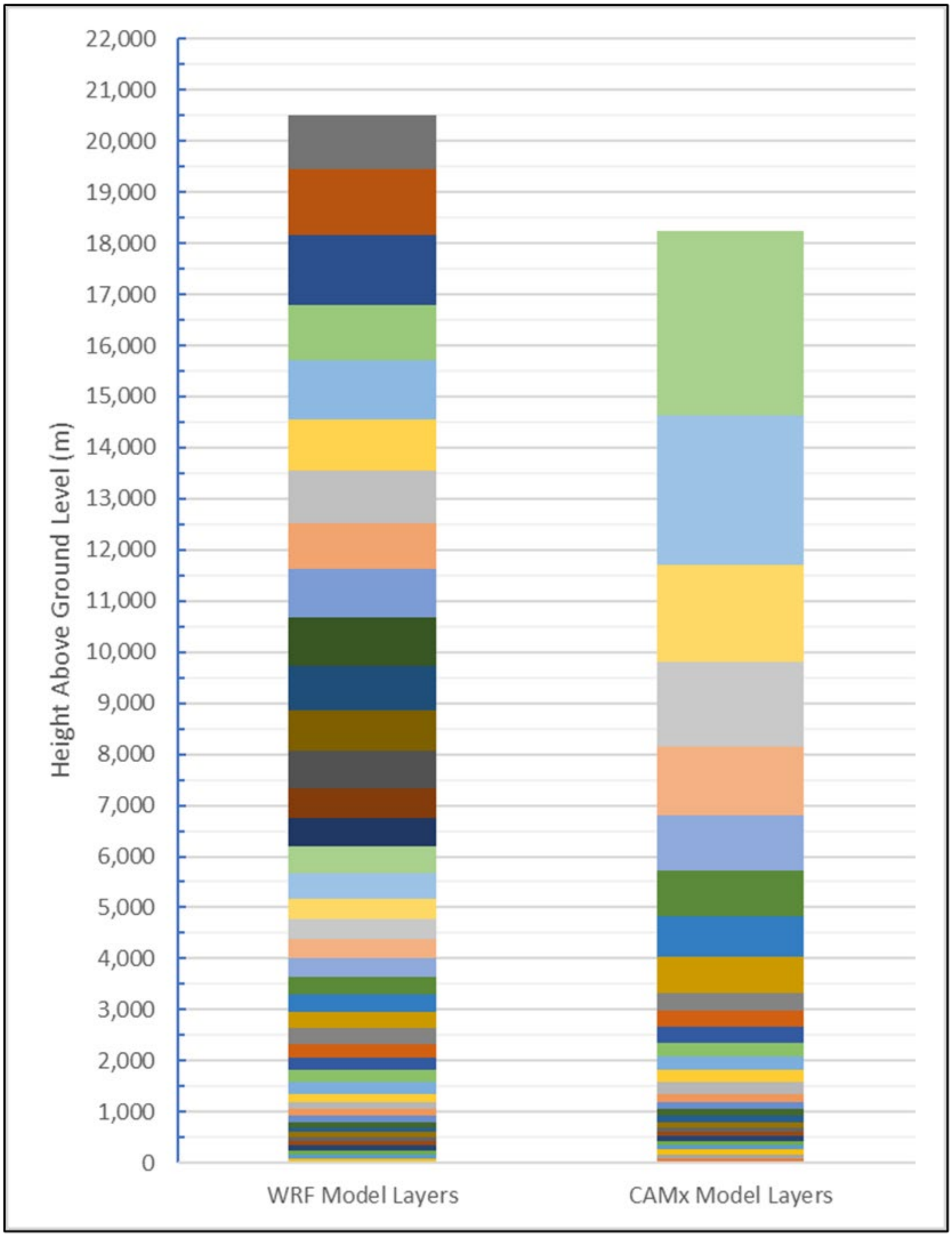

Figure 3-7: WRF and CAMx Vertical Layers for the txs_4km Domain

Details of the map projection, grid boundaries, horizontal and vertical grid cell geometry, land surface data, and meteorological parameterizations are provided in Section 2: *Meteorological Modeling* of Appendix A.

3.4.2 Emissions Inputs

Model-ready hourly speciated emissions were developed for the April through October episode for the base year 2019 and the future year of 2023. This section provides an overview of the emission inputs used in this proposed AD SIP modeling. Details about emissions inventory development are included in Section 3: *Emissions Modeling* of Appendix A.

Emissions inputs, or modeling emissions inventories (EI), include emissions sources from anthropogenic sectors such as point sources (e.g., electric generating units (EGU)), mobile sources (e.g., on-road vehicles), area sources (e.g., population-based emissions estimates), and natural emissions sources (e.g., fires). EIs for each sector were developed using various datasets, models, and estimation techniques. The data sources and models used to develop the 2019 base case EI that were used in this SIP revision are listed in Table 3-4: *EI Data Sources for the TCEQ 2019 Base Case*. A variety of datasets and interpolation techniques were used to develop the EIs for the 2023 future case, which are described in Appendix A.

Table 3-4: EI Data Sources for the TCEQ 2019 Base Case

EI Source Category	Sector/Geographic area	Datasets/Models used for 2019 EI
Point	EGU	2019 Clean Air Market Program Data[16]
Point	Non-EGU, TX	2019 State of Texas Air Reporting System[17]
Point	Non-EGU, Non-TX	EPA 2016v1 Modeling Platform[18]
Non-Point	Oil and Gas, TX	2019 Railroad Commission of Texas
Non-Point	Oil and Gas, Non-TX	EPA 2017 Modeling Platform[19]
Non-Point	Off-Shore	2017 Bureau of Ocean Energy Management[20]
Mobile	On-Road, TX nonattainment areas	Motor Vehicle Emission Simulator (MOVES3)[21] – link-based
Mobile	On-Road, other	MOVES3 – county based
Mobile	Non-Road, TX	TexN2.2
Mobile	Non-Road, Non-TX	MOVES3
Mobile	Off-Road Shipping, tx_4km domain	2019 Automatic Identification System and vessel characteristic IHS 2020; MARINER v1
Mobile	Off-Road Shipping, us_12km domain	EPA 2016v1 Modeling Platform
Mobile	Off-Road Airports, TX nonattainment areas	Texas Transportation Institute (TTI) 2020 data
Mobile	Off-Road Airports, other	EPA 2016v1 Modeling Platform

[16] https://campd.epa.gov/
[17] https://www.tceq.texas.gov/airquality/point-source-ei/psei.html
[18] https://www.epa.gov/air-emissions-modeling/2016v1-platform
[19] https://www.epa.gov/air-emissions-modeling/2017-emissions-modeling-platform
[20] https://www.boem.gov/environment/environmental-studies/ocs-emissions-inventory-2017
[21] https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves

EI Source Category	Sector/Geographic area	Datasets/Models used for 2019 EI
Mobile	Off-Road Locomotives, TX nonattainment areas	TTI 2019 data
Mobile	Off-Road Locomotives, other	EPA 2016v1 Modeling Platform
Area	Area, TX	2020 Air Emissions Reporting Requirements
Area	Area, Non-TX	EPA 2017 Modeling Platform
Natural	Biogenic	Biogenic Emissions Landuse Data (BELD5); BEIS v3.7[22] and SMOKEv4.8
Natural	Fires	2019 MODIS and VIIRS; FINN v2.2
Other	International EI	2019 Community Emission Data System;[23] SMOKEv4.7_CEDS

Total anthropogenic emissions for a model episode day of June 12 in the 2019 base case and 2023 future case from within the HGB 2015 ozone NAAQS nonattainment area are listed in tons per day (tpd) in Table 3-5: *June 12 Episode Day 2019 Base Case Anthropogenic EI in the HGB 2015 Ozone NAAQS Nonattainment Area* and Table 3-6: *June 12 Episode Day 2023 Future Year Anthropogenic Modeling Emissions for the HGB 2015 Ozone NAAQS Nonattainment Area*. The June 12 sample episode day was chosen since it had high monitored ozone concentrations in the nonattainment area.

Mobile sources contributed the greatest amount of nitrogen oxides (NO_X) emissions in 2019 and point sources (non-EGU) contributed the most NO_X emissions in 2023. Area sources contributed the greatest amount of volatile organic compounds (VOC) emissions in both 2019 and 2023. While emissions in certain sectors increased between the 2019 base case and the 2023 future case, there is an overall decrease in NO_X, VOC, and carbon monoxide (CO) emissions.

Table 3-5: June 12 Episode Day 2019 Base Case Anthropogenic EI in the HGB 2015 Ozone NAAQS Nonattainment Area

Emission Source Category	NO_X (tpd)	VOC (tpd)	CO (tpd)
On-Road	77.64	39.06	774.19
Non-Road	36.13	36.65	729.73
Off-Road – Airports	9.20	2.77	23.04
Off-Road – Locomotives	10.48	0.54	2.33
Off-Road – Commercial Marine	63.41	3.62	9.82
Area	35.16	255.86	86.47
Oil and Gas – Drilling	0.29	0.03	0.06
Oil and Gas – Production	1.01	35.25	1.48

[22] https://drive.google.com/drive/folders/1v3i0iH3lqW36oyN9aytfkczkX5hl-zF0
[23] https://data.pnnl.gov/group/nodes/project/13463

Emission Source Category	NO_x (tpd)	VOC (tpd)	CO (tpd)
Point – EGU	30.82	1.17	22.33
Point – Non-EGU	71.46	96.44	66.62
Six-County Total	**335.60**	**471.39**	**1,716.07**

Table 3-6: June 12 Episode Day 2023 Future Year Anthropogenic Modeling Emissions for the HGB 2015 Ozone NAAQS Nonattainment Area

Emission Source Category	NO_x (tpd)	VOC (tpd)	CO (tpd)
On-Road	54.85	31.09	674.78
Non-Road	30.26	36.78	781.27
Off-Road – Airports	7.44	2.54	21.16
Off-Road – Locomotives	7.93	0.39	2.11
Off-Road – Commercial Marine	55.11	3.62	10.33
Area	36.27	270.05	93.57
Oil and Gas – Drilling	0.25	0.02	0.03
Oil and Gas – Production	1.01	16.98	1.48
Point – EGU	42.41	6.86	44.60
Point – Non-EGU	93.42	101.55	69.21
HGB Six-County Total	328.95	469.88	1,698.54
Difference between 2023 and 2019	**-6.65**	**-1.51**	**-17.53**

A map showing the spatial distribution of changes in anthropogenic emissions of NO_X and VOC between the 2023 future case and the 2019 base case is presented in Figure 3-8: *Difference in Anthropogenic NO_X between 2023 Future and 2019 Base Case on June 12 Modeled Episode Day* and Figure 3-9: *Difference in Anthropogenic VOC between 2023 Future and 2019 Base Case on June 12 Modeled Episode Day*. The largest decrease in NO_X emissions occurs along roads, mainly in and around the downtown area as well as along shipping lanes. There are a few red and orange grid cells corresponding to anticipated future increases in point source emissions. VOC emissions mainly increase in Harris County and decrease in surrounding counties.

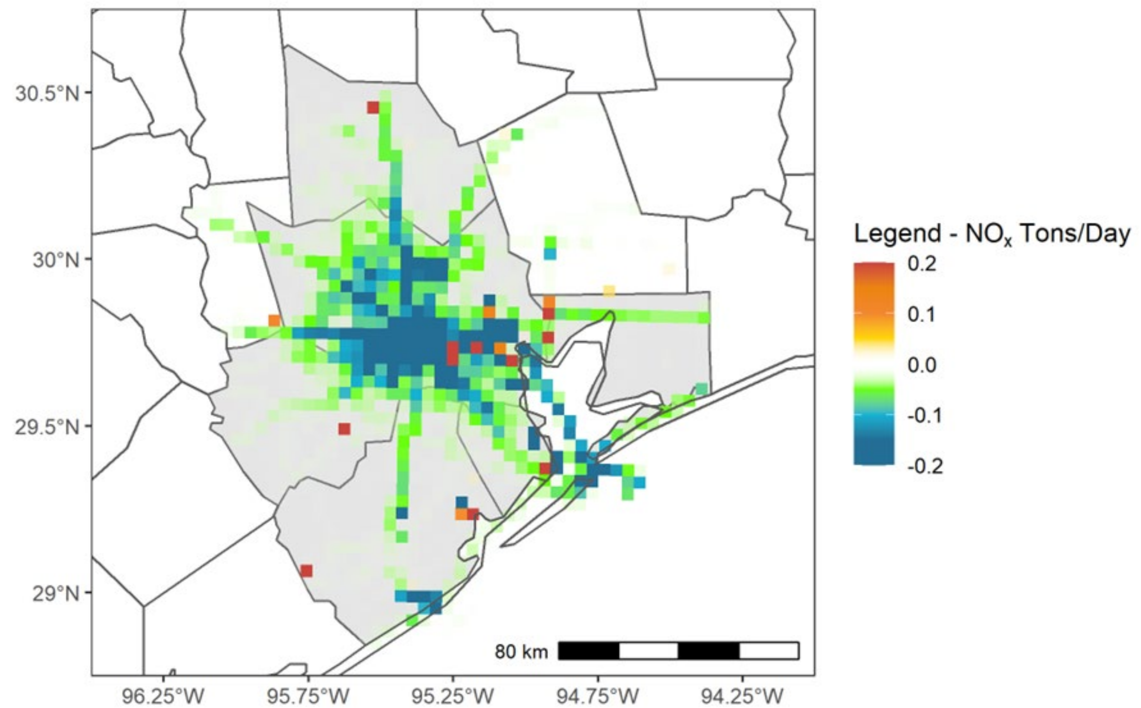

Figure 3-8: Difference in Anthropogenic NO_x between 2023 Future and 2019 Base Case on June 12 Modeled Episode Day

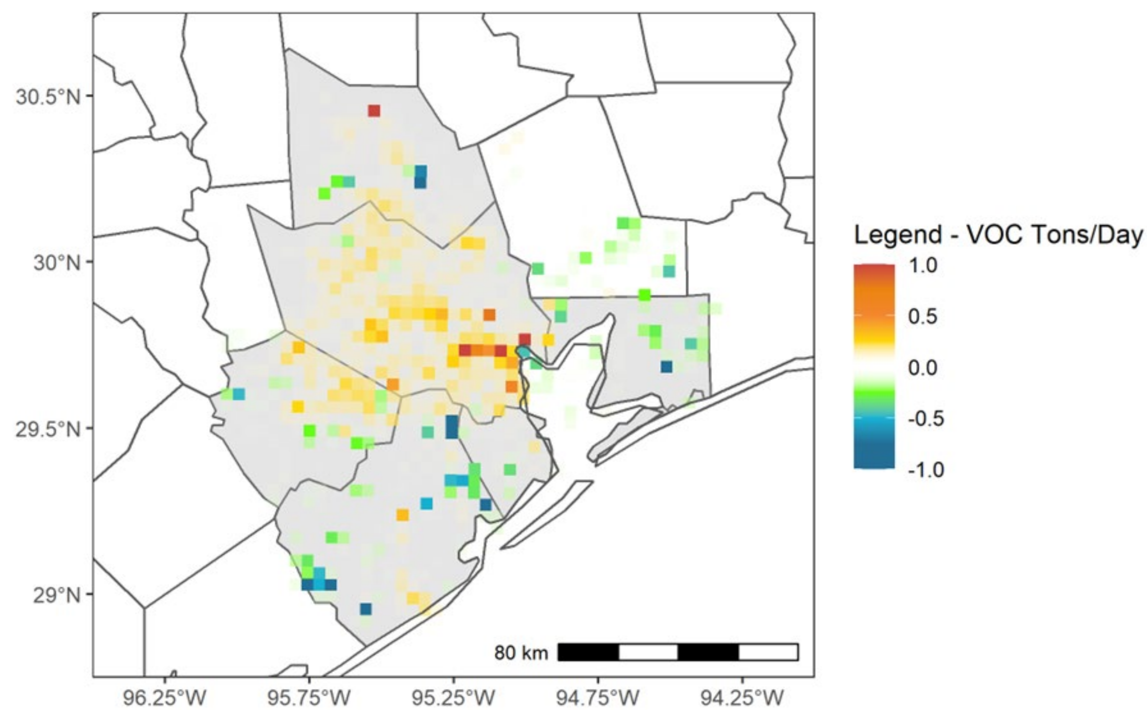

Figure 3-9: Difference in Anthropogenic VOC between 2023 Future and 2019 Base Case on June 12 Modeled Episode Day

3.4.3 Initial and Boundary Condition Inputs

In addition to emissions and meteorological inputs, CAMx requires initial and boundary conditions (IC/BC). Initial conditions refer to the state of the atmosphere in the modeling domain at the start of the modeling episode. Boundary conditions refer to the state of the atmosphere at the five edges (North, South, East, West, and Top) of a domain. IC/BC were derived from the Goddard Earth Observing Station global atmospheric model with Chemistry (GEOS-Chem) model runs for 2019 and 2023. Lateral boundary conditions were developed for each grid cell along all four lateral boundaries of the outer 36 km modeling domain. Top boundary conditions were also developed to represent pollutant concentrations from atmospheric layers above the highest CAMx vertical layer.

The TCEQ contracted with the University of Houston to complete the GEOS-Chem model runs necessary for IC/BC development. The GEOS-Chem model simulations incorporated an eight-month period from March through October with a two-month spin-up time (January and February). A spin-up period is the period of days that precede the actual time period of interest for modeling. The spin-up period is used to ensure that the atmospheric conditions in the model are balanced. For both modeled years (2019 and 2023), GEOS-Chem version 12.7.1 was run at $2^{\circ} \times 2.5^{\circ}$ horizontal resolution with tropospheric chemistry with simplified secondary organic aerosols (Tropchem+simpleSOA) and 2019 meteorology from the Modern-Era Retrospective analysis for Research and Applications, Version 2 (MERRA-2). The 2023 future anthropogenic emissions were interpolated according to a moderate emission scenario from Representative Concentration Pathways (RCP4.5), with regional overwrites or scaling for the U.S., Canada, Mexico, and Asia. The 2023 and 2025 EIs from the EPA 2016v1 modeling platform were used to develop scaling factors at the county-level for the United States and Mexico and the provincial-level for Canada. For Asia, grided scaling factors were generated based on the latest available version (v6b) of the Evaluating the Climate and Air Quality Impact of Short-Lived Pollutants (ECLIPSE) inventory (Stohl et. al, 2015) from the International Institute for Applied Systems Analysis. Additional details of IC/BC development are presented in Section 4: *Initial and Boundary Conditions* of Appendix A.

3.5 PHOTOCHEMICAL MODELING PERFORMANCE EVALUATION

The purpose of model performance evaluation (MPE) is to determine how well the model reproduces measured concentrations of pollutants. The EPA modeling guidance recommends performing an operational model evaluation consisting of calculating multiple statistical parameters and graphical analyses. In addition, the EPA modeling guidance recommends comparing the model performance evaluation results against other similar model applications, such as those compiled in the Emery et al. (2017) paper. Emery et al. (2017) paper provides benchmarks based on performances of many modeling applications in the U.S. The statistical benchmarks for normalized mean bias (NMB), normalized mean error (NME), and correlation of one-hour and MDA8 ozone are listed in Table 3-7: *Statistical Benchmarks for Photochemical Model Evaluation* and can be used to assess model performance. The goal benchmarks indicate performance demonstrated by the top third of model runs evaluated. The criteria benchmark indicate performance achieved by the top two-thirds of model runs evaluated.

Table 3-7: Statistical Benchmarks for Photochemical Model Evaluation

Benchmark	NMB (%)	NME (%)	Correlation
Goal	Less than ± 5	Less than 15	Greater than 0.75
Criteria	Less than ± 15	Less than 25	Greater than 0.50

As recommended in the EPA modeling guidance, the TCEQ evaluations include eight-hour and one-hour performance measures calculated by comparing measured and four-cell bi-linearly interpolated modeled ozone concentrations for all episode days and monitors. The model performance evaluations were performed at all ozone monitors in the HGB 2015 ozone NAAQS nonattainment area, including regulatory and non-regulatory monitors.

The NMB and NME for high ozone days with MDA8 ozone concentrations at or above 60 ppb for monitoring sites in the HGB 2015 ozone NAAQS nonattainment area is presented in Figure 3-10: *NMB for MDA8 Ozone of at least 60 ppb in April through October 2019* and Figure 3-11: *NME for MDA8 Ozone of at least 60 ppb in April through October 2019*. The Atascocita site is not shown as it did not have MDA8 ozone values above 60 ppb. All regulatory monitors in the HGB 2015 ozone NAAQS nonattainment area have NMB within the criteria range except Lynchburg. Many monitors have NMB values within the goal range. This indicates acceptable model performance. All monitors have NME within the criteria range and most monitors fall within goal range indicating acceptable model performance. The Aldine monitor, with the highest 2019 DV, has slightly negative NMB meaning that the model under predicts MDA8 ozone.

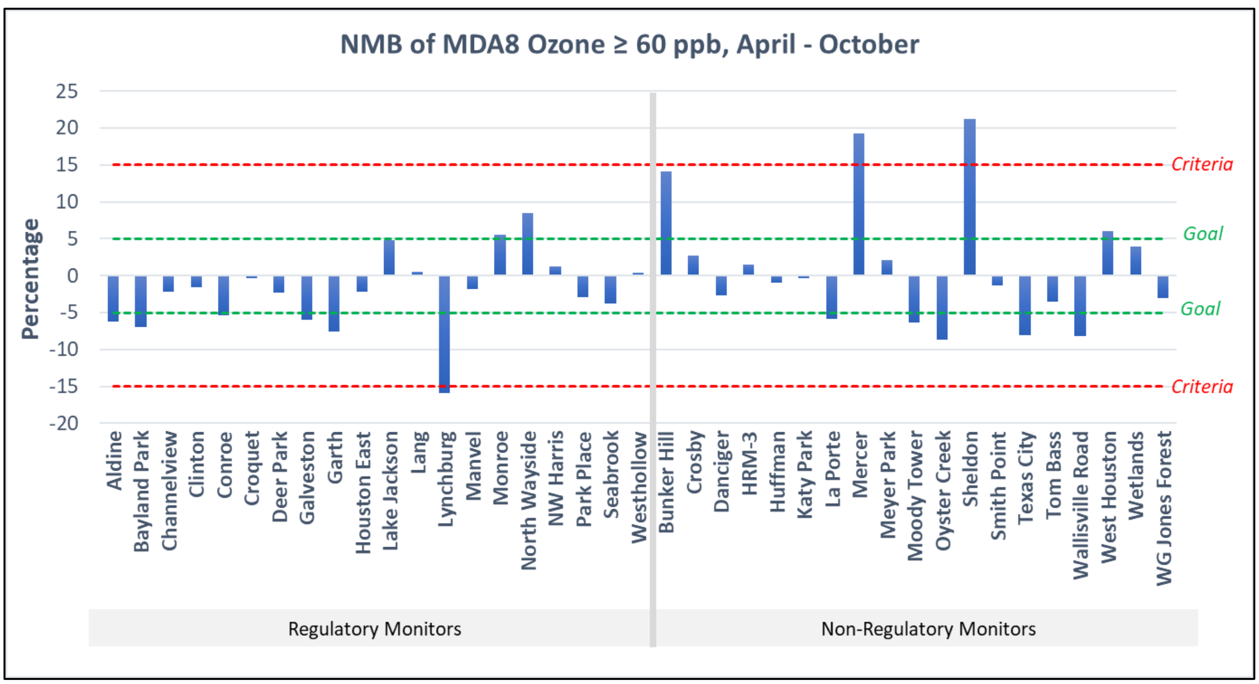

Figure 3-10: NMB for MDA8 Ozone of at least 60 ppb in April through October 2019

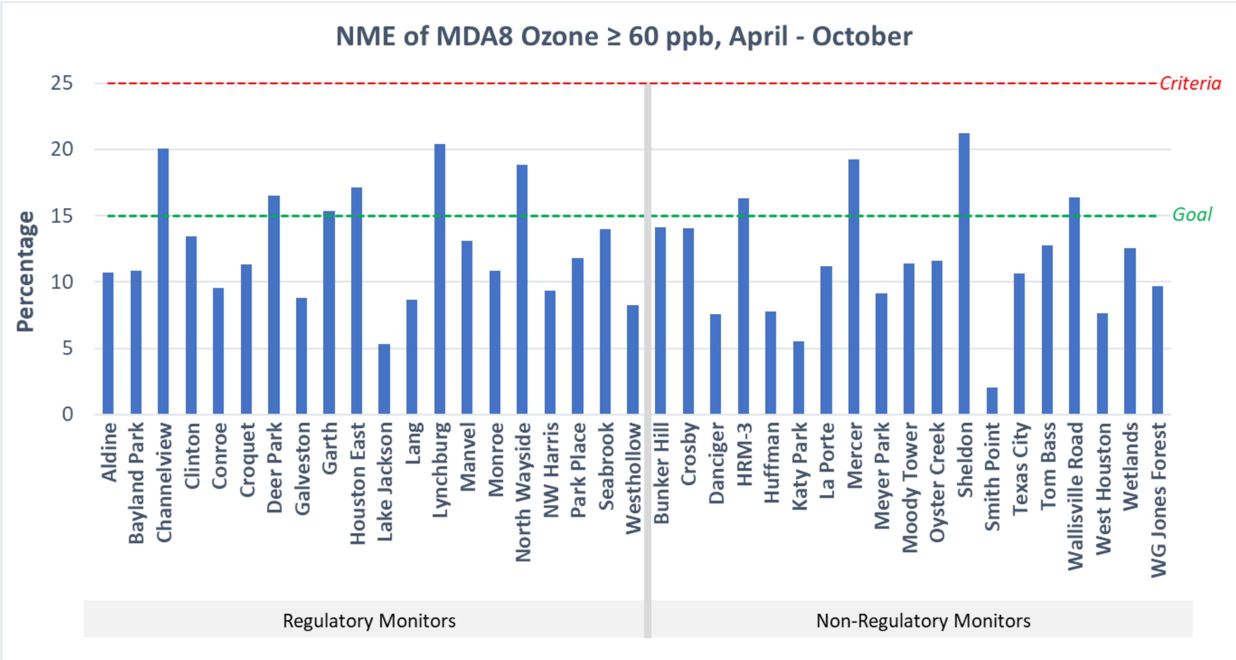

Figure 3-11: NME for MDA8 Ozone of at least 60 ppb in April through October 2019

In addition to the episode-wide evaluation of model performance shown above, an evaluation of modeled eight-hour ozone concentrations for each month and for the episode is presented in Table 3-8: *NMB and NME of Eight-Hour Average Ozone in HGB 2015 Ozone NAAQS Nonattainment Area*. The values represent monthly and seven-month averages from the HGB nonattainment area monitors shown in Figure 3-3.

When evaluated for all observations over 40 ppb, the normalized mean bias is within the criteria range for all months except August and the normalized mean error is within criteria range for all months. The NMB values for the MDA8 ozone are within the criteria range for April and exceed the criteria range for the remaining months. NMB values for MDA8 observations over 60 ppb are within the criteria range for each month and for the entire episode and exhibit positive and negative bias. The NME values for MDA8 ozone are within the criteria value for each month except June and August. The NME values for the ozone over 60 ppb are within the goal range for all months. Model performance is acceptable for each month and the entire episode, with August showing the poorest performance.

Table 3-8: NMB and NME of Eight-Hour Average Ozone in HGB 2015 Ozone NAAQS Nonattainment Area

Month	NMB All Obs ≥ 40 ppb (%)	NME All Obs ≥ 40 ppb (%)	NMB MDA8 Ozone (%)	NME MDA8 Ozone (%)	NMB MDA8 Obs ≥ 60 ppb (%)	NME MDA8 Obs ≥ 60 ppb (%)
Apr	-4.49	12.65	12.80	22.87	-11.54	12.24
May	-4.79	19.61	20.70	27.70	-1.34	9.52
Jun	2.43	18.01	17.72	29.13	-4.21	14.65
Jul	9.54	13.60	20.98	23.39	-1.49	7.70
Aug	16.99	21.52	26.95	29.44	3.92	13.79

Month	NMB All Obs ≥ 40 ppb (%)	NME All Obs ≥ 40 ppb (%)	NMB MDA8 Ozone (%)	NME MDA8 Ozone (%)	NMB MDA8 Obs ≥ 60 ppb (%)	NME MDA8 Obs ≥ 60 ppb (%)
Sep	10.61	13.68	15.58	19.46	3.02	7.29
Oct	3.98	13.93	16.49	21.29	-3.66	12.28
Apr through Oct	2.59	15.70	18.49	24.57	-2.72	11.66

Figure 3-12: *Monthly NMB (for observed MDA8 ≥ 60 ppb) in the HGB 2015 Ozone NAAQS Nonattainment Area* shows that the bias changes depending on the monitor location and the month. While in April, MDA8 peaks are slightly underpredicted at most monitors (cool colors); in August and September, most peaks are overpredicted (warm colors).

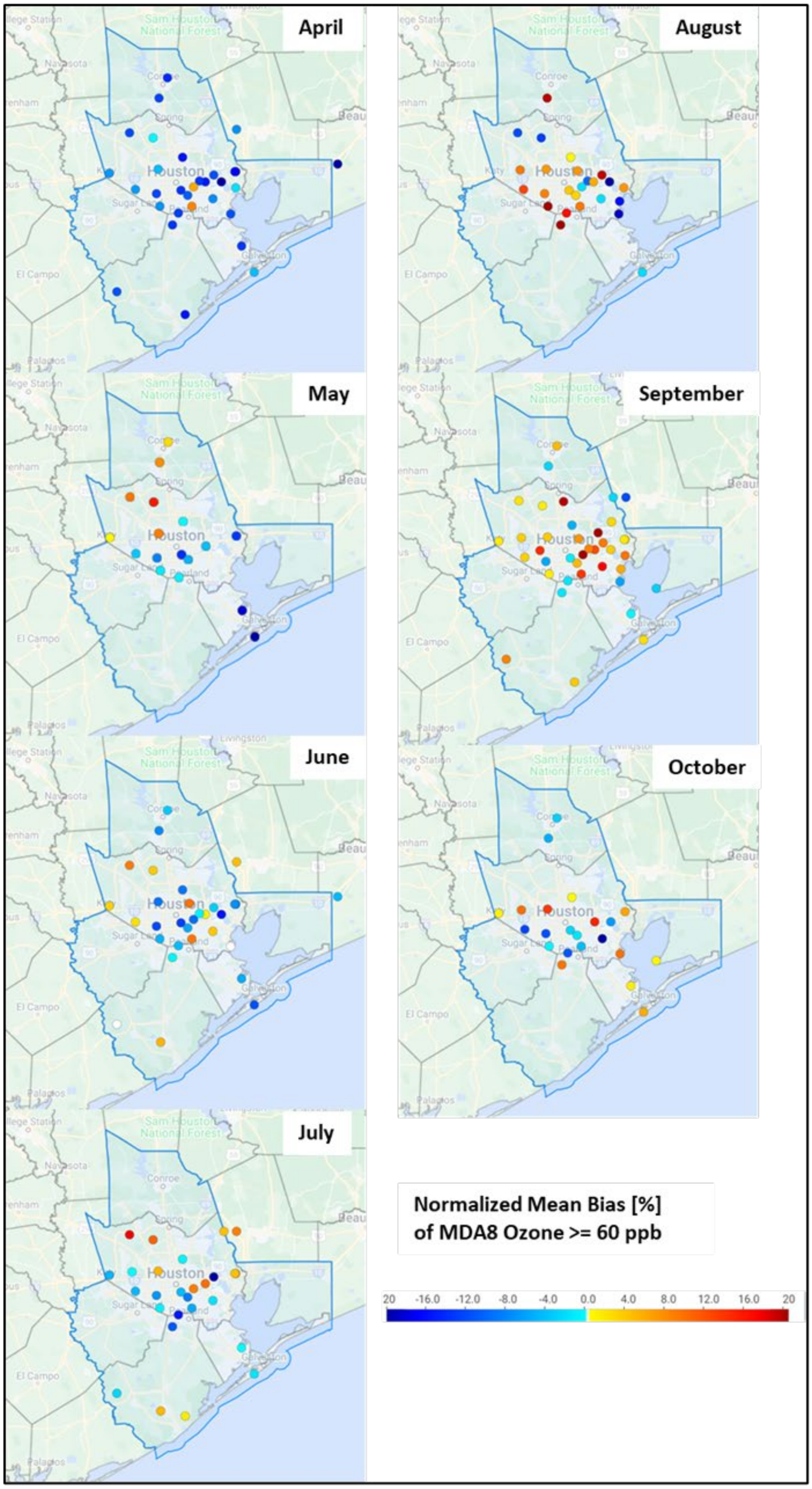

Figure 3-12: Monthly NMB (for observed MDA8 ≥ 60 ppb) in the HGB 2015 Ozone NAAQS Nonattainment Area

The performance evaluation of the base case modeling demonstrates the adequacy of the model to replicate the relationship between ozone levels and the emissions of NO_X and VOC precursors in the atmosphere. The model's ability to suitably replicate this relationship is necessary to have confidence in the model's simulation of the future year ozone and the response to various control measures. Additional detailed evaluations are included in Section 5: *Photochemical Model Performance Evaluation* of Appendix A.

3.6 ATTAINMENT TEST

3.6.1 Future Year Design Values

In accordance with the EPA modeling guidance, the top 10 base case episode days with modeled eight-hour maximum concentrations above 60 ppb, per monitor, were used for the modeled attainment test. All regulatory ozone monitors in the HGB 2015 ozone NAAQS nonattainment area had 10 modeled base case days above 60 ppb as well as over five days of observed MDA8 over 60 ppb and were included in the attainment test. The Relative Response Factor (RRF) that is used in the attainment test was calculated based on the EPA modeling guidance as follows:

- from the base case modeling, the maximum concentrations of the three-by-three grid cell array surrounding each monitor were averaged over the top-10 modeled days to produce the top-10 day average base case MDA8 values;
- from the future case modeling, the concentrations from the corresponding base case top-10 modeled days and maximum grid cells were averaged to calculate the future case top-10 day average future MDA8 values; and
- the RRF was calculated for each monitor as a ratio of the top-10 day average future MDA8 values to the top-10 day average base case MDA8 values.

RRF for each monitor are shown in Table 3-9: *Monitor-Specific Relative Response Factors for Attainment Test*.

Table 3-9: Monitor-Specific Relative Response Factors for Attainment Test

Monitor Short Name	Monitor Name	CAMS Number	2019 Top 10-Day Modeled MDA8 Mean (ppb)	2023 Top 10-Day Modeled MDA8 Mean (ppb)	Relative Response Factor (RRF)
Aldine	Houston Aldine	0008	79.78	78.59	0.985
Bayland Park	Houston Bayland Park	0053	80.92	78.82	0.974
Channelview	Channelview	0015	78.40	78.12	0.996
Clinton	Clinton	0403	81.87	81.02	0.990
Conroe	Conroe Relocated	0078	75.63	75.14	0.994
Croquet	Houston Croquet	0409	81.43	79.86	0.981
Deer Park	Houston Deer Park #2	0035	82.62	82.33	0.996
Galveston	Galveston 99th St.	1034	75.18	74.34	0.989
Garth	Baytown Garth	1017	75.59	75.50	0.999

Monitor Short Name	Monitor Name	CAMS Number	2019 Top 10-Day Modeled MDA8 Mean (ppb)	2023 Top 10-Day Modeled MDA8 Mean (ppb)	Relative Response Factor (RRF)
Houston East	Houston East	0001	80.06	79.72	0.996
Lake Jackson	Lake Jackson	1016	67.80	67.35	0.993
Lang	Lang	0408	80.39	78.90	0.981
Lynchburg	Lynchburg Ferry	1015	78.48	78.18	0.996
Manvel	Manvel Croix Park	0084	80.35	78.82	0.981
Monroe	Houston Monroe	0406	84.14	83.01	0.987
North Wayside	Houston North Wayside	0405	80.39	79.46	0.989
NW Harris	Northwest Harris Co.	0026	79.52	78.76	0.990
Park Place	Park Place	4016	83.15	82.32	0.990
Seabrook	Seabrook Friendship Park	0045	80.25	80.29	1.000
Westhollow	Houston Westhollow	0410	78.89	76.79	0.973

The RRF is then multiplied by the 2019 base case design value (DVB) to obtain the 2023 future case design values (DVF) for each ozone monitor. DVB is calculated as the average of 2019, 2020, and 2021 regulatory design values as shown in Figure 3-13: *Example Calculation of 2019 DVB*.

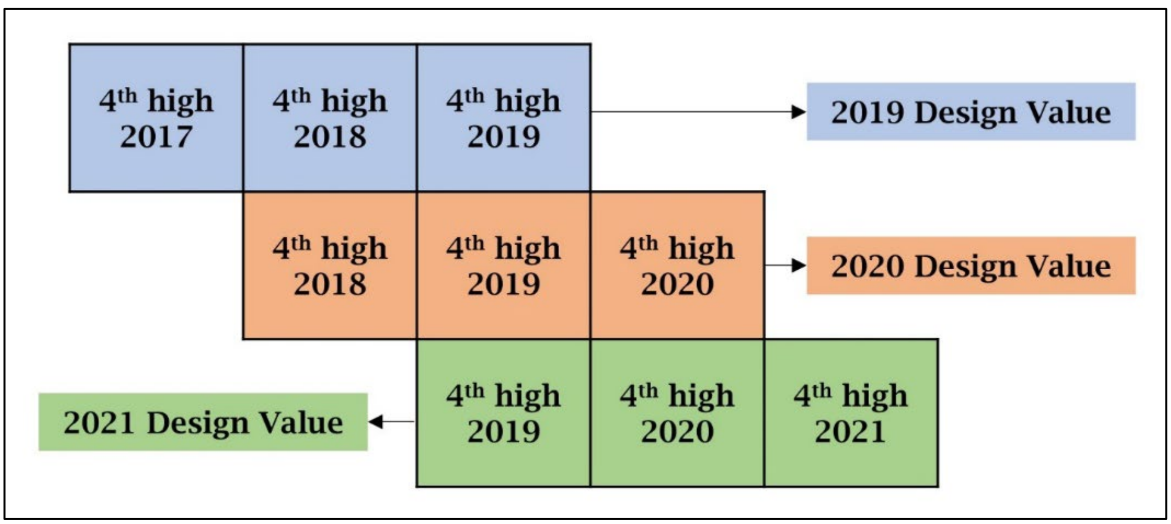

Figure 3-13: Example Calculation of 2019 DVB

In accordance with the EPA modeling guidance, the final DVF is obtained by rounding to the tenths digit and truncating to zero decimal places. The 2023 DVF are presented in Table 3-10: *Summary of the 2023 DVF for the Attainment Test* and in Figure 3-14: *2023 DVF in the HGB 2015 Ozone NAAQS Nonattainment Area*. Application of the attainment test results in ten monitors above the 2015 eight-hour ozone standard of 70 ppb in 2023 with the highest DVF value of 76 ppb at the Houston Aldine monitor.

Table 3-10: Summary of the 2023 DVF for the Attainment Test

Monitor Short Name	Monitor Name	CAMS Number	2019 DVB (ppb)	2023 DVF (ppb)	2023 Truncated DVF (ppb)
Aldine	Houston Aldine	0008	78.00	76.84	76
Bayland Park	Houston Bayland Park	0053	76.67	74.68	74
Channelview	Channelview	0015	68.00	67.76	67
Clinton	Clinton	0403	71.00	70.26	70
Conroe	Conroe Relocated	0078	74.33	73.85	73
Croquet	Houston Croquet	0409	71.33	69.96	69
Deer Park	Houston Deer Park #2	0035	75.67	75.40	75
Galveston	Galveston 99th St.	1034	74.00	73.18	73
Garth	Baytown Garth	1017	71.33	71.25	71
Houston East	Houston East	0001	72.67	72.36	72
Lake Jackson	Lake Jackson	1016	65.00	64.57	64
Lang	Lang	0408	72.00	70.66	70
Lynchburg	Lynchburg Ferry	1015	64.33	64.09	64
Manvel	Manvel Croix Park	0084	74.33	72.91	72
Monroe	Houston Monroe	0406	66.67	65.78	65
North Wayside	Houston North Wayside	0405	65.00	64.25	64
NW Harris	Northwest Harris Co.	0026	72.67	71.97	71
Park Place	Park Place	4016	73.00	72.27	72
Seabrook	Seabrook Friendship Park	0045	67.67	67.69	67
Westhollow	Houston Westhollow	0410	70.00	68.13	68

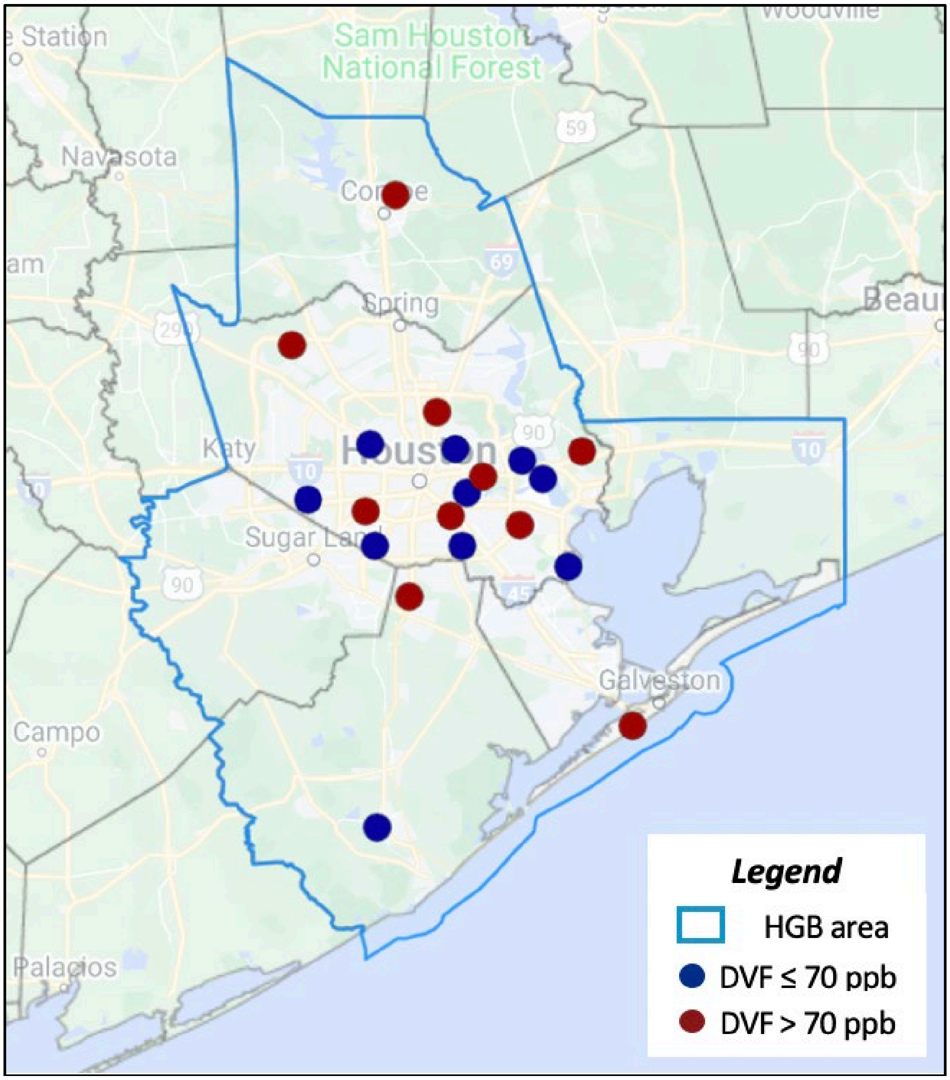

Figure 3-14: 2023 DVF in the HGB 2015 Ozone NAAQS Nonattainment Area

3.6.2 Emission Reduction Credits (ERC) Sensitivity Test Design Values

A sensitivity modeling run was performed to determine the impact of certified and potential (submitted applications that have not yet been certified) ERCs on the 2023 DVF in the HGB 2015 ozone NAAQS nonattainment area. The sensitivity modeling run was performed to ensure that the emissions associated with ERCs remain surplus, as required by 30 Texas Administrative Code Chapter 101, Subchapter H, Division 1.

The ERC sensitivity test resulted in a 0.04 ppb increase to the maximum 2023 DVF in the HGB 2015 ozone NAAQS nonattainment area (from 76.76 ppb to 76.80 ppb at the Aldine monitor) and did not change the maximum 2023 DVF of 76 ppb at Aldine. The DVF increased across all regulatory monitors, with a max DVF increase of 0.06 at the Deer Park monitor. After rounding and truncation, the DVF for the ERC sensitivity changed for the Croquet monitor from 69 ppb to 70 ppb. Results from the ERC sensitivity test are listed in Table 3-11: *HGB Future Year Design Values for ERC Sensitivity*. Additional details of the ERC sensitivity are provided in Section 3.3.1.3: *Sources in Non-Attainment Areas* of Appendix A.

Table 3-11: HGB Future Year Design Values for ERC Sensitivity

Monitor Short Name	Monitor Name	CAMS Number	ERC Sensitivity 2023 Pre-Truncated DVF (ppb)	Difference in 2023 DVF from ERC Sensitivity (ppb)	ERC Sensitivity 2023 Truncated DVF (ppb)
Aldine	Houston Aldine	0008	76.88	0.04	76
Bayland Park	Houston Bayland Park	0053	74.72	0.04	74
Channelview	Channelview	0015	67.80	0.04	67
Clinton	Clinton	0403	70.31	0.05	70
Conroe	Conroe Relocated	0078	73.88	0.03	73
Croquet	Houston Croquet	0409	70.00	0.04	70
Deer Park	Houston Deer Park #2	0035	75.46	0.06	75
Galveston	Galveston 99th St.	1034	73.21	0.03	73
Garth	Baytown Garth	1017	71.30	0.05	71
Houston East	Houston East	0001	72.41	0.05	72
Lake Jackson	Lake Jackson	1016	64.60	0.03	64
Lang	Lang	0408	70.69	0.03	70
Lynchburg	Lynchburg Ferry	1015	64.13	0.04	64
Manvel	Manvel Croix Park	0084	72.96	0.05	72
Monroe	Houston Monroe	0406	65.83	0.05	65
North Wayside	Houston North Wayside	0405	64.29	0.04	64
NW Harris	Northwest Harris Co.	0026	71.99	0.03	71
Park Place	Park Place	4016	72.32	0.05	72
Seabrook	Seabrook Friendship Park	0045	67.74	0.05	67
Westhollow	Houston Westhollow	0410	68.16	0.03	68

3.7 MODELING REFERENCES

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CHAPTER 4: CONTROL STRATEGIES AND REQUIRED ELEMENTS

4.1 INTRODUCTION

The Houston-Galveston-Brazoria (HGB) 2015 ozone National Ambient Air Quality Standard (NAAQS) nonattainment area consists of Brazoria, Chambers, Fort Bend, Galveston, Harris, and Montgomery Counties and includes a wide variety of major and minor industrial, commercial, and institutional entities. The Texas Commission on Environmental Quality (TCEQ) has implemented regulations that address emissions of nitrogen oxides (NO_X) and volatile organic compounds (VOC) from these sources. This chapter describes existing ozone control measures for the HGB nonattainment area, as well as the following moderate ozone nonattainment area state implementation plan (SIP) requirements for the 2015 eight-hour ozone NAAQS: reasonably available control technology (RACT), reasonably available control measures (RACM), motor vehicle emissions budgets (MVEB), and contingency.

4.2 EXISTING CONTROL MEASURES

Since the early 1990s, a broad range of control measures has been implemented for each emission source category for ozone planning in the HGB ozone nonattainment area. For the 1979 one-hour ozone NAAQS, as well as the 1997 and 2008 eight-hour ozone NAAQS, the HGB ozone nonattainment area consisted of eight counties: Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties. Liberty and Waller Counties were not included in the nonattainment area for the 2015 eight-hour ozone NAAQS, resulting in a six-county ozone nonattainment area. Table 4-1: *Existing Ozone Control and Voluntary Measures Applicable to the HGB 2015 Ozone NAAQS Nonattainment Area* lists the existing ozone control strategies that have been implemented for the HGB ozone nonattainment area and apply to the HGB 2015 ozone NAAQS nonattainment area.

Table 4-1: Existing Ozone Control and Voluntary Measures Applicable to the HGB 2015 Ozone NAAQS Nonattainment Area

Measure	Description	Start Date(s)
Highly Reactive Volatile Organic Compounds (HRVOC) Emissions Cap and Trade (HECT) Program and HRVOC Rules 30 Texas Administrative Code (TAC) Chapter 101, Subchapter H, Division 6 and 30 TAC Chapter 115, Subchapter H, Divisions 1 and 2	Affects cooling towers, process vents, and flares, and establishes an annual emissions limit with a cap and trade for each affected site in Harris County Brazoria, Chambers, Fort Bend, Galveston, Liberty, Montgomery, and Waller Counties are subject to permit allowable limits and monitoring requirements	Monitoring requirements began January 31, 2006 HECT program implemented January 1, 2007 HECT cap incrementally stepped-down from 2014 through 2017 for a total 25% cap reduction

Measure	Description	Start Date(s)
HRVOC Fugitive Rules 30 TAC Chapter 115, Subchapter H, Division 3	Leak detection and repair (LDAR) requirements for components in HRVOC service Requirements include more stringent repair times and lower leak detection than general VOC LDAR, and third-party audits	March 31, 2004
Volatile Organic Compounds (VOC) Control Measures – Storage Tanks 30 TAC Chapter 115, Subchapter B, Division 1	Controls on fixed and floating roof tanks storing VOC liquids, including oil and condensate, based on the size of the tank and vapor pressure of the liquid being stored Control efficiency of 95% required on control devices, other than flares and vapor recovery units, for all storage tanks; enhanced inspection, repair, and recordkeeping requirements for fixed roof crude oil or condensate storage tanks with uncontrolled VOC emissions of more than 25 tons per year (tpy) Rule applicability includes fixed roof crude oil or condensate tanks at pipeline breakout stations	July 20, 2018 and earlier
VOC Control Measures – Degassing Operations 30 TAC Chapter 115, Subchapter F, Division 3	Requires vapors from degassing of storage tanks, transport vessels, and marine vessels to be vented to a control device Extended time period required for degassing and lower threshold of storage tanks required to comply with the rule	March 1, 2012 and earlier
VOC Control Measures 30 TAC Chapter 115	VOC measures adopted for reasonably available control technology (RACT) and other state implementation plan (SIP) planning purposes: bakeries, batch processes, general vent gas control, general VOC LDAR, industrial wastewater, loading and unloading operations, solvent-using processes, etc.	December 31, 2002 and earlier
VOC Control Measures – Offset Lithographic Printers 30 TAC Chapter 115, Subchapter E, Division 4	Limits VOC content of inks and cleaning solvents used in offset lithographic printing facilities Revised to lower VOC content limit of solvents and to include smaller sources in the rule	March 1, 2011 for major sources March 1, 2012 for minor sources

Measure	Description	Start Date(s)
VOC Control Measures – Solvent-Using Processes 30 TAC Chapter 115, Subchapter E	Limits VOC content of coatings and requires work practices for coating processes and cleaning operations Revised to implement RACT requirements per control techniques guidelines published by the United States Environmental Protection Agency (EPA) Seven emission source categories in the Houston-Galveston-Brazoria (HGB) area: industrial cleaning solvents; flexible package printing; paper, film, and foil coatings; large appliance coatings; metal furniture coatings; miscellaneous metal and plastic parts coatings; and miscellaneous industrial adhesives	March 1, 2013 and earlier
VOC RACT Rules for the Oil and Natural Gas Industry 30 TAC Chapter 115	VOC measures adopted for RACT addressing the emission source categories in the Control Techniques Guidelines for the Oil and Natural Gas Industry published by the EPA on October 20, 2016	January 1, 2023
Refueling – Stage I 30 TAC Chapter 115, Subchapter C, Division 2	Captures gasoline vapors that are released when gasoline is delivered to a storage tank Vapors returned to the tank truck as the storage tank is being filled with fuel, rather than released into the ambient air	1979 A SIP revision related to Stage I regulations was approved by the EPA, effective June 29, 2015
Nitrogen Oxides (NO_x) Mass Emissions Cap and Trade (MECT) Program and 30 TAC Chapter 117 NO_x Emission Standards for Attainment Demonstration Requirements 30 TAC Chapter 101, Subchapter H, Division 3 30 TAC Chapter 117, Subchapter B, Division 3, Subchapter C, Division 3, and Subchapter D, Division 1	Overall, 80% NO_x reduction from existing industrial sources and utility power plants, implemented through a cap and trade program Affects utility boilers, gas turbines, heaters and furnaces, stationary internal combustion engines, industrial boilers, and other industrial sources	April 1, 2003 and phased in through April 1, 2007

Measure	Description	Start Date(s)
NO_x System Cap Requirements for Electric Generating Facility (EGF) 30 TAC Chapter 117, Subchapter B, Division 3 and Subchapter C, Division 3	Mandatory daily and 30-day system cap emission limits (independent of the MECT Program) for all EGFs at utility power plants and certain industrial/commercial EGFs that also provide power to the electric grid	March 31, 2007 (industrial/commercial EGFs) March 31, 2004 (utility power plants)
Utility Electric Generation in East and Central Texas 30 TAC Chapter 117, Subchapter E, Division 1	NO_x control requirements (approximately 55%) on utility boilers and stationary gas turbines at utility electric generation sites in East and Central Texas	May 1, 2003 through May 1, 2005
NO_x Emission Standards for Nitric Acid and Adipic Acid Manufacturing 30 TAC Chapter 117, Subchapter F	NO_x emission standards for nitric acid and adipic acid manufacturing facilities	November 15, 1999
Stationary Diesel and Dual-Fuel Engines 30 TAC Chapter 117, Subchapter B, Division 3 and Subchapter D, Division 1	Prohibition on operating stationary diesel and dual-fuel engines for testing and maintenance purposes between 6:00 a.m. and noon	April 1, 2002
Natural Gas-Fired Small Boilers, Process Heaters, and Water Heaters 30 TAC Chapter 117, Subchapter E, Division 3	NO_x emission limits on small-scale residential and industrial boilers, process heaters, and water heaters equal to or less than 2.0 million British thermal units per hour	2002
Minor Source NO_x Controls for Non-MECT Sites 30 TAC Chapter 117, Subchapter D, Division 1	NO_x emission limits on boilers, process heaters, stationary engines, and turbines at minor sites not included in the MECT Program (uncontrolled design capacity to emit less than 10 tpy)	March 31, 2005
Texas Low Emission Diesel (TxLED) 30 TAC Chapter 114, Subchapter H, Division 2	Requires all diesels for both on-road and non-road use to have a lower aromatic content and a higher cetane number	October 31, 2005 and phased in through January 31, 2006
TxLED for Marine Fuels 30 TAC Chapter 114, Subchapter H, Division 2	Adds marine distillate fuels X and A, commonly known as DMX and DMA, or Marine Gas Oil, into the definition of diesel fuels, requiring them to be TxLED compliant	October 1, 2007 and phased in through January 1, 2008

Measure	Description	Start Date(s)
Vehicle Inspection and Maintenance (I/M) 30 TAC Chapter 114, Subchapter C	Yearly computer checks for model year 2-24 gasoline-powered vehicles The HGB area meets the federal Clean Air Act (FCAA), §182(c)(3) requirements to implement an I/M program, and according to 40 Code of Federal Regulations (CFR) §51.350(b)(2), an I/M program is required to cover the entire urbanized area based on the 1990 census	May 1, 2002 in Harris County May 1, 2003 in Brazoria, Fort Bend, Galveston, and Montgomery Counties
Texas Emissions Reduction Plan (TERP) 30 TAC Chapter 114, Subchapter K	Provides grant funds for on-road and non-road heavy-duty diesel engine replacement/retrofit	January 2002 See Section 5.4.1.5: *Texas Emissions Reduction Plan (TERP)*
Voluntary Mobile Emission Reduction Program	Various local on-road and non-road measures committed to as part of the 2010 HGB 1997 Eight-Hour Ozone AD SIP Revision and administered by the Houston-Galveston Area Council (H-GAC)	Phased in through 2018
Federal Area/Non-Road Measures	Series of emissions limits, implemented by the EPA, for area and non-road sources Examples: diesel and gasoline engine standards for locomotives and leaf-blowers	Phased in through 2018
Federal Marine Measures	International Marine Diesel Engine and Marine Fuel Standards for Oceangoing Vessels and Emissions Control Areas requires marine diesel fuels used by oceangoing vessels in the North American Emission Control Area to be limited to a maximum sulfur content of 1,000 parts per million, and all new engines on oceangoing vessels operating in these areas must use emission controls that achieve an 80% reduction in NO_x emissions	January 1, 2015 for fuel standards and January 1, 2016 for engine standards
Federal On-Road Measures	Series of emissions limits implemented by the EPA for on-road vehicles: Tier 1, Tier 2, and Tier 3 light-duty and medium-duty passenger vehicle standards; heavy-duty vehicle standards; low sulfur gasoline and diesel standards; National Low Emission Vehicle standards; and reformulated gasoline	Phase in through 2025

Measure	Description	Start Date(s)
Speed Limit Reduction 43 TAC §25.23(f)	Five miles per hour below the speed limit posted before May 1, 2002 on roadways with speeds that were 65 miles per hour or higher	September 2003
California Standards for Certain Gasoline Engines	California standards for non-road gasoline engines 25 horsepower and larger	May 1, 2004
Transportation Control Measures (TCMs)	Various transportation-related, local measures implemented under the previous one-hour and 1997 eight- hour ozone standards (see Appendix D of the 2010 HGB 1997 Eight-Hour Ozone AD SIP Revision) H-GAC has implemented all TCM commitments and provides an accounting of TCMs as part of the transportation conformity process	Phased in through 2013
Voluntary Energy Efficiency/Renewable Energy	Energy efficiency and renewable energy projects enacted by the Texas Legislature outlined in Section 5.4.1.2: *Energy Efficiency and Renewable Energy Measures*	See Section 5.4.1.2

4.3 UPDATES TO EXISTING CONTROL MEASURES

4.3.1 Updates to NO_x Control Measures

Control measures addressing federal Clean Air Act (FCAA), §172 and §182 for the HGB ozone nonattainment area were last updated in a rulemaking adopted March 4, 2020 to address serious RACT requirements for the area under the 2008 ozone NAAQS.

4.3.2 Updates to VOC Control Measures

Control measures addressing FCAA, §172 and §182 for the HGB ozone nonattainment area were last updated in a rulemaking adopted March 4, 2020 to address serious RACT requirements for the area under the 2008 ozone NAAQS and then again in a rulemaking adopted June 30, 2021 to implement the United States Environmental Protection Agency's (EPA) 2016 Control Techniques Guidelines for the Oil and Natural Gas Industry.

4.3.3 Updates to Mobile Source Control Measures

On April 15, 2022, the TCEQ adopted a rulemaking (2021-029-114-AI) to update the state's vehicle inspection and maintenance (I/M) rules in 30 TAC Chapter 114 to be consistent with a change to the Texas Transportation Code required by Senate Bill (SB) 604, 86th Legislature, 2019. The updates related to allowing the display of a vehicle's registration insignia for certain commercial fleet or governmental entity vehicles on a digital license plate in lieu of attaching the registration insignia to the vehicle's windshield. The rulemaking for SB 604 did not include any new control measures and will be submitted to the EPA for consideration and approval with the 30 TAC Chapter 114 rulemaking (2022-026-114-AI), if adopted in November 2023, to implement I/M for Bexar County. The administrative updates made to the I/M program as a result of the rulemaking to implement SB 604 are incorporated into the Bexar County I/M SIP revision (2022-027-SIP-NR) being proposed concurrent with this HGB AD SIP revision.

4.4 RACT ANALYSIS

The RACT analysis submitted as part of this proposed SIP revision is, with some clarifying amendments and updates, the RACT analysis included in the HGB Serious Classification AD SIP Revision for the 2008 Eight-Hour Ozone NAAQS (Project No. 2019-077-SIP-NR) that was adopted by the commission on March 4, 2020 and submitted to EPA on May 13, 2020. The 2020 RACT analysis is submitted as part of this proposed SIP revision in Appendix D: *Reasonably Available Control Technology Analysis*. No additional rules were determined to be required for the HGB area, for which RACT is already implemented at the level required for severe. The 2020 RACT analysis determined that RACT was fulfilled by existing source-specific rules in 30 TAC Chapters 117 and 115 and other federally enforceable measures. Additional NO_x and VOC controls on certain major sources were determined to be either not economically feasible or not technologically feasible. The TCEQ reaffirms the 2020 RACT analysis for this proposed SIP revision for the HGB 2015 ozone NAAQS moderate nonattainment area and will assess the need for any updates to existing control measures required to satisfy RACT for the HGB 2008 ozone NAAQS severe nonattainment area in a forthcoming attainment demonstration SIP revision proposal (Project No. 2023-110-SIP-NR).

4.5 RACM ANALYSIS

4.5.1 General Discussion

FCAA, §172(c)(1) requires states to provide for implementation of all RACM as expeditiously as practicable and to include RACM analyses in the SIP. In the general preamble for implementation of the FCAA Amendments published in the April 16, 1992 issue of the *Federal Register*, the EPA explains that it interprets FCAA, §172(c)(1) as a requirement that states incorporate into their SIP all RACM that would advance a region's attainment date; however, states are obligated to adopt only those measures that are reasonably available for implementation in light of local circumstances (57 FR 13498).

When performing RACM analyses, the TCEQ uses the general criteria specified by the EPA in the proposed approval of the New Jersey RACM analysis published in the January 16, 2009 *Federal Register* (74 FR 2945).

- The control measure is technologically feasible;
- the control measure is economically feasible;
- the control measure does not cause "substantial widespread and long-term adverse impacts;"
- the control measure is not "absurd, unenforceable, or impracticable;" and
- the control measure can advance the attainment date by at least one year.

The EPA did not provide guidance on how to interpret the criteria "advance the attainment date by at least one year." A control measure would have to be implemented by January 1, 2023, the beginning of the attainment year, to be considered as advancing attainment. Given the attainment date, advancing attainment is the only criteria of relevance for the purposes of this proposed SIP revision.

4.5.2 Results of the RACM Analysis

The TCEQ determined that no potential control measures met the criteria to be considered RACM. Because it is not possible to implement any control measures before January 2023, no control measures can meet the criteria of advancing attainment of the NAAQS.

4.6 MOTOR VEHICLE EMISSIONS BUDGETS

An attainment year MVEB represents the maximum allowable emissions from on-road mobile sources for an applicable criteria pollutant or precursor as defined in the SIP for the attainment year. Adequate or approved MVEBs must be used in transportation conformity analyses. The MVEB represents the summer weekday on-road mobile source emissions that have been modeled for the AD and includes all of the on-road control measures reflected in Chapter 4: *Control Strategies and Required Elements* of this SIP revision. The on-road NO_x and VOC emissions inventories (EI) establishing these MVEBs were developed with version 3 of the Motor Vehicle Emission Simulator (MOVES3) model. The resulting MVEBs are shown in Table 4-2: *2023 Attainment Demonstration MVEBs for the HGB 2015 Ozone NAAQS Nonattainment Area.*

Table 4-2: 2023 Attainment Demonstration MVEB for the HGB 2015 Ozone NAAQS Nonattainment Area (tons per day)

Description	NO_x (tpd)	VOC (tpd)
2023 On-Road MVEB based on MOVES3	54.85	31.09

For additional details regarding on-road mobile EI development, refer to Section 3: *Emissions Modeling* of Appendix A.

4.7 MONITORING NETWORK

The ambient air quality monitoring network provides data to verify the attainment status for areas under the 2015 eight-hour ozone NAAQS. The TCEQ monitoring network in the HGB nonattainment area consists of 21 regulatory ambient air ozone monitors located in Brazoria, Chambers, Fort Bend, Galveston, Harris, and Montgomery Counties. The TCEQ, and its local partners, operate ozone monitors at the following air monitoring sites:

- Baytown Garth (482011017);
- Channelview (482010026);
- Clinton (482011035);
- Conroe Relocated (483390078);
- Galveston 99th Street (481671034);
- Houston Aldine (482010024);
- Houston Bayland Park (482010055);
- Houston Croquet (482010051);
- Houston Deer Park #2 (482011039);
- Houston East (482011034);
- Houston Harvard (482010417);
- Houston Monroe (482010062);
- Houston North Wayside (482010046);

- Houston Westhollow (482010066);
- Lake Jackson (480391016);
- Lang (482010047);
- Lynchburg Ferry (482011015);
- Manvel Croix Park (480391004);
- Northwest Harris County (482010029);
- Park Place (482010416); and
- Seabrook Friendship Park (482011050).

The monitors are managed in accordance with EPA requirements prescribed by 40 CFR Part 58 to verify the area attainment status. The TCEQ commits to maintaining an air monitoring network to meet EPA regulatory requirements in the HGB area. The TCEQ continues to work with the EPA through the air monitoring network review process, as required by 40 CFR Part 58, to determine: the adequacy of the ozone monitoring network; additional monitoring needs; and recommended monitor decommissions. Details regarding the annual review of the air monitoring network are located on the TCEQ's Air Monitoring Network Plans webpage (https://www.tceq.texas.gov/airquality/monops/past_network_reviews). Air monitoring data from these monitors continue to be quality assured, reported, and certified according to 40 CFR Part 58.

4.8 CONTINGENCY PLAN

AD SIP revisions for nonattainment areas are required by FCAA, §172(c)(9) to provide for specific contingency measures that would take effect and result in emissions reductions if an area fails to attain a NAAQS by the applicable attainment date or fails to demonstrate reasonable further progress. Recent court decisions have invalidated key aspects of EPA's historical approach to implementing the contingency measure requirement. At the time the proposed SIP revision was being developed, the EPA had historically accepted the use of surplus mobile source emissions reductions from previously implemented federal rules to fulfill the contingency measure requirements. However, the EPA's new draft guidance on contingency measures, published in the *Federal Register* for public comment on March 23, 2023 (88 FR 17571), indicates that contingency measures must be conditional and prospective (not previously implemented) based on the recent court rulings. The draft guidance also establishes an entirely new scheme for determining the amount of emissions reductions necessary to address the contingency requirement.

Since the EPA had not issued final guidance to states regarding contingency measures at the time this SIP revision was developed, this SIP revision relies on the historically approved approach of using surplus mobile source emissions reductions to fulfill the contingency measure requirements.

Under the historical approach, in the General Preamble for implementation of the FCAA published in the April 16, 1992 *Federal Register* (57 FR 13498), the EPA interpreted the contingency requirement to mean additional emissions reductions that are sufficient to equal up to 3% of the emissions in the baseline year inventory. Similarly, the EPA's 2015 eight-hour ozone standard SIP requirements rule (December 6, 2018, 83 FR 62998) states that contingency measures "should provide 1 year's worth of emissions reductions, or approximately 3 percent of the baseline emissions inventory." These emissions reductions should be realized in the year following the year in which the failure is identified.

This proposed AD SIP revision uses the 2017 RFP base year inventory from the concurrent Dallas-Fort Worth (DFW) and HGB Moderate Classification RFP SIP Revision for the 2015 Eight-Hour Ozone NAAQS (Project Number 2022-23-SIP-NR) as the inventory used to calculate the required 3% contingency reductions. The 3% contingency analysis for 2024 is based on a 1.5% reduction in NO_x and a 1.5% reduction in VOC, to be achieved during the one-year period from January 1, 2024 through December 31, 2024. Analyses were performed to assess emissions reductions for the 2024 contingency year from the federal emissions certification programs and for fuel control programs for both on-road and non-road vehicles.

A summary of the 2024 contingency analysis is provided in Table 4-3: *2024 HGB 2015 Ozone NAAQS Nonattainment Area Attainment Contingency Plan (tons per day)*. The analysis demonstrates that the 2024 contingency reductions exceed the 3% reduction requirement; therefore, the AD contingency requirement is met based on the historical approach. Additional documentation for the attainment contingency demonstration calculations is available in the DFW-HGB 2015 Ozone NAAQS Moderate RFP SIP Revision (Project No. 2022-023-SIP-NR), which is scheduled to be proposed concurrent with this proposed AD SIP revision.

Table 4-3: 2024 HGB 2015 Ozone NAAQS Nonattainment Area Attainment Contingency Plan (tons per day)

Contingency Plan Description	NO_x	VOC
Six-county HGB 2017 RFP base year (BY) EI	352.47	459.17
Percent for contingency calculation (total of 3%)	1.5	1.5
2023 to 2024 AD required contingency reductions (RFP BY EI x [contingency percent])	5.29	6.89
Control reductions to meet contingency requirements		
2023 to 2024 emission reductions due to post-1990 Federal Motor Vehicle Control Program, HGB Inspection/Maintenance (I/M) Program, ultra-low sulfur diesel, on-road reformulated gasoline (RFG), 2017 Low Sulfur Gasoline Standard, and on-road Texas Low Emission Diesel (TxLED)	22.00	12.96
2023 to 2024 emission reductions due to federal non-road mobile new vehicle certification standards, non-road RFG, and non-road TxLED	2.89	3.22
Total six-county HGB AD contingency reductions	24.89	16.18
Contingency Excess (+) or Shortfall (-)	19.60	9.29

4.9 ADDITIONAL FCAA REQUIREMENTS

FCAA, §182 sets out a graduated control program for ozone nonattainment areas. According to the EPA's final 2015 eight-hour ozone standard SIP requirements rule, states must submit a SIP element to meet each FCAA, §182 nonattainment area planning requirement for the 2015 eight-hour ozone NAAQS (83 FR 62998). Where an air agency determines that an existing regulation is adequate to meet the applicable nonattainment area planning requirements of FCAA, §182 for a revised ozone NAAQS, that air agency's SIP revision may provide a written statement certifying that determination in lieu of submitting new revised regulations. This section certifies that

Texas meets all additional FCAA nonattainment area requirements applicable to the HGB 2015 ozone NAAQS nonattainment area for the moderate classification, including nonattainment new source review (NSR) program requirements, vehicle inspection and maintenance (I/M) program requirements, and Stage I vapor recovery requirements.

4.9.1 Nonattainment NSR Program

Ozone nonattainment area SIP revisions must include provisions to require permits for the construction and operation of new or modified major stationary sources. Major stationary sources in moderate ozone nonattainment areas are those sources emitting at least 100 tpy of a regulated pollutant. Minor stationary sources are all sources that are not major stationary sources.

An NSR permitting program for nonattainment areas is required by FCAA, §182(a)(2)(C) and further defined in 40 CFR Part 51, Subpart I (Review of New Sources and Modifications). Under these requirements, new major sources or major modifications at existing sources in an ozone nonattainment area must comply with the lowest achievable emissions rate and obtain sufficient emissions offsets.

Nonattainment NSR permits for ozone authorize construction of new major sources or major modifications of existing sources of NO_X or VOC in an area that is designated nonattainment for the ozone NAAQS. Emissions thresholds and pollutant offset requirements under the nonattainment NSR program are based on the nonattainment area's classification. The NSR offset ratio for moderate ozone nonattainment areas is 1.15:1.

The EPA initially approved Texas' nonattainment NSR regulation for ozone on November 27, 1995 (60 FR 49781). The TCEQ has determined that because the Texas SIP already includes 30 TAC §116.12 (Nonattainment and Prevention of Significant Deterioration Review Definitions) and 30 TAC §116.150 (New Major Source or Major Modification in Ozone Nonattainment Area), the nonattainment NSR SIP requirements are met for Texas for the HGB 2015 ozone NAAQS nonattainment area under the moderate classification.

Further, the TCEQ already certified that Texas has EPA-approved rules that cover nonattainment NSR requirements for the HGB 2015 ozone NAAQS nonattainment area in the 2015 Eight-Hour Ozone NAAQS EI SIP Revision for the Houston-Galveston-Brazoria, Dallas-Fort Worth, and Bexar County Nonattainment Areas. On September 9, 2021, the EPA published final approval of the emissions statement and nonattainment NSR certification statement portions of the EI SIP Revision (86 FR 50456).

4.9.2 I/M Program

Texas established a vehicle emissions testing program on January 1, 1995, meeting the EPA's requirements for I/M programs. Enhanced vehicle emissions inspections were implemented in Harris County on May 1, 2002, and in Brazoria, Fort Bend, Galveston, and Montgomery Counties on May 1, 2003. I/M program requirements are codified in 30 TAC Section 114, Subchapter C.

The HGB area meets the FCAA, §182(b)(4) requirements to implement an I/M program, and according to 40 CFR §51.350(b)(2), an I/M program is required to cover the entire urbanized area based on the 1990 census. As previously certified in the 2016 HGB

2008 Eight-Hour Ozone AD Moderate Classification SIP Revision, the current I/M program in the HGB covers the required HGB urbanized area. On May 17, 2017, the EPA approved the portions of the 2016 HGB 2008 Eight-Hour Ozone AD Moderate Classification SIP Revision that describe how FCAA requirements for I/M are met in the HGB area for the 2008 eight-hour ozone NAAQS (82 FR 22291). The TCEQ has determined that the I/M program SIP requirements are met for Texas for the HGB 2015 ozone NAAQS nonattainment area.

A demonstration addressing the EPA's requirement for I/M performance standard modeling for existing I/M programs is provided in Section 4.11: *I/M Program Performance Standard Modeling (PSM)*.

4.9.3 Stage I Vapor Recovery

Stage I vapor recovery is a control strategy to capture gasoline vapors that are released when gasoline is delivered to a storage tank. The vapors are returned to the tank truck as the storage tank is being filled with fuel, rather than released to the ambient air. The EPA took a direct final action on April 30, 2015 (80 FR 24213) to approve revisions to the Texas SIP related to Stage I regulations. The TCEQ has determined that the Stage I vapor recovery SIP requirements are met for Texas for the HGB 2015 ozone NAAQS nonattainment area.

4.10 EMISSION CREDIT GENERATION

The Emissions Banking and Trading rules in 30 TAC Chapter 101, Subchapter H, Divisions 1 and 4 require sources in nonattainment areas to have SIP emissions to be eligible to generate emission credits. SIP emissions are the actual emissions from a facility or mobile source during the SIP emissions year, not to exceed any applicable local, state, or federal requirement. For point sources, the SIP emissions cannot exceed the amount reported to the state's EI; if no emissions were reported for a point source facility in the SIP emissions year, then the facility is not eligible for credits.

This SIP revision revises the SIP emissions year used for emission credit generation. If adopted and submitted to the EPA, the new SIP emissions year will be 2019 for point source electric generating units with emissions recorded in the EPA's Air Markets Program Data, 2019 for all other point sources with emissions recorded in TCEQ's STARS emissions database, 2019 for oil and gas area sources, 2020 for all other area sources, and 2019 for all mobile sources.

On April 9, 2021, the TCEQ sent notice to point sources through agency email system and posted notice on the TCEQ website that 2019 point source emissions revisions for the STARS database must be provided by July 9, 2021 to be included in this SIP revision; as discussed in Chapter 2: *Anthropogenic Emissions Inventory Description*, those revision were incorporated into this SIP revision.

4.11 INSPECTION AND MAINTENANCE (I/M) PROGRAM PERFORMANCE STANDARD MODELING (PSM)

On October 7, 2022, the EPA published the final *Determinations of Attainment by the Attainment Date, Extensions of the Attainment Date, and Reclassification of Areas Classified as Marginal for the 2015 Ozone National Ambient Air Quality Standards* (87 FR 60897). This rule requires states to provide a demonstration that the existing or proposed I/M program for a newly designated or reclassified ozone nonattainment area meets the emissions reduction benchmarks specified for the area's ozone NAAQS classification level. The EPA interprets the I/M performance requirement to mean upon designation or reclassification that a proposed or existing I/M program must meet the I/M performance benchmark. These I/M emissions reductions should be realized in the attainment year or program implementation year.

Texas established a vehicle emissions testing program on January 1, 1995, meeting the EPA's requirements for I/M programs. Enhanced vehicle emissions inspections were implemented in Harris County on May 1, 2002, and in Brazoria, Fort Bend, Galveston, and Montgomery Counties on May 1, 2003. I/M program requirements are codified in 30 TAC Section 114, Subchapter C.

The TCEQ performed the required performance standard modeling analysis of the HGB 2015 ozone NAAQS nonattainment area using the requirements in the EPA guidance document, *Performance Standard Modeling for New and Existing Vehicle Inspection and Maintenance (I/M) Programs Using the MOVES Mobile Source Emissions Model* (EPA-420-B-22-034, October 2022). The TCEQ specifically used the Enhanced Performance Standard that reflects the I/M program design elements as specified in 40 CFR §51.351(i) that are implemented in the HGB area. The assessment uses a 2023 analysis year, the attainment year under the 2015 ozone NAAQS for moderate nonattainment areas. The PSM analysis was performed for each of the five counties within the HGB 2015 ozone NAAQS nonattainment area in which the HGB I/M program is required to operate (Chambers County is not subject to the I/M program requirement). Summaries of the 2023 I/M PSM analysis are provided in: Table 4-4: *Summary of NO_X Performance Standard Evaluation for the HGB 2015 Ozone NAAQS Nonattainment Area Existing I/M Program*; and Table 4-5: *Summary of VOC Performance Standard Evaluation for the HGB 2015 Ozone NAAQS Nonattainment Area Existing I/M Program*.

Evaluating whether an existing I/M program meets the enhanced performance standard requires demonstrating that the existing program emission rates for NO_X and VOC do not exceed the benchmark program's emission rates. The benchmark program's emission rates include a 0.02 gram per mile buffer for each pollutant, as noted in Tables 4-4 and 4-5. The analysis demonstrates that the existing HGB area I/M program emissions rates are lower than the performance standard benchmark emission rates for all five counties required to operate an I/M program within the HGB 2015 ozone NAAQS nonattainment area. Therefore, the HGB 2015 ozone nonattainment area I/M program performance requirement is met.

All required documentation for the I/M program performance standard benchmark assessment is available in Appendix C: *Inspection and Maintenance (I/M) Program Performance Standard Modeling (PSM) for the Existing I/M Program in the Houston-Galveston-Brazoria 2015 Ozone National Ambient Air Quality Standard Nonattainment Area*.

Table 4-4: Summary of NO_x Performance Standard Evaluation for the HGB 2015 Ozone NAAQS Nonattainment Area Existing I/M Program

County	I/M Program NO_x Emission Rate	I/M NO_x Performance Standard Benchmark	I/M NO_x Performance Standard Benchmark Plus Buffer	Does Existing Program Meet I/M Performance Standard?
Brazoria	0.29	0.29	0.31	Yes
Fort Bend	0.27	0.27	0.29	Yes
Galveston	0.24	0.24	0.26	Yes
Harris	0.26	0.26	0.28	Yes
Montgomery	0.28	0.28	0.30	Yes

Table 4-5: Summary of VOC Performance Standard Evaluation for the HGB 2015 Ozone NAAQS Nonattainment Area Existing I/M Program

County	I/M Program VOC Emission Rate	I/M VOC Performance Standard Benchmark	I/M VOC Performance Standard Benchmark Plus Buffer	Does Existing Program Meet I/M Performance Standard?
Brazoria	0.17	0.17	0.19	Yes
Fort Bend	0.19	0.20	0.22	Yes
Galveston	0.17	0.18	0.20	Yes
Harris	0.14	0.14	0.16	Yes
Montgomery	0.16	0.16	0.18	Yes

CHAPTER 5: WEIGHT OF EVIDENCE

5.1 INTRODUCTION

The corroborative analyses presented in this chapter demonstrate the progress that the Houston-Galveston-Brazoria (HGB) 2015 ozone National Ambient Air Quality Standard (NAAQS) nonattainment area is making towards attainment of the 70 parts per billion (ppb) standard. This corroborative information supplements the photochemical modeling analysis presented in Chapter 3: *Photochemical Modeling*. The United States Environmental Protection Agency's (EPA) *Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone $PM_{2.5}$ and Regional Haze* (EPA, 2018; hereafter referred to as modeling guidance) states that all modeled attainment demonstrations (AD) should include supplemental evidence that the conclusions derived from the basic attainment modeling are supported by other independent sources of information. This chapter details the supplemental evidence, i.e., the corroborative analyses, for this proposed HGB AD State Implementation Plan (SIP) revision.

This chapter describes analyses that corroborate the conclusions of Chapter 3. First, information regarding trends in ozone and ozone precursors in the HGB nonattainment area is presented. Analyses of ambient data corroborate the modeling analyses and independently support the AD. An overview is provided of trends in background ozone levels transported into the HGB nonattainment area, in ozone chemistry, and in meteorological influences on ozone. More detail on ozone and emissions in the HGB area is provided in Appendix B: *Conceptual Model for the Houston-Galveston-Brazoria Nonattainment Area for the 2015 Eight-Hour Ozone National Ambient Air Quality Standard*. Second, this chapter describes air quality control measures that are not quantified but are nonetheless expected to yield tangible air quality benefits, even though they were not included in the proposed AD modeling discussed in Chapter 3.

5.2 ANALYSIS OF AMBIENT TRENDS AND EMISSIONS TRENDS

The EPA's modeling guidance states that examining recently observed air quality and emissions trends is an acceptable method to qualitatively assess progress toward attainment. Declining trends in observed concentrations of ozone and its precursors and in emissions, past and projected, are consistent with progress toward attainment. The strength of evidence produced by emissions and air quality trends is increased if an extensive monitoring network exists.

The six-county HGB 2015 ozone NAAQS nonattainment area has an extensive continuous air monitoring station (CAMS) network and as of 2021 has 21 regulatory ozone monitors, 21 nitrogen oxides (NO_X) monitors, and 15 automated gas chromatograph (auto-GC) for volatile organic compounds (VOC). Details for these monitors are listed in Table 5-1: *Monitor Information for the HGB Area*. Only regulatory ozone monitors are displayed in the table. More detail on nonregulatory monitors, monitor locations, and other parameters measured per monitor can be found on the Texas Commission on Environmental Quality (TCEQ) Air Monitoring Sites webpage (https://www.tceq.texas.gov/airquality/monops/sites/air-mon-sites). Monitors will be referenced by their monitor abbreviation for the rest of the section. Ozone data used in this Chapter are only from regulatory monitors that report to the EPA's Air Quality

System (AQS). All other pollutant data is from Texas Air Monitoring Information System (TAMIS) unless otherwise noted.

Table 5-1: Monitor Information for the HGB Area

Monitor Name	Abbreviation	AQS No.[1]	CAMS No.[2]	Compounds or Parameters Measured
Manvel Croix Park	Manvel	480391004	0084	Ozone, NO_X
Lake Jackson	Lake Jackson	480391016	1016	Ozone, NO_X, VOC
Oyster Creek	Oyster Creek	480391607	1607	NO_X, VOC
Texas City 34th Street	Texas City	481670056	0620	NO_X, VOC
Galveston 99th Street	Galveston	481671034	1034	Ozone, NO_X
Houston Aldine	Aldine	482010024	008, 0108, 0150	Ozone, NO_X
Channelview	Channelview	482010026	0015, 0115	Ozone, NO_X, VOC
Northwest Harris County	NW Harris	482010029	0026, 0110, 0154	Ozone, NO_X
Channelview Drive Water Tower	CView Water Tower	482010036	1036	VOC
Houston North Wayside	North Wayside	482010046	0405, 1033	Ozone
Lang	Lang	482010047	0408	Ozone, NO_X
Houston Croquet	Croquet	482010051	0409	Ozone
Houston Bayland Park	Bayland Park	482010055	0053, 0146, 0181	Ozone, NO_X
Galena Park	Galena Park	482010057	0167, 1667	VOC
Houston Monroe	Monroe	482010062	0406	Ozone
Houston Westhollow	Westhollow	482010066	0410, 3003	Ozone
Milby Park	Milby Park	482010069	0169	VOC
Park Place	Park Place	482010416	0416	Ozone, NO_X
Houston Harvard Street	Harvard	482010417	0417	Ozone, NO_X
Wallisville Road	Wallisville	482010617	0617	NO_X, VOC
HRM #3 Haden Rd	HRM 3	482010803	0114, 0603	NO_X, VOC
HRM 7 Baytown	HRM 7	482010807	0607	VOC
Lynchburg Ferry	Lynchburg	482011015	0165, 1015	Ozone, NO_X, VOC
Baytown Garth	Garth	482011017	1017	Ozone
Houston East	Houston East	482011034	0001	Ozone, NO_X
Clinton	Clinton	482011035	0055, 0113, 0304, 0403	Ozone, NO_X, VOC

Monitor Name	Abbreviation	AQS No.[1]	CAMS No.[2]	Compounds or Parameters Measured
Houston Deer Park #2	Deer Park	482011039	0035, 0139, 0235, 1001, 3000	Ozone, VOC
Seabrook Friendship Park	Seabrook	482011050	0045	Ozone, NO_X
Houston North Loop	North Loop	482011052	1052	NO_X
Houston Southwest Freeway	Southwest Freeway	482011066	1066	NO_X
HRM 16-Deer Park	HRM 16	482011614	1614	VOC
Cesar Chavez	Cesar Chavez	482016000	0175, 1020	VOC
Conroe Relocated	Conroe	483390078	0078	Ozone, NO_X

1 AQS: EPA's Air Quality System.
2 CAMS: Continuous Air Monitoring System.

This section examines ambient concentration and emissions trends from the extensive ozone and ozone-precursor monitoring network in the HGB area. Appendix B provides additional details on ozone formation in the region. Results from this section show declining ozone trends despite a continuous increase in the population of the HGB 2015 ozone NAAQS nonattainment area, growth in vehicle miles traveled (VMT), and steady to increasing trends in NO_X and VOC.

5.2.1 Ozone Trends

Because ozone varies both temporally and spatially, there are several ways that trends in ozone concentrations are analyzed. This section will discuss ozone design value trends, trends in the fourth-highest eight-hour ozone concentrations, and background ozone trends.

5.2.1.1 Ozone Design Value Trends

A design value is the statistic used to determine compliance with the NAAQS. For the 2015 eight-hour ozone NAAQS, design values are calculated by averaging fourth-highest daily maximum eight-hour average (MDA8) ozone values at each regulatory monitor over three years. The eight-hour ozone design value for a metropolitan area is the maximum design value from all the area's regulatory monitors' individual design values. Design values of 71 ppb and greater exceed the 2015 eight-hour ozone NAAQS.

Figure 5-1: *Eight-Hour Ozone Design Values in the HGB Area* shows that design values have decreased in the HGB 2015 ozone NAAQS nonattainment area. The 2022 eight-hour ozone design value for the area is 78 ppb. This design value represents an 11% decrease from the 2012 design value of 88 ppb. Ozone decreases may be due to changes in meteorology, background ozone, and/or emissions. The largest design value decrease occurred from 2013 through 2014, when the eight-hour ozone design value dropped by 7 ppb.

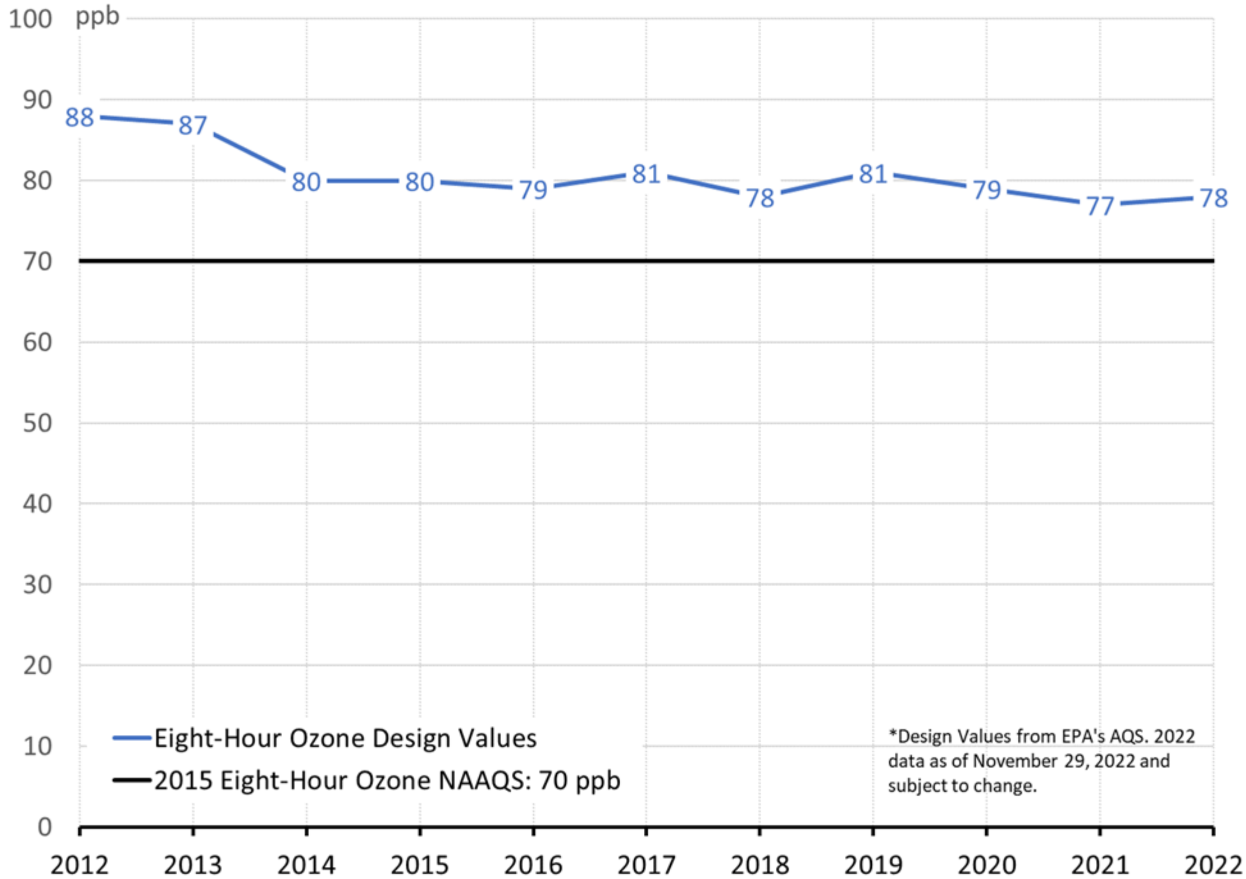

Figure 5-1: Eight-Hour Ozone Design Values in the HGB Area

Because ozone levels vary spatially, it is also prudent to investigate trends at all monitors in an area. Figure 5-2: *Eight-Hour Ozone Design Values by Monitor in the HGB Area* displays the eight-hour design values from 2012 through 2022 at each regulatory monitor in the HGB area. The individual monitors' trends are less important for assessing trends than the overall range in design values across the area. Figure 5-2 demonstrates that design values have been decreasing across the HGB area and not only at the monitor with the highest design value. Prior to 2013, no monitors in the HGB area measured below the 2015 eight-hour ozone NAAQS. As of 2021, over half of the monitors in the HGB area measure below the 2015 eight-hour ozone NAAQS.

Figure 5-2 also shows how the monitor with the highest eight-hour ozone design value in the HGB area has changed over time. From 2012 through 2015, Manvel observed eight-hour ozone design values several ppb higher than other monitors. From 2016 to 2020, the highest design value was at Aldine. Bayland Park observed the highest design value in 2021 and 2022. Most years show a difference of several ppb between the maximum design value and the second highest design value.

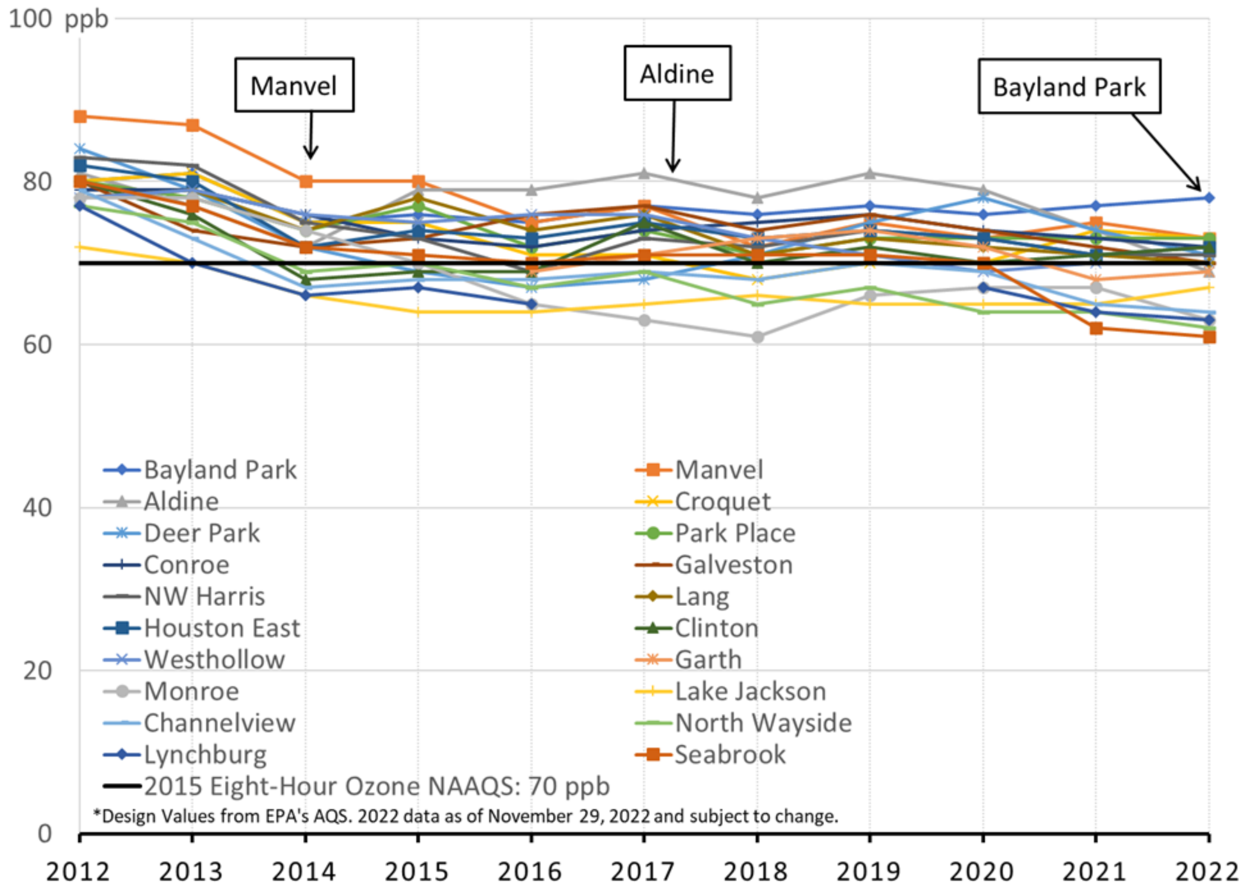

Figure 5-2: Eight-Hour Ozone Design Values by Monitor in the HGB Area

Displaying regulatory monitor level eight-hour ozone design values on a map can give better insight into ozone formation patterns within the HGB area. Kriging interpolation was used to determine the spatial variation of eight-hour ozone design values across the area for 2012, 2016, and 2021. The maps of those values for three different years are displayed in Figure 5-3: *Eight-Hour Ozone Design Value Maps for the HGB Area*. Only the monitors with the maximum eight-hour ozone design value for each year are labeled on the maps. The maps demonstrate how much eight-hour ozone design values have decreased across the entire HGB area. All monitors in 2012 were above the 2015 ozone NAAQS, but by 2021 many monitors were below the 2015 ozone NAAQS and only one monitor was above the 2008 ozone NAAQS of 75 ppb.

In addition to the level of the design values, the maps also illustrate the changing location of the minimum and maximum eight-hour ozone design values. The monitor with the maximum design value in 2012, Manvel, is located southwest of the Houston Ship Channel, an area with a large amount of industrial activity. In 2016, the maximum design value was located at Aldine, located north of the Houston Ship Channel. In 2021, the maximum eight-hour ozone design value was located at Bayland Park, north of Manvel and west of the Houston Ship Channel. The location of the minimum eight-hour ozone design value has also changed; however, lower design values for all three of the years shown are observed to the south and in the east central portion of the area. In 2012, higher ozone design values were observed in areas closer to the Houston

Ship Channel, such as Deer Park. Design values near the ship channel were much lower in 2016 and 2021, with low design values at Monroe and Lynchburg in 2016 and at Seabrook in 2021. These spatial patterns seem consistent with wind flows in the area and ozone formation dynamics, with lower values observed either upwind or closer to emissions sources and high values observed downwind.

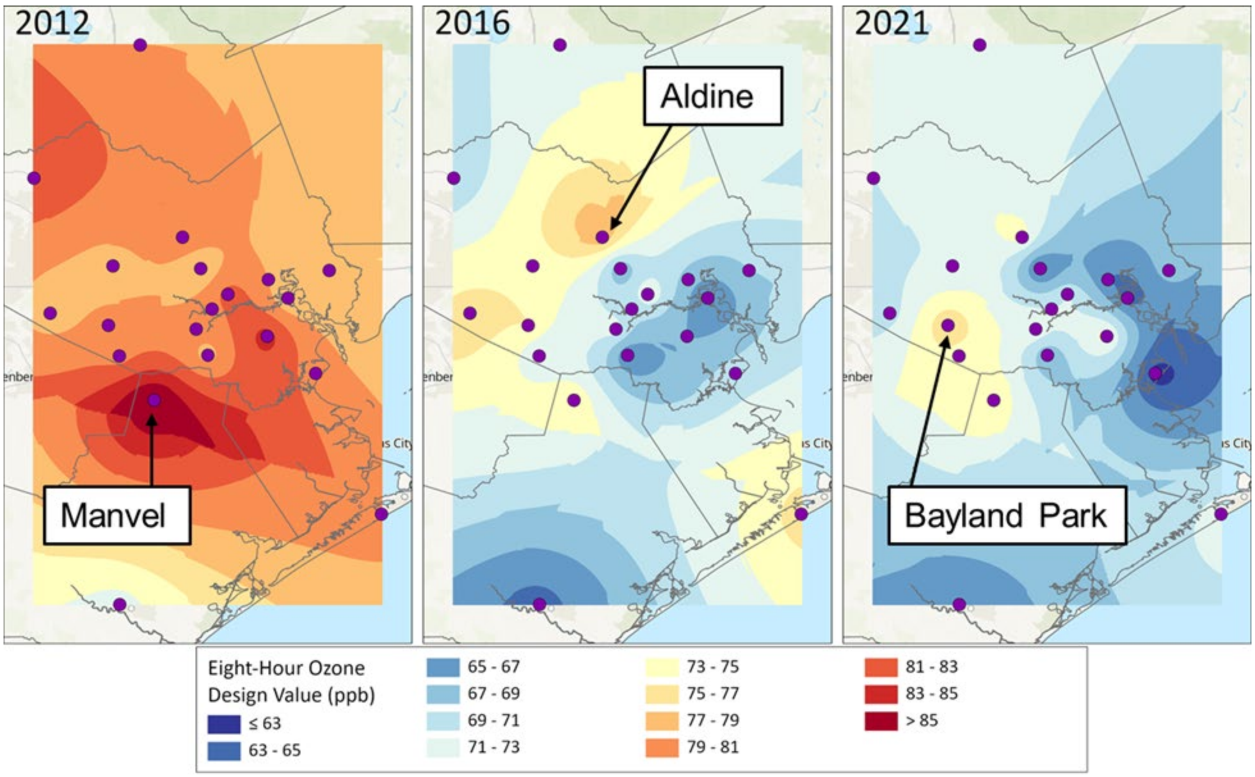

Figure 5-3: Eight-Hour Ozone Design Value Map for the HGB Area

<u>5.2.1.2 Fourth-Highest Eight-Hour Ozone Trends</u>

Because eight-hour ozone design values are three-year averages, trends tend to be smoother, making year-to-year variations in ozone concentrations due to factors such as meteorology less apparent. Trends in the yearly fourth-highest MDA8 ozone concentrations provide more insight into each individual year. Fourth-highest MDA8 ozone trends can also determine what levels of ozone are required for the area to monitor attainment. Area-wide fourth-highest MDA8 ozone trends are not very instructive because design values are calculated on a per monitor basis. Instead, fourth-highest MDA8 ozone trends are investigated at each regulatory monitor in the HGB area. Figure 5-4: *Fourth-Highest MDA8 Ozone Concentration by Monitor in the HGB Area* shows data from 2010 through 2022 to examine all years used in 2012 through 2022 design value computations.

Trends show that there is more variability present in fourth-highest MDA8 ozone values compared to design values. Fourth-highest MDA8 ozone values decreased from 2010 through 2014, and then stagnated through 2022. Most monitors showed an overall decrease in fourth-highest MDA8 ozone from 2010 through 2022, except for Bayland Park and Westhollow. In 2022, Bayland Park measured the highest fourth-highest MDA8 ozone since 2010. Several of the highest ozone days at Bayland Park are currently under investigation as exceptional events. More details are available in Chapter 6: *Ongoing Work*.

The monitor with the maximum fourth-highest MDA8 ozone concentration changes from year to year and is not always the same as the monitor with the areawide maximum design value. This indicates that overall, ozone in the area is not changing very much and that changes at individual monitors are likely due to changes in shifting wind directions on high ozone days rather than changes in emissions.

For most years, individual monitors did not exhibit similar trends, and different monitors may have had increasing or decreasing fourth-highest MDA8 ozone values from year to year. This indicates that there may be local factors influencing ozone concentrations. In 2014 and 2015, almost all monitors exhibit similar trends, with values decreasing area-wide in 2014 and increasing area-wide in 2015. This indicates that ozone concentrations in those years may be strongly influenced by non-local factors such as meteorology. Another notable year in the trend is 2020. Although 2020 did not observe fourth-highest MDA8 ozone values as low as those in 2014, they were still lower than more recent years.

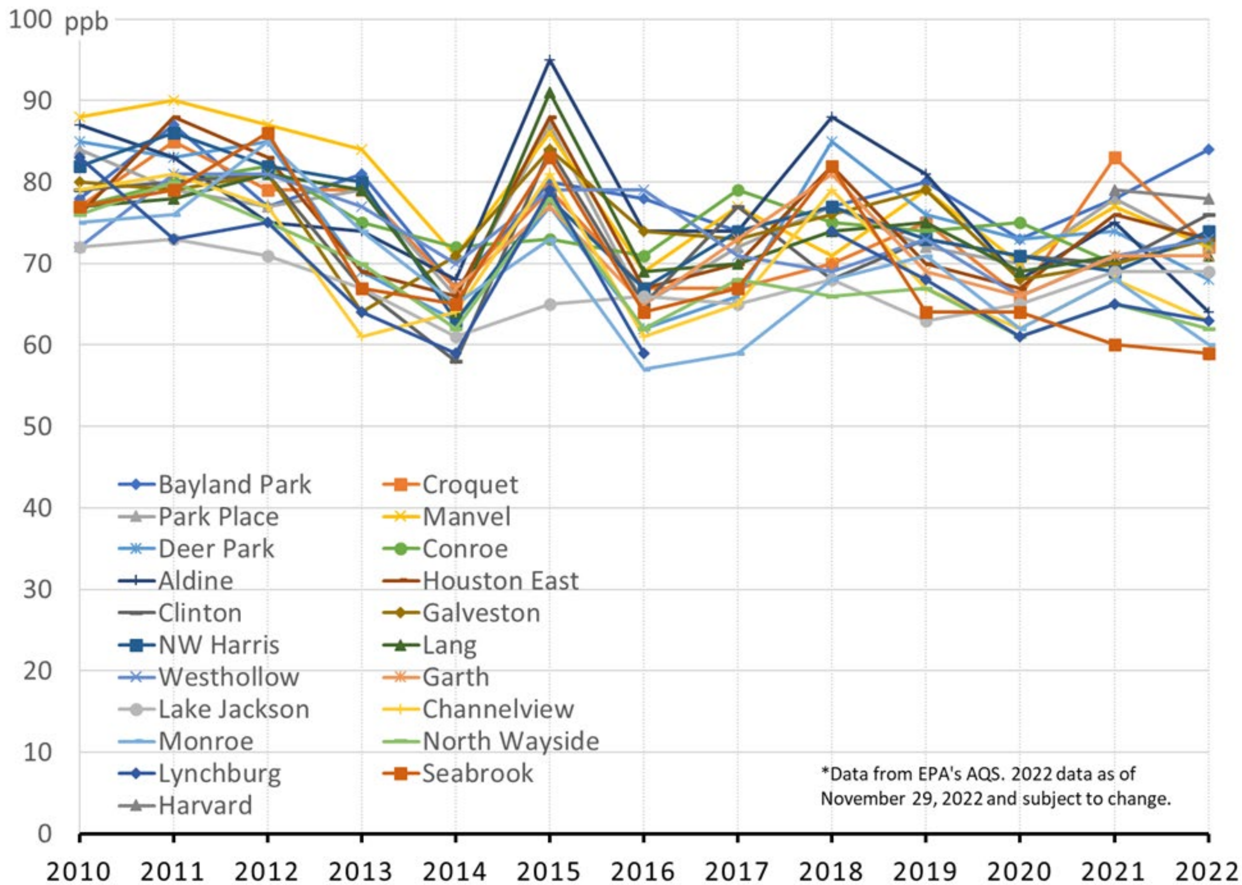

Figure 5-4: Fourth-Highest MDA8 Ozone Concentration by Monitor in the HGB Area

5.2.1.3 Background Ozone Trends

Regional background ozone, which will be referred to as background ozone for the remainder of this section, reflects the ozone produced from all sources outside of the six-county HGB 2015 ozone NAAQS nonattainment area. Examination of background ozone trends provide insight into whether observed ozone changes are from locally produced ozone or from transported ozone. The technique for estimating background ozone concentrations, which uses the lowest MDA8 ozone value from selected sites to determine the background ozone concentrations, is detailed in Appendix B.

Locally produced ozone (within the HGB area) was calculated by subtracting the background ozone concentration from the highest MDA8 ozone value for the area. Results were then separated into low ozone days and high ozone days to investigate if high ozone is due to changes in background ozone or changes in local ozone. For this analysis, high ozone days are any day with a MDA8 ozone value greater than 70 ppb. Low ozone days are any day with a MDA8 ozone value less than or equal to 70 ppb.

Although the HGB area has a year-round ozone season, no high ozone days occurred outside of the months of March through October from 2012 through 2021. To focus on months that observe the highest eight-hour ozone concentrations, this analysis uses ozone data from only the months of March through October. These months will be referred to as ozone season for the rest of this chapter.

Figure 5-5: *Ozone Season Trends in MDA8 Ozone, Background Ozone, and Locally Produced Ozone for High versus Low Ozone Days in the HGB Area* shows that the area-wide median background ozone is 26 ppb on low ozone days and 48 ppb on high ozone days. Although background ozone is higher on high ozone days, local ozone production also increases at a proportional rate on these days. For both high and low ozone days, background ozone accounts for approximately 60% of the MDA8 ozone and locally produced ozone accounts for approximately 40% of the MDA8 ozone. Background ozone, MDA8 ozone, and locally produced ozone are stable on low ozone days. On high ozone days, background ozone concentrations decrease slightly, and locally produced ozone concentrations increase slightly, resulting in a flat MDA8 ozone trend.

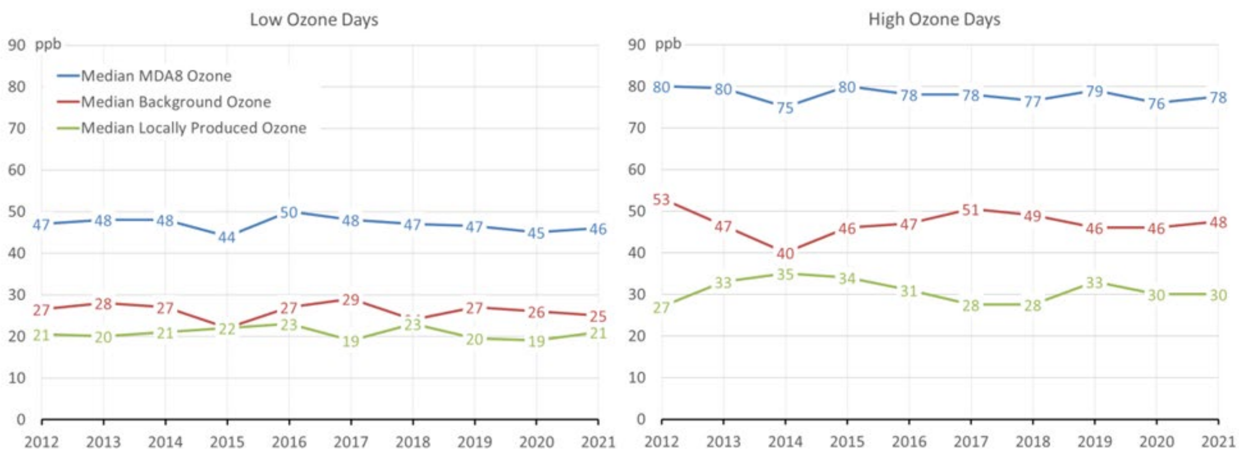

Figure 5-5: Ozone Season Trends in MDA8 Ozone, Background Ozone, and Locally Produced Ozone for High versus Low Ozone Days in the HGB Area

5.2.2 NO_X Trends

NO_X, a precursor to ozone formation, is a mixture of nitrogen oxide (NO) and nitrogen dioxide (NO_2). NO_X is primarily emitted by fossil fuel combustion, lightning, biomass burning, and soil. Examples of common NO_X emission sources in urban areas are automobiles, diesel engines, other small engines, residential water heaters, industrial heaters, flares, and industrial and commercial boilers. Mobile, residential, and commercial NO_X sources are usually numerous smaller sources distributed over a large geographic area, while industrial sources are usually large point sources, or numerous small sources, clustered in a small geographic area. Because of the large number of NO_X sources, elevated ambient NO_X concentrations can occur throughout the HGB area.

There have been 25 NO_X monitors in operation in the HGB area at some point from 2012 through 2021, however, only 19 were used to calculate area-wide NO_X trends due to incomplete data. To remove the effects of incomplete data, the data were first checked for validity. Validity criteria are outlined in detail in Appendix B. The NO_X monitors not included in the area-wide trends due to incomplete data were Mustang Bayou (CAMS 0619), Oyster Creek, Houston Texas Avenue (CAMS 0411), Harvard, Deer Park, and North Loop.

All valid hours and years of ozone season NO_X data were used to calculate the yearly median and 95th percentile NO_X trends shown in Figure 5-6: *Ozone Season NO_X Trends* *in the HGB Area*. Overall, from 2012 through 2021, 95th percentile NO_x showed a decrease of 3% and median NO_x showed an increase of 2%. There were decreases for both statistics from 2012 through 2017. After 2017, NO_x trends flattened. There is a low for both 95th percentile and median NO_x in 2020. In 2021, NO_x concentrations increased. More detailed analysis of NO_x trends, including monitor level trends, is available in Appendix B.

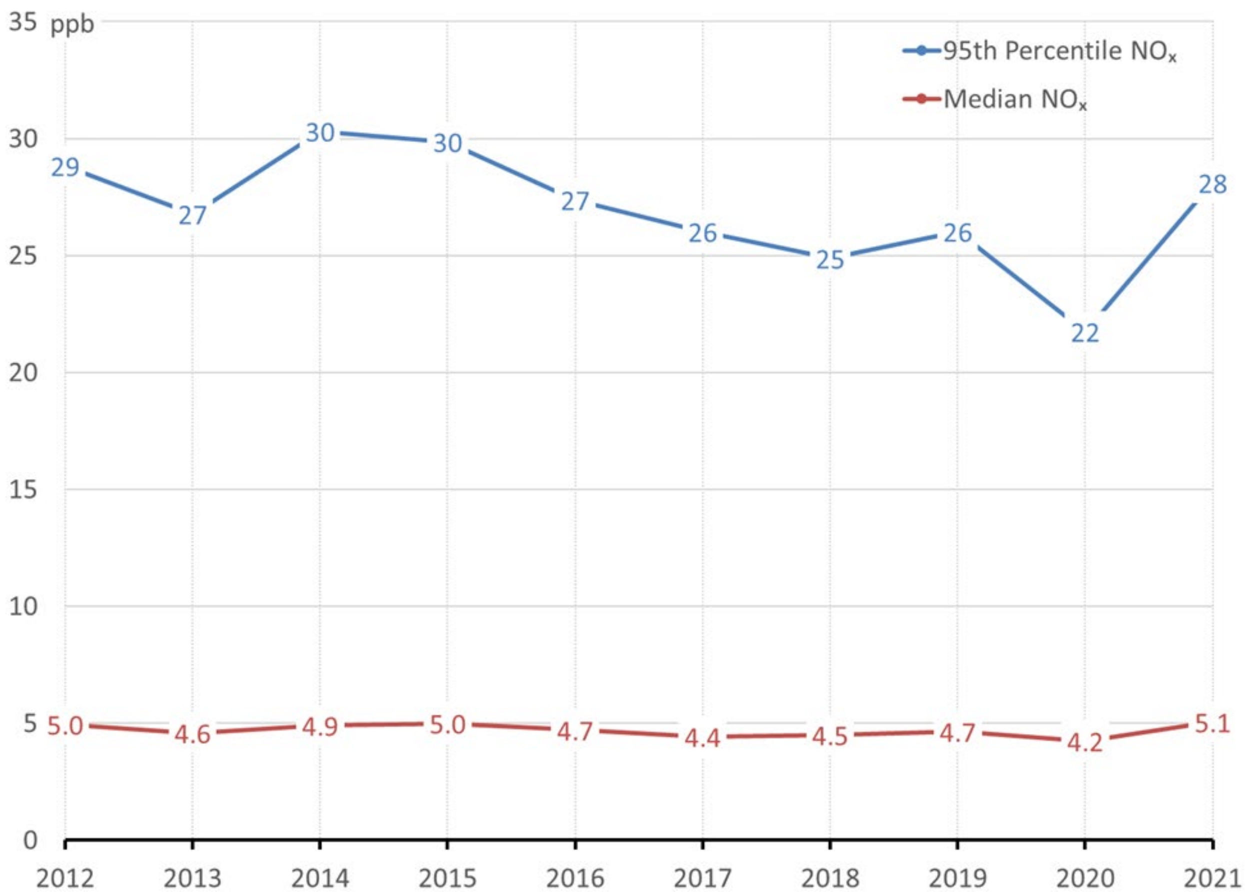

Figure 5-6: Ozone Season NO_x Trends in the HGB Area

From the late 1990s to the present, federal, state, and local measures have resulted in significant NO_x reductions from on-road and non-road sources within the HGB area. The TCEQ funded a study by the Texas Transportation Institute (TTI) to estimate on-road emissions trends throughout Texas from 1999 through 2050 using the 2014a version of the Motor Vehicle Emission Simulator (MOVES2014a) model (TTI, 2015). On-road emissions in the HGB area are estimated to have large decreases from 1999 through 2021 and beyond, even as daily VMT is estimated to increase. This reduction in on-road NO_x is projected to continue as older, higher-emitting vehicles are removed from the fleet and are replaced with newer, lower-emitting ones.

A similar pattern is reflected in a TCEQ non-road emissions trends analysis using the Texas NONROAD (TexN) model. Non-road emissions are estimated to decrease from 1999 through 2021 and beyond even as the number of non-road engines, based on equipment population, has increased. As with the on-road fleet turnover effect, reductions in non-road NO_x emissions are projected to continue as older, higher-emitting equipment is removed from the fleet and replaced with newer, lower-emitting equipment.

Point source NO_x emission trends from the State of Texas Air Reporting System (STARS) were also investigated. These emissions are from sources that meet the reporting requirements under the TCEQ emissions inventory rule (30 TAC §101.10). The emissions trends analysis uses 10 years of data from 2012 through 2021.

Emissions trends in tons per year (tpy) by site are displayed in Figure 5-7: *HGB Area Point Source NO_x Emissions by Site*. Because the HGB area has so many point sources, only the top emitters are displayed on the chart. All other point source emissions in the HGB area were added together and displayed as the Sum of All Others. Point source NO_x emission trends show that the top 10 reporting sites accounted for 52% of the total point source NO_x emissions in the HGB area in 2021. Each of these sites report total NO_x emissions exceeding 800 tpy in 2021, with the largest emitter, NRG Texas Power LLC – WA Parish Electric Generating Station, reporting over 5,000 tons of NO_x in 2021. Overall trends in NO_x emissions have increased 7% from 2012 through 2021. This correlates with the ambient NO_x trends, which showed little change from 2012 through 2021.

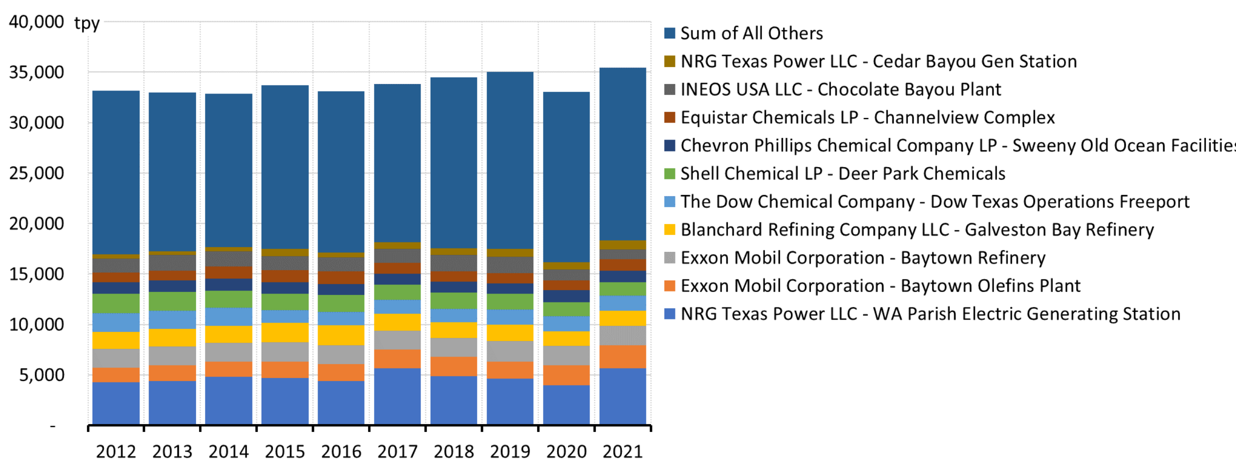

Figure 5-7: HGB Area Point Source NO_x Emissions by Site

5.2.3 VOC Trends

Total non-methane organic compounds (TNMOC), which is used to represent total VOC concentrations, can enhance ozone production in combination with NO_x and sunlight. VOC is emitted from numerous sources including large industrial processes, automobiles, solvents, paints, dry-cleaning, fuels, and even natural sources such as trees. TNMOC is an important precursor to ozone formation, particularly in the HGB area, where the Houston Ship Channel, a large source of industrial VOC emissions, is located. Not all VOC species have the same ozone production potential. A subset of VOC called highly reactive volatile organic compounds (HRVOC) are more likely to produce large amounts of ozone. Because of their ozone formation potential, six of these HRVOC are regulated in Texas. These HRVOC include ethylene, propylene, 1-butene, c-2-butene, t-2-butene, and 1,3-butadiene. The following section will discuss trends in ambient concentrations of both TNMOC and HRVOC from the auto-GC monitors.

In addition to the 15 current auto-GC monitors, there was one auto-GC monitor, Danciger (CAMS 0618), that was in operation in 2012 but ceased operations prior to 2021. To remove effects of incomplete data on VOC trends, the data were first checked for validity, as detailed in Appendix B. Out of the 16 auto-GC monitors in operation from 2012 through 2021, only 11 were used to calculate area-wide TNMOC and HRVOC trends. The auto-GC monitors not included in the area-wide trends due to incomplete data were Oyster Creek, CView Water Tower, Galena Park, HRM 7, and HRM 16.

All valid hours and years of ozone season data were used to calculate yearly median and 95th percentile TNMOC and HRVOC trends. Ozone season trends for ambient TNMOC and HRVOC concentrations are presented in Figure 5-8: *Ozone Season Median and 95th Percentile TNMOC and HRVOC Trends in the HGB Area*. TNMOC and HRVOC are displayed on different scales due to their differing units of measurement. TNMOC is recorded in parts per billion carbon (ppbC) and HRVOC is recorded in parts per billion by volume (ppb).

Overall, both TNMOC and HRVOC trends are like those for NO_X, especially in recent years. The 95th percentile TNMOC and HRVOC levels increased from 2012 through 2021 by 4% and 14%, respectively. Median values show less change, with a decrease of 2% in median TNMOC and an increase of 11% in median HRVOC. Increases occurred mostly in 2021. Prior to 2021, both TNMOC and HRVOC appeared to be slowly decreasing, with the lowest values observed in 2017 and 2020. More detailed VOC and HRVOC trends, including monitor level trends, are available in Appendix B.

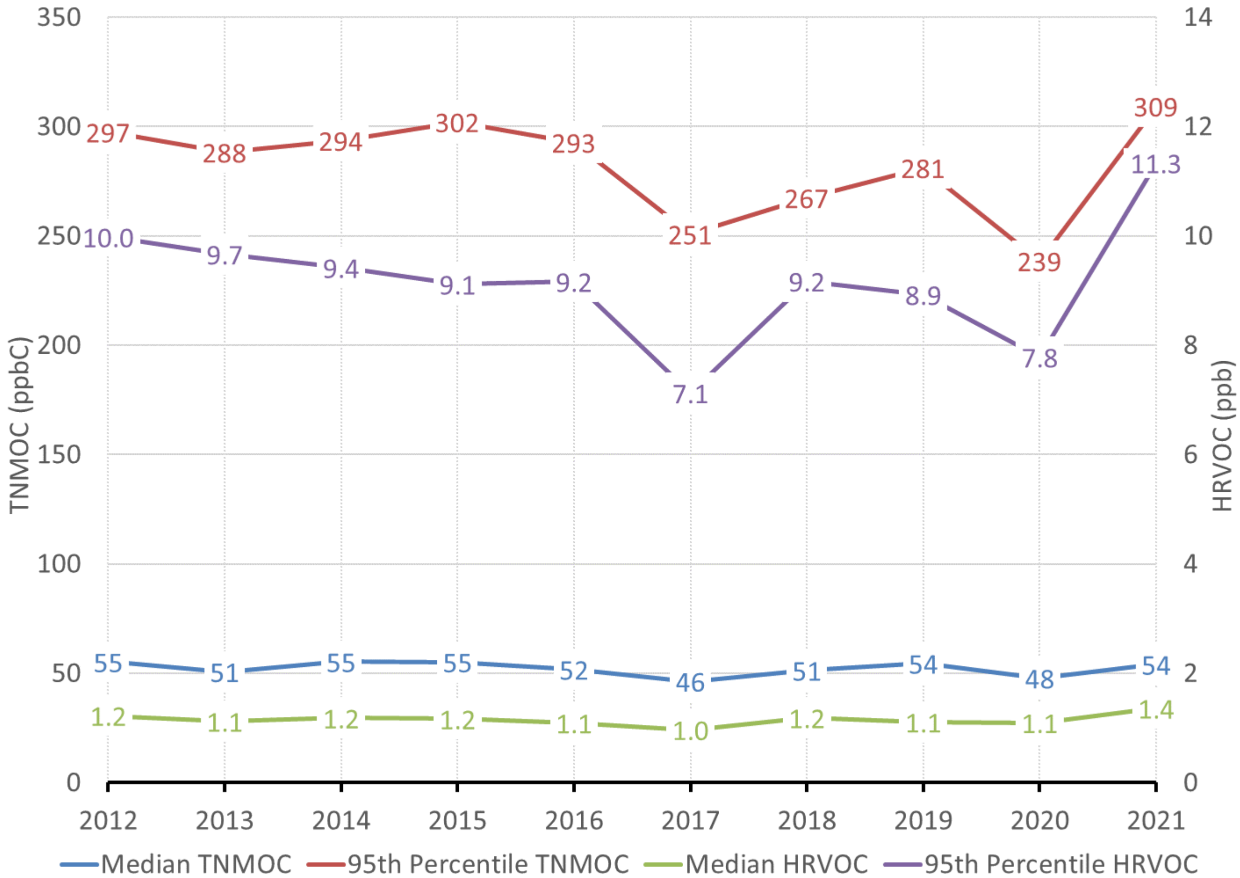

Figure 5-8: Ozone Season Median and 95th Percentile TNMOC and HRVOC Trends in the HGB Area

From the late 1990s to the present, federal, state, and local measures have resulted in VOC reductions from on-road and non-road sources within the HGB area. The TCEQ studies mentioned in Section 5.2.2 *NO_x Trends* showed decreases in on-road and non-road VOC from 1999 through the present. These reductions are projected to continue as older, higher-emitting vehicles and equipment are removed from the fleet and replaced with newer, lower-emitting ones.

Point source VOC and HRVOC emission trends from STARS were also investigated. Figure 5-9: *HGB Area Point Source VOC Emissions by Site* shows that the top 11 reporting sites accounted for 41% of the total HGB area point source VOC emissions in 2021. Each of these sites reported total VOC emissions exceeding 500 tpy in 2021, with the largest emitter, Exxon Mobile Corporation – Baytown Refinery, reporting over 2,000 tpy. Overall, VOC emissions are decreasing, with a 14% decrease from 2012 through 2021, though the 11 sites with the largest VOC emissions showed almost no change. Trends from the top 11 VOC sources correlates the ambient VOC trends, but overall trends in VOC emissions show more decline when compared to ambient TNMHC trends.

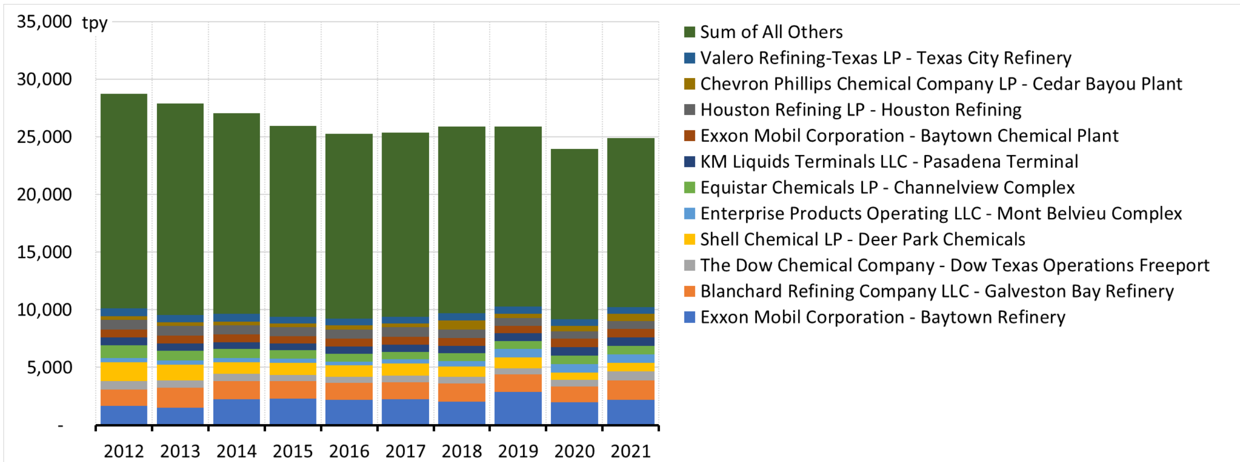

Figure 5-9: HGB Area Point Source VOC Emissions by Site

Figure 5-10: *HGB Area Point Source HRVOC Emissions by Site* shows that the top nine reporting sites accounted for 51% of the total HGB area point source HRVOC emissions in 2021. Each of these sites report total HRVOC emissions exceeding 100 tpy in 2021, with the largest emitter, The Dow Chemical Company – Dow Texas Operations Freeport, reporting over 300 tpy in 2021. Overall, HRVOC emissions decreased 3% from 2012 through 2021, with increases occurring after 2013. The top nine sources had a 3% increase in HRVOC emissions over that same time. This correlates with the ambient HRVOC trends for the HGB area, which show little change from 2012 through 2021.

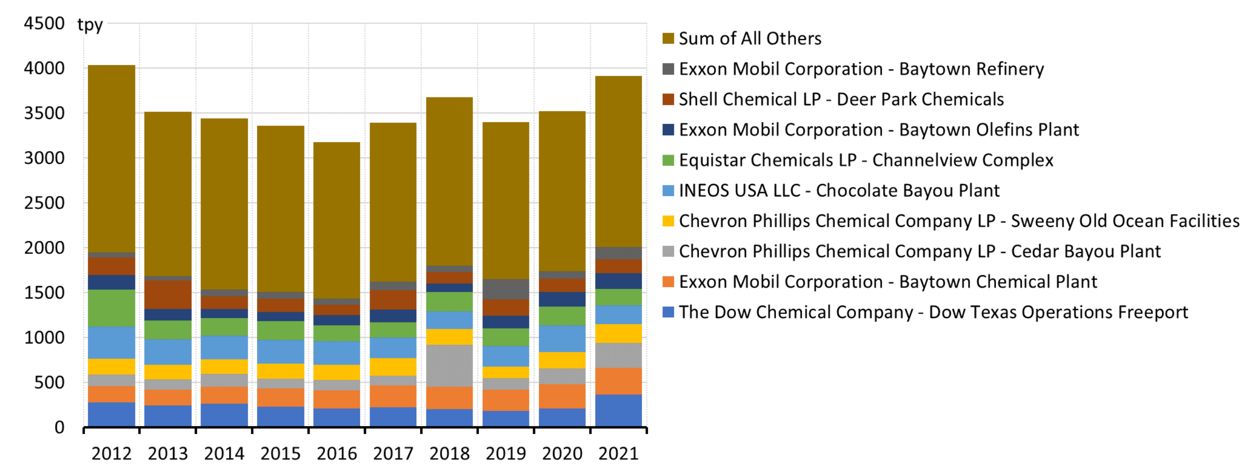

Figure 5-10: HGB Area Point Source HRVOC Emissions by Site

5.2.4 VOC and NO_x Limitations

Ozone is formed from the interaction of precursors (NO_x and VOC) in proportions determined by their molecular properties, therefore, unless precursors are present in these exact proportions in an airshed, ozone formation will be governed by whichever precursor is scarcer or limited. If one precursor is present in excess in the atmosphere, that excess will be unused in chemical reactions that form ozone; and ozone formation will be more dependent on the presence of the other precursor.

Because the formation of ozone is due to the interaction of these precursors, the relative proportion of VOC and NO_x in an airshed, the VOC-to-NO_x ratio, is an important indicator of the likely efficacy of different emission control strategies. The VOC and NO_x limitation of an airshed indicates how ozone will change in response to reductions of either VOC or NO_x. A NO_x limited regime occurs when the radicals from VOC oxidation are abundant, and therefore ozone formation is more sensitive to the amount of NO_x present in the atmosphere. In these regimes, controlling NO_x would be more effective in reducing ozone concentrations. In VOC limited regimes, NO_x is abundant, and therefore ozone formation is more sensitive to the number of radicals from VOC oxidation present in the atmosphere. In VOC limited regimes, controlling VOC emissions would be more effective in reducing ozone concentrations. Areas where ozone formation is not strongly limited by either VOC or NO_x are considered transitional and controlling either VOC or NO_x emissions would reduce ozone concentrations.

VOC-to-NO_x ratios are calculated by dividing hourly TNMOC concentrations in ppbC by hourly NO_x concentrations in parts per billion by volume (ppbv), more commonly referred to as ppb. The value of the ratio then determines the limitation of the air mass. While ratio definitions for VOC limited, NO_x limited, or transitional atmospheric conditions vary, this analysis uses the cut points described in the EPA photochemical assessment monitoring stations (PAMS) training workshop (Hafner and Penfold, 2018). Ratios less than 5 ppbC/ppb are considered VOC limited, ratios above 15 ppbC/ppb are considered NO_x limited, and ratios between 5 ppbC/ppb and 15 ppbC/ppb are considered transitional. Calculation of VOC-to-NO_x ratios are limited by the number of collocated auto-GC and NO_x monitors in the area. In addition, auto-GC monitors are often source-oriented, and do not necessarily reflect the conditions of the whole area.

This analysis used seven monitors in the HGB area that have collocated VOC and NO_x data: Channelview, Clinton, Lynchburg, HRM 3, Wallisville, Oyster Creek, and Deer Park. These monitors do not typically measure high ozone values, meaning the VOC/NO_x ratios may not represent the chemical regime that is present at the ozone design value setting monitors. Trends at Deer Park only go through 2018, because the NO_x monitor at that site ceased operations after that year. Because Oyster Creek started operation in December 2016, trends at that monitor start in 2017. All monitors are in the area around the Houston Ship Channel except Oyster Creek in Brazoria County near Lake Jackson. Ratios were calculated for each hour of the day for the ozone season and then aggregated to determine the median ratio for each year. Results are shown in Figure 5-11: *Median VOC-to-NO_x Ratios During the Ozone Season in the HGB Area*.

Most monitors show slight variations in VOC-to-NO_x ratios but only one monitor, Channelview, had a noticeable trend. While remaining in the transitional regime, ratios at Channelview have trended toward being VOC limited. Lynchburg Ferry had one VOC limited year, 2017, which may be due to missing data and does not necessarily represent the true conditions at that monitor during that year.

Most monitors in the Houston Ship Channel show a transitional regime, so either NO_x or VOC reductions would reduce ozone concentrations. The Clinton monitor measures ratios that, while still transitional, are closer to VOC limited. This could be due to the monitor location on the western edge of the ship channel and close to downtown Houston. This would mean that the Clinton Monitor measures more urban emissions compared to the other monitors, which encounter more industrial emissions. The Oyster Creek Monitor measures transitional conditions but is close to NO_x limited. Since it is not close to the Houston Ship Channel or urban core, this monitor observes much lower NO_x.

This analysis indicates that monitors located near the urban core measure closer to VOC limited conditions, monitors in industrial areas measure near the mid-point of transitional conditions, and monitors in more suburban area measure closer to NO_x limited conditions. It appears that the atmospheric chemistry surrounding many monitors in the HGB area has not changed from 2012 through 2021. Some combination of VOC and NO_x controls would possibly be effective in reducing ozone concentrations in the HGB area. In transitional areas, VOC or NO_x controls may not result in equal ozone reductions, one species may reduce ozone more than the other.

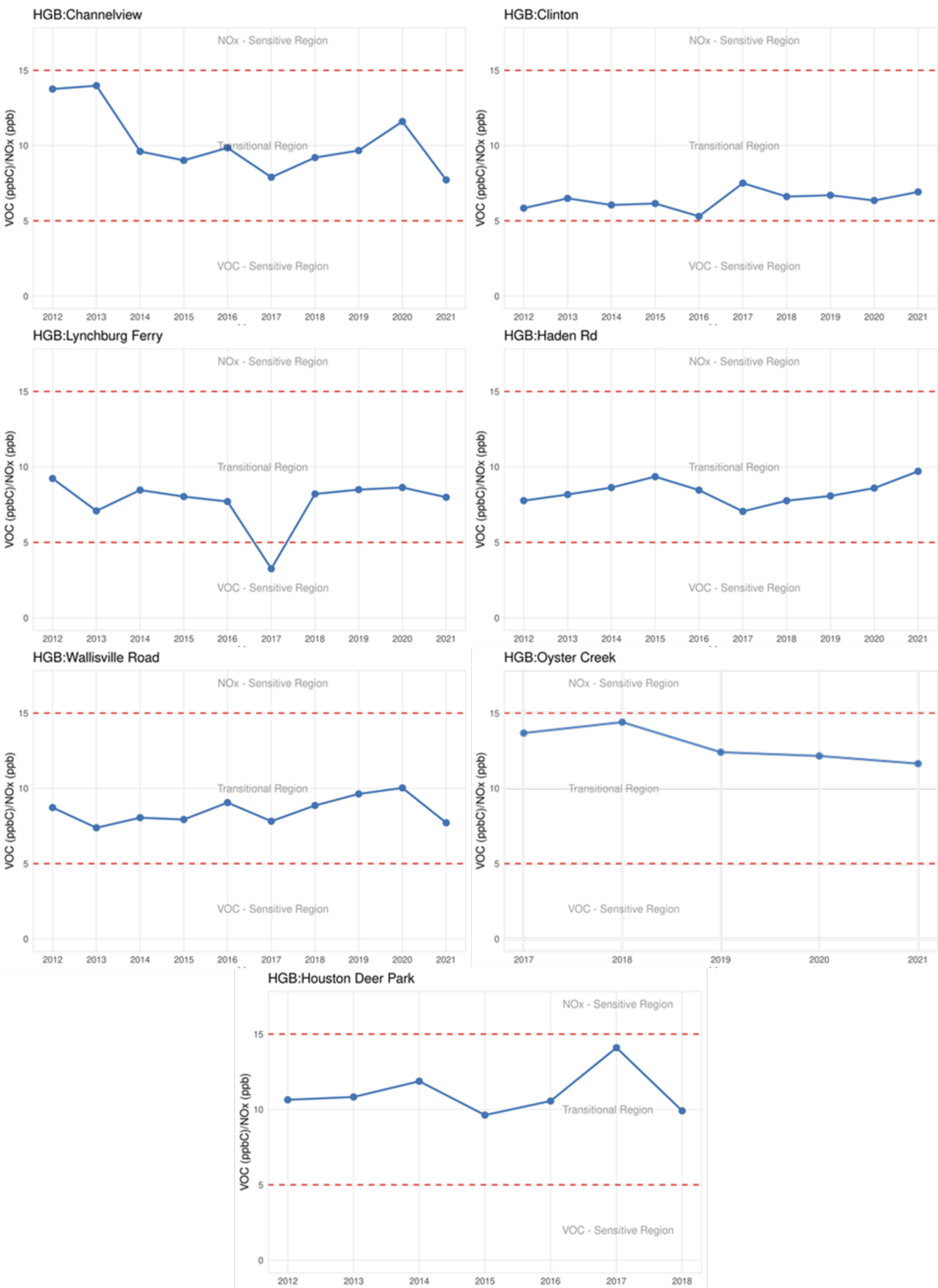

Figure 5-11: Median VOC-to-NO_x Ratios During the Ozone Season in the HGB Area

5.2.4.1 Modeling Sensitivity Analysis

Photochemical modeling of the 2019 base case was performed with reduced anthropogenic VOC and NO_X emissions in and around the HGB area and the impact of these reduced emission on the 2019 ozone Base Case Design Value (DVB) was obtained. The DVB calculation and its use in an attainment test is described in Chapter 3: *Photochemical Modeling*. Figure 5-12: *Modeling Domain and Monitors for HGB Area VOC and NO_X Sensitivity Analysis* shows a map with a red outline surrounding the HGB ozone nonattainment area and parts of adjacent counties that comprises the modeling domain and the various monitors used for this analysis represented as circles within the modeling domain.[24] Anthropogenic emissions of VOC and NO_X across this modeling domain were reduced by 20% relative to emissions in each grid cell for the sensitivity analysis.

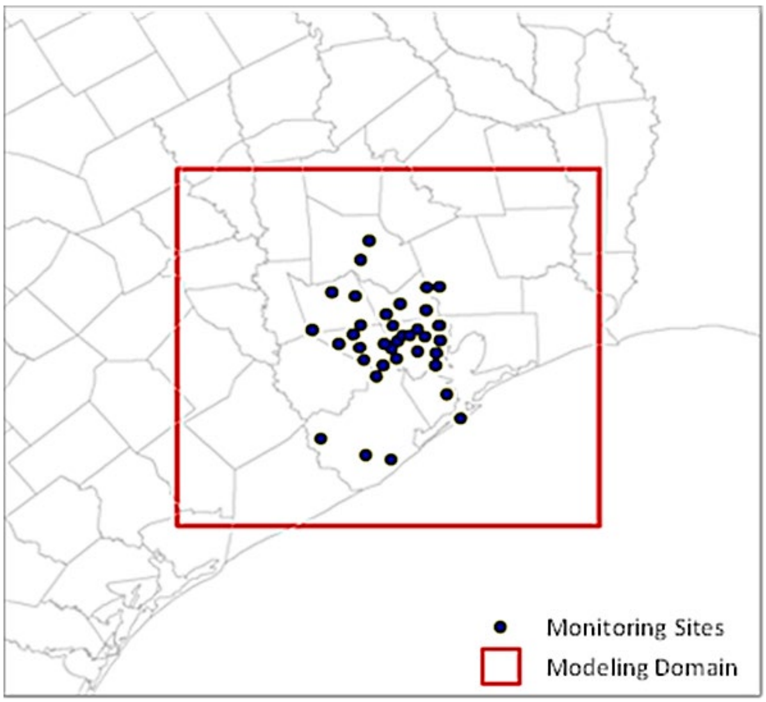

Figure 5-12: Modeling Domain and Monitors for HGB VOC and NO_X Sensitivity Analysis

The impact on the 2019 ozone DVB was estimated for the top modeled 10 days within the months of April through October by completing three model runs – 2019 base case scenario, a 20% anthropogenic NO_X emissions reduction scenario, and a 20% anthropogenic VOC emissions reduction scenario The impact was estimated by calculating a ratio of the average MDA8 ozone from the top 10 days from the 20% anthropogenic emissions reduction emission scenario to the base case scenario for each monitor and adjusting the 2019 DVB with the ratio. The results showed that

[24] Disclaimer: Maps in this document were generated by the Air Quality Division of the Texas Commission on Environmental Quality. The products are for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. They do not represent an on-the-ground survey and represent only the approximate relative location of property boundaries. For more information concerning these maps, contact the Air Quality Division at 512-239-1459.

though ozone decreased when VOC or NO_X was decreased, reductions in NO_X were more impactful. Figure 5-13: *Modeled Impact of NO_X and VOC Reductions on 2019 DVB* shows the estimated change in the 2019 ozone DVB at each monitor due to a 20% reduction in anthropogenic NO_X and VOC emissions in and around the HGB area. The maximum estimated decrease in ozone base case design value from a 20% NO_X reduction is 3.1 ppb, about three times greater than decrease of 0.9 ppb from a 20% VOC reductions scenario at the same monitor. The maximum estimated decrease in ozone base case design value from a 20% VOC reduction is 1.3 ppb.

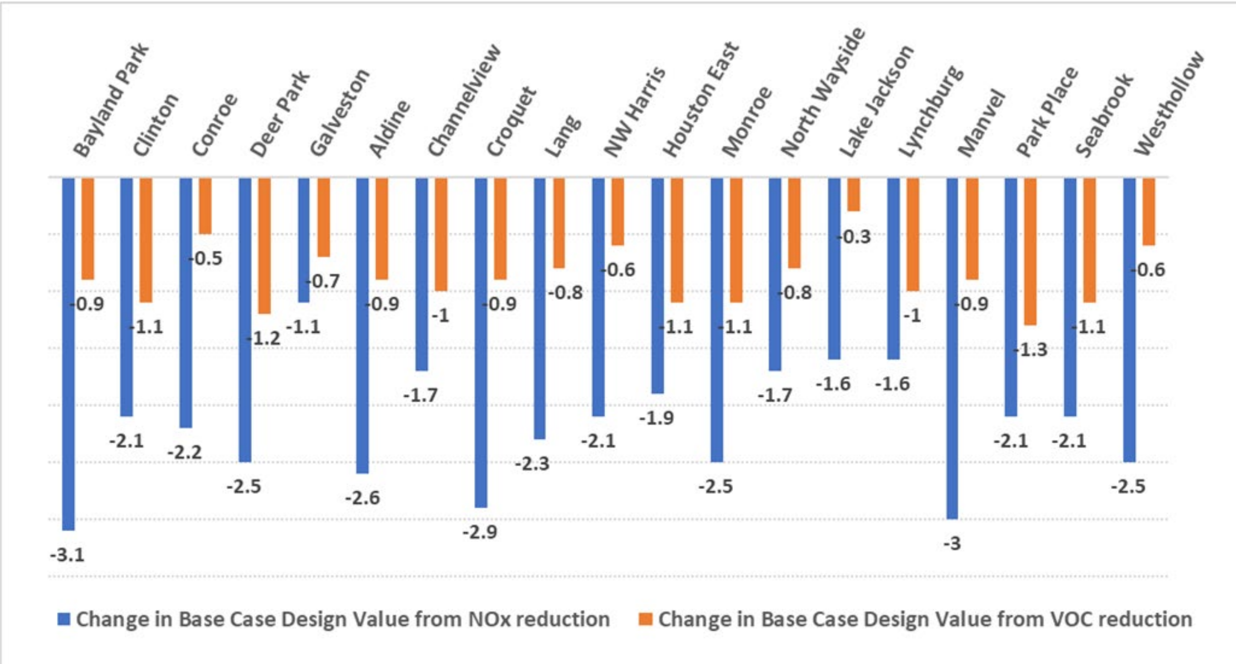

Figure 5-13: Modeled Impact of VOC and NO_X Reductions on 2019 Ozone DVB

The modeling results show that the impact of NO_X reductions on 2019 ozone base case design values is higher than the impact from VOC reductions. The impact from NO_X reductions is higher in suburban areas than in the industrial areas. This correlates well with the VOC/NO_X ratio analysis, which shows transitional conditions across the HGB area, but conditions closer to NO_X limited further from the urban core. These analyses indicate that NO_X reductions would have more impact on ozone at the design value setting monitors, which are downwind of the HGB area urban core.

5.2.5 Meteorological Influences on Ozone

Meteorological conditions play an important role in ozone formation. Year-to-year variability in meteorological conditions in turn cause variability in ozone concentration trends. Although design values consider this variability by averaging the fourth-highest MDA8 ozone over three years, this is often not enough to account for years with extreme meteorological conditions such as low wind speeds, drought, or extremely high temperatures. Investigating meteorological influences on ozone trends allows analysis of how ozone concentrations respond to changes in emissions rather than changes in the meteorology.

Meteorologically adjusted MDA8 ozone values represent what the ozone would have been if meteorological effects on ozone concentrations are removed. Without the influence of meteorology, changes observed in ozone concentrations are more likely due to emission changes rather than extreme meteorological events. The EPA developed a statistical model that uses local weather data to adjust the ozone trends according to the meteorology for that year (Wells et al., 2021). These trends compare the average, 90th percentile, and 98th percentile MDA8 ozone from May through September to the meteorologically adjusted average, 90th percentile, and 98th percentile MDA8 ozone from May through September. The EPA calculated these trends for each ozone monitor in the HGB area from 2012 through 2021 (EPA, 2022). Although results for all statistics were examined, only the 98th percentile trends will be discussed in this document since it most closely relates with the ozone values that are used in the design value calculations.

For each year the maximum, median, and minimum 98th percentile MDA8 value was calculated from all regulatory monitors within the HGB area. This allows for easier examination of the results across all monitors. The results for the 98th percentile are displayed in Figure 5-14: *Meteorologically Adjusted Ozone Trends for May through September in the HGB Area*. These trends confirm that the low ozone in 2014 and the high ozone in 2015 were largely influenced by the meteorology. From 2012 through 2021 the trends show only small decreases in ozone, both measured and meteorologically adjusted. Overall trends are very flat, even more so when ozone is adjusted for meteorology. This correlates well with the flat trends observed in both NO_x and VOC concentrations.

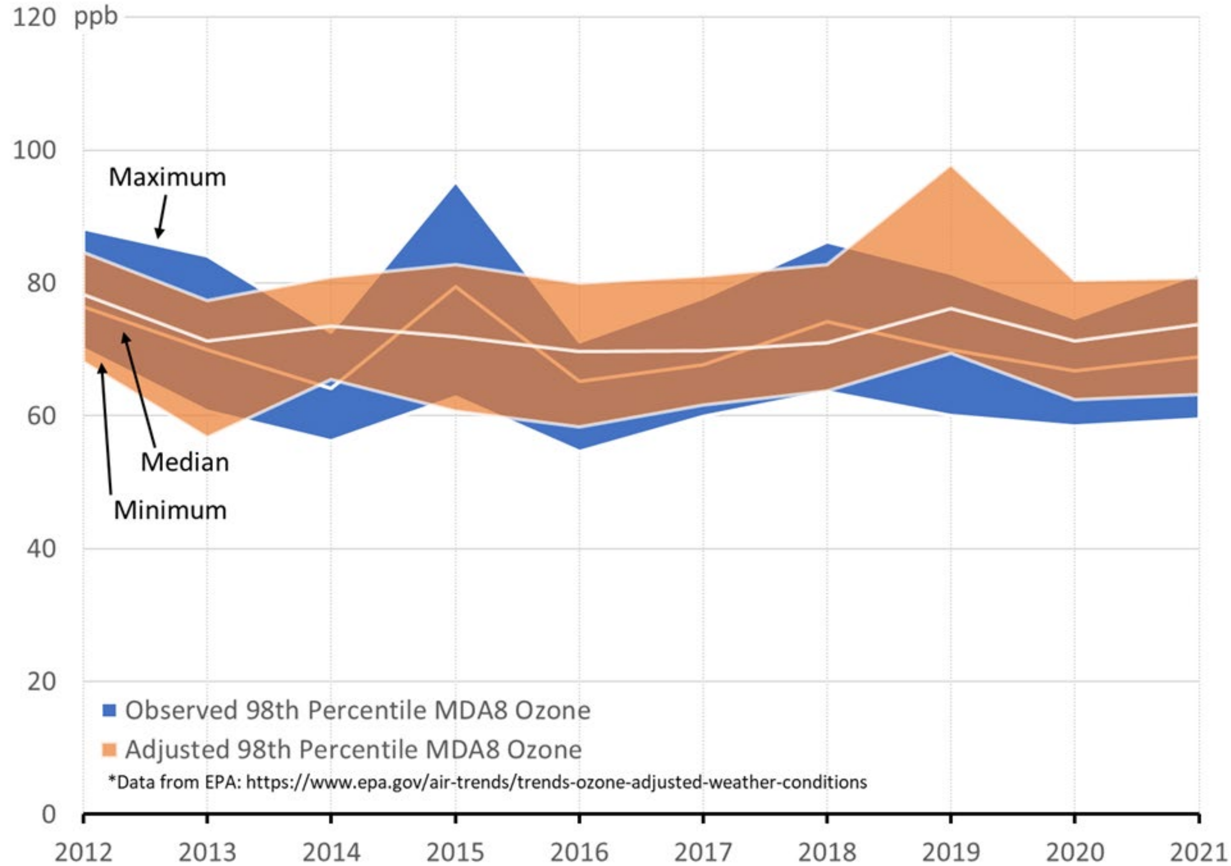

Figure 5-14: Meteorologically Adjusted Ozone Trends for May through September in the HGB Area

5.3 QUALITATIVE CORROBORATIVE ANALYSIS

This section outlines additional measures, not included in the photochemical modeling, which are expected to further reduce ozone levels in the HGB ozone nonattainment area. Various federal, state, and local control measures exist that are anticipated to provide real emissions reductions; however, these measures are not included in the photochemical model because they may not meet all the EPA's standard tests of SIP creditability (permanent, enforceable, surplus, and quantifiable) but are crucial to the success of the air quality plan in the HGB area.

5.3.1 Additional Measures

5.3.1.1 SmartWay Transport Partnership and the Blue Skyway Collaborative

Among its various efforts to improve air quality in Texas, the TCEQ continues to promote two voluntary programs in cooperation with the EPA: SmartWay Transport Partnership and Blue Skyways Collaborative.

The SmartWay Transport Partnership is a market-driven partnership aimed at helping businesses move goods in the cleanest most efficient way possible. This is a voluntary EPA program primarily for the freight transport industry that promotes strategies and technologies to help improve fleet efficiency while also reducing air emissions.

There are over 4,000 SmartWay partners in the United States (U.S.), including most of the nation's largest truck carriers, all the Class 1 rail companies, and many of the top Fortune 500 companies. Since its founding, SmartWay has reduced oil consumption by 336 million barrels.[25] Since 2004, SmartWay partners have prevented the release of 2,700,000 tons of NO_X and 112,000 tons of particulate matter into the atmosphere.[26]

Ports in the U.S. rely on SmartWay's Port Drayage Truck program to help reduce pollution in and around major national ports. The Port of Houston Authority's (PHA) partnership with the Environmental Defense Fund and the Houston-Galveston Area Council (H-GAC) in the Port Drayage Truck Bridge Loan Program received $9 million from the EPA's Diesel Emissions Reduction Act (DERA) SmartWay Program in 2009. On average, four trucks a month, or about 50 trucks a year, were approved for replacement funding. The EPA has awarded the PHA with three additional DERA grants. In 2015, the PHA received two grants of nearly $900,000 each, to replace 41 older drayage trucks operating in the Port of Houston with newer, cleaner trucks. In 2017, the EPA awarded the PHA with a DERA grant of $143,500 to replace diesel buses with clean diesel-powered vehicles.

Approximately 247 Texas companies are SmartWay partners, with 48 of them in the HGB area.[27] The SmartWay Transport Partnership will continue to benefit the HGB area by reducing emissions as more companies and affiliates join, and additional idle reduction, trailer aerodynamic kits, low-rolling resistance tire, and retrofit technologies are incorporated into SmartWay-verified technologies.

The Blue Skyways Collaborative was created to encourage voluntary air emission reductions by planning or implementing projects that use innovations in diesel engines, alternative fuels, and renewable energy technologies applicable to on-road and non-road sources.[28] The Blue Skyways Collaborative partnerships include international, federal, state, and local governments, non-profit organizations, environmental groups, and private industries.

5.3.1.2 Energy Efficiency and Renewable Energy (EE/RE) Measures

Energy efficiency (EE) measures are typically programs that reduce the amount of electricity and natural gas consumed by residential, commercial, industrial, and municipal energy consumers. Examples of EE measures include increasing insulation in homes, installing light-emitting diode or compact fluorescent light bulbs, and replacing motors and pumps with high efficiency units. Renewable energy (RE) measures include programs that generate energy from resources that are replenished or are otherwise not consumed as with traditional fuel-based energy production. Examples of RE include wind energy and solar energy projects.

Texas leads the nation in RE generation from wind. As of 2021, Texas has 34,370 megawatts (MW) of installed wind generation capacity, 25.9% of the 132,753 MW installed wind capacity in the U.S. Texas' total net electrical generation from renewable

[25] https://www.epa.gov/smartway/smartway-program-successes
[26] https://www.epa.gov/smartway/smartway-trends-indicators-and-partner-statistics-tips
[27] https://www.epa.gov/smartway/smartway-partner-list
[28] https://blueskyways.org/

wind generators in 2021 was 99.47 million megawatt-hours (MWh), approximately 26.3% of the 378.2 million MWh total wind net electrical generation for the U.S. In 2021, total net electrical generation from renewable wind generators in Texas was 11.9% more than in 2020.

Texas non-residential solar electricity generation in 2021 totaled 17.2 million MWh, a 69.5% increase from 2020. The 2021 total installed solar electricity generation capacity in Texas was 10,374 MW, a 73% increase from 2020.

While EE/RE measures are beneficial and do result in lower overall emissions from fossil fuel-fired power plants in Texas, emission reductions resulting from these programs are not explicitly included in photochemical modeling for SIP purposes because local efficiency or renewable energy efforts may not result in local emissions reductions or may be offset by increased demand in electricity. The complex nature of the electrical grid makes accurately quantifying emission reductions from EE/RE measures difficult.

While specific emission reductions from EE/RE measures are not provided in the SIP, persons interested in estimates of energy savings and emission reductions from EE/RE measures can access additional information and reports from the Texas A&M Engineering Experiment Station's Energy Systems Laboratory (ESL) website (https://esl.tamu.edu). The Texas Emissions Reduction Plan (TERP) reports submitted to the TCEQ regarding EE/RE measures are available on the ESL website on the TERP Reports webpage (https://esl.tamu.edu/terp/documents/terp-reports).

5.3.1.3 Cross-State Air Pollution Rule (CSAPR)

The EPA originally finalized CSAPR to help eastern states meet federal Clean Air Act (FCAA) interstate transport obligations for the 1997 eight-hour ozone, 1997 fine particulate matter ($PM_{2.5}$), and 2006 $PM_{2.5}$ NAAQS by requiring reductions in electric generating unit (EGU) emissions that cross state lines. The rule required reductions in ozone season NO_X emissions for states under the ozone requirements and in annual sulfur dioxide (SO_2) and NO_2 for states under $PM_{2.5}$ requirements. Texas was included in the original CSAPR program for the 1997 eight-hour ozone and 1997 $PM_{2.5}$ standards. As of 2016, Texas is no longer subject to the original CSAPR trading programs for the 1997 eight-hour ozone and $PM_{2.5}$ standards but became subject to the EPA's CSAPR Update Rule to address transport obligations under the 2008 eight-hour ozone standard and the EPA's transport FIP for the 2015 eight-hour ozone standard.

On September 7, 2016, the EPA signed the final CSAPR Update Rule for the 2008 eight-hour ozone standard. The EPA's modeling showed that emissions from within Texas no longer significantly contribute to downwind nonattainment or interference with maintenance for the 1997 eight-hour ozone NAAQS even without implementation of the original CSAPR ozone season NO_X emissions budget. Accordingly, sources in Texas are no longer subject to the emissions budget calculated to address the 1997 eight-hour ozone NAAQS. However, this rule finalized a new ozone season NO_X emissions budget for Texas, effective for the 2017 ozone season, to address interstate transport with respect to the 2008 eight-hour ozone NAAQS. On July 10, 2018, the EPA published a proposed close-out of CSAPR, proposing to determine that the CSAPR Update Rule fully addresses interstate pollution transport obligations for the 2008 eight-hour ozone NAAQS in 20 covered states, including Texas. The EPA's modeling analysis projects that by 2023 there will be no remaining nonattainment or maintenance areas for the 2008 eight-hour ozone NAAQS in the CSAPR Update region and therefore the EPA would have no obligation to establish additional control requirements for sources in these states. As a result, these states would not need to submit SIP revisions establishing additional control requirements beyond the CSAPR Update. The final rule was published on December 21, 2018 with an effective date of February 19, 2019 (83 FR 65878). On September 13, 2019, the U.S. Court of Appeals for the District of Columbia (D.C.) Circuit (D.C.) Circuit remanded the CSAPR Update back to the EPA after finding that the rule is inconsistent with the FCAA and allows upwind states to continue their significant contributions to downwind air quality problems beyond the attainment dates for those downwind areas. On October 1, 2019, the D.C. Circuit Court vacated the CSAPR close-out rule.

On April 30, 2021, the EPA published the final Revised CSAPR Update for the 2008 ozone NAAQS, effective June 29, 2021 (86 FR 23054). For nine out of the 21 states, including Texas, for which the CSAPR Update was previously found to be only a partial remedy, projected 2021 emissions do not significantly contribute to nonattainment or maintenance problems for the 2008 ozone NAAQS in downwind states. Therefore, no further emission reductions beyond those under the CSAPR Update are required for Texas to address interstate air pollution under the 2008 ozone NAAQS.

On August 8, 2018, the commission adopted the 2015 Ozone NAAQS Transport SIP Revision (Non-Rule Project No. 2017-039-SIP-NR) which included a modeling analysis demonstrating that Texas does not contribute to nonattainment or interfere with maintenance of the 2015 ozone NAAQS in any other state. On March 30, 2021, the EPA published final disapproval of the portion of the 2015 Ozone NAAQS Transport SIP Revision relating to visibility transport with a determination that visibility transport requirements for the 2015 ozone NAAQS are met through Federal Implementation Plans (FIP) in place for the Texas Regional Haze program, and no further federal action is required (86 FR 16531). On February 22, 2022, the EPA proposed disapproval of the remaining portions of the 2015 Ozone NAAQS Transport SIP Revision (87 FR 9798), which the EPA finalized on February 13, 2023 (88 FR 9336).

The EPA signed a final FIP on March 15, 2023 to address obligations for 23 states, including Texas, to eliminate significant contribution to nonattainment, or interference with maintenance, of the 2015 ozone NAAQS in other states. As part of the final FIP to address interstate transport obligations for the 2015 ozone NAAQS, the EPA is including 22 states, including Texas, in a revised and strengthened CSAPR NO_x Ozone Season Group 3 Trading Program for EGUs beginning in the 2023 ozone season. The EPA is also establishing emissions limitations beginning in 2026 for non-EGU sources located within 20 states, including Texas. The control measures for the identified EGU and non-EGU sources apply to both existing units and any new, modified, or reconstructed units meeting the final rule's applicability criteria.

5.3.1.4 Texas Emissions Reduction Plan (TERP)

The TERP program was created in 2001 by the 77th Texas Legislature to provide grants to offset the incremental costs associated with reducing NO_x emissions from high-emitting heavy-duty internal combustion engines on heavy-duty vehicles, non-road equipment, marine vessels, locomotives, and some stationary equipment.

The primary emissions reduction incentives are awarded under the Diesel Emissions Reduction Incentive (DERI) program. DERI incentives are awarded to projects to replace, repower, or retrofit eligible vehicles and equipment to achieve NO_x emission reductions in Texas ozone nonattainment areas and other counties identified as affected counties under the TERP program where ground-level ozone is a concern.

From 2001 through August 2022, $1,192,434,745 in DERI grants were awarded for projects projected to help reduce an estimated 189,151 tons of NO_x in the period over which emissions reductions are reported for each project under the program. This includes $486,563,405 going to activities in the HGB area, with an estimated 81,317 tons of NO_x reduced in the HGB area in the period over which emissions reductions are reported for each project under the program.

Three other incentive programs under the TERP program will result in the reduction in NO_x emissions in the HGB area.

The Drayage Truck Incentive Program was established in 2013 to provide grants for the replacement of drayage trucks operating in and from seaports and rail yards located in nonattainment areas. In 2017, the name of this program was changed to the Seaport and Rail Yard Areas Emissions Reduction Program (SPRY), and replacement and repower of cargo handling equipment was added to the eligible project list. Through August 2022, the program awarded $28,702,701, with an estimated 1,303 tons of NO_x reduced in the period over which emissions reductions are reported for each project under the program. In the HGB area $26,662,128 was awarded to projects with an estimated 1,214 tons of NO_x reduced in the period over which emissions reductions are reported for each project under the program.

The Texas Clean Fleet Program (TCFP) was established in 2009 to provide grants for the replacement of light-duty and heavy-duty diesel vehicles with vehicles powered by alternative fuels, including: natural gas, liquefied petroleum gas, hydrogen, methanol (85% by volume), or electricity. This program is for larger fleets; therefore, applicants must commit to replacing at least 10 eligible diesel-powered vehicles with qualifying alternative fuel or hybrid vehicles. From 2009 through August 2022, $69,363,635 in TCFP grants were awarded for projects to help reduce an estimated 704 tons of NO_x in the period over which emissions reductions are reported for each project under the program. In the HGB area, $22,177,013 in TCFP grants were awarded with an estimated 192 tons of NO_x reduced in the period over which emissions reductions are reported for each project under the program.

The Texas Natural Gas Vehicle Grant Program (TNGVGP) was established in 2011 to provide grants for the replacement of medium-duty and heavy-duty diesel vehicles with vehicles powered by natural gas. This program may include grants for individual vehicles or multiple vehicles. From 2011 through August 2022, $54,012,006 in TNGVGP grants were awarded for projects to help reduce an estimated 1,668 tons of NO_x in the period over which emissions reductions are reported for each project under the program. In the HGB area, $14,511,489 in TNGVGP grants were awarded to projects with an estimated 366 tons of NO_x reduced in the period over which emissions reductions are reported for each project under the program.

Through FY 2017, both the TCFP and TNGVGP required that the majority of the grant-funded vehicle's operation occur in the Texas nonattainment areas, other counties designated as affected counties under the TERP, and the counties in and between the triangular area between Houston, San Antonio, and Dallas-Fort Worth. Legislative changes in 2017 expanded the eligible areas into a new Clean Transportation Zone, to include the counties in and between an area bounded by Dallas-Fort Worth, Houston, Corpus Christi, Laredo, and San Antonio.

5.3.1.5 Clean School Bus Program

HB 3469, 79th Texas Legislature, 2005, Regular Session, established the Clean School Bus Program, which provides monetary incentives for school districts in the state for reducing emissions of diesel exhaust from school buses through retrofit of older school buses with diesel oxidation catalysts, diesel particulate filters, and closed crankcase filters. As a result of legislative changes in 2017, this program also includes replacement of older school buses with newer, lower-emitting models. Through August 2022, the TCEQ Clean School Bus Program has awarded $53,053,626 in grants for 7,860 retrofit and replacement activities across the state. This amount includes $4,694,101 in federal funds. Of the total amount, $11,729,995 has been awarded for 2,764 school bus retrofit and replacement activities in the HGB area, resulting in a projected 6 tons of NO_X reduced in the period for which emissions reductions are reported for each project under the program.

5.3.1.6 87th Texas Legislature 2021

A summary of the bills passed during the 87th Texas Legislature, 2021, Regular and Special Sessions, which have the potential to impact the HGB area are discussed in this section. For legislative updates regarding EE/RE measures and programs, see Section 5.3.1.2: *Energy Efficiency and Renewable Energy Measures*.

HB 4472, Relating to the TERP

HB 4472 directed the TCEQ to remit not less than 35% of TERP Trust Fund to the Texas Department of Transportation (TxDOT) for congestion mitigation and air quality improvement projects in nonattainment areas and affected counties. The TxDOT is required to report to the TCEQ by October 1 of each year a description, estimated emission reductions, and costs of the related projects. The TxDOT could fund additional projects to reduce emissions within Texas nonattainment areas.

HB 4772 set 55% as the minimum amount of time a marine vessel or engine must operate in the Texas intercoastal waters adjacent to a nonattainment area or affected county to be eligible for a TERP DERI grant. This may increase the number of eligible marine vessels or engines that could be replaced or retrofitted with cleaner engines, thus reducing NO_X emissions along the Texas coast.

HB 4772 added New Technology Implementation Grant (NTIG) projects that reduce flaring emissions and other site emissions to the list of projects that TCEQ must give preference to when awarding grants. The requirement that flaring and other oil and gas site emissions reduction projects capture waste heat to generate electricity solely for on-site service was removed under the NTIG program. These changes may yield more grant awards to reduce flaring and other emissions under the NTIG program.

5.3.1.7 Local Initiatives

The H-GAC has a number of locally implemented strategies in the HGB nonattainment area, including projects, programs, partnerships, and policies. These programs are expected to be implemented in the HGB 2015 ozone NAAQS nonattainment area by 2023. Due to the continued progress of these measures, additional air quality benefits will be gained and will further reduce precursors to ground-level ozone formation. A summary of each strategy is included in Appendix E: *Local Initiatives Submitted by the Houston-Galveston Area Council: Existing and Future Houston-Galveston-Brazoria Mobile Emission Reduction Measures*.

5.4 CONCLUSIONS

The TCEQ used several sophisticated technical tools to evaluate the past and present causes of high ozone in the HGB 2015 ozone NAAQS nonattainment area to predict the area's future air quality, as discussed in this chapter. Historical trends in ozone and ozone precursor concentrations and their causes have been investigated extensively. The following conclusions can be reached from these evaluations.

The eight-hour ozone design values decreased from 2012 through 2022. The preliminary 2022 eight-hour design value for the HGB area was 78 ppb, an 11% decrease from the 2012 design value of 88 ppb. The largest design value decreases occurred prior to 2014. After 2014, ozone declines in the HGB area are stagnated.

This trend of slight decreases is seen not only in ozone design values, but also in the fourth-highest eight-hour ozone values and background ozone. In general, background ozone accounts for approximately 60% of ozone in the HGB area and locally produced ozone accounts for approximately 40% of ozone in the area.

Ambient concentrations of ozone precursors, point source emissions of ozone precursors, and meteorologically adjusted ozone trends are mostly flat from 2012 through 2021. With precursor trends mostly flat, it appears that most of the changes observed in ozone concentrations are due to meteorology.

Trends in VOC-to-NO_X ratios show that, although all areas measure in the transitional regime, areas in Brazoria County are closer to NO_X-limited, areas in the Houston Ship Channel are transitional, and areas closer to the downtown urban core of Houston are more VOC-limited. With many monitors showing transitional conditions, controls on either NO_X or VOC emissions may be effective in reducing ozone in the HGB area; however, controls on either VOC or NO_X may not result in equal reductions in ozone, one species may reduce ozone at greater rates than the other, even in transitional areas. This is confirmed by modeling, which shows that although monitors observe a benefit from VOC reductions, NO_X reductions have a larger impact on ozone concentrations at the design value setting monitors. This HGB AD SIP revision documents a fully evaluated photochemical modeling analysis and a thorough weight-of-evidence assessment. Based on the TCEQ's modeling and available data, the HGB area is not expected to attain the 2015 ozone NAAQS by the August 3, 2024 attainment date.

5.5 REFERENCES

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CHAPTER 6: ONGOING AND FUTURE INITIATIVES

6.1 INTRODUCTION

The Texas Commission on Environmental Quality (TCEQ) is committed to maintaining healthy air quality in the Houston-Galveston-Brazoria (HGB) area and continues to work toward this goal. Texas continues to invest resources in air quality scientific research for better understanding of atmospheric chemical processes and the advancement of pollution control technology, refining quantification of emissions, and improving the science for ozone modeling and state implementation plan (SIP) analysis. Additionally, the TCEQ is working with the United States Environmental Protection Agency (EPA), local leaders, and the scientific community to evaluate new measures for addressing ozone precursors. This chapter describes ongoing technical work that will be beneficial for identifying effective and efficient approaches for improving air quality and management in Texas and the HGB ozone nonattainment area.

6.2 ONGOING WORK

6.2.1 Other Emissions Inventory Improvement Projects

The TCEQ emissions inventory (EI) reflects years of emissions data improvement, including extensive point and area source inventory reconciliation with ambient emissions monitoring data. Reports detailing recent TCEQ EI improvement projects can be found at the TCEQ's Air Quality Research and Contract Projects webpage (https://www.tceq.texas.gov/airquality/airmod/project/pj.html).

6.2.2 Air Quality Research Program

6.2.2.1 TCEQ Applied Research Projects

The TCEQ sponsors applied research projects to support the SIP and other agency requirements. Previous project goals have included improving the understanding of ozone and particulate matter formation, developing advanced modeling techniques, enhancing emission estimates, and air quality monitoring during special studies. Final project reports are available at the TCEQ Air Quality Research and Contract Projects webpage (https://www.tceq.texas.gov/airquality/airmod/project).

6.2.2.2 Black and Brown Carbon ($(BC)^2$) Monitoring

The $(BC)^2$ monitoring network was created to identify the influence of wildfires and dust events on urban air quality in Texas. The network started in 2019 as a pilot study in El Paso, sampling aerosol properties as indicators of biomass burning and dust impacts. The network expanded in 2020, adding three sites in the HGB area. After continued measurements in 2021 and 2022, the network is being enhanced with two sites in the Dallas-Fort Worth (DFW) area. The $(BC)^2$ network has identified periods when biomass burning events are most likely in eastern Texas, while improving the long-term understanding of dust effects in El Paso. The $(BC)^2$ data contributes to analyses studying the relationship between biomass burning and exceptional ozone and particulate matter air quality events.

6.2.2.3 Tracking Aerosol Convection Interactions Experiment – Air Quality (TRACER-AQ) Field Study

The TRACER-AQ field study in 2021 and 2022 was a collaboration between the TCEQ, National Aeronautics and Space Administration (NASA), the Department of Energy, Texas universities, and many others to improve the understanding of coastal air quality challenges through advanced monitoring platforms. Instrumented aircraft, ships, drones, and mobile laboratories complemented ground stations to examine the spatial and temporal patterns of pollutants in the HGB area. Unique measurements offshore characterized ozone and other pollutants in the marine environment. Analysis of the TRACER-AQ data is ongoing and expected to contribute to the understanding and improving of air quality in coastal Texas for many years to come. Details about TRACER-AQ and the collected data are available at the NASA TRACER-AQ website (https://www-air.larc.nasa.gov/missions/tracer-aq).

6.2.2.4 Texas Air Quality Research Program (AQRP)

The goals of the AQRP are:

- to support scientific research related to Texas air quality in the areas of emissions inventory development, atmospheric chemistry, meteorology, and air quality modeling; and
- to integrate AQRP research with the work of other organizations and to communicate the results of AQRP research to air quality decision-makers and stakeholders.

The AQRP is supporting seven projects during the 2022-2023 biennium and listed below are six projects that could have findings relevant to the HGB area.

The statewide projects are:

- Evaluating the Ability of Statistical and Photochemical Models to Capture the Impacts of Biomass Burning Smoke on Urban Air Quality in Texas (project number 22-003);
- Hydrogen Cyanide for Improved Identification of Fire Plumes in the $(BC)^2$ Network (project number 22-006); and
- Refining Ammonia Emissions Using Inverse Modeling and Satellite Observations Over Texas and the Gulf of Mexico and Investigating its Effect on Fine Particulate Matter (project number 22-019).

The HGB area projects are:

- Modeling Analysis of TRACER-AQ and Over-Water Measurements to Improve Prediction of On-Land and Offshore Ozone (project number 22-008);
- Quantifying the Emissions and Spatial/Temporal Distributions of Consumer Volatile Chemical Products (VCPs) in the Greater Houston Area to Understand Their Impacts on Summertime Ozone Formation (project number 22-020); and
- Source-Sector Nitrogen Oxides (NO_X) Emissions Analysis with Sub-Kilometer Scale Airborne Observations in Houston During TRACER-AQ (project number 22-023).

The AQRP program began in 2010 and has supported research in Houston, DFW, San Antonio, and El Paso. Details about the AQRP and past research can be found at Air Quality Research Program website (https://aqrp.ceer.utexas.edu).

6.2.3 Wildfire and Smoke Impact

The TCEQ is reviewing ambient air monitoring data from monitors in the HGB area and has determined that there were ozone episodes in 2022 that appear to have been influenced by smoke from wildfires. Additional information on Texas smoke planning is available in the Texas A&M Forest Service Smoke Management Plan (https://tfsweb.tamu.edu/uploadedFiles/TFS_Main/Manage_Forests_and_Land/Prescribed_Fires/TFS%20SMP.pdf).

On June 20, September 13, September 21, and October 8, 2022, the Houston Bayland Park monitoring site (48201005), and on June 20 and September 21, 2022, the Houston Harvard Street monitoring site (482010417) measured high maximum daily eight-hour average ozone concentrations. Fires adversely influenced these ozone measurements, causing the area to exceed the 2008 eight-hour ozone NAAQS. The TCEQ has issued preliminary flags for the ozone data for these two monitoring sites on the days indicated. The TCEQ is submitting this exceptional event demonstration to the EPA and requesting that the affected data be excluded from comparison to any Ozone NAAQS, as provided for in the exceptional event rule. The TCEQ provided for public comment on this demonstration for 30 days, as required by federal rules. All comments received will be included in the final version of the exceptional event demonstration.

Appendices Available Upon Request

Vanessa T. De Arman
vanessa.dearman@tceq.texas.gov
512.239.5609