TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

AGENDA ITEM REQUEST

for Proposed State Implementation Plan Revision

AGENDA REQUESTED: 11/29/2023

DATE OF REQUEST: 11/10/2023

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

CAPTION: Docket No. 2023-1223-SIP. Consideration for publication of, and hearing on, the proposed Houston-Galveston-Brazoria Severe Area Attainment Demonstration State Implementation Plan (SIP) Revision for the 2008 Eight-Hour Ozone National Ambient Air Quality Standard.

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 2026, and a contingency plan. (Vanessa T. De Arman, John Minter; Project No. 2023-110-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:** November 10, 2023

Thru: Laurie Gharis, Chief Clerk
Kelly Keel, Interim Executive Director

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

Docket No.: 2023-1223-SIP

Subject: Commission Approval for Proposed Houston-Galveston-Brazoria (HGB) Severe Area Attainment Demonstration (AD) State Implementation Plan (SIP) Revision for the 2008 Eight-Hour Ozone National Ambient Air Quality Standard (NAAQS)

HGB 2008 Ozone NAAQS Severe AD SIP Revision
Non-Rule Project No. 2023-110-SIP-NR

Background and reason(s) for the SIP revision:
The HGB 2008 ozone NAAQS nonattainment area, consisting of Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties, was previously classified as serious nonattainment for the 2008 eight-hour ozone NAAQS of 0.075 parts per million (ppm) with a July 20, 2021 attainment date. Based on 2020 monitoring data, the HGB area did not attain the standard.[1] On April 5, 2021, the Texas Commission on Environmental Quality (TCEQ) submitted a one-year attainment date extension request to the U.S. Environmental Protection Agency (EPA). On October 7, 2022, EPA published a final notice denying the one-year attainment date extension request and reclassifying the area to severe for the 2008 eight-hour ozone NAAQS, effective November 7, 2022 (87 *Federal Register* (FR) 60926).

Since the HGB area has been reclassified by EPA, the area is now subject to the severe nonattainment requirements in the federal Clean Air Act (FCAA), §182(d), and TCEQ is required to submit severe classification AD and reasonable further progress (RFP) SIP revisions to EPA. The attainment date for severe areas is July 20, 2027 with a 2026 attainment year (87 FR 60926).[2] EPA set a May 7, 2024 deadline for states to submit AD and RFP SIP revisions to address the 2008 eight-hour ozone standard severe nonattainment area requirements.

With the severe classification, the HGB 2008 ozone NAAQS nonattainment area is also subject to FCAA, §182(d)(3), which requires states to submit plans to include requirements for the FCAA, §185 penalty fee. EPA set a November 7, 2025 deadline for states to submit a SIP revision to address the FCAA, §185 requirements (87 FR 60926). This requirement will be addressed in a future rulemaking.

Scope of the SIP revision:
As a result of the reclassification, TCEQ is required to submit to EPA an AD SIP revision consistent with FCAA requirements for areas classified as severe nonattainment for the 2008 eight-hour ozone NAAQS. This HGB AD SIP revision is scheduled to be proposed in conjunction with the Dallas-Fort Worth (DFW) and HGB 2008 Eight-Hour Ozone Severe Area RFP SIP Revision (Project Number 2023-108-SIP-NR).

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[1] 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 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.

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A.) Summary of what the SIP revision would do:
This proposed 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. To ensure that emissions from transportation projects that use federal transportation funding conform to the SIP, this proposed HGB AD SIP revision contains nitrogen oxides (NO_X) and volatile organic compounds (VOC) motor vehicle emissions budgets (MVEB) for the 2026 attainment year.

This proposed SIP revision incorporates concurrently proposed revisions to 30 Texas Administrative Code (TAC) Chapter 115 to correct inadvertent errors made in a previously adopted rulemaking that implemented EPA's 2016 Control Techniques Guidelines for the Oil and Natural Gas Industry (Rule Project No. 2020-038-115-AI) and to address SIP contingency measure requirements under the 2008 ozone NAAQS. This proposed SIP revision also incorporates concurrently proposed revisions to 30 TAC Chapter 117 to address a rule petition for stationary diesel engines and associated emissions monitoring requirements.

B.) Scope required by federal regulations or state statutes:
This proposed HGB AD SIP revision is consistent with the requirements of FCAA, §182(d) and EPA's *Implementation of the 2008 National Ambient Air Quality Standards for Ozone: State Implementation Plan Requirements; Final Rule* (2008 eight-hour ozone standard SIP requirements rule) published on March 6, 2015. 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 HGB AD SIP revision also includes a modeled attainment demonstration and a WoE analysis.[3]

This proposed SIP revision also includes performance standard modeling for the existing vehicle inspection and maintenance (I/M) program and certification statements to confirm that clean fuel fleet, I/M, and nonattainment new source review requirements have been met for the HGB 2008 eight-hour ozone severe nonattainment area. The severe classification vehicle miles traveled growth offset requirements under FCAA, §182(d)(1) are addressed in the concurrently proposed DFW-HGB severe classification RFP SIP revision for the 2008 eight-hour ozone NAAQS (Project No. 2023-108-SIP-NR).

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 SIP revision is required by FCAA, §110(a)(1) and is also proposed under the commission's general authority under Texas Water Code, §5.102, General Powers and §5.105, General Policy. States are required 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 by 42 United States Code, §§7420 *et seq.*, and implementing rules in 40 Code of Federal Regulations Part 51.

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[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.

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Effect on the:

A.) Regulated community:
The proposed HGB AD SIP revision contains a contingency plan, as required by FCAA, §172(c)(9), which incorporates new control requirements proposed in a concurrent VOC rulemaking (Rule Project No. 2023-116-115-AI). Contingency measures, as necessary, would be implemented to reduce VOC emissions if EPA determines that the HGB 2008 eight-hour ozone NAAQS nonattainment area did not attain the standard.

This proposed SIP revision would also provide compliance flexibility for emissions monitoring for owners or operators of non-exempt stationary diesel engines through the concurrently proposed NO_X rulemaking (Rule Project No. 2023-117-117-AI). Owners or operators of affected units meeting specific criteria at major or minor sources of NO_X would not be required to use an emissions monitor for NO_X, nor would they be required to comply with existing ammonia monitoring requirements. Owners or operators would still be required to demonstrate initial compliance with pollutant emission specifications, which can be done with a stack test.

This proposed SIP revision would also impact the regulated community by changing the SIP base emissions year for emissions banking and trading credit generation for the HGB 2008 ozone NAAQS nonattainment area to 2019 for point sources. On April 9, 2021, TCEQ communicated this change to regulated entities.

B.) Public:
The general public in the HGB ozone NAAQS nonattainment area may benefit from the HGB area ultimately meeting the ozone NAAQS and the area being redesignated as attainment for the 2008 eight-hour ozone NAAQS.

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

Stakeholder meetings:
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 2008 Eight-Hour Ozone Severe 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:
Although EPA finalized its 2015 eight-hour ozone standard SIP requirements rule (83 FR 62998), the final rule did not revoke the 2008 eight-hour ozone standard. EPA stated that revocation of the 2008 eight-hour ozone standard would be addressed in a separate future action. However, because of the February 16, 2018 United States Court of Appeals for the District of Columbia Circuit opinion in the case *South Coast Air Quality Management District v. EPA, 882 F.3d 1138 (D.C. Cir.*

2018), the requirement for EPA to reclassify the area and for TCEQ to submit this AD SIP revision is expected to remain even if the 2008 eight-hour ozone standard is revoked.

EPA released new draft guidance on contingency measures, published in the *Federal Register* for public comment on March 23, 2023 (88 FR 17571). The draft guidance proposed an entirely new scheme for determining the amount of emissions reductions necessary to address the contingency requirement. Since EPA had not issued final guidance to the states regarding the quantity of required reductions from contingency measures at the time this proposed HGB AD SIP revision was developed, this proposed SIP revision relies on the historically approved approach (3% of the 2011 RFP base year emissions) to determine the amount of emissions reductions necessary to address the contingency requirement.

Would this SIP 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 SIP 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, EPA would 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 federal implementation plan (FIP) any time 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 2008 ozone NAAQS nonattainment area. EPA would 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: November 29, 2023
Anticipated public hearing date: January 4, 2024
Anticipated public comment period: December 1, 2023 through January 16, 2024
Anticipated adoption date: April 24, 2024

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

HOUSTON-GALVESTON-BRAZORIA 2008 EIGHT-HOUR OZONE STANDARD NONATTAINMENT AREA

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

HOUSTON-GALVESTON-BRAZORIA SEVERE AREA ATTAINMENT DEMONSTRATION STATE IMPLEMENTATION PLAN REVISION FOR THE 2008 EIGHT-HOUR OZONE NATIONAL AMBIENT AIR QUALITY STANDARD

PROJECT NUMBER 2023-110-SIP-NR

Proposal
November 29, 2023

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EXECUTIVE SUMMARY

Eight counties comprise the Houston-Galveston-Brazoria (HGB) 2008 ozone National Ambient Air Quality Standard (NAAQS) (0.075 parts per million) nonattainment area: Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties. Based on monitoring data from 2018, 2019, and 2020, the area did not attain the 2008 eight-hour ozone NAAQS by the attainment date for areas classified as serious, July 20, 2021.[1] On April 5, 2021, the Texas Commission on Environmental Quality (TCEQ) submitted a one-year attainment date extension request to the United States Environmental Protection Agency (EPA). On October 7, 2022, EPA published a final notice denying the one-year attainment date extension request and reclassifying the area from serious to severe for the 2008 eight-hour ozone NAAQS, effective November 7, 2022 (87 *Federal Register* (FR) 60926).

The HGB 2008 ozone NAAQS nonattainment area is now subject to the requirements in FCAA, §182(d) for severe nonattainment areas. The TCEQ is required to submit severe ozone classification attainment demonstration (AD) and reasonable further progress (RFP) state implementation plan (SIP) revisions to EPA. The attainment date for areas classified as severe is July 20, 2027, with a 2026 attainment year (80 FR 60926).[2] The EPA set a May 7, 2024 deadline for states to submit AD and RFP SIP revisions to address the 2008 eight-hour ozone standard severe nonattainment area requirements. With the severe classification, the HGB 2008 ozone NAAQS nonattainment area is subject to the FCAA, §182(d)(3), which requires states to submit plans to include requirements for the §185 penalty fee. EPA set a November 7, 2025 deadline for states to submit a SIP revision to address the FCAA, §185 requirements (87 FR 60926).

This proposed HGB AD SIP revision includes the following required SIP elements: 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 program requirements, nonattainment new source review, and clean fuel fleet program requirements have been met for the HGB 2008 ozone NAAQS nonattainment area. The severe classification vehicle miles traveled growth offset demonstration required under FCAA, §182(d)(1) is addressed in the concurrent proposed Dallas-Fort Worth (DFW) and HGB severe classification RFP SIP revision for the 2008 eight-hour ozone NAAQS (Project No. 2023-108-SIP-NR).

Contingency measures are control requirements 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 RFP. EPA has interpreted recent court decisions to have invalidated key aspects of EPA's historical approach to implementing the contingency measure requirement. At the time these proposed contingency measures were being developed, EPA had historically accepted the use of surplus emissions reductions from

[1]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.

previously implemented control measures to fulfill the contingency measure requirements. However, 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 suggests an entirely new scheme for determining the amount of emissions reductions necessary to address the contingency requirement.

The contingency measures proposed in the concurrent Chapter 115 rulemaking (Rule Project No. 2023-116-115-AI) are conditional and prospective (not previously implemented), which follows EPA's interpretation of recent court decisions. These proposed measures do not rely on the historical approach of using surplus emissions reductions from previously implemented measures to fulfill contingency requirements. Since EPA had not issued final guidance to states regarding the amount of required reductions from contingency measures at the time this proposed HGB AD SIP revision was developed, this proposed SIP revision relies on the historically approved approach to determine the amount of emissions reductions necessary to address the contingency requirement.

This proposed HGB AD SIP revision is concurrent with the proposed DFW and Houston-Galveston-Brazoria (HGB) 2008 Eight-Hour Ozone Severe Classification RFP SIP Revision (Project No. 2023-108-SIP-NR), the proposed 30 Texas Administrative Code (TAC) Chapter 115 rulemaking (Rule Project No. 2023-116-115-AI), and the proposed 30 TAC Chapter 117 rulemaking (Rule Project No. 2023-117-117-AI).

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 2008 ozone NAAQS nonattainment area is estimated to be 75 parts per billion (ppb) in 2026.The quantitative and qualitative analyses in Chapter 5: *Weight of Evidence* supplement the photochemical modeling analysis presented in Chapter 3: *Photochemical Modeling* to characterize 2026 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 75 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 case and 2026 future case modeling results to estimate 2026 eight-hour ozone design values.[3]

Table ES-1: *Summary of 2019 Base and 2026 Future Case Anthropogenic Modeling Emissions for HGB 2008 Ozone NAAQS Nonattainment Area for June 12 Episode Day* lists the anthropogenic modeled 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 2026 future

[3] The future case modeling includes projected emissions for the attainment year of 2026 since that is the last full ozone season prior to the attainment date for the nonattainment area.

case ozone modeling. The differences in modeled emissions between the 2019 base case and the 2026 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, as discussed in Chapter 4: *Control Strategies and Required Elements*.

Table ES-1: Summary of 2019 Base and 2026 Future Case Anthropogenic Modeling Emissions for HGB 2008 Ozone NAAQS Nonattainment Area for June 12 Episode Day

Emission Source Category	2019 NO_X (tpd)	2026 NO_X (tpd)	2019 VOC (tpd)	2026 VOC (tpd)
On-Road	81.36	47.91	40.39	28.05
Non-Road	37.00	28.47	37.42	38.54
Off-Road – Airports	9.25	9.13	2.83	2.89
Off-Road – Locomotives	12.37	7.73	0.63	0.38
Off-Road – Commercial Marine	63.41	49.28	3.62	3.76
Area	35.91	37.82	262.43	288.01
Oil and Gas – Drilling	0.30	0.23	0.03	0.02
Oil and Gas – Production	1.48	1.48	41.82	20.74
Point – EGU	30.82	42.78	1.17	6.86
Point – Non-EGU	71.72	94.54	97.39	103.10
HGB Nonattainment Area Total	343.62	319.37	487.73	492.35

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 2026 attainment year inventories establish the NO_X and VOC MVEBs that, once found adequate or approved by EPA, must be used in transportation conformity analyses. The attainment MVEBs represent the 2026 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: *2026 Attainment Demonstration MVEBs for the HGB 2008 Ozone NAAQS Nonattainment Area (tons per day)*.

The eight-hour ozone design values for the 2019 base case design value (DVB) and modeled 2026 future case design value (DVF) for the regulatory ozone monitors in the HGB 2008 ozone NAAQS nonattainment area are shown in Table ES-2: *Summary of 2019 DVBs and Modeled 2026 DVFs for HGB 2008 Ozone NAAQS Nonattainment Area Regulatory Monitors*. In accordance with EPA's November 2018 *Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze*, the 2026 DVFs presented have been rounded to one decimal place and then truncated.[4] Based on TCEQ's modeling and available data, the HGB area is expected to attain the 2008 ozone NAAQS by the July 20, 2027 attainment date.

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

Table ES-2: Summary of 2019 DVBs and Modeled 2026 DVFs for HGB 2008 Ozone NAAQS Nonattainment Area Regulatory Monitors

Monitor Name	CAMS Number	2019 DVB (ppb)	Relative Response Factor	2026 DVF (ppb)
Houston Aldine	0008	78.00	0.971	75
Houston Bayland Park	0053	76.67	0.955	73
Channelview	0015	68.00	0.985	66
Clinton	0403	71.00	0.978	69
Conroe Relocated	0078	74.33	0.980	72
Houston Croquet	0409	71.33	0.962	68
Houston Deer Park #2	0035	75.67	0.984	74
Galveston 99th St.	1034	74.00	0.974	72
Baytown Garth	1017	71.33	0.986	70
Houston East	0001	72.67	0.985	71
Lake Jackson	1016	65.00	0.978	63
Lang	0408	72.00	0.964	69
Lynchburg Ferry	1015	64.33	0.985	63
Manvel Croix Park	0084	74.33	0.965	71
Houston Monroe	0406	66.67	0.973	64
Houston North Wayside	0405	65.00	0.975	63
Northwest Harris Co.	0026	72.67	0.975	70
Park Place	0416	73.00	0.977	71
Seabrook Friendship Park	0045	67.67	0.988	66
Houston Westhollow	0410	70.00	0.954	66

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

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 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 TCEQ to September 1, 2011, unless continued in existence by the Texas Sunset Act. In 2011, the 82nd Texas Legislature continued the existence of TCEQ until 2023. In 2023, the 88th Regular Session of the Texas Legislature continued the existence of TCEQ until 2035.

With the creation of the TNRCC (and its successor TCEQ), authority over air quality is found in both the Texas Water Code (TWC) and the TCAA. The general authority of 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 TCEQ, and the responsibilities and authority of the executive director. TWC, Chapter 5 also authorizes TCEQ to implement action when emergency conditions arise and to conduct hearings. The TCAA specifically authorizes 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 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 TCEQ to enter property and make inspections. They also may make recommendations to the commission concerning any action of TCEQ that affects their territorial jurisdiction, may bring enforcement actions, and may execute cooperative agreements with 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 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.

Applicable Law

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

Statutes

All sections of each subchapter are included, with the most recent effective date, unless otherwise noted.

TEXAS HEALTH & SAFETY CODE, Chapter 382	September 1, 2023
TEXAS WATER CODE	September 1, 2023

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), (11)(B) - (F), (e)(13), and (e)(15), (e)(16), and (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
§122.122: Potential to Emit February 23, 2017

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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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ACT	Alternative Control Techniques
AD	attainment demonstration
AEDT	Aviation Environmental Design Tool
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*
g/l	grams per liter
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
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
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
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
SO_2	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

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
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/air quality/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 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 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 Revision for the 2008 Eight-Hour Ozone NAAQS (Project Number: 2019-077-SIP-NR).

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

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

1.2.3 2008 Eight-Hour Ozone NAAQS History

On March 27, 2008, the United States Environmental Protection Agency (EPA) published a final rule revising the eight-hour ozone standard, lowering the primary and secondary eight-hour ozone NAAQS to 0.075 parts per million (ppm) or 75 parts per billion (ppb) (73 *Federal Register* (FR) 16436). Attainment of this standard (expressed as 0.075 ppm) is achieved when an area's design value does not exceed 75 ppb. On May 21, 2012, EPA published initial final designations for the 2008 eight-hour ozone standard with an effective date of July 20, 2012 (77 FR 30088). The EPA's classifications approach rule for the 2008 eight-hour ozone NAAQS, also published on May 21, 2012, established the air quality thresholds assigned to all nonattainment areas, as well as establishing December 31 of each relevant calendar year as the attainment date for all nonattainment area classification categories and revoking the 1997 eight-hour ozone NAAQS for transportation conformity purposes (77 FR 30160).

The United States Court of Appeals for the District of Columbia (D.C. Circuit Court) published an opinion on December 23, 2014 agreeing with two challenges to EPA's May 21, 2012 classifications approach rule for the 2008 eight-hour ozone NAAQS. The court vacated the provisions of the rule relating to attainment deadlines and revocation of the 1997 eight-hour ozone NAAQS for transportation conformity purposes. As part of the final 2008 eight-hour ozone standard SIP requirements rule, published on March 6, 2015, EPA modified 40 Code of Federal Regulations §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, and revoked the 1997 eight-hour ozone NAAQS for all purposes (80 FR 12264).

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 a SIP revision to satisfy the federal Clean Air Act, §172(c)(3) and §182(a)(1) emissions inventory reporting requirements and establish a 2011 emissions inventory base year for the Dallas-Fort Worth and HGB nonattainment areas. EPA published direct final approval of this SIP revision on February 20, 2015 (80 FR 9204).

1.2.3.1 Moderate Classification AD for the 2008 Eight-Hour Ozone 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, 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, 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 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 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[5] and did not qualify for a one-year attainment date extension in accordance with FCAA, §181(a)(5).[6] On August 23, 2019, 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 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. 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.

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

[6] 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.

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 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.

1.2.3.3 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.[7] On April 5, 2021, TCEQ submitted a one-year attainment date extension request to EPA. On October 7, 2022, 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 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.

1.2.4 2015 Eight-Hour Ozone NAAQS History

On October 1, 2015, EPA lowered the primary and secondary eight-hour ozone NAAQS to 0.070 ppm and published the final rule revising the NAAQS in the *Federal Register* on October 26, 2015, effective December 28, 2015 (80 FR 65292). On June 4, 2018, 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 satisfied 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 included certification statements to confirm that the emissions statement and nonattainment new source review requirements were met for the HGB, DFW, and Bexar County 2015 eight-hour ozone nonattainment areas. On June 29, 2021, EPA published final approval of the EI for the HGB 2015 ozone nonattainment area (86 FR 34139). On September 9, 2021, EPA published final approval of the nonattainment new source review and emissions statement portions of the SIP revision (86 FR 50456).

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[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.

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).[8] On October 7, 2022, 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. 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.

On October 12, 2023, Texas Governor Greg Abbott signed and submitted a letter to EPA to reclassify the Bexar County, DFW, and HGB moderate 2015 eight-hour ozone NAAQS nonattainment areas to serious. As indicated in EPA's *Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area Classifications Approach*; Final Rule published on March 9, 2018 (83 FR 10376), the attainment date for a serious classification is August 3, 2027, with a 2026 attainment year.

1.2.5 Existing Ozone Control Strategies

Existing control strategies implemented to address the 1997 and 2008 eight-hour ozone standards are expected to continue to reduce emissions of ozone precursors in the HGB 2008 ozone NAAQS nonattainment area and positively impact progress toward attainment of the ozone NAAQS. The eight-hour ozone design values for the HGB 2008 ozone NAAQS nonattainment area from 1991 through 2022 are illustrated in Figure 1-1: *Ozone Design Values and Population in the HGB 2008 Ozone NAAQS Nonattainment Area*. Eight-hour ozone design values have decreased over the past 31 years. The 2022 eight-hour ozone design value of 78 ppb represents a 37% decrease from the 1991 value of 124 ppb. This decrease in design value occurred despite a 90% increase in area population from 1991 through 2022.

[8] *Id.*

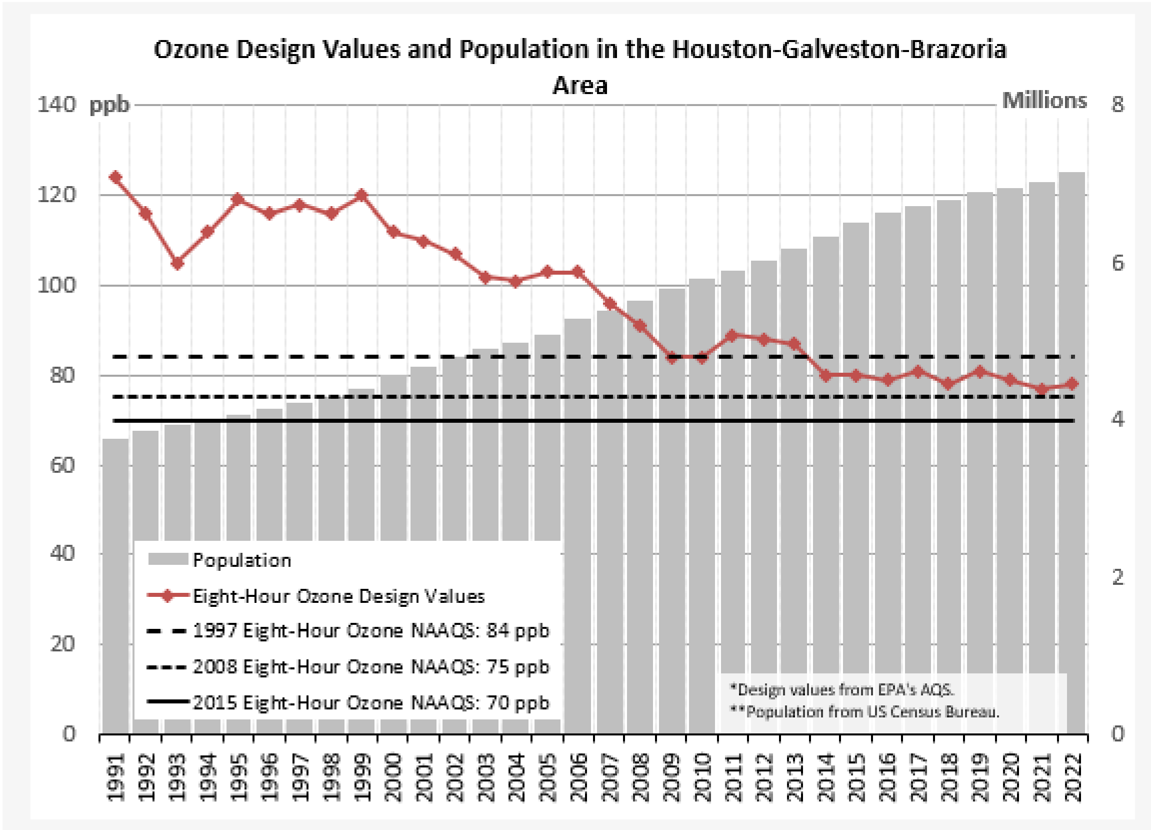

Figure 1-1: Ozone Design Values and Population in the HGB 2008 Ozone NAAQS Nonattainment Area

1.3 HEALTH EFFECTS

In 2008, EPA revised the primary eight-hour ozone NAAQS to 0.075 ppm (75 ppb). To support the 2008 eight-hour primary ozone standard, EPA provided information that suggested that health effects may potentially occur at levels lower than the previous 0.08 ppm (84 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. The 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 (https://www.h-gac.com/board-of-directors/advisory-committees/regional-air-quality-planning-advisory-committee).

1.4.2 HGB Virtual 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, FCAA, §185 fees, and an update from EPA. More information is available on the HGB Air Quality TIM webpage (https://www.tceq.texas.gov/air quality/airmod/meetings/aqtim-hgb.html).

1.4.3 HGB Stakeholder Meetings

The TCEQ hosted and attended multiple meetings in 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, FCAA, §185 fees, and planning activities for the HGB 2008 Eight-Hour Ozone Severe Classification AD SIP Revision. Attendees included representatives from industry, county and city government, environmental groups, and the public.

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, FCAA, §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	January 4, 2024	7:00 p.m.	Houston-Galveston Area Council 3555 Timmons Ln Houston, TX 77027

The public comment period will open on December 1, 2023 and close on January 16, 2024. Written comments will be accepted via mail, fax, or through TCEQ's Public

Comment system (https://tceq.commentinput.com/). File size restrictions may apply to comments being submitted via TCEQ's Public Comment system. All comments should reference the "HGB 2008 Ozone NAAQS Severe AD SIP Revision" and should reference Project Number 2023-110-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 TCEQ's Public Comment system. File size restrictions may apply to comments being submitted via TCEQ's Public Comment system. Comments must be received by 11:59 p.m. CST on January 16, 2024.

An electronic version of the HGB 2008 Ozone NAAQS Severe AD SIP Revision and appendices is available at 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

For a detailed explanation of the social and economic issues involved with the concurrently proposed rule revisions associated with this proposed SIP revision (Rule Project Nos. 2023-116-115-AI and 2023-117-117-AI), refer to the preamble that precedes each rule package.

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 FCAA, §182(a) and 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) 2008 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 2008 NAAQS ozone nonattainment area. Therefore, some minor sources in the area report to the point source EI.

To collect the data, 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 TCEQ's Air Quality Division.

Stationary sources must have state implementation plan (SIP) emissions and meet other requirements to be able to 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, 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, 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 TCEQ's website.[9]

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.

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

The emissions data for the different area source categories are developed, reviewed for quality assurance, stored in the Texas Air Emissions Repository database, and compiled to develop the statewide area source EI.

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: non-road 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 Non-Road Model Categories Emissions Estimation Methodology

The Motor Vehicle Emission Simulator 3 (MOVES3) model was EPA's latest mobile source emissions model available for estimating non-road source category emissions at the time of inventory development. The MOVES4 model was not used in this SIP revision since TCEQ had already invested significant resources to develop a non-road mobile source EI using MOVES3. As EPA stated in its notice of availability published in the *Federal Register* on September 12, 2023 "[…] state and local agencies that have already completed significant work on a SIP with a version of MOVES3 (*e.g.,* attainment modeling has already been completed with MOVES3) may continue to rely on this earlier version of MOVES" (88 FR 62567, 62569). TCEQ has invested significant time and resources to develop a Texas-specific version of the non-road component of the MOVES model called Texas non-road utility version 2 (TexN2) that replaces EPA defaults used to determine emissions with county-specific activity data.[10] 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.

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

2.4.2 Drilling Rig Diesel Engine 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 characterization profiles.[11] 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.[12] 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. The CMV EI includes at-port and underway emissions activity data from Category 1, 2, and 3 CMVs by county for applicable counties in the HGB 2008 nonattainment area. A U.S. Army Corps of Engineers project to deepen and widen the Houston Ship Channel (Project 11), once complete, is expected to reduce NO_X emissions from ocean-going vessels due to improved traffic flow. The project is estimated to be complete by the 2026 attainment year for the HGB 2008 ozone NAAQS nonattainment area. Since these traffic flow improvements were not captured in the study TCEQ commissioned to develop the CMV EI, TCEQ proposes adjusting the CMV EI to account for anticipated NO_X emissions reductions resulting from the completion of Project 11 by 2026. To account for improved vessel traffic, the total 2026 NO_X emissions for all Category 3 vessels (ocean-going vessels) were reduced by 3% based on the projections provided from project studies.[13] If information becomes available prior to adoption that indicates Project 11 will not be complete by 2026, TCEQ will remove the CMV EI NO_X adjustment for adoption.

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.[14] 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

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[11] 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

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

[13] https://www.swg.usace.army.mil/Portals/26/docs/Planning/Public%20Notices-Civil%20Works/HSC-ECIP%20FIFR-EIS/App%20J%20%20Clean%20Air%20Act%20%20GC%20Determination%20(30Jan20).pdf?ver=2020-04-29-095348-507

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

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 on-road EIs developed using MOVES3. The MOVES4 model was not used in this SIP revision since TCEQ had already invested significant resources to develop an on-road mobile source EI using MOVES3. As EPA stated in its notice of availability published in the *Federal Register* on September 12, 2023 "[…] state and local agencies that have already completed significant work on a SIP with a version of MOVES3 (*e.g.,* attainment modeling has already been completed with MOVES3) may continue to rely on this earlier version of MOVES" (88 FR 62567, 62569). Updated on-road EIs and emissions factors were developed using 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 2008 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; 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 TCEQ's Air Quality Research and Contract Projects webpage (https://www.tceq.texas.gov/air quality/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).[15]

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 75 ppb have historically been monitored within the nonattainment area. 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 and indicates the modeling is suitable for use in conducting the modeling attainment test.

The photochemical modeling analysis also includes a future case modeling analysis. Future case modeling estimates the change in ozone concentrations due to changes in anthropogenic emissions in a future year, the attainment year of 2026, 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 estimated ozone concentrations be in the future if the same meteorological conditions (that resulted in a high ozone episode in the past) were to repeat?

Results of the 2019 base case and the 2026 future case photochemical modeling runs are presented, which were used to estimate the 2026 attainment year eight-hour ozone design values. This chapter summarizes the components of the 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 used 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 for the modeled 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 modeling episode in the Houston-Galveston-Brazoria (HGB) 2008 eight-hour ozone NAAQS moderate nonattainment area (HGB 2008 ozone NAAQS nonattainment area).

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

One of the recommended criteria for selecting a modeling episode is that the episode be in the recent past and that it 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 2008 ozone NAAQS of 75 parts per billion (ppb). Figure 3-1: *Exceedance Days in the HGB 2008 Ozone NAAQS Nonattainment Area by Year from 2012 through 2022* shows the number of exceedance days for the 2008 ozone NAAQS over an 11-year period in the HGB 2008 ozone NAAQS nonattainment area. The year 2019 had 22 days with MDA8 ozone above 75 ppb, which is a sufficient number of exceedance days for a modeling episode.

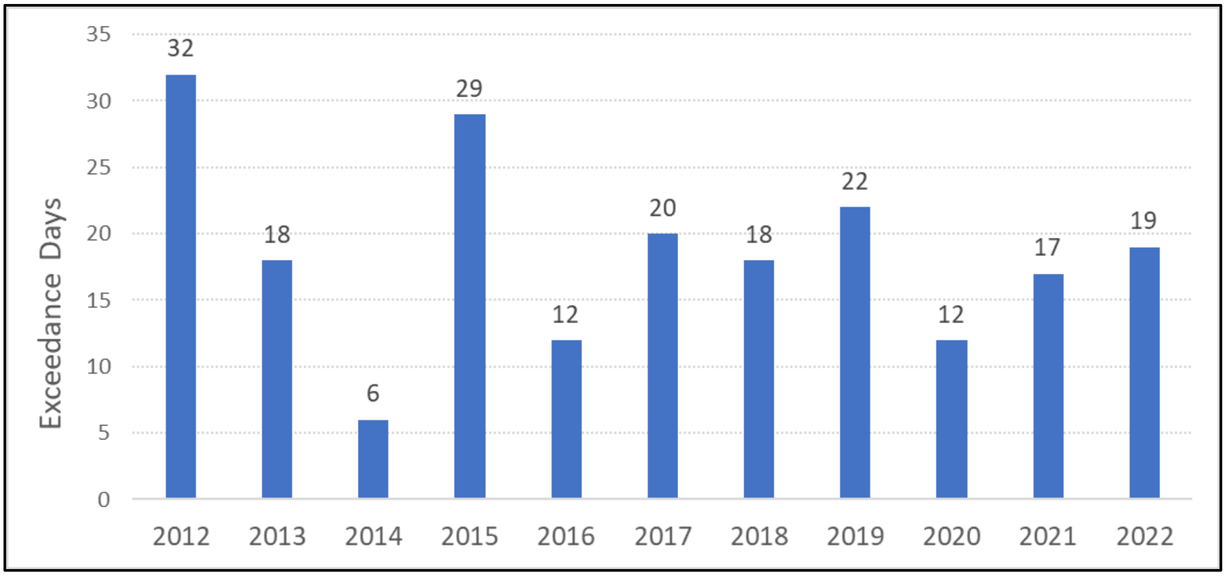

Figure 3-1: Exceedance Days in the HGB 2008 Ozone NAAQS Nonattainment Area by Year from 2012 through 2022

In selecting a modeling episode, EPA recommends that the exceedance days follow historically observed temporal trends. Figure 3-2: *Exceedance Days by Month from 2012 through 2022 in the HGB 2008 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 occurred from March through October with a few exceedances in March. Most exceedances occur between April and October, peaking in August.

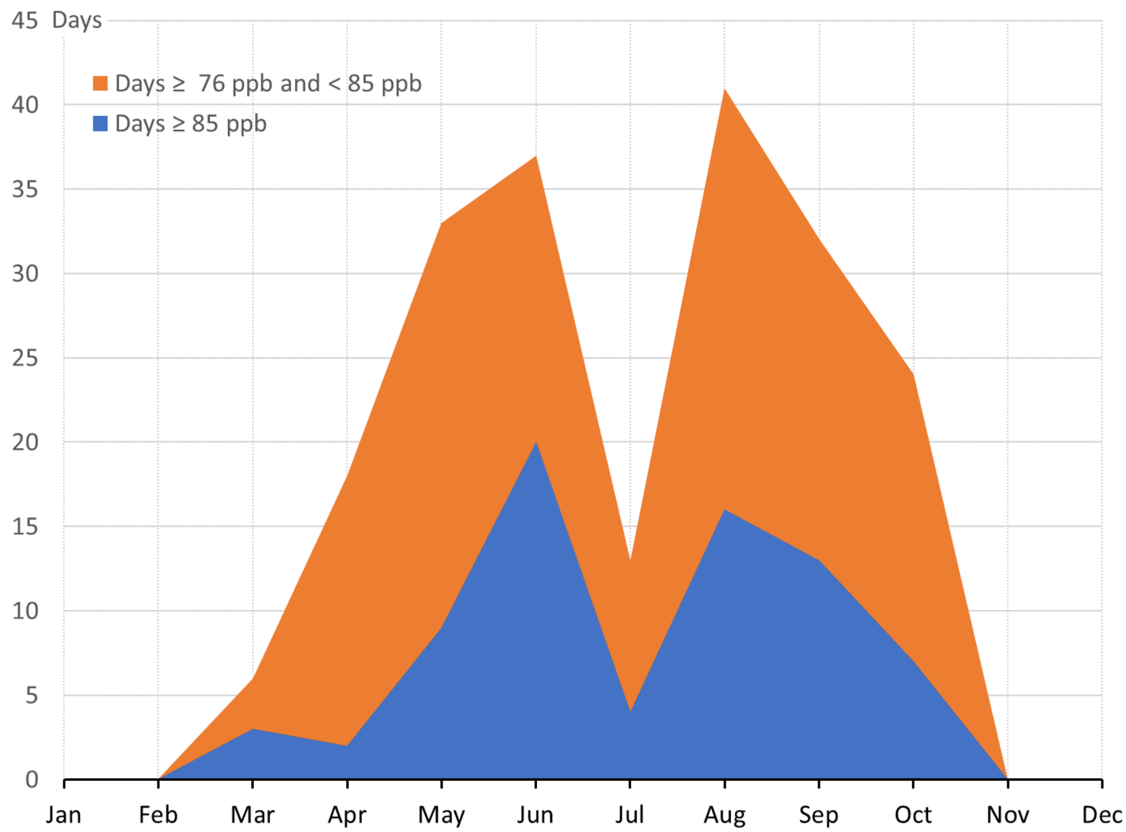

Figure 3-2: Exceedance Days by Month from 2012 through 2022 in the HGB 2008 Ozone NAAQS Nonattainment Area

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 modeling episode when the MDA8 ozone concentration exceeded 60 ppb, the threshold for being included in the future year modeled attainment test. There are 20 regulatory monitors within the eight counties of the HGB 2008 ozone NAAQS nonattainment area. The regulatory monitors are shown in Figure 3-3: *Map of Ozone Monitoring Sites in the HGB 2008 Ozone NAAQS Nonattainment Area* as blue circles and are labeled with the monitor's short name and continuous air monitoring station (CAMS) number.[16]

[16] 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.

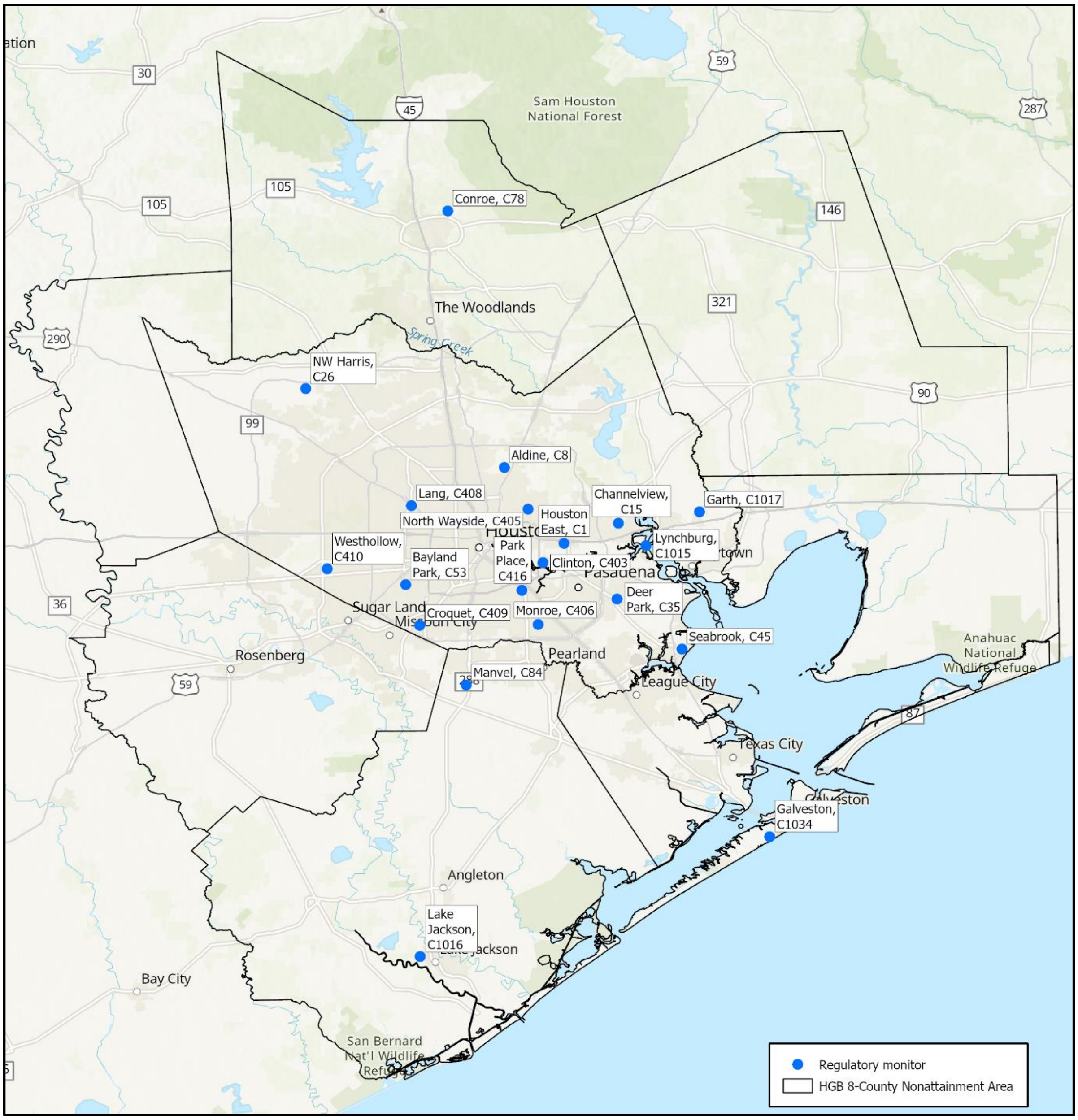

Figure 3-3: Map of Ozone Monitoring Sites in the HGB 2008 Ozone NAAQS Nonattainment Area

Table 3-1: *Exceedance Days and Ozone Conditions 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 2008 ozone NAAQS nonattainment area have at least five days with MDA8 ozone above 60 ppb. The monitor with the highest number of days with MDA8 ozone above 75 ppb is the Houston Bayland Park monitor with eight ozone exceedance days. The monitor with the highest 2019 design value is the Houston Aldine monitor with the design value of 81 ppb. That monitor had four ozone exceedance days. The 2019 design value for the Lynchburg Ferry monitor does not meet the validity requirement and therefore the value is not shown 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 75 ppb	2019 Regulatory Ozone Design Value (ppb)
Aldine	Houston Aldine	0008	93	30	4	81
Bayland Park	Houston Bayland Park	0053	91	28	8	77
Channelview	Channelview	0015	76	10	1	70
Clinton	Clinton	0403	92	7	2	72
Conroe	Conroe Relocated	0078	83	18	1	76
Croquet	Houston Croquet	0409	84	13	3	70
Deer Park	Houston Deer Park #2	0035	107	19	4	75
Galveston	Galveston 99th St.	1034	81	16	3	76
Garth	Baytown Garth	1017	76	12	1	74
Houston East	Houston East	0001	88	11	2	74
Lake Jackson	Lake Jackson	1016	68	5	0	65
Lang	Lang	0408	88	17	2	73
Lynchburg	Lynchburg Ferry	1015	77	7	1	N/A
Manvel	Manvel Croix Park	0084	90	11	5	75
Monroe	Houston Monroe	0406	82	9	3	66
North Wayside	Houston North Wayside	0405	74	7	0	67
NW Harris	Northwest Harris County	0026	86	11	2	74
Park Place	Park Place	4016	88	20	3	73
Seabrook	Seabrook Friendship Park	0045	90	7	1	71
Westhollow	Houston Westhollow	0410	77	23	3	71

The EPA modeling guidance also recommends that the episode include meteorological patterns that represent a variety of conditions that correspond to high ozone. An assessment of the meteorological conditions in the HGB 2008 ozone NAAQS nonattainment area in 2019 showed that the year was not atypical, and therefore was reasonable for modeling ozone. Details of the episode selection process for TCEQ's 2019 modeling platform are provided in Section 1.2: *Modeling Episode* of Appendix A.

3.3 PHOTOCHEMICAL MODELING

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). TCEQ's choice of CAMx meets 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 the continental United States, and a 4 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 2008 ozone NAAQS nonattainment area is contained within tx_4km, the finest resolution domain, as shown in Figure 3-5: *HGB 2008 Ozone NAAQS Nonattainment Area and CAMx 4 km Modeling Domain*. In the vertical direction, each CAMx domain reaches up to over 18 km. 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
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

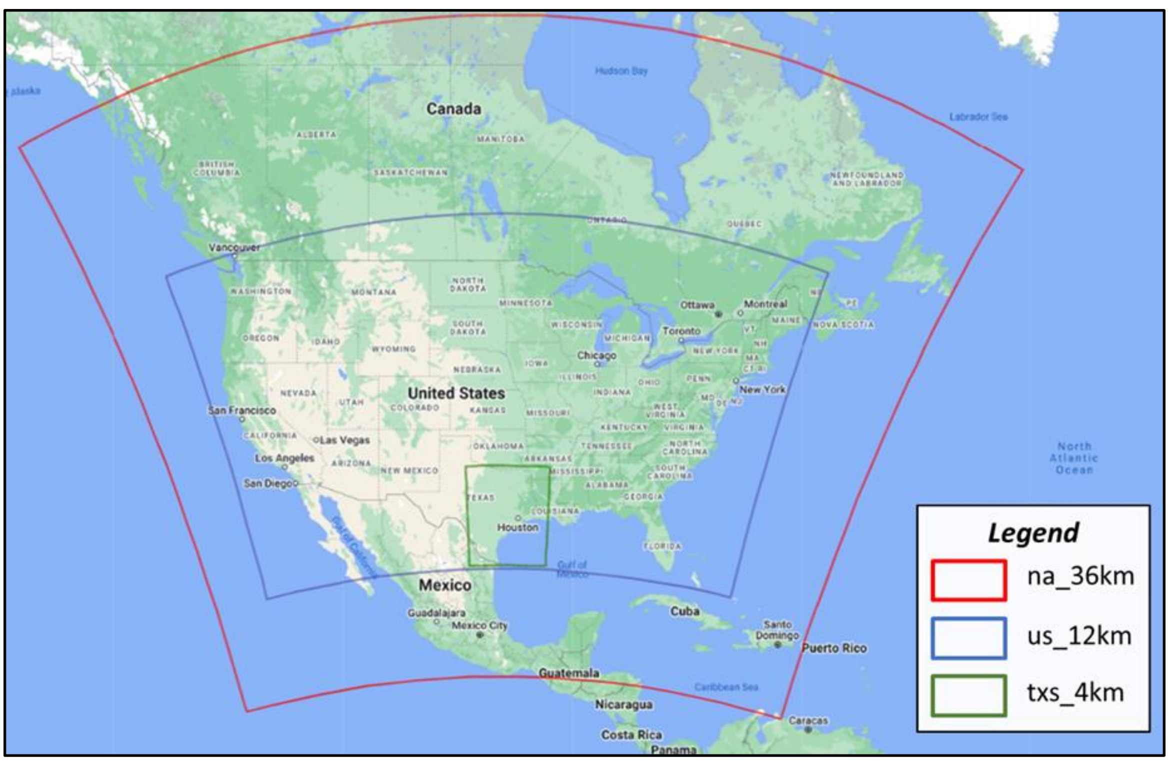

Figure 3-4: CAMx Modeling Domains

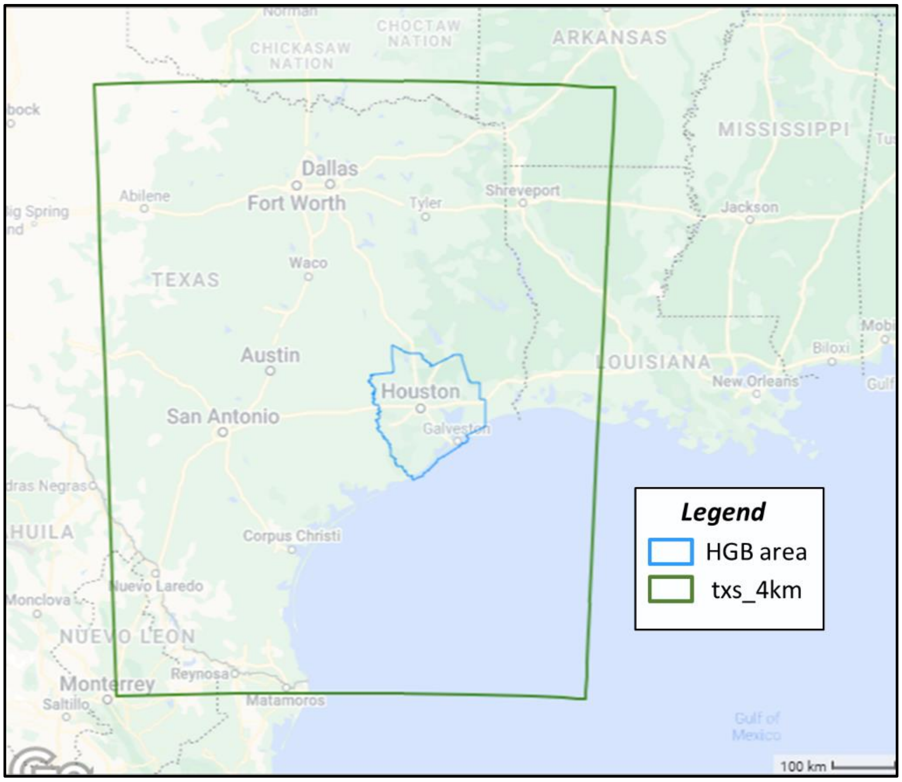

Figure 3-5: HGB 2008 Ozone NAAQS Nonattainment Area and CAMx 4 km Modeling Domain

3.3.2 CAMx Options

TCEQ used the CAMx options summarized in Table 3-3: *CAMx Configuration Options* for this SIP revision. Details regarding the configuration testing conducted by 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. 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

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 the CAMx modeling platform.

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, which includes the 2008 ozone NAAQS nonattainment areas of 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.

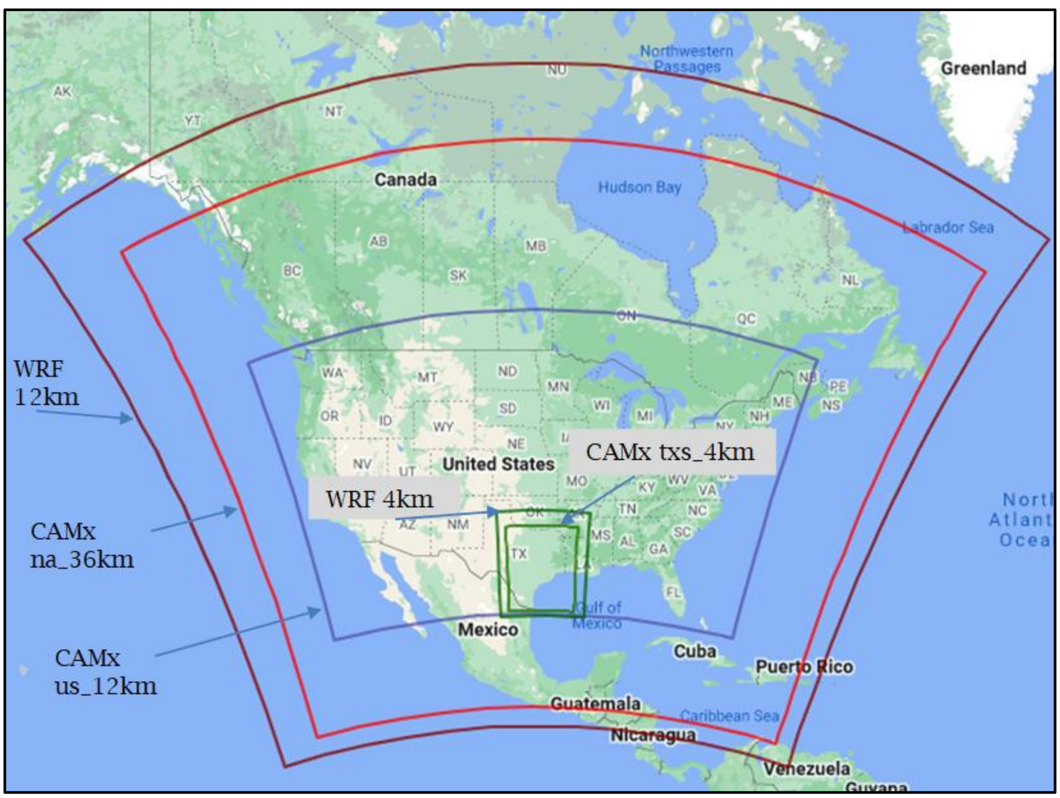

Figure 3-6: CAMx and WRF Domains

The WRF domains have 44 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. CAMx is set up to have 30 layers. The lowest CAMx layer covers the first two WRF layers. CAMx layers 2 through 21 align with WRF layers 3 through 22. CAMx layers 22 through 30 encompass multiple WRF layers as displayed in Figure 3-7: *WRF and CAMx Vertical Layers for the txs_4km Domain.*

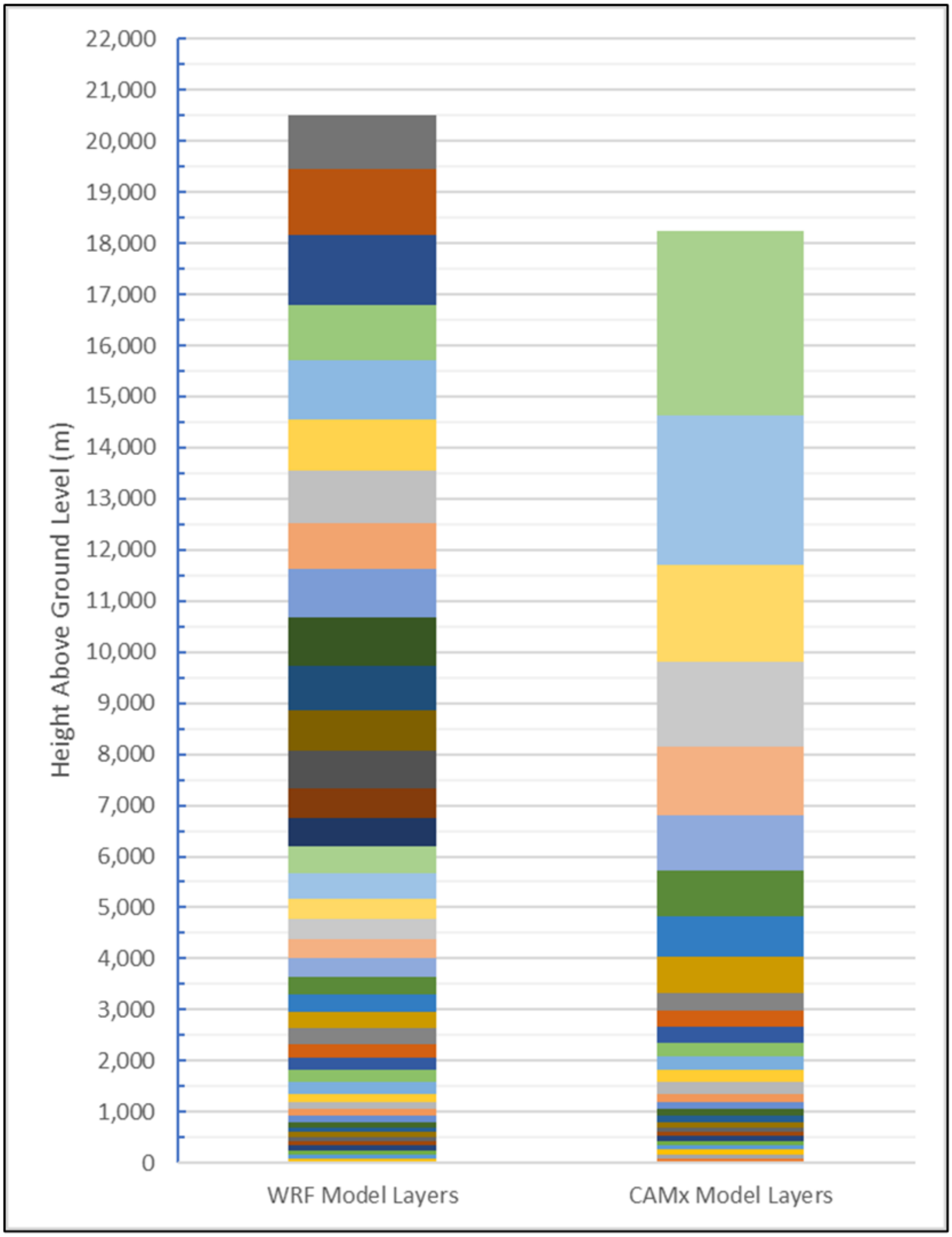

Figure 3-7: WRF and CAMx Vertical Layers for the txs_4km Domain

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 modeling episode for the 2019 base case and the 2026 future case. 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). Based on the EPA modeling guidance, 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 2026 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[17]
Point	Non-EGU, TX	2019 State of Texas Air Reporting System[18]
Point	Non-EGU, Non-TX	EPA 2016v1 Modeling Platform[19]
Non-Point	Oil and Gas, TX	2019 Railroad Commission of Texas
Non-Point	Oil and Gas, Non-TX	EPA 2017 Modeling Platform[20]
Non-Point	Off-Shore	2017 Bureau of Ocean Energy Management[21]
Mobile	On-Road, TX nonattainment areas	Motor Vehicle Emission Simulator (MOVES3)[22] – link-based
Mobile	On-Road, other	MOVES3 – county based
Mobile	Non-Road, TX	TexN2.2
Mobile	Non-Road, Non-TX	MOVES3

[17] https://campd.epa.gov/
[18] https://www.tceq.texas.gov/airquality/point-source-ei/psei.html
[19] https://www.epa.gov/air-emissions-modeling/2016v1-platform
[20] https://www.epa.gov/air-emissions-modeling/2017-emissions-modeling-platform
[21] https://www.boem.gov/environment/environmental-studies/ocs-emissions-inventory-2017
[22] 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 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
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[23] and SMOKEv4.8
Natural	Fires	2019 MODIS and VIIRS; FINN v2.2
Other	International EI	2019 Community Emission Data System;[24] SMOKEv4.7_CEDS

The MOVES4 model was not used in this SIP revision since TCEQ had already invested significant resources to develop a non-road mobile source EI using MOVES3. As EPA stated in its notice of availability published in the *Federal Register* on September 12, 2023, "[…] state and local agencies that have already completed significant work on a SIP with a version of MOVES3 (*e.g.,* attainment modeling has already been completed with MOVES3) may continue to rely on this earlier version of MOVES" (88 FR 62567, 62569).

Total anthropogenic emissions for a sample model episode day of June 12 in the 2019 base case and 2026 future case from within the HGB 2008 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 2008 Ozone NAAQS Nonattainment Area* and Table 3-6: *June 12 Episode Day 2026 Future Year Anthropogenic Modeling Emissions for the HGB 2008 Ozone NAAQS Nonattainment Area*. Emissions from some categories differ on a daily basis and therefore a summary was prepared for a sample day from the modeling episode that had high monitored ozone concentrations in the nonattainment area.

Table 3-5 and 3-6 show on-road mobile sources contributed the greatest amount of nitrogen oxides (NO_X) emissions in 2019 and non-EGU point sources contributed the most NO_X emissions in 2026. Area sources contributed the greatest amount of volatile organic compounds (VOC) emissions in both 2019 and 2026. Emissions from individual categories increased or decreased between the 2019 base case and the 2026

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

future case; however, the sum of NO_X and carbon monoxide (CO) emissions from all source categories decreased while VOC emissions increased in the 2026 future case.

Table 3-5: June 12 Episode Day 2019 Base Case Anthropogenic EI in the HGB 2008 Ozone NAAQS Nonattainment Area

Emission Source Category	NO_X (tpd)	VOC (tpd)	CO (tpd)
On-Road	81.36	40.39	801.88
Non-Road	37.00	37.42	741.73
Off-Road – Airports	9.25	2.83	23.89
Off-Road – Locomotives	12.37	0.63	2.75
Off-Road – Commercial Marine	63.41	3.62	9.82
Area	35.91	262.43	91.98
Oil and Gas – Drilling	0.30	0.03	0.07
Oil and Gas – Production	1.48	41.82	2.22
Point – EGU	30.82	1.17	22.33
Point – Non-EGU	71.72	97.39	66.95
Eight-County Total	**343.62**	**487.73**	**1,763.62**

Table 3-6: June 12 Episode Day 2026 Future Year Anthropogenic Modeling Emissions for the HGB 2008 Ozone NAAQS Nonattainment Area

Emission Source Category	NO_X (tpd)	VOC (tpd)	CO (tpd)
On-Road	47.91	28.05	624.90
Non-Road	28.47	38.54	834.73
Off-Road – Airports	9.13	2.89	24.33
Off-Road – Locomotives	7.73	0.38	2.48
Off-Road – Commercial Marine	49.28	3.76	10.85
Area	37.82	288.01	103.49
Oil and Gas – Drilling	0.23	0.02	0.02
Oil and Gas – Production	1.48	20.74	2.22
Point – EGU	42.78	6.86	44.60
Point – Non-EGU	94.54	103.10	73.41
HGB Eight-County Total	**319.37**	**492.35**	**1,721.03**
Difference between 2026 and 2019	**-24.25**	**4.62**	**-42.59**

A map showing the spatial distribution changes in anthropogenic emissions of NO_X and VOC between the 2026 future case and the 2019 base case on a sample June 12 episode day is presented in Figure 3-8: *Difference in Anthropogenic NO_X between 2026 Future Case and 2019 Base Case on June 12 Modeled Episode Day* and Figure 3-9: *Difference in Anthropogenic VOC between 2026 Future Case 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 that indicate anticipated future increases in point source emissions. VOC emissions increase mainly in Harris and Fort Bend Counties and decrease in surrounding counties.

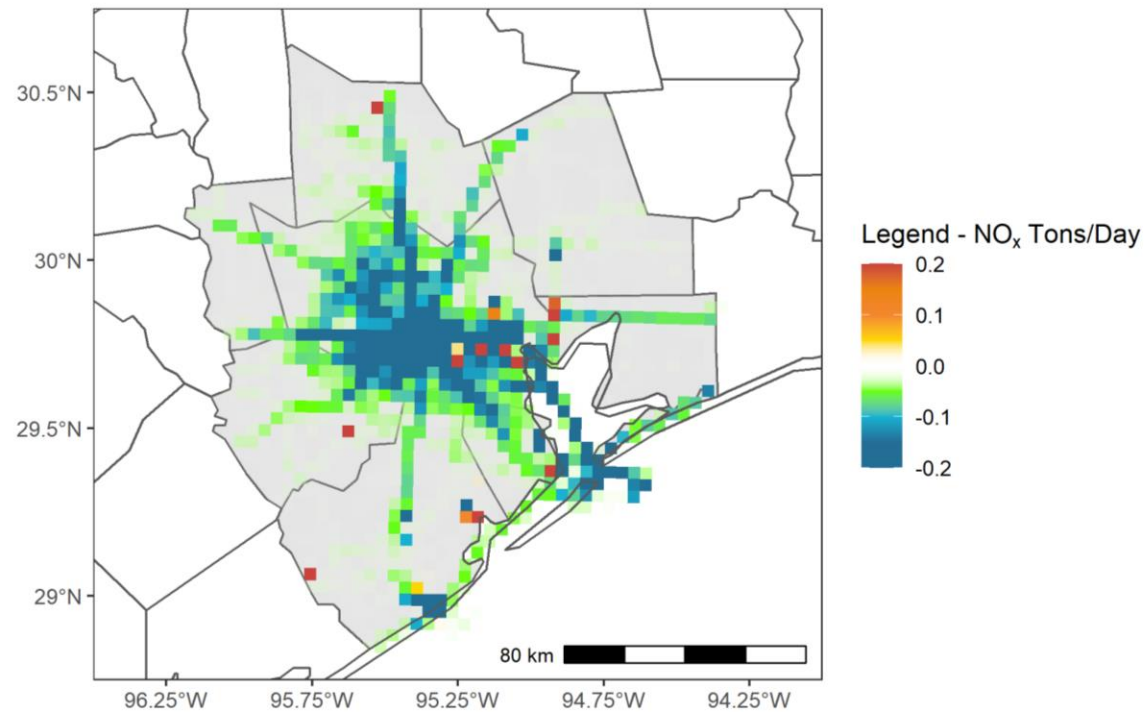

Figure 3-8: Difference in Anthropogenic NO_x between 2026 Future Case and 2019 Base Case on June 12 Modeled Episode Day

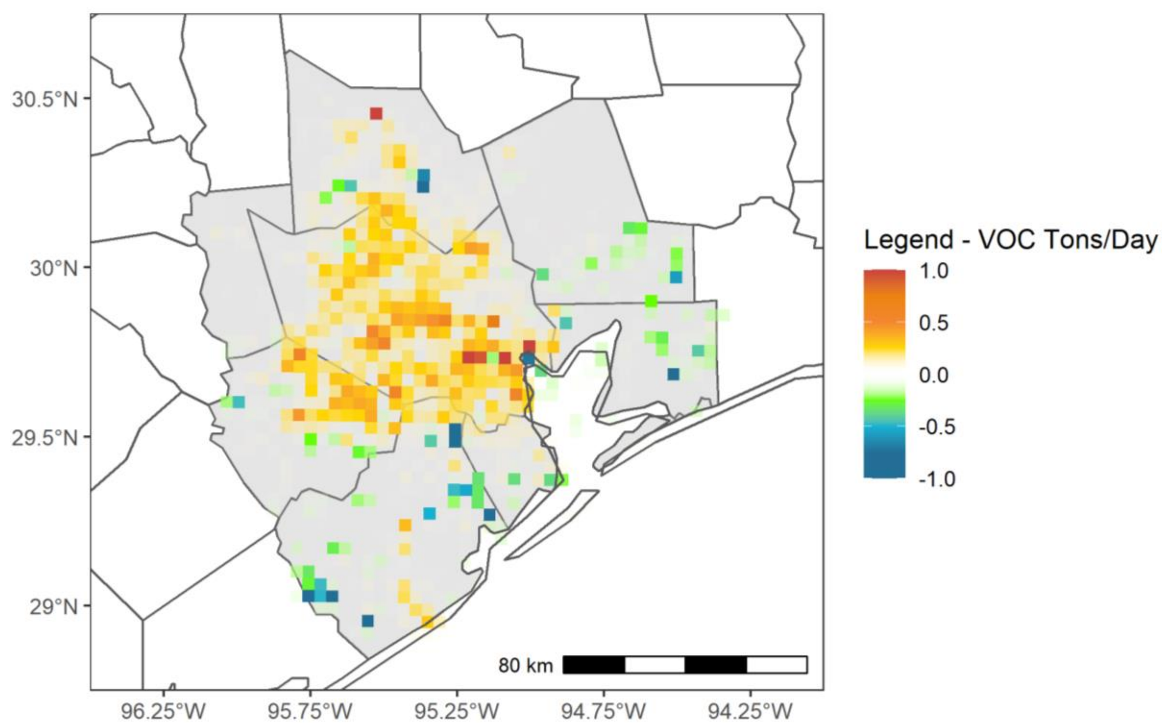

Figure 3-9: Difference in Anthropogenic VOC between 2026 Future Case and 2019 Base Case on June 12 Modeled Episode Day

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 four lateral edges of a domain (North, South, East, West) and a 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 2026. 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.

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 2026), 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 2026 future anthropogenic emissions were interpolated according to a moderate emission scenario from Representative Concentration Pathways (RCP4.5), with regional scaling for the United States, Canada, Mexico, and Asia. The 2023 and 2025 EI from EPA's 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, gridded 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, EPA also recommends comparing MPE results against other similar model applications, such as those reported in Emery et al. (2017) paper. The paper provides benchmarks for normalized mean bias (NMB), normalized mean error (NME), and correlation of one-hour and MDA8 ozone based on performance of many modeling applications in the U.S. Table 3-7: *Benchmarks for Photochemical Model Performance Evaluation Statistics* lists these benchmarks. The goal benchmarks correspond to the performance demonstrated by the top third of model runs evaluated and should be viewed as the best a model can be expected to achieve. The criteria benchmarks correspond to the performance achieved by the top two-thirds of model runs evaluated and should be viewed as what a majority of models can be expected to achieve.

In TCEQ's evaluation of the 2019 base case, statistical values near the goal or criteria benchmarks were used as indications that the model performance was good or acceptable, respectively.

Table 3-7: Benchmarks for Photochemical Model Performance Evaluation Statistics

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

This section provides a broad overview of modeling performance in the HGB 2008 ozone NAAQS nonattainment area, with a more in-depth analysis available in Section 5: *Photochemical Modeling Performance Evaluation* of Appendix A.

TCEQ performed MPE by comparing 2019 base case CAMx modeling results to measured ozone concentrations at all ozone monitors in the HGB 2008 ozone NAAQS nonattainment area, including regulatory and non-regulatory monitors. For this evaluation, statistical performance measures of NMB and NME were calculated using measured and four-cell bi-linearly interpolated modeled ozone concentrations for all episode days and monitors. These statistical parameters were compared to benchmarks set by Emery et al. (2017).

As discussed in EPA's modeling guidance, operational performance evaluations should be conducted across various temporal and spatial scales. The NMB and NME for high ozone days with MDA8 ozone concentrations at or above 60 ppb for monitoring sites in the HGB 2008 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 2008 ozone NAAQS nonattainment area have NMB within the criteria range except Lynchburg. Many monitors have NMB values within the goal range. This indicates acceptable to good model performance. All monitors have NME within the criteria range and most monitors fall within goal range indicating acceptable to good model performance. The Aldine monitor, with the highest 2019 DV, has slightly negative NMB, meaning that the model under predicts MDA8 ozone at that monitor.

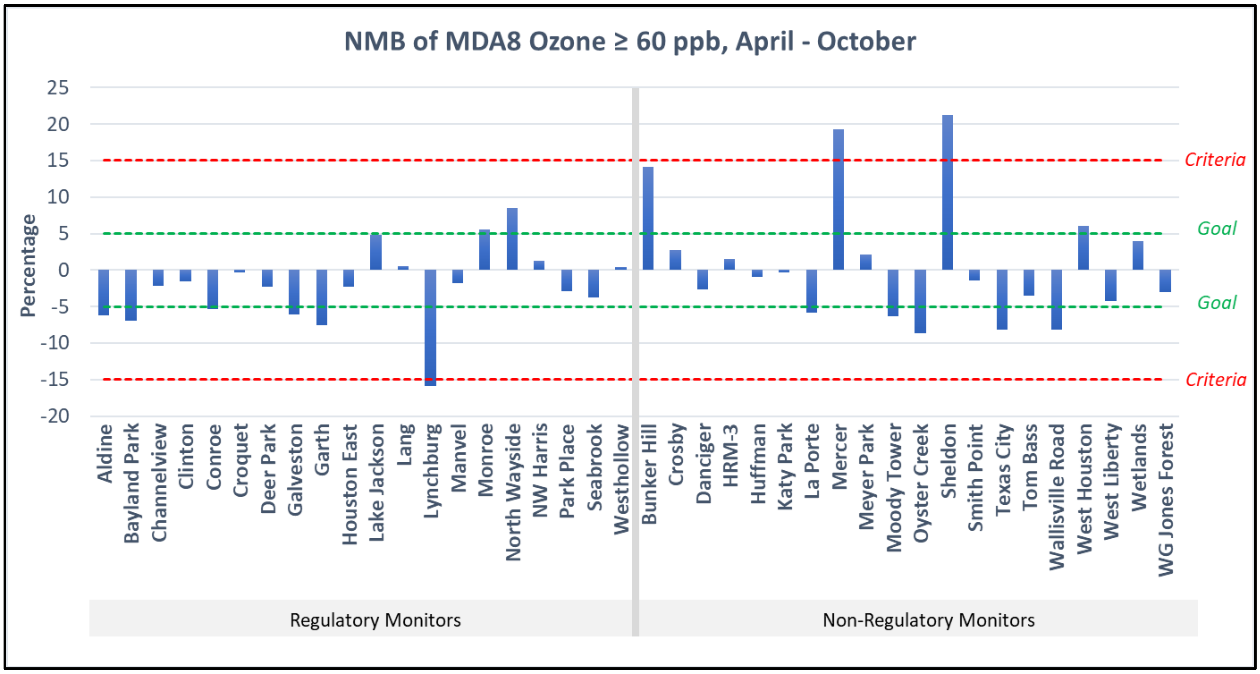

Figure 3-10: NMB for MDA8 Ozone of at least 60 ppb in April through October 2019

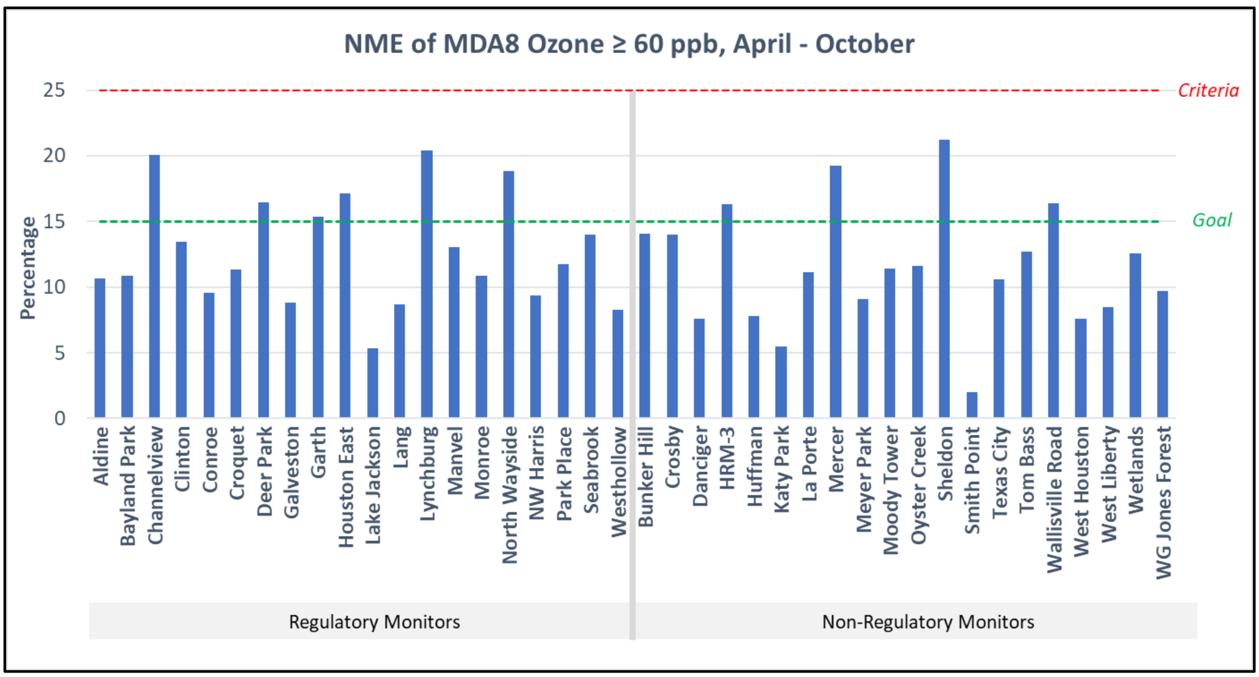

Figure 3-11: NME for MDA8 Ozone of at least 60 ppb in April through October 2019

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 entire modeling episode is presented in Table 3-8: *NMB and NME of Eight-Hour Average Ozone in the HGB 2008 Ozone NAAQS Nonattainment Area*. The values represent monthly and seven-month averages from the HGB 2008 ozone NAAQS nonattainment area monitors.

When evaluated for all observations over 40 ppb, both the normalized mean bias and the normalized mean error are within the criteria range for all months in the modeling episode except August. NMB values for the MDA8 ozone are within the criteria range for April and exceed the criteria range for the remaining months of the modeling episode. NMB values for MDA8 observations over 60 ppb are within the goal range for each individual month within the modeling episode except April, which is outside of the goal range but within the criteria range. The NME values for MDA8 ozone are within the criteria value for April, July, September, and October. The NME values for the MDA8 over 60 ppb are within the goal range for each month of the modeling episode. Model performance is acceptable for each month and the entire modeling episode, with August showing the poorest performance.

Table 3-8: NMB and NME of Eight-Hour Average Ozone in the HGB 2008 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	-4.41	12.58	12.82	22.82	-11.38	12.1
May	-4.69	19.56	20.9	27.76	-1.34	9.52
Jun	2.61	17.99	17.92	29.14	-4.15	14.59
Jul	9.66	13.64	21.17	23.52	-1.26	7.71
Aug	17.08	21.58	27.25	29.68	3.92	13.79
Sep	10.63	13.72	15.71	19.59	2.86	7.34
Oct	4.07	13.92	16.65	21.36	-3.66	12.28
Apr through Oct	2.67	15.67	18.66	24.66	-2.74	11.62

Figure 3-12: *Monthly NMB (for observed MDA8 ≥ 60 ppb) in the HGB 2008 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).

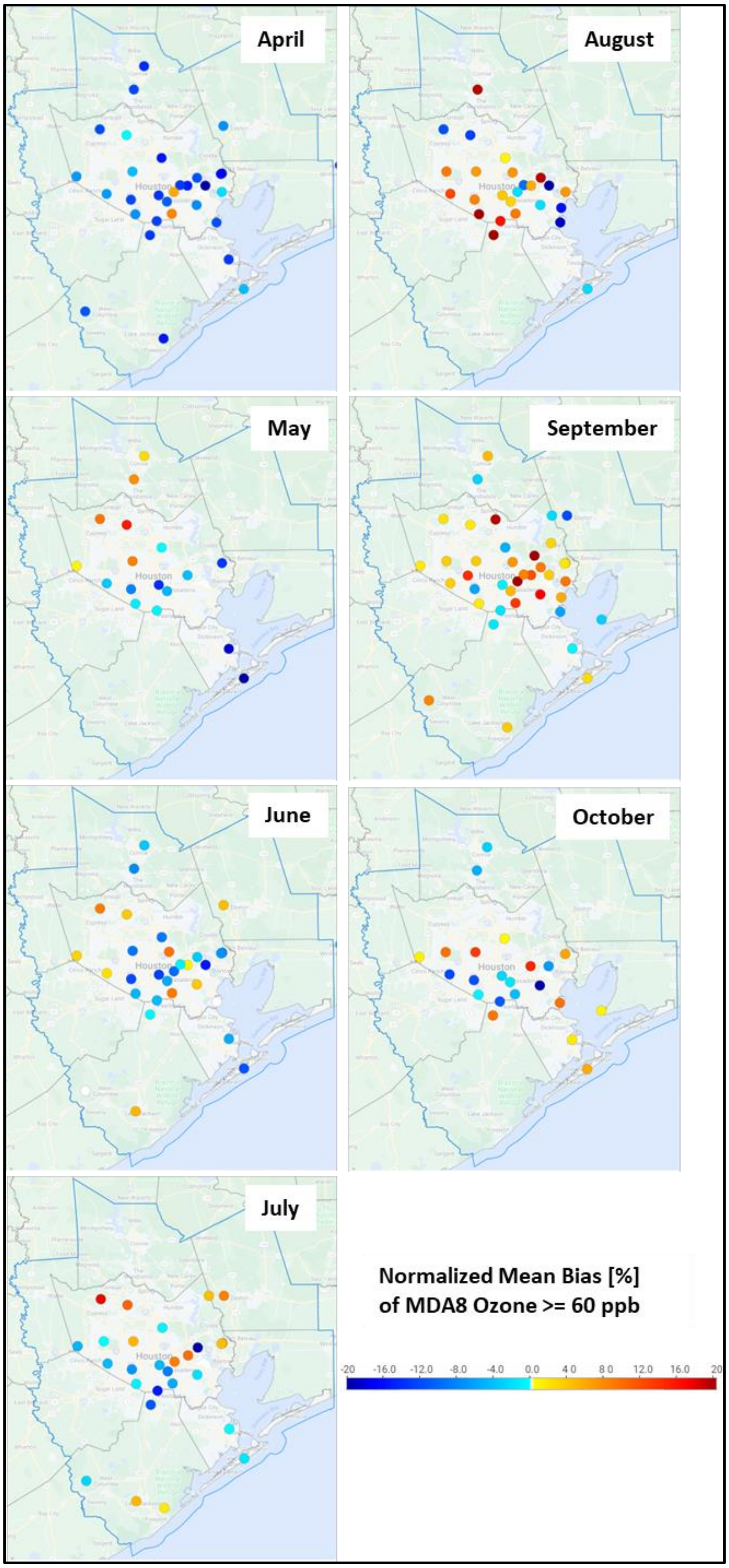

Figure 3-12: Monthly NMB (for observed MDA8 ≥ 60 ppb) in the HGB 2008 Ozone NAAQS Nonattainment Area

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 MODELED 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 2008 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 modeled attainment test. The Relative Response Factor (RRF) that is used in the modeled 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.

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

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

Monitor Short Name	Monitor Name	CAMS Number	2019 Top 10-Day Modeled MDA8 Mean (ppb)	2026 Top 10-Day Modeled MDA8 Mean (ppb)	Relative Response Factor (RRF)
Aldine	Houston Aldine	0008	79.78	77.47	0.971
Bayland Park	Houston Bayland Park	0053	80.92	77.25	0.955
Channelview	Channelview	0015	78.40	77.20	0.985
Clinton	Clinton	0403	81.88	80.09	0.978
Conroe	Conroe Relocated	0078	75.63	74.14	0.980
Croquet	Houston Croquet	0409	81.43	78.34	0.962
Deer Park	Houston Deer Park #2	0035	82.62	81.26	0.984
Galveston	Galveston 99th St.	1034	75.18	73.20	0.974

Monitor Short Name	Monitor Name	CAMS Number	2019 Top 10-Day Modeled MDA8 Mean (ppb)	2026 Top 10-Day Modeled MDA8 Mean (ppb)	Relative Response Factor (RRF)
Garth	Baytown Garth	1017	75.59	74.56	0.986
Houston East	Houston East	0001	80.06	78.83	0.985
Lake Jackson	Lake Jackson	1016	67.80	66.29	0.978
Lang	Lang	0408	80.40	77.54	0.964
Lynchburg	Lynchburg Ferry	1015	78.48	77.29	0.985
Manvel	Manvel Croix Park	0084	80.35	77.50	0.965
Monroe	Houston Monroe	0406	84.14	81.83	0.973
North Wayside	Houston North Wayside	0405	80.39	78.39	0.975
NW Harris	Northwest Harris County	0026	79.52	77.50	0.975
Park Place	Park Place	4016	83.16	81.26	0.977
Seabrook	Seabrook Friendship Park	0045	80.26	79.28	0.988
Westhollow	Houston Westhollow	0410	78.89	75.26	0.954

The RRF is then multiplied by the 2019 base case design value (DVB) to obtain the 2026 future case design values (DVF) for each ozone monitor. The 2019 DVB is calculated as the average of 2019, 2020, and 2021 regulatory DVs as shown in Figure 3-13: *Example Calculation of 2019 DVB.*

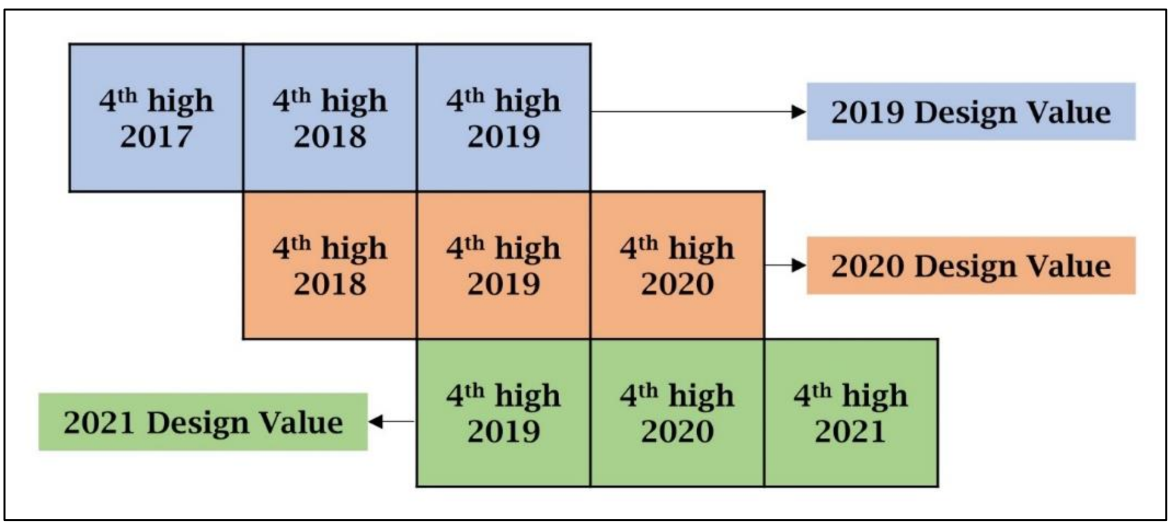

Figure 3-13: Example Calculation of 2019 DVB

As required by the EPA modeling guidance, the final regulatory DVF is obtained by rounding to the tenths digit and truncating to zero decimal places. The 2026 DVF are presented in Table 3-10: *Summary of the 2026 DVF for the Modeled Attainment Test* and in Figure 3-14: *2026 DVF in the HGB 2008 Ozone NAAQS Nonattainment Area*. Application of the modeled attainment test results in all monitors at or below the 2008 eight-hour ozone standard of 75 ppb in 2026 with the highest DVF value of 75 ppb at the Houston Aldine monitor.

Table 3-10: Summary of the 2026 DVF for the Modeled Attainment Test

Monitor Short Name	Monitor Name	CAMS Number	2019 DVB (ppb)	2026 DVF (ppb)	2026 Truncated DVF (ppb)
Aldine	Houston Aldine	0008	78.00	75.75	75
Bayland Park	Houston Bayland Park	0053	76.67	73.19	73
Channelview	Channelview	0015	68.00	66.96	67
Clinton	Clinton	0403	71.00	69.45	69
Conroe	Conroe Relocated	0078	74.33	72.87	72
Croquet	Houston Croquet	0409	71.33	68.63	68
Deer Park	Houston Deer Park #2	0035	75.67	74.42	74
Galveston	Galveston 99th St.	1034	74.00	72.05	72
Garth	Baytown Garth	1017	71.33	70.35	70
Houston East	Houston East	0001	72.67	71.55	71
Lake Jackson	Lake Jackson	1016	65.00	63.55	63
Lang	Lang	0408	72.00	69.44	69
Lynchburg	Lynchburg Ferry	1015	64.33	63.36	63
Manvel	Manvel Croix Park	0084	74.33	71.70	71
Monroe	Houston Monroe	0406	66.67	64.84	64
North Wayside	Houston North Wayside	0405	65.00	63.38	63
NW Harris	Northwest Harris County	0026	72.67	70.82	70
Park Place	Park Place	4016	73.00	71.33	71
Seabrook	Seabrook Friendship Park	0045	67.67	66.85	66
Westhollow	Houston Westhollow	0410	70.00	66.77	66

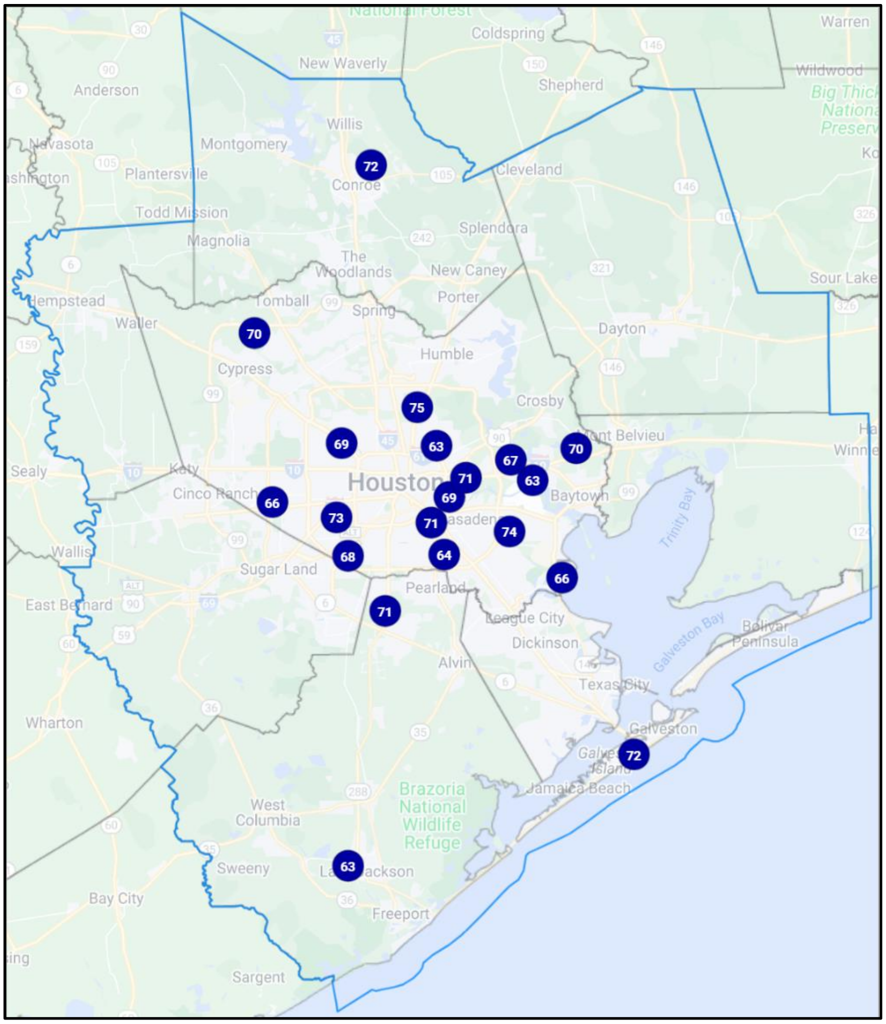

Figure 3-14: 2026 DVF in the HGB 2008 Ozone NAAQS Nonattainment Area

3.6.2 Unmonitored Area Analysis

The standard modeled attainment test is applied only at monitor locations. The EPA modeling guidance recommends that areas not near monitoring locations (unmonitored areas) be subjected to an unmonitored area (UMA) analysis. The UMA analysis is intended to demonstrate that unmonitored areas are also expected to reach attainment by the required attainment date or identify any areas outside monitoring location that are at risk of not meeting the ozone standard.

EPA developed Software for the Modeled Attainment Test - Community Edition (SMAT-CE) that allows states to perform the recommended UMA analysis. However, EPA also allows states to develop alternative techniques suitable for states' needs. To conduct the UMA analysis, TCEQ developed its own software, the TCEQ Attainment Test for Unmonitored Areas (TATU), that is integrated into TCEQ's model post-processing stream. Similar to SMAT-CE, the TATU incorporates modeled predictions into a spatial interpolation procedure using the Voronoi Neighbor Averaging technique. More information about TATU is provided in Appendix A: *Modeling Technical Support Document (TSD).*

The spatially analyzed 2026 future case design values obtained from the UMA analysis are presented in Figure 3-15: *Spatially Analyzed 2026 DVF in the HGB 2008 Ozone NAAQS Nonattainment Area Using Ozone Value from Each Grid Cell*. The figure shows that all grid cells within or near the nonattainment area are below 75 ppb.

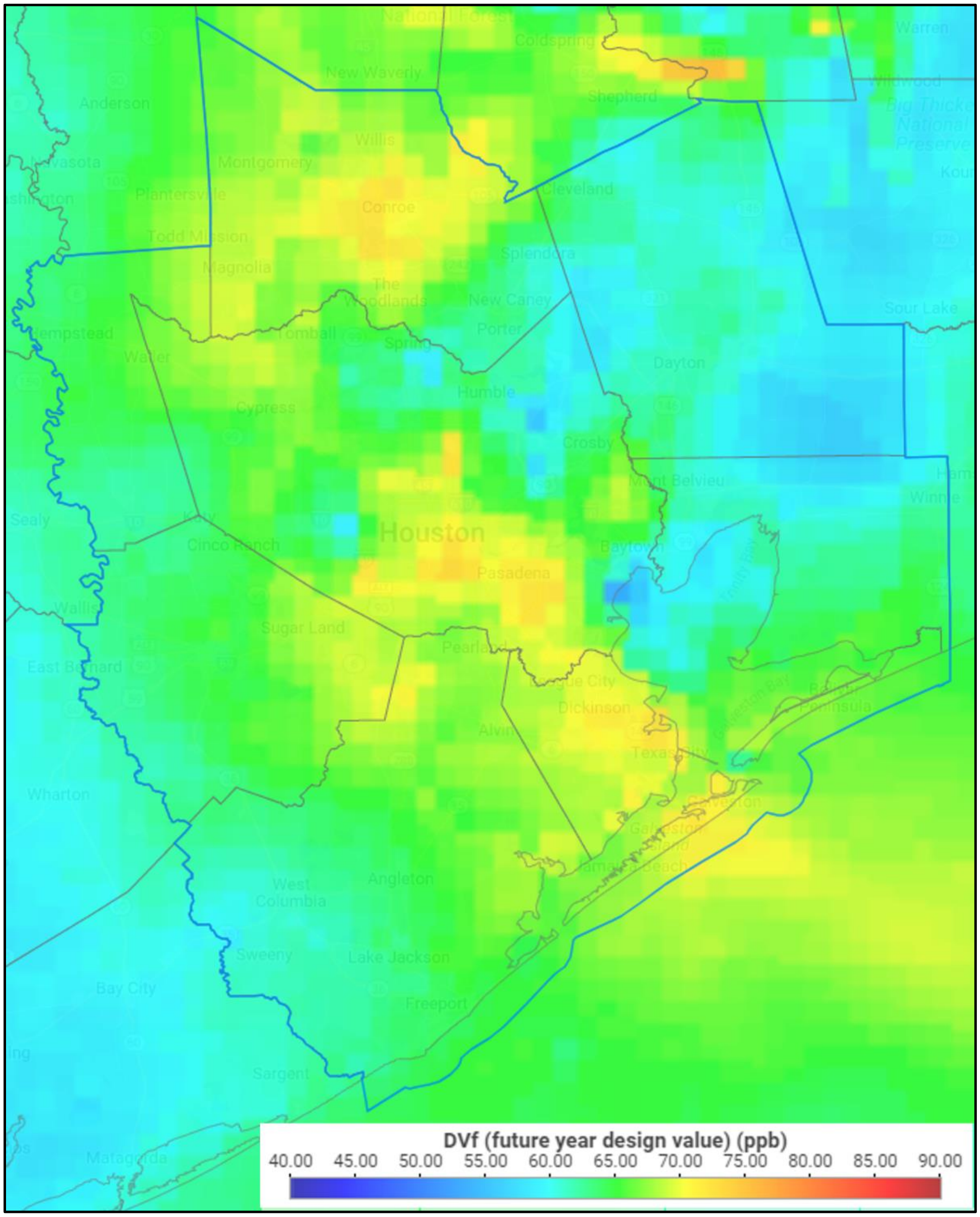

Figure 3-15: Spatially Analyzed 2026 DVF in the HGB 2008 Ozone NAAQS Nonattainment Area Using Ozone Value from Each Grid Cell

3.6.3 Emission Reduction Credits (ERC) Sensitivity Test

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 2026

DVF in the HGB 2008 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 0.06 ppb increase to the maximum 2026 DVF in the HGB 2008 ozone NAAQS nonattainment area (from 75.75 ppb to 75.81 ppb at the Aldine monitor) and did not change the maximum truncated 2026 DVF of 75 ppb. The DVF increased across all regulatory monitors, with a maximum DVF increase of 0.15 at the Houston East monitor. After rounding and truncation, the DVF for the ERC sensitivity changed only at the Seabrook monitor from 66 ppb to 67 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 2026 Pre-Truncated DVF (ppb)	Difference in 2026 DVF from ERC Sensitivity (ppb)	ERC Sensitivity 2026 Truncated DVF (ppb)
Aldine	Houston Aldine	0008	75.81	0.06	75
Bayland Park	Houston Bayland Park	0053	73.26	0.07	73
Channelview	Channelview	0015	67.06	0.10	67
Clinton	Clinton	0403	69.58	0.13	69
Conroe	Conroe Relocated	0078	72.91	0.04	72
Croquet	Houston Croquet	0409	68.70	0.07	68
Deer Park	Houston Deer Park #2	0035	74.54	0.12	74
Galveston	Galveston 99th St.	1034	72.10	0.05	72
Garth	Baytown Garth	1017	70.46	0.11	70
Houston East	Houston East	0001	71.70	0.15	71
Lake Jackson	Lake Jackson	1016	63.58	0.03	63
Lang	Lang	0408	69.50	0.06	69
Lynchburg	Lynchburg Ferry	1015	63.49	0.13	63
Manvel	Manvel Croix Park	0084	71.77	0.07	71
Monroe	Houston Monroe	0406	64.93	0.09	64
North Wayside	Houston North Wayside	0405	63.46	0.08	63
NW Harris	Northwest Harris County	0026	70.87	0.05	70
Park Place	Park Place	4016	71.46	0.13	71
Seabrook	Seabrook Friendship Park	0045	66.96	0.11	67
Westhollow	Houston Westhollow	0410	66.82	0.05	66

3.6.4 Texas Low Emission Diesel (TxLED) Program Sensitivity Analysis

The Texas Low Emission Diesel (TxLED) program was initially implemented in May of 2000 to reduce emissions of NO_X from diesel-powered on-road vehicles and non-road engines operating in 110 central and eastern Texas counties.[25] An EPA memorandum from September of 2001 specified the following NO_X emission reductions for TxLED:[26]

- 4.8% for 2002-and-newer diesel on-road vehicles;
- 6.2% for 2001-and-older diesel on-road vehicles;
- 4.8% for non-road engines meeting Tier 3 and Tier 4 emission standards;
- 6.2% for non-road engines meeting Base, Tier 0, Tier 1, and Tier 2 emission standards; and
- 0% for non-road engines less than or equal to 50 horsepower (hp).

These TxLED NO_X reduction benefits from September of 2001 were incorporated into the on-road and non-road AD modeling runs for both the 2019 base case and 2026 future case. In February 2023, EPA released updated guidance (referred to as 2023 EPA Cetane Program guidance) that modifies the way that the TxLED emissions reductions are estimated.[27] The EPA specifies a formula in the 2023 EPA Cetane Program guidance that modifies the TxLED NO_X reductions to roughly:

- 0% for 2003-and-newer diesel on-road vehicles;
- 1.5% for 2002-and-older diesel on-road vehicles;
- 0% for non-road engines meeting Tier 3 and Tier 4 emission standards; and
- 1.5% for non-road engines meeting Base, Tier 0, Tier 1, and Tier 2 emission standards.

A sensitivity modeling run was performed to determine the impact of quantifying NO_X benefits for the TxLED program based on the 2023 EPA Cetane Program guidance on the 2026 DVF in the HGB 2008 ozone NAAQS nonattainment area. This sensitivity modeling run required changing the estimated on-road and non-road TxLED NO_X reductions in the 110 central and eastern Texas counties for both the 2019 base case and the 2026 future year.

Results from the TxLED program sensitivity test show that the pre-truncated DVF in the HGB 2008 ozone NAAQS nonattainment decreased across all regulatory monitors, with a maximum decrease of 0.04 ppb at the Aldine and Conroe monitors. The maximum 2026 pre-truncated DVF at the Aldine monitor decreased from 75.75 ppb to 75.71 ppb. After rounding and truncation, the 2026 DVF for the TxLED program sensitivity did not change for any monitor except for the Channelview monitor, which decreased from 67 to 66 ppb. Results from the TxLED program sensitivity test are listed in *Table 3-12: HGB Future Year Design Values for TxLED Sensitivity*. Details about

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[25] https://www.tceq.texas.gov/airquality/mobilesource/txled.
[26] https://www.epa.gov/sites/default/files/2016-11/documents/tx-led-fuel-benefit-2001-09-27.pdf
[27] https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1016IFV.pdf

NO_x emissions impacts for the TxLED program sensitivity test for on-road and non-road sources are provided in Section 3.4.1 and 3.5.3 of Appendix A, respectively.

Table 3-12: HGB Future Year Design Values for TxLED Sensitivity

Monitor Short Name	Monitor Name	CAMS Number	TxLED Sensitivity 2026 Pre-Truncated DVF (ppb)	Difference in 2026 DVF from TxLED Sensitivity (ppb)	TxLED Sensitivity 2026 Truncated DVF (ppb)
Aldine	Houston Aldine	0008	75.71	-0.04	75
Bayland Park	Houston Bayland Park	0053	73.16	-0.03	73
Channelview	Channelview	0015	66.94	-0.02	66
Clinton	Clinton	0403	69.43	-0.02	69
Conroe	Conroe Relocated	0078	72.83	-0.04	72
Croquet	Houston Croquet	0409	68.60	-0.03	68
Deer Park	Houston Deer Park #2	0035	74.40	-0.02	74
Galveston	Galveston 99th St.	1034	72.03	-0.02	72
Garth	Baytown Garth	1017	70.34	-0.01	70
Houston East	Houston East	0001	71.53	-0.02	71
Lake Jackson	Lake Jackson	1016	63.52	-0.03	63
Lang	Lang	0408	69.42	-0.02	69
Lynchburg	Lynchburg Ferry	1015	63.34	-0.02	63
Manvel	Manvel Croix Park	0084	71.67	-0.03	71
Monroe	Houston Monroe	0406	64.82	-0.02	64
North Wayside	Houston North Wayside	0405	63.36	-0.02	63
NW Harris	Northwest Harris County	0026	70.79	-0.03	70
Park Place	Park Place	4016	71.32	-0.01	71
Seabrook	Seabrook Friendship Park	0045	66.83	-0.02	66
Westhollow	Houston Westhollow	0410	66.74	-0.03	66

3.6.5 Reasonably Available Control Measures (RACM) Point Sources and Area Sources Sensitivity Analysis

As part of the RACM analysis for this SIP revision, modeling was conducted to estimate the impact of general VOC emissions on future year design values. The results of this modeling were utilized to determine if reductions in general VOC emissions will assist or advance attainment. Additional details of the RACM analysis are provided in Chapter 4.

Two RACM sensitivity modeling runs were conducted: a RACM point sources sensitivity modeling with 10% reductions in the 2026 future case VOC emissions from non-EGU point sources that are not part of the HECT program and a RACM area source sensitivity modeling with 5% reductions in 2026 future case VOC emissions from the non-oil and gas area source emission sector. The area source VOC emissions are predominantly low reactive with only small contribution from highly reactive VOC and therefore the impact of separate VOC classes was not analyzed.

Results from the RACM point sources sensitivity test show that the pre-truncated DVF in the HGB 2008 ozone NAAQS nonattainment decreased across all regulatory monitors, with a maximum decrease of 0.18 ppb at the Houston East monitor. The maximum 2026 pre-truncated DVF at the Aldine monitor decreased from 75.75 ppb to 75.68 ppb. After rounding and truncation, the 2026 DVF for the RACM point sources sensitivity did not change at the DV setting monitor, which is Aldine, and that DVF remains 75 ppb. The only monitor for which the truncated DVF changes is the Channelview monitor, for which DVF decreased from 67 to 66 ppb. Results from the RACM point sources sensitivity test are listed in Table 3-13: *HGB Future Year Design Values for RACM Point Sources Sensitivity*. Additional details of the RACM point sources sensitivity test are provided in Section 3.3.1.3: *Sources in Non-Attainment Areas* of Appendix A.

Table 3-13: HGB Future Year Design Values for RACM Point Sources Sensitivity

Monitor Short Name	Monitor Name	CAMS Number	RACM Point Sources Sensitivity 2026 Pre-Truncated DVF (ppb)	Difference in 2026 DVF from RACM Point Sources Sensitivity (ppb)	RACM Point Sources Sensitivity 2026 Truncated DVF (ppb)
Aldine	Houston Aldine	0008	75.68	-0.07	75
Bayland Park	Houston Bayland Park	0053	73.11	-0.08	73
Channelview	Channelview	0015	66.84	-0.12	66
Clinton	Clinton	0403	69.30	-0.15	69
Conroe	Conroe Relocated	0078	72.82	-0.05	72
Croquet	Houston Croquet	0409	68.54	-0.09	68
Deer Park	Houston Deer Park #2	0035	74.28	-0.14	74
Galveston	Galveston 99th St.	1034	72.00	-0.05	72
Garth	Baytown Garth	1017	70.23	-0.12	70
Houston East	Houston East	0001	71.37	-0.18	71
Lake Jackson	Lake Jackson	1016	63.53	-0.02	63
Lang	Lang	0408	69.38	-0.06	69
Lynchburg	Lynchburg Ferry	1015	63.20	-0.16	63
Manvel	Manvel Croix Park	0084	71.61	-0.09	71
Monroe	Houston Monroe	0406	64.73	-0.11	64
North Wayside	Houston North Wayside	0405	63.30	-0.08	63
NW Harris	Northwest Harris County	0026	70.77	-0.05	70
Park Place	Park Place	4016	71.19	-0.14	71
Seabrook	Seabrook Friendship Park	0045	66.71	-0.14	66
Westhollow	Houston Westhollow	0410	66.73	-0.04	66

Results from the RACM area sources sensitivity test show that the pre-truncated DVF in the HGB 2008 ozone NAAQS nonattainment decreased across all regulatory monitors, with a maximum decrease of 0.06 ppb. The maximum 2026 pre-truncated

DVF at the Aldine monitor decreased from 75.75 ppb to 75.71 ppb. After rounding and truncation, the 2026 DVF for the RACM area sources sensitivity did not change for any monitor except for the Channelview monitor, which decreased from 67 to 66 ppb. Results from the RACM area sources sensitivity test are listed in Table 3-14: *HGB Future Year Design Values for RACM Area Sources Sensitivity*. Additional details of the RACM area sources sensitivity test are provided in Section 3.3.1.3: *Sources in Non-Attainment Areas* of Appendix A.

Table 3-14: HGB Future Year Design Values for RACM Area Sources Sensitivity

Monitor Short Name	Monitor Name	CAMS Number	RACM Area Sources Sensitivity 2026 Pre-Truncated DVF (ppb)	Difference in 2026 DVF from RACM Area Sources Sensitivity (ppb)	RACM Area Sources Sensitivity 2026 Truncated DVF (ppb)
Aldine	Houston Aldine	0008	75.71	-0.04	75
Bayland Park	Houston Bayland Park	0053	73.14	-0.05	73
Channelview	Channelview	0015	66.92	-0.04	66
Clinton	Clinton	0403	69.39	-0.06	69
Conroe	Conroe Relocated	0078	72.85	-0.02	72
Croquet	Houston Croquet	0409	68.58	-0.05	68
Deer Park	Houston Deer Park #2	0035	74.37	-0.05	74
Galveston	Galveston 99th St.	1034	72.03	-0.02	72
Garth	Baytown Garth	1017	70.31	-0.04	70
Houston East	Houston East	0001	71.50	-0.05	71
Lake Jackson	Lake Jackson	1016	63.54	-0.01	63
Lang	Lang	0408	69.41	-0.03	69
Lynchburg	Lynchburg Ferry	1015	63.31	-0.05	63
Manvel	Manvel Croix Park	0084	71.65	-0.05	71
Monroe	Houston Monroe	0406	64.79	-0.05	64
North Wayside	Houston North Wayside	0405	63.35	-0.03	63
NW Harris	Northwest Harris County	0026	70.79	-0.03	70
Park Place	Park Place	4016	71.27	-0.06	71
Seabrook	Seabrook Friendship Park	0045	66.80	-0.05	66
Westhollow	Houston Westhollow	0410	66.74	-0.03	66

3.6.6 Houston Ship Channel Sensitivity Analysis

The Houston Ship Channel expansion project, known as Project 11,[28] would widen and deepen the Ship Channel, which would improve navigation and maneuvering. The "Locally Preferred Plan" was chosen to proceed on the project and the project is anticipated to be finished by 2026. This project would impact marine emissions from

[28] https://www.expandthehoustonshipchannel.com/

ocean going vessels while hoteling or in transit in Harris, Chambers, and Galveston Counties. The emissions changes from Project 11 were estimated by U.S. Army Corps of Engineers.[29, 30] To estimate the impact these emission changes would have on the 2026 DVF in the HGB 2008 ozone NAAQS nonattainment area, a sensitivity modeling run was performed and 2026 DVF estimated. The modeling sensitivity is not relied upon to meet attainment demonstration requirements for the HGB 2008 ozone NAAQS severe nonattainment area but was completed to assess potential ozone impacts from improved traffic flow for ocean-going vessels once Project 11 is complete. If information becomes available prior to adoption that indicates Project 11 will not be complete by 2026, TCEQ will remove the Houston Ship Channel Sensitivity Analysis for adoption.

The HSC sensitivity test resulted in a 0.02 ppb decrease of the maximum pre-truncated 2026 DVF in the HGB 2008 ozone NAAQS nonattainment area (from 75.75 ppb to 75.73 ppb) at the Aldine monitor and did not change the maximum truncated 2026 DVF of 75 ppb. The pre-truncated DVF decreased across most regulatory monitors. After rounding and truncation, the DVF for the HSC sensitivity only changed at the Channelview monitor from 67 ppb to 66 ppb. Results from the HSC sensitivity test are listed in Table 3-15: *HGB Future Year Design Values for HSC Sensitivity*. Additional details of the HSC sensitivity are provided in Section 3.6.1, *Commercial Marine Vessels (CMV)* of Appendix A.

Table 3-15: HGB Future Year Design Values for HSC Sensitivity

Monitor Short Name	Monitor Name	CAMS Number	HSC Sensitivity 2026 Pre-Truncated DVF (ppb)	Difference in 2026 DVF from HSC Sensitivity (ppb)	HSC Sensitivity 2026 Truncated DVF (ppb)
Aldine	Houston Aldine	0008	75.73	-0.02	75
Bayland Park	Houston Bayland Park	0053	73.18	-0.01	73
Channelview	Channelview	0015	66.95	-0.01	66
Clinton	Clinton	0403	69.43	-0.02	69
Conroe	Conroe Relocated	0078	72.86	-0.01	72
Croquet	Houston Croquet	0409	68.61	-0.02	68
Deer Park	Houston Deer Park #2	0035	74.4	-0.02	74
Galveston	Galveston 99th St.	1034	72.04	-0.01	72
Garth	Baytown Garth	1017	70.34	-0.01	70
Houston East	Houston East	0001	71.54	-0.01	71
Lake Jackson	Lake Jackson	1016	63.54	-0.01	63
Lang	Lang	0408	69.43	-0.01	69

[29] https://www.swg.usace.army.mil/Portals/26/docs/Planning/Public%20Notices-Civil%20Works/HSC-ECIP%20FIFR-EIS/App%20G%20-%20Environmental%20Supporting%20Document%20(3Mar2020).pdf?ver=2020-04-29-094501-380

[30] https://www.swg.usace.army.mil/Portals/26/docs/Planning/Public%20Notices-Civil%20Works/HSC-ECIP%20FIFR-EIS/App%20G%20%20Att%201%20%20Projected%20Emissions%20Reductions%20for%20HSC%20ECIP%20(12Nov2019).pdf?ver=2020-01-21-082111-303

Monitor Short Name	Monitor Name	CAMS Number	HSC Sensitivity 2026 Pre-Truncated DVF (ppb)	Difference in 2026 DVF from HSC Sensitivity (ppb)	HSC Sensitivity 2026 Truncated DVF (ppb)
Lynchburg	Lynchburg Ferry	1015	63.35	-0.01	63
Manvel	Manvel Croix Park	0084	71.68	-0.02	71
Monroe	Houston Monroe	0406	64.82	-0.02	64
North Wayside	Houston North Wayside	0405	63.37	-0.01	63
NW Harris	Northwest Harris County	0026	70.81	-0.01	70
Park Place	Park Place	4016	71.32	-0.01	71
Seabrook	Seabrook Friendship Park	0045	66.83	-0.02	66
Westhollow	Houston Westhollow	0410	66.77	0.00	66

3.7 MODELING REFERENCES

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U.S. Environmental Protection Agency. 2018. *Modeling Guidance for Demonstrating Air Quality Goals for Ozone, $PM_{2.5}$ and Regional Haze*. https://www.epa.gov/sites/default/files/2020-10/documents/o3-pm-rh-modeling_guidance-2018.pdf, last accessed on Jan. 20, 2023.

CHAPTER 4: CONTROL STRATEGIES AND REQUIRED ELEMENTS

4.1 INTRODUCTION

The Houston-Galveston-Brazoria (HGB) ozone nonattainment area for the 2008 Eight-Hour Ozone National Ambient Air Quality Standard (NAAQS), which consists of Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties, 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 previously adopted for the HGB ozone nonattainment area as well as how Texas meets the following ozone nonattainment area state implementation plan (SIP) requirements for the 2008 eight-hour ozone NAAQS: reasonably available control measures (RACM), including reasonably available control technology (RACT), motor vehicle emissions budgets (MVEB), and contingency measures.

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 nonattainment area(s). For the one-hour ozone NAAQS, the HGB ozone nonattainment area consisted of eight counties: Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller. This same nonattainment area was later designated nonattainment for 1997 eight-hour, and the 2008 eight-hour NAAQS. On June 4, 2018, the United States Environmental Protection Agency (EPA) designated a six-county HGB area including Brazoria, Chambers, Fort Bend, Galveston, Harris, and Montgomery Counties as nonattainment for the 2015 eight-hour ozone NAAQS (83 *Federal Register* (FR) 25776). Liberty and Waller Counties were designated as attainment for the 2015 NAAQS and were not included in the area's nonattainment designation. Table 4-1: *Existing Ozone Control and Voluntary Measures Applicable to the HGB Eight-County Nonattainment Area* lists the existing ozone control strategies implemented for the 1979 one-hour, the 1997 eight-hour and the 2008 eight-hour ozone standards throughout the eight counties comprising the HGB 2008 ozone NAAQS nonattainment area.

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

Measure	Description	Start Date(s)
Nitrogen Oxides (NO_X) Mass Emissions Cap and Trade (MECT) Program and 30 Texas Administrative Code (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
NO_X System Cap Requirements for Electric Generating Facilities (EGFs) 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)
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

Measure	Description	Start Date(s)
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
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
Houston-Galveston-Brazoria (HGB) Major Utility Electric Generation Source Rule 30 TAC Chapter 117, Subchapter C, Division 3	NO_x control requirements for major source (25 tpy of NO_x or more) utility electric generating facilities Applies to utility boilers, auxiliary steam boilers, stationary gas turbines, and duct burners used in turbine exhaust ducts used in electric power generating systems	November 15, 1999
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
East Texas Combustion Sources 30 TAC Chapter 117, Subchapter E, Division 4	NO_x emission limits for stationary rich-burn, gas-fired internal combustion engines (240 horsepower and greater) Measure implemented to reduce ozone in the HGB area although controls not applicable in the HGB area	March 1, 2010

Measure	Description	Start Date(s)
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 (state-wide rule)	July 1, 2002
VOC Control Measures 30 TAC Chapter 115	VOC control measures adopted to satisfy reasonably available control technology (RACT) and other SIP planning requirements for sources including: vent gas, industrial wastewater, water separation, municipal solid waste landfills, batch processes, loading and unloading operations, VOC leak detection and repair (LDAR), solvent-using processes, fugitive emission control in petroleum refining, natural gas/gasoline processing, and petrochemical processing, cutback asphalt, and pharmaceutical manufacturing facilities	December 31, 2002 and earlier
Highly Reactive Volatile Organic Compounds (HRVOC) Emissions Cap and Trade (HECT) Program and HRVOC Rules 30 Texas 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 Seven perimeter counties 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.
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

Measure	Description	Start Date(s)
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	March 1, 2012 and earlier
Storage of VOC 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
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 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

Measure	Description	Start Date(s)
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
Petroleum Dry Cleaning Systems 30 TAC Chapter 115, Subchapter F, Division 4	Control requirements for petroleum dry cleaning system dryers and filters at sources that use less than 2,000 gallons of petroleum solvent per year	May 21, 2011
Rules for the Oil and Natural Gas Industry 30 TAC Chapter 115 Subchapter B Division 7	VOC measures adopted for RACT addressing the emission source categories in the Control Techniques Guidelines for the Oil and Natural Gas Industry published by 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 tank truck as storage tank is filled with fuel, rather than released into ambient air	1979 A SIP revision related to Stage I regulations was approved by EPA, effective June 29, 2015.
Voluntary Texas Emissions Reduction Plan (TERP) 30 TAC Chapter 114, Subchapter K	Voluntary program that provides grant funds for on-road and non-road heavy-duty diesel engine replacement/retrofit	January 2002 See Section 5.3.1.4: *Texas Emissions Reduction Plan (TERP)*
Texas Low Emission Diesel 30 TAC Chapter 114, Subchapter H, Division 2	Requires all diesel fuel for both on-road and non-road use to have a lower aromatic content and a higher cetane number	Phased in from October 31, 2005 through January 31, 2006
Vehicle Inspection/ 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

Measure	Description	Start Date(s)
Gasoline Engines	Standards for non-road gasoline engines 25 horsepower and larger	May 1, 2004
Transportation Control Measures (TCM)	Various transportation-related, local measures implemented under the previous one-hour and 1997 eight-hour ozone standards (see Appendix F of the 2010 HGB 1997 Eight-Hour Ozone AD SIP Revision) Houston-Galveston Area Council (H-GAC (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 (EE/RE)	Energy efficiency and renewable energy projects enacted by the Texas Legislature outlined in Section 5.3.1.2: *Energy Efficiency and Renewable Energy Measures*	See Section 5.3.1.2
Voluntary Mobile Emissions 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 H-GAC	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 EPA for on-road vehicles Included in measures: Tier 1, Tier 2, and Tier 3 light-duty and medium-duty passenger vehicle standards, heavy-duty vehicle standards, low sulfur diesel standards, National Low Emission Vehicle standards, and reformulated gasoline	Phase in through 2010 Tier 3 phase in from 2017 through 2025

Measure	Description	Start Date(s)
Federal Area/Non-Road Measures	Series of emissions limits implemented by EPA for area and non-road sources Examples: diesel and gasoline engine standards for locomotives and leaf-blowers	Phase in through 2018
HGB Area On-Road and Non-Road Reformulated Gasoline (RFG)	Requires all gasoline sold year-round to have low Reid vapor pressure to meet federal RFG requirements	January 1, 1995 in Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties

4.3 UPDATES TO EXISTING CONTROL MEASURES

4.3.1 Updates to NO_X Control Measures

On April 15, 2022, TCEQ adopted a rulemaking to update rule language to be consistent with a change to the Texas Transportation Code required by Senate Bill (SB) 604, 86th Legislature, 2019 (SB 604), relating to 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 (Rule Project No. 2021-029-114-AI). The rulemaking to implement SB 604 did not include any new control measures. On May 31, 2023, the commission approved a proposed I/M SIP revision for publication and public comment and hearing (Project No. 2022-027-SIP-NR) that incorporates the adopted rulemaking to implement SB 604. The adopted rulemaking and proposed SIP revision, if adopted, will be submitted to EPA to revise the SIP.

In response to a rule petition for changes to existing rule provisions in Chapter 117 (Project No. 2023-127-PET-NR), owners or operators of stationary diesel engines designed, constructed, operated, and certified to meet the requirements of 40 CFR Part 1039 would not be required to use a continuous or predictive emissions monitoring system to monitor NO_X emissions from the affected unit. Owners or operators would furthermore not be required to monitor ammonia emissions pursuant to existing Chapter 117 ammonia emission monitoring requirements. The affected unit would still be subject to a NO_X and an ammonia emission specification, and the owner or operator would still be required to test the unit to demonstrate initial compliance with the respective emission specification. The concurrent proposed Chapter 117 rulemaking (Rule Project No. 2023-117-117-AI) would provide the compliance flexibility through rule updates in Subchapter B, Division 3 for major sources of NO_X and in Subchapter D, Division 1 for minor sources of NO_X.

4.3.2 Updates to VOC Control Measures

Control measures addressing FCAA, §172 and §182 for the 2008 HGB ozone nonattainment area were last updated in a rulemaking adopted June 30, 2021 (Rule Project No. 2020-038-115-AI) to implement RACT for the oil and natural gas emission source categories covered in EPA's control techniques guidelines (CTG) document, *Control Techniques Guidelines for the Oil and Natural Gas Industry* published in 2016 (EPA-453/B-16-001 *2016/10*). EPA published final approval of the rule revisions on August 15, 2023, effective September 14, 2023 (88 FR 55379).

Updates are needed to correct errors made in the June 2021 Chapter 115 rulemaking. These updates are included in a concurrently proposed 30 TAC Chapter 115 rulemaking (Rule Project No. 2023-116-115-AI) that, would more closely align the requirements in Chapter 115 with EPA's CTG. The revisions would include exemptions inadvertently omitted from Chapter 115, allowing audio, visual, or olfactory monitoring for equipment in heavy liquid service, and correcting errors in the rule language providing for a reduced monitoring frequency based on good performance. All proposed corrections are consistent with the recommendations in the CTG.

4.4 NEW CONTROL MEASURES

4.4.1 Stationary Sources

The concurrent Chapter 115 rulemaking also proposes new contingency measures to satisfy FCAA contingency measure requirements (Rule Project No. 2023-116-115-AI). These proposed contingency measures are described in Section 4.9, *Contingency Plan*.

4.5 RACT ANALYSIS

4.5.1 General Discussion

Ozone nonattainment areas classified as moderate and above are required to meet the mandates of FCAA under §172(c)(1) and §182(b)(2) and (f) to address RACT. According to EPA's *Implementation of the 2008 National Ambient Air Quality Standards for Ozone: State Implementation Plan Requirements: Final Rule* (2008 eight-hour ozone standard SIP requirements rule) published on March 6, 2015, states containing areas classified as moderate ozone nonattainment or higher must submit a SIP revision to fulfill the RACT requirements for all CTG emission source categories and all non-CTG major sources of NO_x and VOC (80 FR 12264). Specifically, this HGB Attainment Demonstration (AD) SIP revision must contain adopted RACT regulations, certifications where appropriate that existing provisions are RACT, and/or negative declarations that there are no sources in the nonattainment area covered by a specific CTG source category.

The HGB area was previously classified as serious ozone nonattainment for the 2008 eight-hour ozone NAAQS with an attainment date of July 20, 2021 (84 FR 44238). Based on monitoring data from 2018 through 2020, the HGB serious ozone nonattainment area did not attain the 2008 eight-hour ozone NAAQS in the 2020 attainment year and TCEQ submitted a one-year attainment date extension request to EPA in accordance with FCAA, §181(a)(5). On October 7, 2022, EPA published the final notice denying TCEQ's one-year attainment date extension request and reclassifying the HGB nonattainment area from serious to severe nonattainment for the 2008 eight-hour ozone NAAQS, effective November 7, 2022 (87 FR 60926).

The major source threshold for severe nonattainment areas is 25 tpy of actual or potential emissions of either NO_x or VOC. Due to the HGB nonattainment area's previous severe classification under the 1997 eight-hour ozone NAAQS, rules to implement FCAA requirements for nonattainment areas have been in place for the HGB nonattainment area through the existing 30 TAC Chapter 115 and Chapter 117 rules, including a major source threshold of 25 tpy, as of March 10, 2010. The RACT analysis for this proposed SIP revision evaluated RACT requirements at the existing major source threshold of 25 tpy of NO_x or VOC in the HGB 2008 ozone NAAQS nonattainment area.

RACT is defined as the lowest emissions limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility (44 FR 53761, September 17, 1979). RACT requirements for moderate and higher classification nonattainment areas are included in the FCAA to ensure that significant source categories at major sources of ozone precursor emissions are controlled to a reasonable extent but not necessarily to best available control technology (BACT) levels expected of new sources or to maximum achievable control technology levels required for major sources of hazardous air pollutants.

Details of TCEQ's analysis of the sources and the applicable rules to demonstrate that the state is fulfilling the RACT requirements for the HGB 2008 eight-hour severe ozone nonattainment area are in Appendix D.

4.5.2 NO_x RACT Determination

The TCEQ reviewed the 2019 point source emissions inventory (EI) to verify that the NO_x controls and reductions implemented through 30 TAC Chapter 117 for the HGB ozone nonattainment area continue to address RACT requirements for the 2008 ozone NAAQS. The current EPA-approved 30 TAC Chapter 117 rules continue to fulfill RACT requirements for all NO_x source categories identified in EPA alternative control technology (ACT) guidance documents. All NO_x major sources in the HGB 2008 eight-hour severe ozone nonattainment area are covered by existing emission limits in Chapter 117, which EPA previously approved. Details of this analysis are included in Appendix D.

4.5.3 VOC RACT Determination

In the eight HGB-area counties that were reclassified as severe nonattainment under the 2008 eight-hour NAAQS, all VOC emission source categories addressed by CTG and ACT documents in the HGB area are controlled through existing rules in 30 TAC Chapter 115 or other approved regulations that fulfill RACT requirements. Tables D-2: *State Rules Addressing VOC RACT Requirements in CTG Reference Documents* and D-3: *State Rules Addressing VOC RACT Requirements in ACT Reference Documents* of Appendix D provide additional details on the CTG and ACT source categories.

Based on a review of the EPA-approved negative declarations TCEQ previously submitted for the HGB 2008 eight-hour ozone SIP revisions, TCEQ is resubmitting negative declarations for the following CTG or ACT source categories for the HGB 2008 eight-hour severe ozone nonattainment area:

- Fiberglass Boat Manufacturing Materials;
- Leather Tanning and Finishing Operations;
- Surface Coating for Flatwood Coatings;
- Letterpress Printing;
- Automobile and Light-Duty Truck Assembly Coatings; and
- Manufacture of Pneumatic Rubber Tires.

For all non-CTG and non-ACT major VOC emission sources for which VOC controls are technologically and economically feasible, RACT is fulfilled through existing 30 TAC Chapter 115 rules and other federally enforceable measures. Additional VOC controls on certain major sources were determined either not to be economically feasible or not to be technologically feasible. Appendix D, Table D-5: *State Rules Addressing VOC RACT Requirements for Major Emission Sources in the HGB Area* provides additional detail on the non-CTG and non-ACT major emission sources.

4.6 RACM ANALYSIS

4.6.1 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 FCAA Amendments published in the April 16, 1992 issue of the *Federal Register*, EPA explained that it interprets FCAA, §172(c)(1) as a requirement that states incorporate into their SIPs 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, TCEQ uses the general criteria specified by EPA in the proposed approval of the New Jersey RACM analysis published in the January 16, 2009 issue of the *Federal Register* (74 FR 2945) and finalized by EPA in the May 15, 2009 issue of the *Federal Register* (74 FR 22837).

RACM is defined by EPA as any potential control measure for application to point, area, on-road, or non-road emission source categories that meets the following criteria:

- 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.

EPA did not provide guidance on how to interpret the criteria "advance the attainment date by at least one year." Considering the July 20, 2027 attainment date for this HGB AD SIP revision, TCEQ evaluated this aspect of RACM based on advancing the attainment date by one year, to July 20, 2026.

4.6.2 Results of the RACM Analysis

TCEQ determined that no potential control measures met the criteria to be considered RACM. As discussed in Chapter 3: *Photochemical Modeling* of this SIP revision, the current modeling results indicate that the HGB area will demonstrate attainment by its July 20, 2027 attainment date.

To determine if attainment can be reached by July 20, 2026, TCEQ estimated the potential 2025 design value using both modeled 2026 future design value (DVF) of 75 ppb and the preliminary 2023 monitored design value (2023 DV) of 82 ppb as of September 8, 2023. Assuming that changes in design value are linear, the per year change in design value needed to reach the 2026 modeled DVF of 75 ppb from the preliminary monitored 2023 DV of 82 ppb is 2.33 ppb. Using the 2.33 ppb per year change in design value, the estimated potential 2025 design value would be 77.33 ppb, requiring an additional reduction of 1.39 ppb to reach attainment of 2008 eight-hour ozone NAAQS one year earlier. Assuming linear emissions reduction per year, the per year emissions reduction needed to reach a modeled DVF of 75 ppb from the 2019 base year design value (DVB) was calculated to be 3.46 tpd of NO_x emissions. Further assuming a linear relationship between NO_x emissions and design values, the amount of NO_x emissions reductions needed to get the additional 1.39 ppb was calculated to be 2.06 tpd. To advance attainment by one year, to July 20, 2026 with a 2025 attainment year, a control measure would have to be in place by the beginning of ozone season in the 2025 attainment year, January 1, 2025, to be considered RACM and provide a NO_x reduction of 2.06 tpd. Because no control strategies were identified that could provide at least 2.06 tpd of NO_x reductions and be implemented by the January 1, 2025 deadline, it is not possible to advance attainment by one year.

4.7 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 MOVES4 model was not used in this SIP revision since TCEQ had already invested significant resources to develop a non-road mobile source EI using MOVES3. As EPA stated in its notice of availability published in the *Federal Register* on September 12, 2023, "[…] state and local agencies that have already completed significant work on a SIP with a version of MOVES3 (*e.g.,* attainment modeling has already been completed with MOVES3) may continue to rely on this earlier version of MOVES" (88 FR 62567, 62569).

The resulting MVEBs are shown in Table 4-2: *2026 Attainment Demonstration MVEB for the HGB 2008 Ozone NAAQS Nonattainment Area (tons per day).*

Table 4-2: 2026 Attainment Demonstration MVEB for the HGB 2008 Ozone NAAQS Nonattainment Area (tons per day)

Description	NO_x (tpd)	VOC (tpd)
2026 On-Road MVEB based on MOVES3	47.91	28.05

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

4.8 MONITORING NETWORK

The ambient air quality monitoring network provides data to verify the attainment status for areas under the 2008 eight-hour ozone NAAQS. The TCEQ monitoring network in the HGB nonattainment area consists of 21 regulatory ambient air ozone monitors located in Brazoria, 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 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 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.

4.9 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 (RFP). EPA has interpreted recent court decisions to have invalidated key aspects of EPA's historical approach to implementing the contingency measure requirement. At the time this proposed AD SIP revision was being developed, EPA had historically accepted the use of surplus emissions reductions from previously implemented control measures to fulfill the contingency measure requirements. However, 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 EPA's interpretation of 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.

The contingency measures proposed in the concurrent 30 TAC Chapter 115 rulemaking (Rule Project No. 2023-116-115-AI) are conditional and prospective (not previously implemented), which follows EPA's interpretation of recent court decisions. These measures do not rely on the historical approach of using surplus emissions reductions to fulfill the contingency measure requirements. Since EPA had not issued final guidance to states regarding the amount of required reductions from contingency measures at the time this SIP revision was developed, this proposed AD SIP revision relies on the historically approved approach (3% of the RFP base year emissions) to determine the amount of emissions reductions necessary to address the contingency requirement. Under the historical approach, in the General Preamble for implementation of the FCAA published in the April 16, 1992 *Federal Register*, EPA interpreted the contingency requirement to mean additional emissions reductions that are sufficient to equal 3% of the emissions in the baseline year inventory (57 FR 13498).

The emission reduction targets associated with the proposed contingency measures were calculated using the HGB-area 2011 RFP base year inventory from the concurrent proposed DFW and HGB Severe Classification RFP SIP Revision for the 2008 Eight-Hour Ozone NAAQS (Project No. 2023-108-SIP-NR). The 3% contingency reduction requirement is based on a 0% reduction in NO_x and a 3% reduction in VOC. The proposed contingency measures would be triggered upon EPA publication of a notice in the *Federal Register* that the HGB area failed to attain the 2008 ozone NAAQS and TCEQ's subsequent publication in the *Texas Register* specifying what contingency measures are being implemented and establishing the implementation schedule, which is proposed to be by no later than nine months after *Texas Register* publication.

A summary of the contingency analysis is provided in Table 4-4: *HGB 2008 Ozone NAAQS Nonattainment Area Attainment Contingency Plan (tons per day)*. The analysis demonstrates that the contingency reductions meet the 3% emissions reduction requirement using conditional and prospective measures. Additional documentation for the attainment contingency demonstration calculations is available in the concurrently proposed DFW-HGB 2008 Ozone NAAQS Severe RFP SIP Revision (Project No. 2023-108-SIP-NR).

4.9.1 Area Source and Point Source Contingency Measure Controls

Six area and point source control measures are being proposed in a concurrent rulemaking for 30 TAC Chapter 115 (Rule project 2023-116-115-AI) that, if adopted, will fulfill SIP contingency requirements in the HGB 2008 ozone NAAQS nonattainment area. The proposed rulemaking covers the following source categories: degreasing, industrial maintenance coatings, industrial cleaning solvents, emulsified asphalt paving, traffic marking coatings, and industrial adhesives. Three of these measures target a mix of area and point sources: degreasing, industrial cleaning solvents, and industrial adhesives. The other three; industrial maintenance coatings, emulsified asphalt paving, and traffic marking coatings, are area sources. A summary of the VOC emissions reductions in tpd from each contingency measure is provided in Table 4-3: *Eight-County HGB 2008 Ozone NAAQS Nonattainment Area VOC Contingency Measure Reductions (tons per day)*.

4.9.1.1 Degreasers

This measure would reduce VOC emissions from solvent degreasers by adopting requirements which would establish a new limit for VOC content for the solvents used in these applications of 25 grams per liter (g/l). TCEQ estimates reductions from degreasing contingency measures to be 7.44 tpd for the HGB 2008 ozone NAAQS nonattainment area.

4.9.1.2 Industrial Maintenance Coatings

This measure would reduce VOC emissions from industrial maintenance coatings by adopting requirements which would establish a new limit for VOC content for the coating products used for these applications of 250 g/l of VOC. TCEQ estimates reductions from industrial maintenance coatings contingency measures to be 2.79 tpd for the HGB 2008 ozone nonattainment area.

4.9.1.3 Industrial Cleaning Solvents

This measure would reduce VOC emissions from cleaning solvents by adopting requirements which would establish a more stringent limit for VOC content for cleaning solvents used to clean general materials of 25 g/l of VOC. The existing VOC limit to clean all materials is 50 g/l. The current rule has exemptions for cleaning certain specialty materials, which are assumed to currently be cleaned with very high VOC content cleaners. The contingency measure would remove these exemptions and set limits proven to be feasible in other states and lower than the assumed current use. The measure would remove the existing exemption for stationary source solvent cleaning operations that emit less than 3 tpy of VOC. TCEQ estimates reductions from industrial cleaning solvents contingency measures to be 1.71 tpd for the HGB 2008 ozone nonattainment area.

4.9.1.4 Emulsified Asphalt Paving

This measure would reduce VOC emissions from emulsified asphalt operations by adopting requirements which would establish a more stringent limit for VOC content for emulsified asphalt of 0.5% VOC content by weight. TCEQ estimates reductions from emulsified asphalt contingency measures to be 1.36 tpd for the HGB 2008 ozone nonattainment area.

4.9.1.5 Traffic Marking Coatings

This measure would reduce VOC emissions from traffic marking coatings by adopting requirements which would establish a more stringent limit for VOC content for traffic marking coatings of 100 g/l of VOC. The currently effective HGB VOC limit is the same as the limit in the National Architectural and Industrial Coatings Rule, EPA final rule published September 11, 1998 (63 FR 48848), which is 150 g/l. TCEQ estimates reductions from traffic marking coatings contingency measures to be 0.88 tpd for the HGB 2008 ozone nonattainment area.

4.9.1.6 Industrial Adhesives

This measure would reduce VOC emissions from industrial adhesives by adopting requirements which would establish limits for VOC content of industrial adhesives by category that are overall more stringent. Current 30 TAC Chapter 115 VOC limits are based on EPA's 2008 Control Techniques Guidelines for Miscellaneous Industrial Adhesives (EPA 453/R-08-005 2008/09). The proposed limits, which are based on current rules in other states, would be more stringent for 28 categories of adhesives, less stringent for four, and the same for 14. TCEQ estimates reductions from industrial adhesives contingency measures to be 3.12 tpd for the HGB 2008 ozone nonattainment area.

Table 4-3: Eight-County HGB 2008 Ozone NAAQS Nonattainment Area VOC Contingency Measure Reductions (tons per day)

Proposed Control Measure	VOC Reductions (tpd)	Previous VOC Limits (Percent or g/l of Product)	Proposed VOC Limits (Percent or g/l of Product)	Proposed Location in Chapter 115
Degreasing	7.44	None	25 g/l	Subchapter E, Division 1
Industrial Maintenance Coatings	2.79	450 g/l	250 g/l	Subchapter E, Division 5
Industrial Cleaning Solvents	1.71	50 g/l	25 g/l general and higher specialty[1]	Subchapter E, Division 6
Emulsified Asphalt Paving	1.36	Use-specific percentages by weight	0.5% VOC by weight	Subchapter F, Division 1
Traffic Marking Coatings	0.88	150 g/l	100 g/l	Subchapter E, Division 5
Industrial Adhesives	3.12	Use-specific limits[2]	Use-specific limits[3]	Subchapter E, Division 7
Total Reductions	**17.30**	**N/A**	**N/A**	**N/A**

Note 1: Limits are based on the material being cleaned.
Note 2: Use-specific limits developed in accordance with Control Techniques Guidelines for Miscellaneous Industrial Adhesives (EPA 453/R-08-005 2008/09).
Note 3: Use-specific limits developed in accordance with rules in other states.

4.9.2 Contingency Measure Summary

The proposed contingency measure reductions are conditional and prospective (not previously implemented) and will reduce VOC emissions in the HGB 2008 ozone NAAQS nonattainment area if they are triggered. A summary of the contingency measure demonstration is located below in Table 4-4.

Table 4-4: HGB 2008 Ozone NAAQS Nonattainment Area Attainment Contingency Plan (tons per day)

Line	Contingency Plan Description	NO_x	VOC
Line 1	Eight-county 2011 controlled base year EI	471.62	549.59
Line 2	Percent for contingency calculation (total of 3%)	0.00	3.00
Line 3	Eight-county HGB required contingency reductions (Line 1 x Line 2 expressed as a percent)	0.00	16.49
	Control Reductions to Meet Contingency Requirements	**NO_x**	**VOC**
Line 4	Total eight-county HGB contingency reductions	0.00	17.30
Line 5	Contingency Excess (+) or Shortfall (-)	0.00	0.81
Line 6	Are the contingency reductions greater than or equal to the required contingency reductions?	Yes	Yes

4.10 ADDITIONAL FCAA REQUIREMENTS

FCAA, §182 sets out a graduated control program for ozone nonattainment areas. According to 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), and the EPA interprets this requirement to also apply to nonattainment area requirements for the 2008 eight-hour ozone NAAQS. 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 2008 ozone NAAQS nonattainment area for the severe classification, including I/M program requirements, nonattainment new source review (NSR) program requirements, and vehicle miles traveled (VMT) growth offset requirements, along with the clean fuel fleet program requirement for areas classified as serious and above. A SIP revision to address FCAA, §185 fee requirements is due to EPA by November 7, 2025 and is not addressed in this proposed SIP revision.

4.10.1 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 have been implemented in five of the eight counties in the HGB 2008 ozone NAAQS nonattainment area (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 Chapter 114, Subchapter C.

The HGB area meets the FCAA, §182(c)(3) requirements that an I/M program be in place in the HGB area that is consistent with a serious or higher ozone classification. On May 15, 2017, EPA approved the portions of the 2016 HGB 2008 Eight-Hour Ozone

Standard AD 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 2008 ozone NAAQS nonattainment area under the severe classification.

A demonstration addressing the EPA's requirement for I/M performance standard modeling for existing I/M programs is provided in Section 4.12: *I/M Program Performance Standard Modeling (PSM)*.

4.10.2 Vehicle Miles Traveled (VMT) Growth Demonstration

For areas designated as severe ozone nonattainment, a VMT growth demonstration is required. The VMT growth demonstration for the HGB 2008 severe ozone NAAQS nonattainment area is provided in the concurrent proposed DFW-HGB severe classification RFP SIP revision for the 2008 eight-hour ozone NAAQS (Project No. 2023-108-SIP-NR).

4.10.3 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 severe ozone nonattainment areas are those sources emitting at least 25 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 severe ozone nonattainment areas is 1.3:1.

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 Areas), the nonattainment NSR SIP requirements are met for Texas for the HGB 2008 ozone NAAQS nonattainment area under the severe classification.

4.10.4 Clean Fuel Fleet Program

The clean fuel fleet program is required by FCAA, §182(c)(4) for serious areas and above. FCAA, §182(c)(4)(B) allows states to opt-out with an adequate substitute program. Texas has a currently approved substitute program in 30 TAC Chapter 114, Subchapter K, Division 5. On January 31, 2014, EPA published direct final approval of revisions to the Texas motor vehicle rules in 30 TAC Chapter 114 that established the substitute program and affirmed that Texas' substitute program continues to meet clean fuel fleet program requirements (79 FR 5287).

4.10.5 FCAA, §185 Fee

With the severe classification, the HGB 2008 ozone NAAQS nonattainment area is subject to FCAA, §182(d)(3), which requires states to submit plans to include the requirements of FCAA, §185, Enforcement for Severe and Extreme Ozone Nonattainment Areas for Failure to Attain.

The FCAA, §185(a) requires each SIP to impose a penalty fee for major stationary sources of VOC located in the nonattainment area if the area fails to attain the ozone NAAQS by the applicable attainment date. The FCAA, §182(f) requires all SIP requirements that apply for VOC emissions to also apply for NO_x emissions, so the fee would apply to both ozone precursors. The fee is required to be imposed for each calendar year after the missed attainment date until EPA redesignates the area as attainment for the 2008 eight-hour ozone NAAQS. If the state does not impose and collect the fee, or if the state's fee provisions do not meet the FCAA requirements, then FCAA, §185(d) requires that EPA impose and collect the fee with interest. The fee and interest would not be returned to the state.

The EPA is requiring states submit a SIP revision to address these requirements to EPA by November 7, 2025 (87 FR 60926, 60931). This SIP revision does not address this requirement.

4.11 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 EPA, the new SIP emissions year will be 2019 for point source electric generating units with emissions recorded in 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, TCEQ sent notice to point sources through the agency's e-mail 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 revisions were incorporated into this SIP revision.

4.12 I/M PROGRAM PERFORMANCE STANDARD MODELING (PSM)

On October 7, 2022, 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. However, an I/M performance standard demonstration completed for any ozone NAAQS is applicable until a new version of EPA's on-road mobile emissions model is released, as long as the most stringent applicable performance standard is used in the initial assessment.

Texas established a vehicle emissions testing program on January 1, 1995, meeting 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 2008 and 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). Because the performance standard modeling results apply to all ozone NAAQS, 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 and are consistent with a serious or higher ozone designation. The assessment uses a 2023 analysis year, an analysis year under both the 2008 and 2015 ozone NAAQS, for the first MOVES3 PSM assessment completed for the HGB ozone nonattainment area. The PSM analysis was performed for each of the five counties within the HGB 2008 ozone NAAQS nonattainment area in which the HGB I/M program is required to operate. Chambers, Liberty, and Waller Counties are not included in the I/M program since the current I/M program in the HGB ozone nonattainment area sufficiently covers a population equal to the HGB urbanized area, as required by federal law. Summaries of the 2023 I/M enhanced PSM analysis are provided in:

- Table 4-5: *Summary of NO_X Enhanced Performance Standard Evaluation for the HGB Ozone Nonattainment Area Existing I/M Program using MOVES3*; and
- Table 4-6: *Summary of VOC Enhanced Performance Standard Evaluation for the HGB Ozone Nonattainment Area Existing I/M Program using MOVES3.*

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 4-5 and 4-6. The analysis demonstrates that the existing HGB area I/M program emissions rates do not exceed the performance standard benchmark emission rates for all five counties required to operate an I/M program within the HGB 2008 ozone NAAQS nonattainment area. Therefore, the HGB 2008 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 Ozone Nonattainment Area.*

Table 4-5: Summary of NO_x Enhanced Performance Standard Evaluation for the HGB Ozone Nonattainment Area Existing I/M Program using MOVES3

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 4-6: Summary of VOC Enhanced Performance Standard Evaluation for the HGB Ozone Nonattainment Area Existing I/M Program using MOVES3

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) 2008 ozone National Ambient Air Quality Standard (NAAQS) nonattainment area is making towards attainment of the 75 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 the EPA 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 2008 ozone NAAQS nonattainment area, in ozone chemistry, and in meteorological influences on ozone. More detail on ozone and emissions in the HGB 2008 ozone NAAQS nonattainment area is provided in Appendix B: *Conceptual Model for the Houston-Galveston-Brazoria Nonattainment Area for the 2008 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 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.

Eight counties in the HGB area were designated as nonattainment: Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller. The HGB 2008 ozone NAAQS nonattainment area is located on the coast of Texas and has exhibited a steadily increasing population, which was over 7.3 million in 2022 (Census Bureau 2022). The area has an extensive continuous air monitoring station (CAMS) network and as of 2022 has 21 regulatory ozone monitors, 21 nitrogen oxides (NO_X) monitors, and 16 automated gas chromatograph (auto-GC) for monitoring volatile organic compounds (VOC). Details for these monitors are listed in Table 5-1: *Monitor Information for the HGB 2008 Ozone NAAQS Nonattainment Area*. Only regulatory ozone monitors are displayed in the table. More detail on monitors, monitor locations, and other parameters measured per monitor can be found on the Texas Commission on Environmental Quality (TCEQ) Air Monitoring Sites webpage.[31] Monitors will be referenced by their monitor abbreviation for the rest of the section. Ozone data used for the analysis presented in this chapter are only from regulatory monitors that report to EPA's Air Quality System (AQS), which has been quality assured by EPA. All other pollutant data are from Texas Air Monitoring Information System (TAMIS) unless otherwise noted.

Table 5-1: Monitor Information for the HGB 2008 Ozone NAAQS Nonattainment Area

Monitor Name	Abbreviation	AQS No.	CAMS No.	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	0008, 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
Manchester East Avenue N	Manchester	482010307	1029	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

[31] https://www.tceq.texas.gov/airquality/monops/sites/air-mon-sites

Monitor Name	Abbreviation	AQS No.	CAMS No.	Compounds or Parameters Measured
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
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

This section examines ambient concentrations and precursor emissions trends from the extensive ozone and ozone-precursor monitoring network. 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 2008 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. For this analysis, TCEQ examined trends in ozone design value, fourth-highest eight-hour ozone concentrations, and background ozone to assess progress towards attainment.

5.2.1.1 Ozone Design Value Trends

A design value is the statistic used to determine compliance with the NAAQS (40 CFR §50.15(b); 40 CFR Part 50, Appendix P). For the 2008 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 76 ppb and greater exceed the 2008 eight-hour ozone NAAQS.

Figure 5-1: *Eight-Hour Ozone Design Values in the HGB 2008 Ozone NAAQS Nonattainment Area* shows that design values have decreased in the HGB 2008 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 any or all of the factors that drive ozone formation: 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.

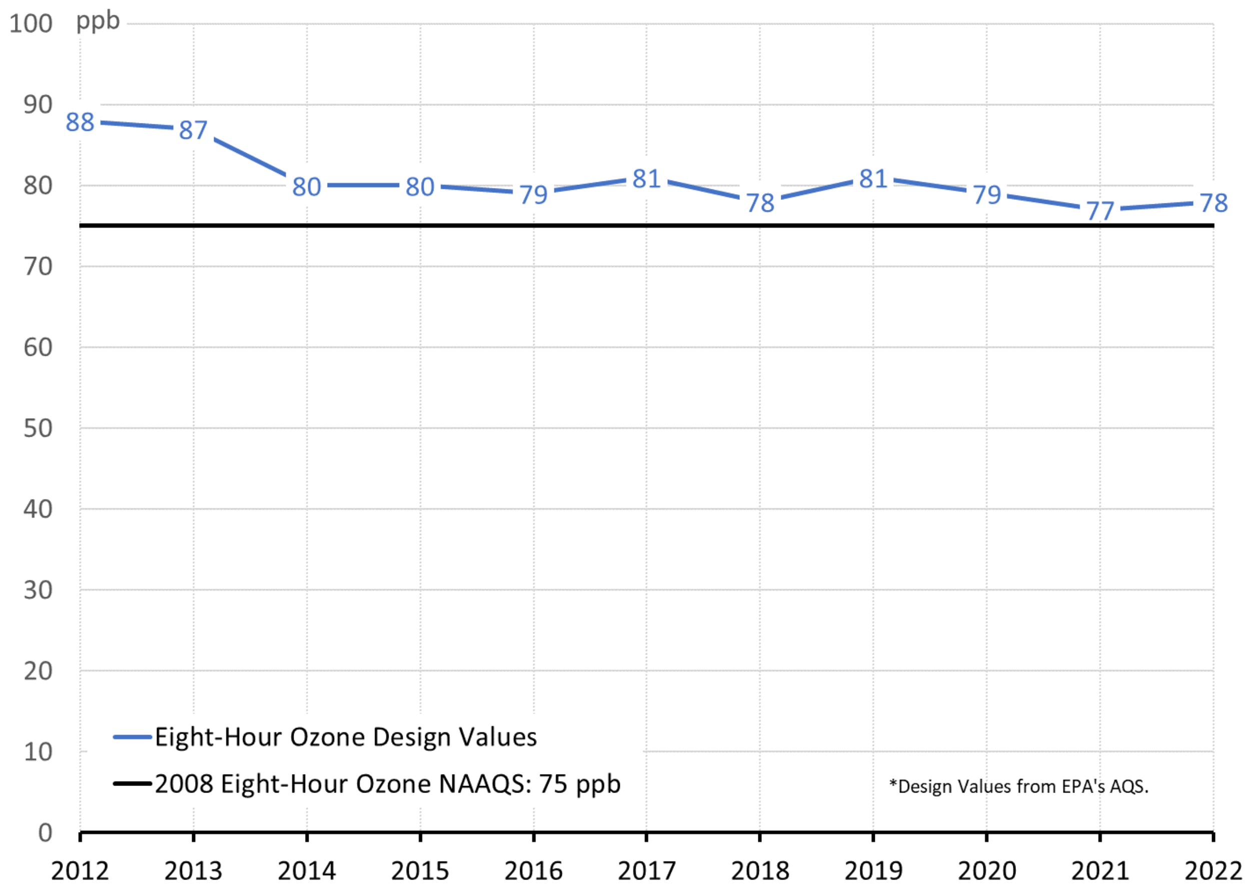

Figure 5-1: Eight-Hour Ozone Design Values in the HGB 2008 Ozone NAAQS Nonattainment Area

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 2008 Ozone NAAQS Nonattainment Area* displays the eight-hour design values from 2012 through 2022 at each regulatory monitor in the 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 2008 ozone NAAQS nonattainment area and not only at the monitor with the highest design value. As of 2022, only one monitor in the area, Bayland Park, measures above the 2008 eight-hour ozone NAAQS.

Figure 5-2 also shows how the monitor with the highest eight-hour ozone design value in the HGB 2008 ozone NAAQS nonattainment 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.

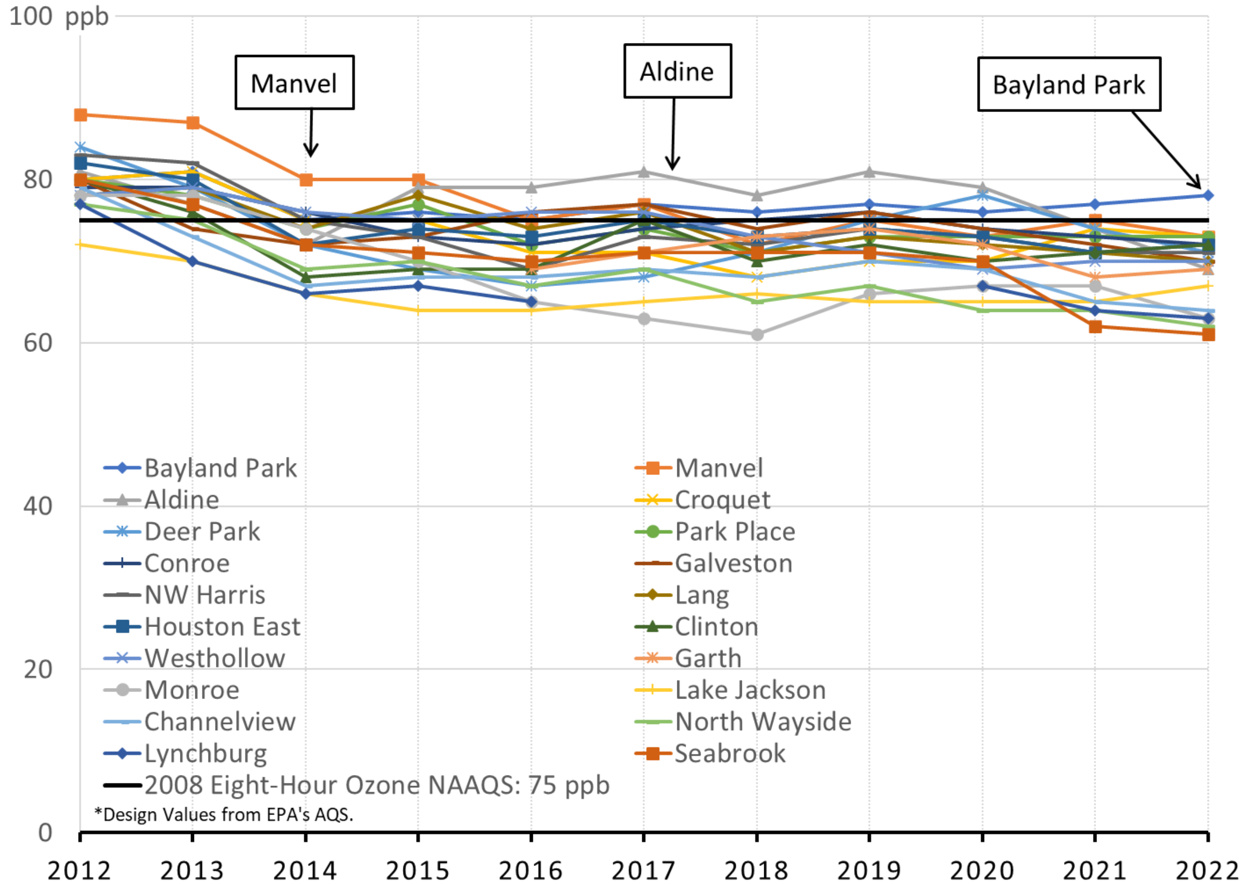

Figure 5-2: Eight-Hour Ozone Design Values by Monitor in HGB 2008 Ozone NAAQS Nonattainment Area

Displaying regulatory monitor level eight-hour ozone design values on a map can give better insight into ozone formation patterns. Kriging interpolation was used to determine the spatial variation of eight-hour ozone design values across the area for 2012, 2017, and 2022. The maps of those values for three different years are displayed in Figure 5-3: *Eight-Hour Ozone Design Value Maps for the HGB 2008 Ozone NAAQS Nonattainment Area.*[32] 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 2008 ozone NAAQS

[32] 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.

nonattainment area. In 2012, only one monitor was below the 2008 ozone NAAQS, but by 2022 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 2017 and 2022, with low design values at Monroe and Lynchburg in 2017 and at Seabrook in 2022. The spatial patterns from 2012, 2017, and 2022 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.

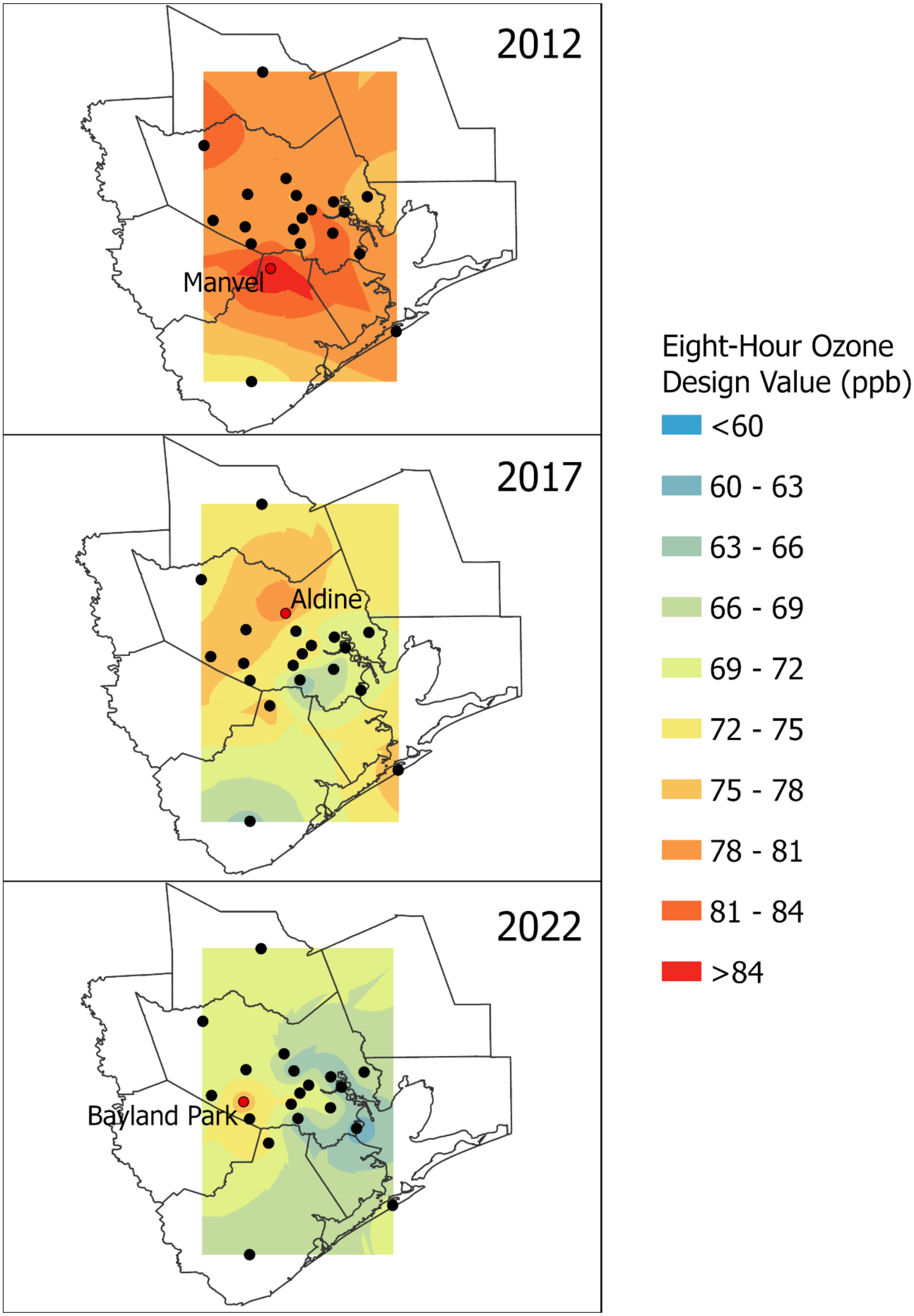

Figure 5-3: Eight-Hour Ozone Design Value Maps for the HGB 2008 Ozone NAAQS Nonattainment Area

5.2.1.2 Fourth-Highest Eight-Hour Ozone Trends

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.

Area-wide fourth-highest MDA8 ozone trends would not be instructive because design values are calculated on a per monitor basis. Instead, fourth-highest MDA8 ozone trends are investigated at each regulatory monitor. Figure 5-4: *Fourth-Highest MDA8 Ozone Concentration by Monitor in the HGB 2008 Ozone NAAQS Nonattainment 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. Most monitors showed an overall decrease in fourth-highest MDA8 ozone from 2010 through 2022, except for Bayland Park and Westhollow, which showed an increase. Most of those decreases occurred prior to 2014. 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 and Future Initiatives*.

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 to each other, meaning that different monitors may have had increasing or decreasing fourth-highest MDA8 ozone values from year to year. This indicates that there may be other local factors in addition to meteorological variability that are 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 2014 and 2015 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.

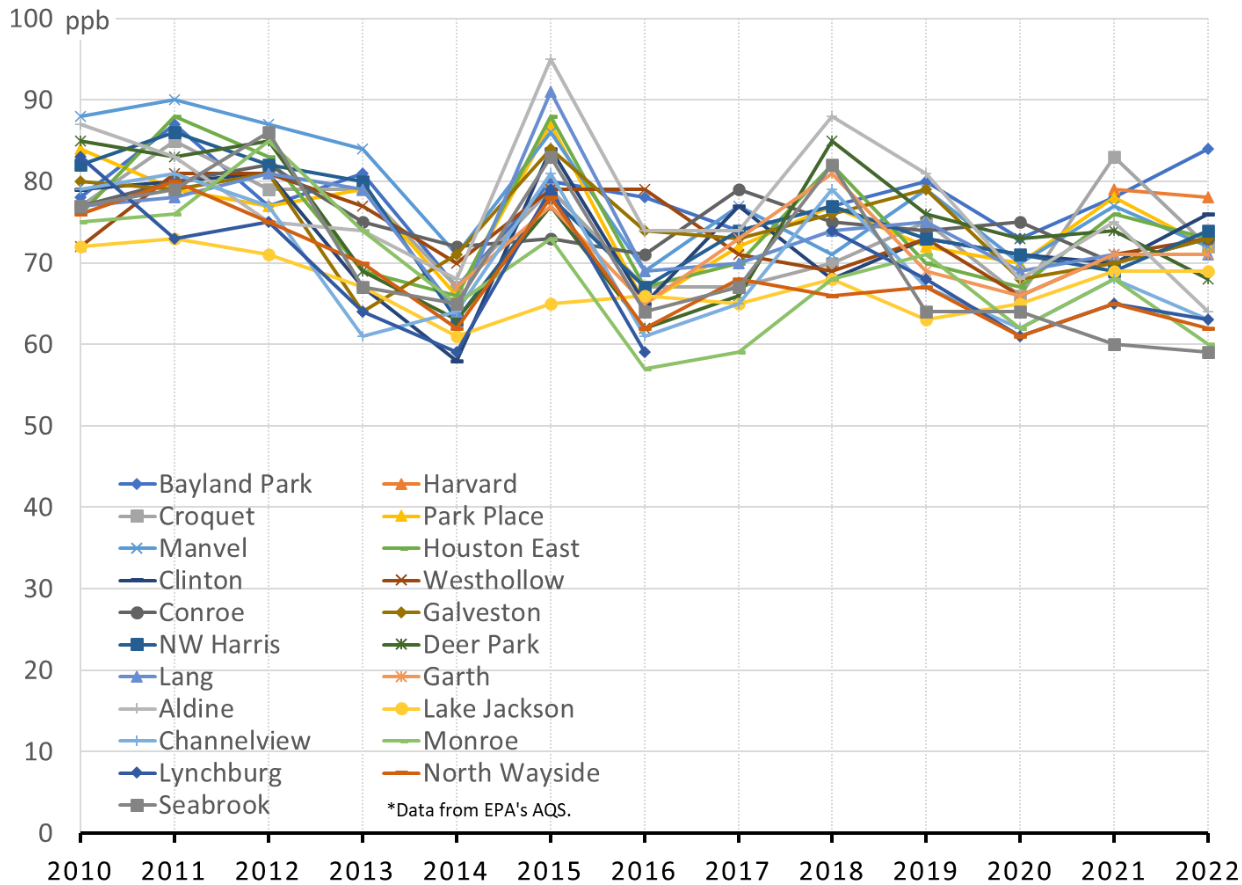

Figure 5-4: Fourth-Highest MDA8 Ozone Concentrations by Monitor in the HGB 2008 Ozone NAAQS Nonattainment Area

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 eight-county HGB 2008 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 is detailed in Appendix B. The technique uses the lowest MDA8 ozone value from selected sites, which are typically located on the outskirts of the nonattainment area, to determine the background ozone concentrations.

Locally produced ozone (within the HGB 2008 ozone NAAQS nonattainment 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 75 ppb. Low ozone days are any day with a MDA8 ozone value less than or equal to 75 ppb.

Although the HGB 2008 ozone NAAQS nonattainment area has a year-round ozone season, no high ozone days occurred outside of the months of March through October from 2012 through 2022. 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 2008 Ozone NAAQS Nonattainment Area* shows that the area-wide median background ozone is 27 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 have shown slight increases on low ozone days. On high ozone days, background ozone concentrations have decreased, and locally produced ozone concentrations have increased, resulting in a flat MDA8 ozone trend.

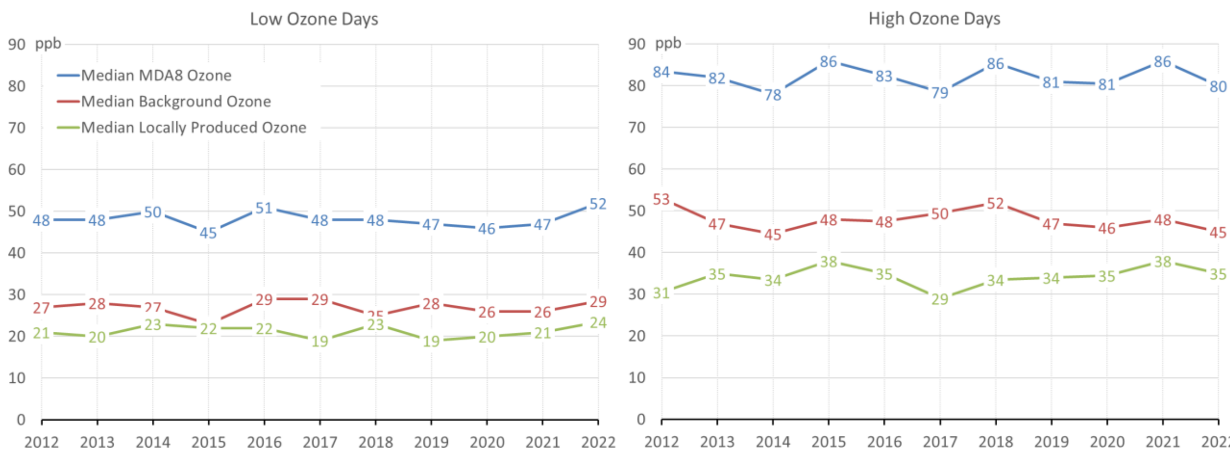

Figure 5-5: Ozone Season Trends in MDA8 Ozone, Background Ozone, and Locally Produced Ozone for High versus Low Ozone Days in the HGB 2008 Ozone NAAQS Nonattainment Area

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 2008 ozone NAAQS nonattainment area.

Because NO_x reacts in the presence of sunlight, NO_x concentrations tend to be lower in the summer and higher in the winter. To focus on NO_x values that lead to ozone formation, this analysis used only NO_X concentrations that occurred during the ozone season, from March through October.

There have been 25 NO_X monitors in operation in the HGB 2008 ozone NAAQS nonattainment area at some point from 2012 through 2022, however, only 19 were used to calculate area-wide NO_X trends due to incomplete data at the other monitors.

Only monitors that had eight or more valid years of data for the ozone seasons from 2012 through 2022 were used in this analysis. A year was considered valid if there were at least 75% valid days of NO_X data during the ozone season and a day was considered valid if there were at least 75% of valid hours of NO_X data recorded for that day. Out of the 25 NO_X monitors in operation from 2012 through 2022, only 19 were used to calculate area-wide NO_X trends. 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 2008 Ozone NAAQS Nonattainment Area*. Overall, from 2012 through 2022, 95th percentile NO_X showed an increase of 2% (numbers in Figure 5-6 are rounded) and median NO_X showed a decrease of 4%. 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 but NO_X concentrations increased in subsequent years. More detailed analysis of NO_X trends, including monitor level trends, is available in Appendix B.

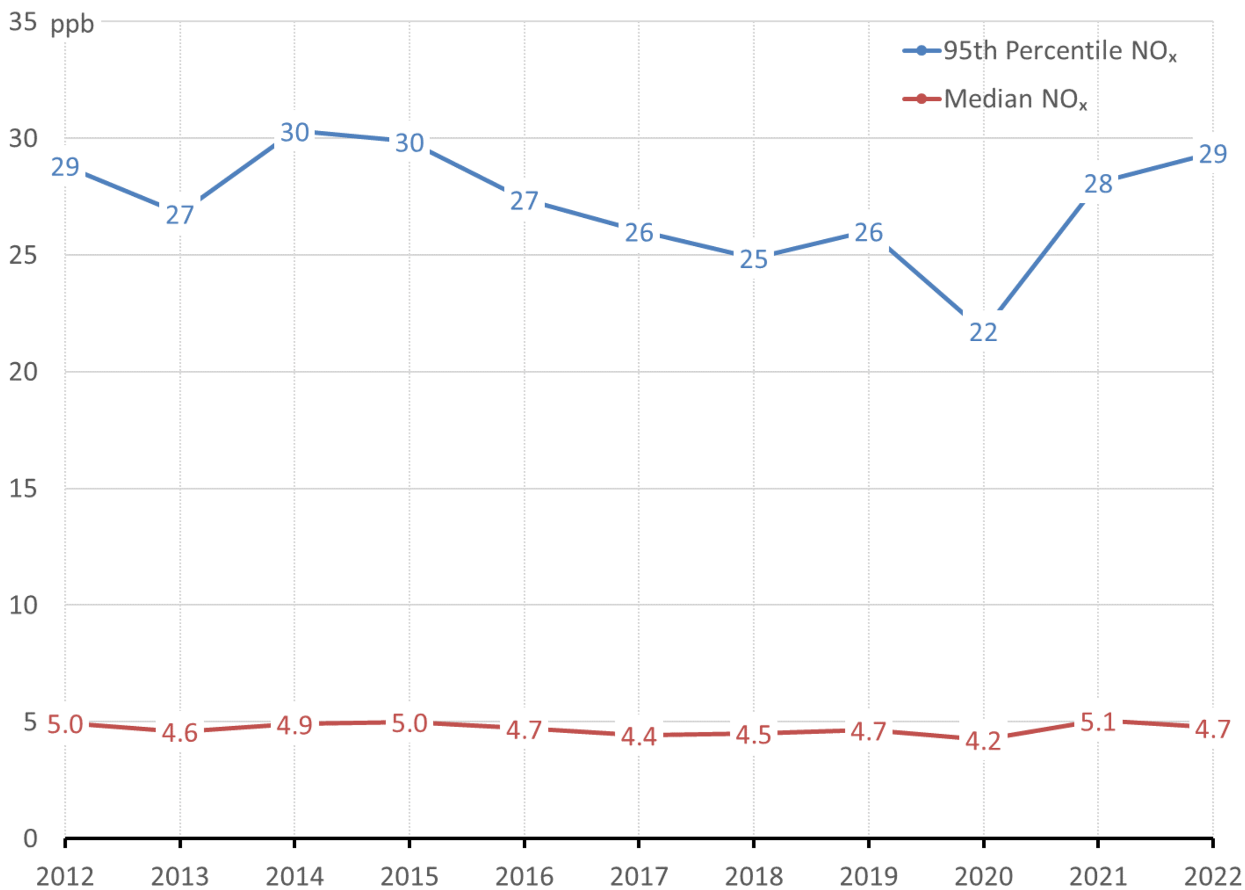

Figure 5-6: Ozone Season NO_x Trends in the HGB 2008 Ozone NAAQS Nonattainment Area

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 2008 ozone NAAQS nonattainment area. The TCEQ funded a study by the Texas A&M 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 2008 ozone NAAQS nonattainment area were estimated to decrease significantly from 1999 through 2022 and beyond, even as daily VMT is estimated to have increased. 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 vehicles.

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 2022 and beyond even as the number of non-road engines, based on equipment population, is expected to increase. 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's emissions inventory rule (30 TAC §101.10). The emissions trends analysis uses 10 years of data from 2012 through 2021. Emissions from 2022 were not available in time to be included in this analysis.

Emissions trends in tons per year (tpy) by site are displayed in Figure 5-7: *HGB 2008 Ozone NAAQS Nonattainment Area Point Source NO_X Emissions by Site*. Because the area has many point sources, only the top emitters are displayed on the chart. All other point source emissions were added together and displayed as in the Sum of All Others category in the chart. 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 2008 ozone NAAQS nonattainment area in 2021. Each of these sites reports total NO_X emissions exceeding 800 tpy 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.

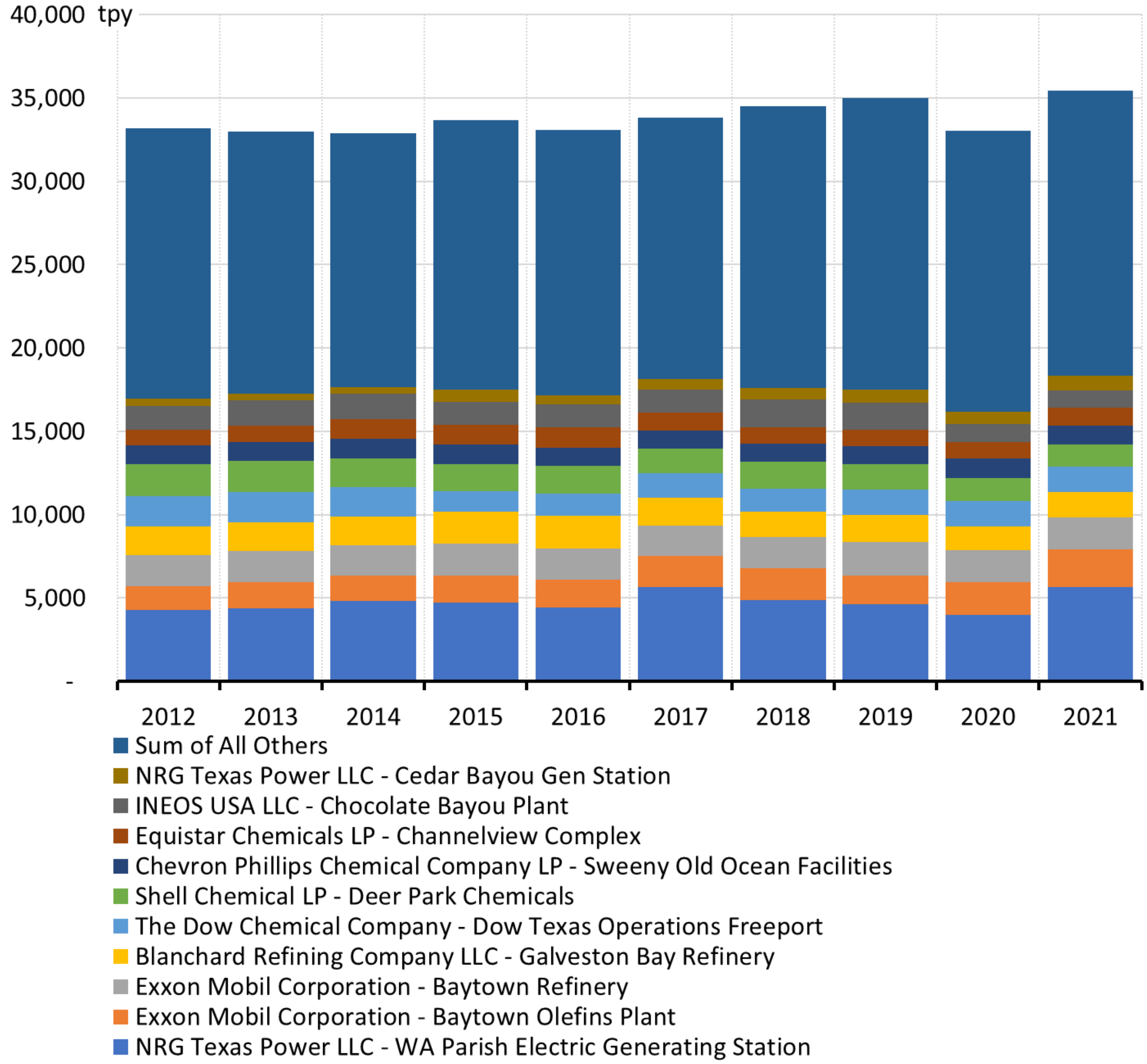

Figure 5-7: HGB 2008 Ozone NAAQS Nonattainment Area Point Source NO_x Emissions by Site

5.2.3 VOC Trends

Total non-methane organic compounds (TNMOC), which is a term 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 the HGB 2008 ozone NAAQS nonattainment area. 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 16 current auto-GC monitors, there was one auto-GC monitor, Danciger (CAMS 0618), that was in operation in 2012 but ceased operations prior to 2022; this monitor was included in the analysis for a total of 17 monitors. To remove effects of incomplete data on VOC trends, the data were first checked for validity. Only monitors that had eight or more valid years of data for the ozone season from 2012 through 2022 were used in this analysis. A year was considered valid if there were at least 75% valid days of data during the ozone season and a day was considered valid if there were at least 75% of valid hours of data recorded for that day. Out of the 16 auto-GC monitors in operation from 2012 through 2022, only 11 (including Danciger) 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, Manchester, 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 2008 Ozone NAAQS Nonattainment 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 (ppbV), more commonly referred to as ppb.

The 95th percentile TNMOC and HRVOC levels decreased from 2012 through 2022 by 15% and 12%, respectively. Median values show more variability between TNMOC and HRVOC, with a decrease of 12% in median TNMOC and an increase of 10% in median HRVOC. Most decreases occurred prior to 2017. Although most statistics showed overall decreases, there were large increases that occurred in 2021. The high values observed in 2021 appeared to have decreased in 2022. More detailed VOC and HRVOC trends, including monitor level trends, are available in Appendix B.

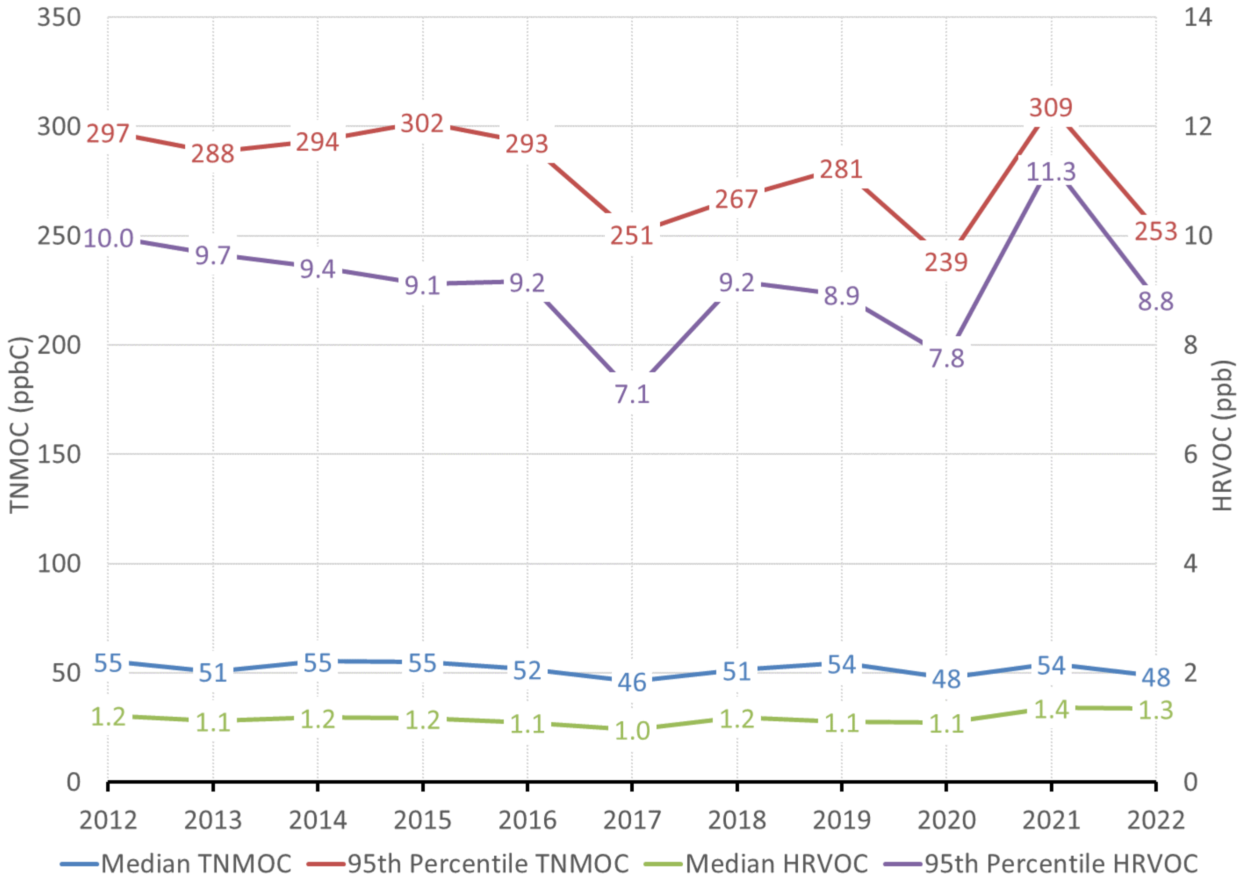

Figure 5-8: Ozone Season Median and 95th Percentile TNMOC and HRVOC Trends in the HGB 2008 Ozone NAAQS Nonattainment Area

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 2008 ozone NAAQS nonattainment 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 as well. 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 2008 Ozone Nonattainment Area Point Source VOC Emissions by Site* shows that the top 11 reporting sites accounted for 41% of the total HGB 2008 ozone nonattainment area point source VOC emissions in 2021. Each of these sites reported total VOC emissions exceeding 500 tpy in 2021. 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 corroborate ambient VOC trends, but overall trends in VOC emissions show more decline when compared to ambient TNMHC trends.

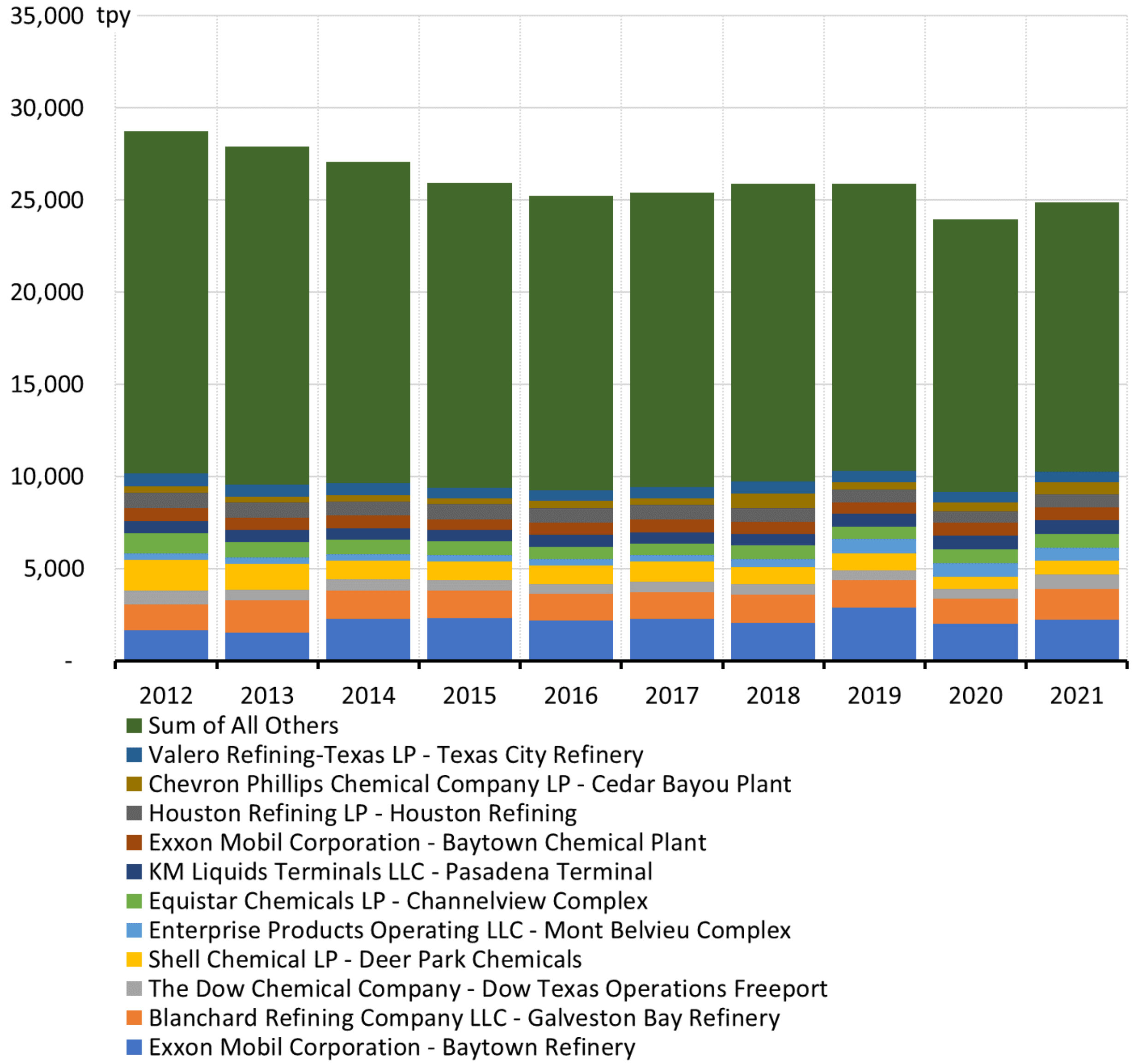

Figure 5-9: HGB 2008 Ozone Nonattainment Area Point Source VOC Emissions by Site

Figure 5-10: *HGB 2008 Ozone Nonattainment Area Point Source HRVOC Emissions by Site* shows that the top nine reporting sites accounted for 51% of the total HGB 2008 ozone NAAQS nonattainment area point source HRVOC emissions in 2021. Each of these sites reports total HRVOC emissions exceeding 100 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, which show little change from 2012 through 2021.

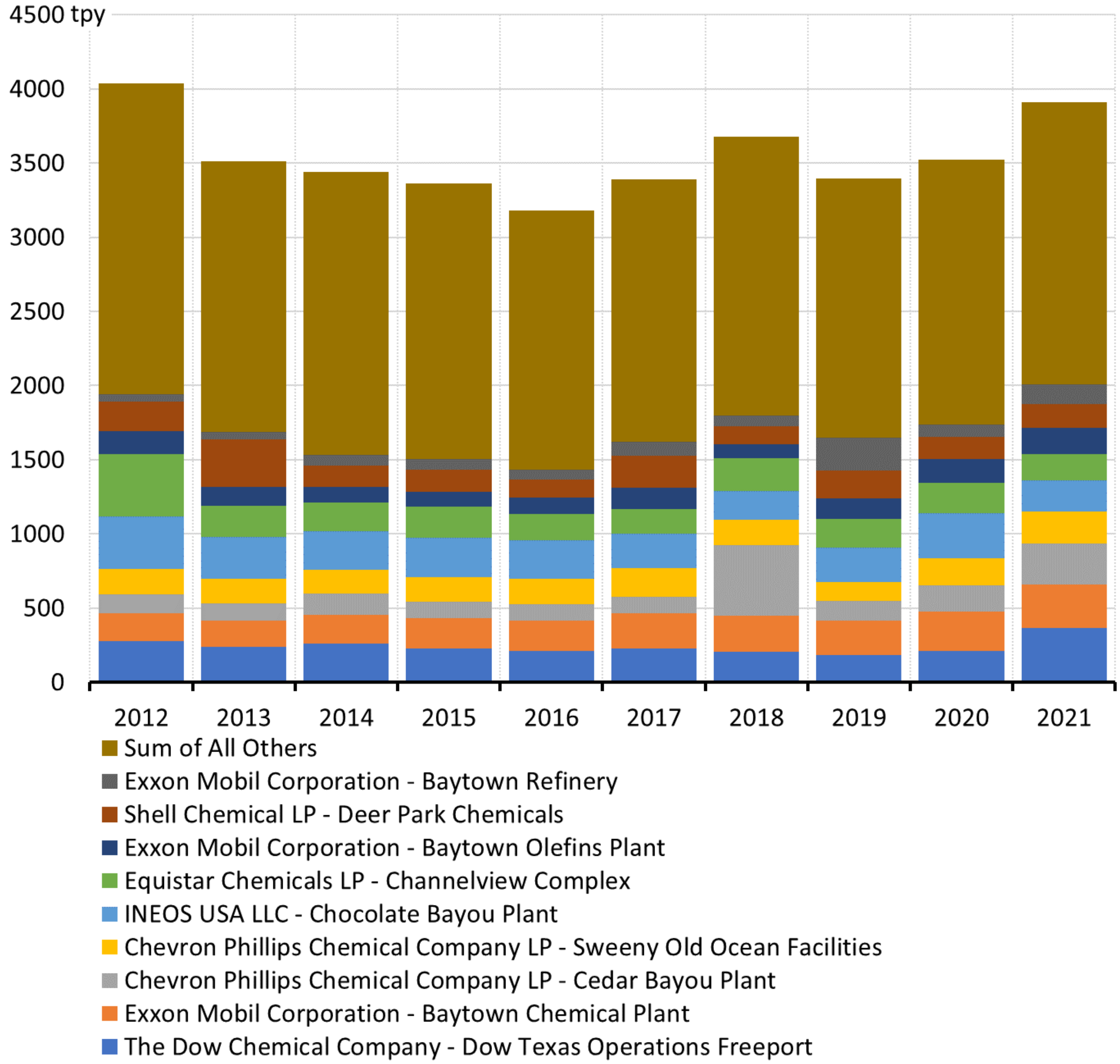

Figure 5-10: HGB 2008 Ozone Nonattainment Area Point Source HRVOC Emissions by Site

5.2.4 VOC and NO_x Limitation

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 or 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 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 2008 ozone NAAQS nonattainment area that have collocated VOC and NO_x data: Channelview, Clinton, Lynchburg, HRM 3 (Haden Road), 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 of these 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 2008 Ozone NAAQS Nonattainment Area*.

Most of these monitors show slight variations in VOC-to-NO_x ratios from year to year. Ratios at Channelview have remained in the transitional regime over the past eleven years but have trended from closer to NO_x limited in 2012 to closer to VOC limited in 2022. Lynchburg Ferry has one year that was VOC limited, 2017, which may be due to missing data and does not necessarily represent the true conditions at that monitor during that year.

HRM 3, Wallisville, and Deer Park, which are monitors near the Houston Ship Channel, show a transitional regime, so either NO_x or VOC reductions would reduce ozone concentrations. Clinton has stayed close to the threshold between VOC limited and transitional, but remained mostly in the transitional regime until 2022, when it measured in the VOC limited regime. 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 changed to NO_X limited in 2022. 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 areas measure closer to NO_X limited conditions. It appears that the atmospheric chemistry surrounding many monitors in the HGB 2008 ozone NAAQS nonattainment area has not changed from 2012 through 2022. Some combination of VOC and NO_X controls would possibly be effective in reducing ozone concentrations in the HGB 2008 ozone NAAQS nonattainment area. In transitional areas, VOC or NO_X controls may not result in equal ozone reductions, one precursor may reduce ozone more than the other.

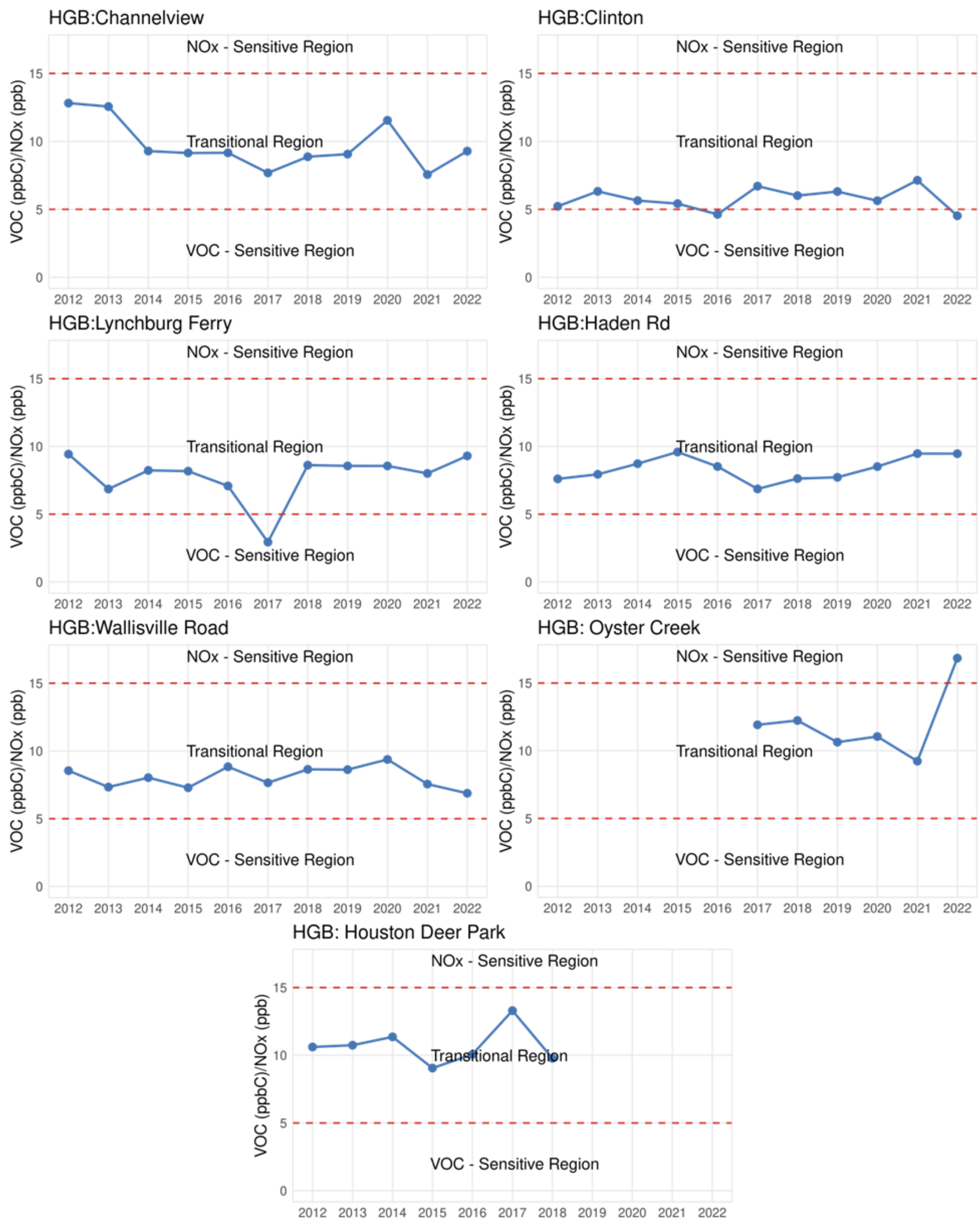

Figure 5-11: Median VOC-to-NO_x Ratios During the Ozone Season in the HGB 2008 Ozone NAAQS Nonattainment Area

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 2008 ozone NAAQS nonattainment area to assess the impact these reduced emissions would have on the 2019 ozone Base Case Design Value (DVB). 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 2008 Ozone NAAQS Nonattainment Area VOC and NO_x Sensitivity Analysis* shows a map with a red outline surrounding the HGB 2008 ozone NAAQS nonattainment area and parts of adjacent counties that comprises the modeling domain, with the various monitors used for this analysis represented as circles within the modeling domain. 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.

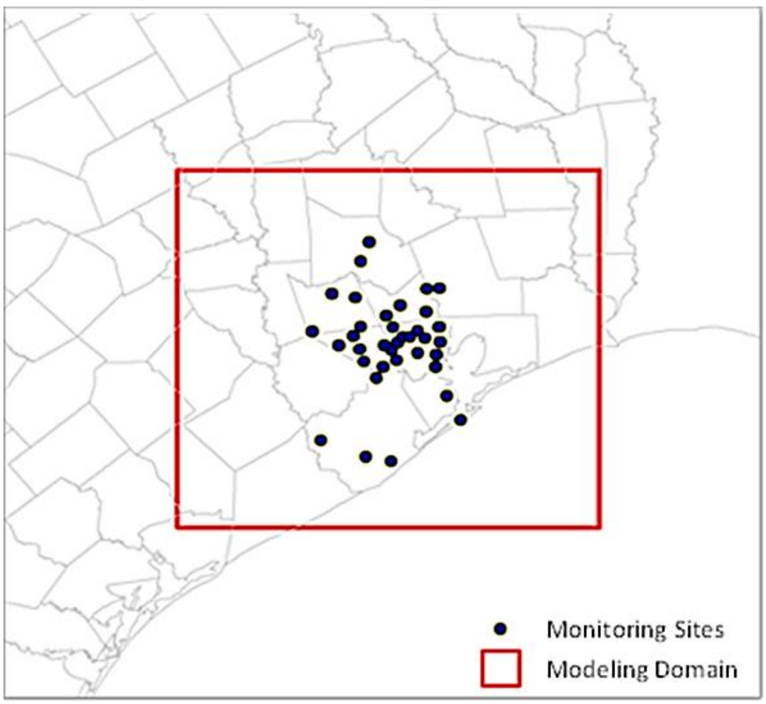

Figure 5-12: Modeling Domain and Monitors for HGB 2008 Ozone NAAQS Nonattainment Area VOC and NO_x Sensitivity Analysis

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—a 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 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 2008 ozone NAAQS nonattainment 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.

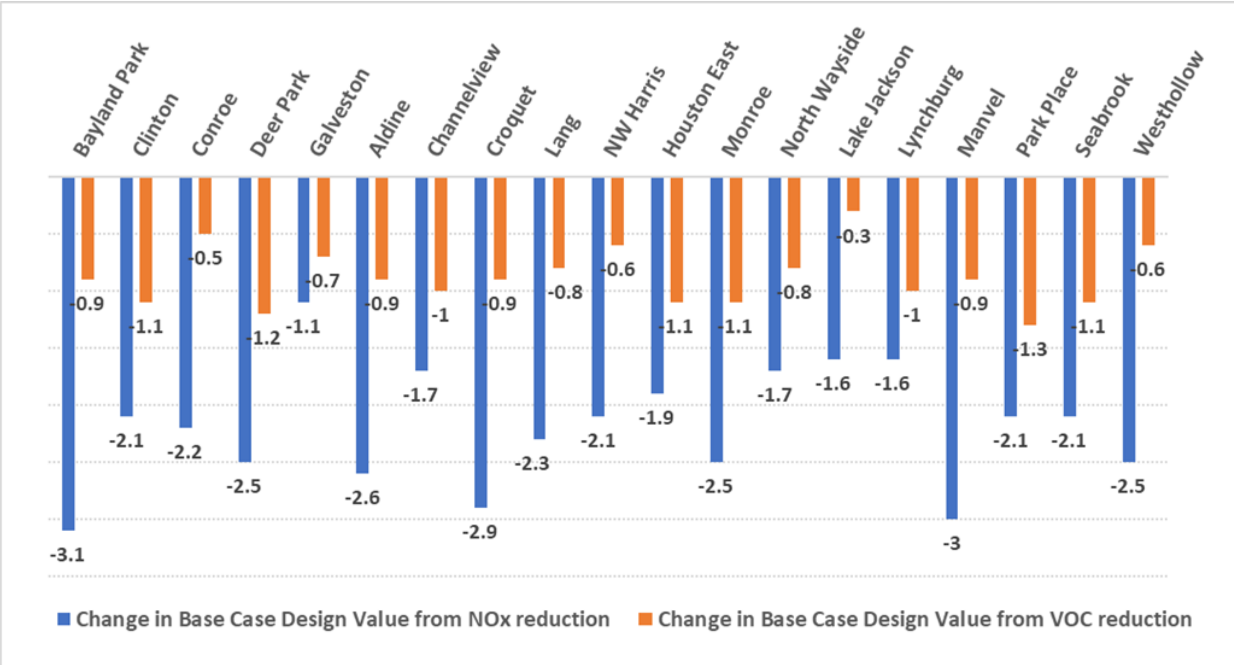

Figure 5-13: Modeled Impact of VOC and NO_x Reductions on 2019 Ozone DVB

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.

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 causes 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 facilitates 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 17 ozone monitors in the HGB 2008 ozone NAAQS nonattainment area from 2012 through 2022 (EPA, 2023). The four currently operating ozone monitors not included in this analysis were Galveston, Park Place, Harvard, and Garth. 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 2008 ozone NAAQS nonattainment 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 2008 Ozone NAAQS Nonattainment 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 2022 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 trends observed in both NO_X and VOC concentrations.

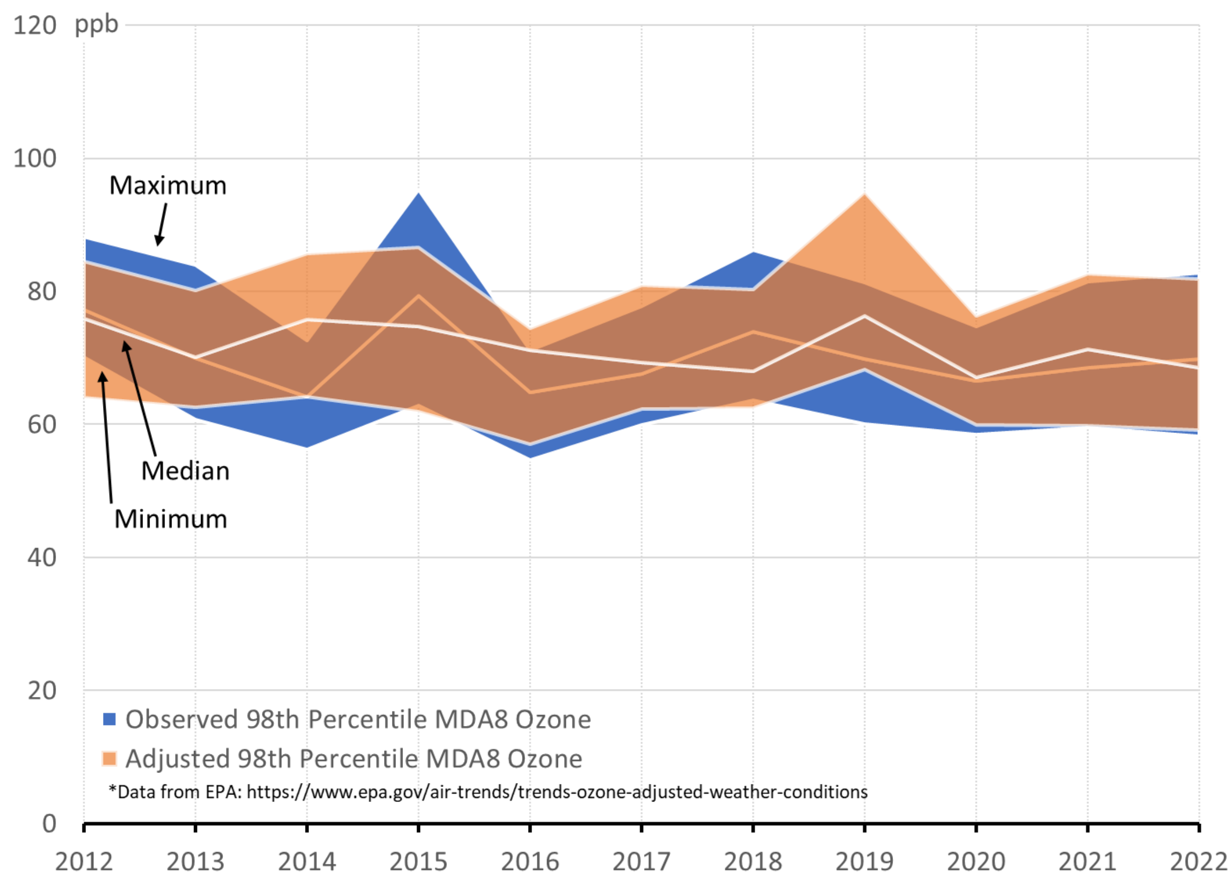

Figure 5-14: Meteorologically-Adjusted Ozone Trends for May through September in the HGB 2008 Ozone NAAQS Nonattainment Area

5.3 QUALITATIVE CORROBORATIVE ANALYSIS

Emission reduction measures that were not included in the photochemical modeling 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 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, TCEQ continues to promote two voluntary programs in cooperation with 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 reducing air emissions.

There are nearly 4,000 SmartWay partners in the 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 357 million barrels.[33] 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.[34] Approximately 247 Texas companies are SmartWay partners, with 48 of them in the HGB area.[35] 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.

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 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, EPA awarded the PHA with a DERA grant of $143,500 to replace diesel buses with clean diesel-powered vehicles.[36]

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[33] https://www.epa.gov/smartway/smartway-program-successes
[34] *Id.*
[35] https://www.epa.gov/smartway/smartway-partner-list
[36] https://www.epa.gov/ports-initiative/smartway-program-promoting-supply-chain-sustainability-ports

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.[37] 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, solar, and battery storage 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 wind generators in 2021 was 99.47 million megawatt-hours (MWh),[38] approximately 26.3% of the 378.2 million MWh total wind net electrical generation for the U.S.[39] In 2021, total net electrical generation from renewable wind generators in Texas was 11.9% more than in 2020.[40]

Texas non-residential solar electricity generation in 2021 totaled 17.2 million MWh, a 69.5% increase from 2020.[41] The 2021 total installed solar electricity generation capacity in Texas was 10,374 MW, a 73% increase from 2020.[42]

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.

The Texas A&M Engineering Experiment Station's Energy Systems Laboratory estimates energy savings and emissions reductions from EE/RE measures. House Bill 4885 from the 88th Texas Legislature, Regular Session increased funding up to $500,000 from $216,000 per fiscal year for the Energy Systems Laboratory to evaluate emission reductions from wind and other renewable energy sources, energy efficiency programs of the Public Utility Commission of Texas or the State Energy Conservation Office, and

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[37] https://blueskyways.org/
[38] https://www.eia.gov/electricity/annual/html/epa_04_07_b.html
[39] https://www.eia.gov/electricity/annual/xls/epa_03_01_b.xlsx
[40] *Id.*
[41] https://www.eia.gov/electricity/annual/xls/epa_03_21.xlsx
[42] https://www.eia.gov/electricity/annual/html/epa_04_07_b.html

the implementation of advanced building codes. 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). Reports submitted to TCEQ regarding EE/RE measures are available on the ESL website.

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 EPA's CSAPR Update Rule to address transport obligations under the 2008 eight-hour ozone standard and EPA's transport FIP for the 2015 eight-hour ozone standard.

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, 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, EPA proposed disapproval of the remaining portions of the 2015 Ozone NAAQS Transport SIP Revision (87 FR 9798), which EPA finalized on February 13, 2023 (88 FR 9336).

On June 5, 2023, EPA published a final FIP (the Good Neighbor Plan) 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 (88 FR 36654). As part of the final FIP to address interstate transport obligations for the 2015 ozone NAAQS, EPA is including Texas and 21 other states in a revised and strengthened CSAPR NO_X Ozone Season Group 3 Trading Program for EGUs beginning in the 2023 ozone season. 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.

Multiple parties have challenged the final FIP in multiple federal courts, including Texas, resulting in multiple orders by courts to stay the effectiveness of the FIP in several jurisdictions. As a result of those court orders, on July 31, 2023, the EPA published an interim final rule to stay the implementation of the Good Neighbor Plan for certain states, including Texas (88 FR 49295).

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 July 2023, TCEQ awarded $1,314,330,754 in DERI grants for projects projected to help reduce a projected 190,070 tons of NO_X in the period over which emissions reductions are reported for each project under the program. This includes $518,892,845 going to activities in the HGB area, with a projected 82,250 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 (DTIP), the Texas Clean Fleet Program (TCFP), and the Texas Natural Gas Vehicle Grant Program (TNGVGP). The DTIP 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 July 2023, the program awarded $37,137,756, with a projected 1,643 tons of NO_X reduced in the period over which emissions reductions are reported for each project under the program. In the HGB area $34,601,005 was awarded to projects with a projected 1,534 tons of NO_X reduced in the period over which emissions reductions are reported for each project under the program.

The 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 July 2023, $81,617,123 in TCFP grants were awarded for projects to help reduce a projected 750 tons of NO_X in the period over which emissions reductions are reported for each project under the program. In the HGB area, $24,328,637 in TCFP grants were awarded with a projected 202 tons of NO_X reduced in the period over which emissions reductions are reported for each project under the program.

The 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 July 2023, $59,636,804 in TNGVGP grants were awarded for projects to help reduce a projected 1,723 tons of NO_X in the period over which emissions reductions are reported for each project under the program. In the HGB area, $15,070,383 in TNGVGP grants were awarded to projects with a projected 369 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

House Bill 3469, 79th Texas Legislature, 2005, Regular Session, established the Clean School Bus Program, which provides monetary incentives to 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 July 2023, the TCEQ Clean School Bus Program has awarded $76,900,769 in grants for retrofit and replacement activities across the state, resulting in a projected 302 tons of NO_X reduced in the period over which emissions reductions are reported for each project under the program. This amount includes $4,694,101 in federal funds. Of the total amount, $13,480,770 has been awarded for school bus retrofit and replacement activities in the HGB area, resulting in a projected 17 tons of NO_X reduced in the period over which emissions reductions are reported for each project under the program.

5.3.1.6 88th Texas Legislature

The bills passed during the 88th Texas Legislature, 2023, Regular and Special Sessions, that have the potential to impact air quality in the HGB area include HB 4885 and Rider 7 in the General Appropriations Act for TCEQ. For legislative updates regarding EE/RE measures and programs, see Section 5.3.1.2: Energy Efficiency and Renewable Energy Measures.

HB 4885, Relating to programs established and funded under the Texas emissions reduction plan.

HB 4885 changes the Texas Emissions Reduction Plan (TERP) programs to establish the Texas hydrogen infrastructure, vehicle, and equipment (THIVE) grant program and add downstream "refining" oil and gas activities to projects eligible for the New Technology Implementation Grant Program (NTIG). These programs are expected to accelerate the replacement of older, more polluting equipment with newer and cleaner equipment. New grant application periods for these programs are expected in Fiscal Year 2024 with public webinars to explain program requirements.

General Appropriations Act for the TCEQ, Rider 7 - Air Quality Planning

Rider 7 of the General Appropriations Act for TCEQ appropriated $2,500,000 for air quality planning activities to reduce fine particulate matter ($PM_{2.5}$) in affected counties not designated nonattainment for $PM_{2.5}$ NAAQS as of September 1, 2023, which includes the HGB area. Grants will be issued to local governments for inventorying emissions, monitoring of pollution levels, air pollution and data analysis; modeling pollution levels; and administration of the program. Because NO_X and VOC are precursors for both ozone and $PM_{2.5}$, these efforts may also help reduce ozone concentrations in the HGB area.

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 being implemented in the HGB 2008 ozone NAAQS nonattainment area and are expected to still be active in 2026. 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 2008 ozone NAAQS nonattainment area to evaluate the area's future air quality. Historical trends in ozone and ozone precursor concentrations and their causes have been investigated extensively and result in the following conclusions.

The eight-hour ozone design values decreased from 2012 through 2022. The preliminary 2022 eight-hour design value for the HGB 2008 ozone NAAQS nonattainment 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 area 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 2008 ozone NAAQS nonattainment area, and locally produced ozone accounts for approximately 40% of ozone in the area. On high ozone days, background ozone concentrations have decreased, and locally produced ozone concentrations have increased, resulting in a flat MDA8 ozone trend. Ambient concentrations and point source emissions of ozone precursors have variable trends, with increases observed for NO_X, but decreases observed for VOC and HRVOC. Meteorologically adjusted ozone trends are mostly flat from 2012 through 2022.

Trends in VOC-to-NO_X ratios show that 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 2008 ozone NAAQS nonattainment area; however, controls on either VOC or NO_X may not result in equal reductions in ozone, one precursor may reduce ozone at greater rates than the other. Modeling shows that, although some 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 TCEQ's modeling and available data, the HGB 2008 ozone NAAQS nonattainment area is expected to attain the 2008 ozone NAAQS by the July 20, 2027 attainment date.

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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) 2008 eight-hour ozone NAAQS severe nonattainment area (HGB 2008 ozone NAAQS nonattainment area) and continues to work toward this goal. Texas continues to invest resources in air quality scientific research related to better understanding atmospheric chemical processes, the advancement of pollution control technology, refining quantification of emissions, and improving the science for ozone modeling. Additionally, 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 in Texas and the HGB 2008 ozone NAAQS 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 are available at 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 State Implementation Plan (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 TCEQ's Air Quality Research and Contract Projects webpage (https://www.tceq.texas.gov/airquality/airmod/project/pj.html).

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

The $(BC)^2$ monitoring project was created to identify the influence of wildfires and dust events on urban air quality in Texas. The study started in 2019 as a pilot study in El Paso, sampling aerosol properties as indicators of biomass burning and dust impacts. The study expanded in 2020, adding three sites in the HGB area. After continued measurements in 2021 and 2022, the study is being enhanced with two sites in the Dallas-Fort Worth (DFW) area. The $(BC)^2$ project has identified periods when biomass burning events are most likely in eastern Texas and has improved the understanding of dust effects in El Paso. The $(BC)^2$ data contribute 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 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 2008 ozone NAAQS nonattainment 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 improvement 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 AQRP program began in 2010 and has supported research in Houston, Dallas-Fort Worth, San Antonio, and El Paso. Details about the AQRP and past research can be found at the University of Texas at Austin's AQRP website (https://aqrp.ceer.utexas.edu).

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. Six projects that could have findings relevant to the HGB 2008 ozone NAAQS nonattainment area are listed below.

Statewide Projects:

- 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).

6.2.3 Wildfire and Smoke Impact

The TCEQ reviewed ambient air monitoring data from monitors in the HGB 2008 ozone NAAQS nonattainment area and 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 issued preliminary flags for the ozone data for these two monitoring sites on the days indicated. The TCEQ developed an exceptional event demonstration for these dates, 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, which will be submitted to EPA for consideration. Information concerning this and other ozone exceptional events demonstrations developed by the TCEQ is available on the TCEQ's Ozone Data Exceptional Event Flag Demonstrations webpage (https://www.tceq.texas.gov/airquality/airmod/docs/ozone-data-exceptional-event-flag-demonstrations).

Appendices Available Upon Request

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