AGENDA ITEM REQUEST
for State Implementation Plan Revision Adoption

AGENDA REQUESTED: July 1, 2020
DATE OF REQUEST: June 12, 2020

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


The SIP revision includes a technical analysis and weight-of-evidence analysis to demonstrate that the Bexar County marginal ozone nonattainment area would attain the 2015 eight-hour ozone NAAQS by its attainment date “but for” anthropogenic emissions emanating from outside the United States, in accordance with FCAA, §179B. (Brian Foster, Terry Salem) (Non-Rule Project No. 2019-106-SIP-NR)

Tonya Baer
Deputy Director

Donna F. Huff
Division Director

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Agenda Coordinator

Copy to CCC Secretary? NO X YES
Texas Commission on Environmental Quality  
Interoffice Memorandum

To: Commissioners  
Date: June 12, 2020

Thru: Bridget C. Bohac, Chief Clerk  
       Toby Baker, Executive Director

From: Tonya Baer, Deputy Director  
       Office of Air

Docket No.: 2019-0905-SIP

Subject: Commission Approval of the Federal Clean Air Act (FCAA) Section 179B Demonstration State Implementation Plan (SIP) Revision for the Bexar County 2015 Eight-Hour Ozone National Ambient Air Quality Standard (NAAQS) Nonattainment Area

Bexar County 2015 Eight-Hour Ozone Nonattainment Area FCAA, §179B Demonstration SIP Revision  
Non-Rule Project No. 2019-106-SIP-NR

Background and reason(s) for the SIP revision:

On October 1, 2015, the United States Environmental Protection Agency (EPA) revised the primary and secondary NAAQS for ozone to an eight-hour standard of 0.070 parts per million. Effective September 24, 2018, the EPA designated Bexar County as marginal nonattainment for the 2015 eight-hour ozone NAAQS with a September 24, 2021 attainment deadline (83 FR 35136). Attainment of the ozone NAAQS is determined using three full years of monitoring data, and attainment of the 2015 eight-hour ozone standard for marginal nonattainment areas will be determined using monitoring data from 2018, 2019 and 2020.¹

Because attainment of the NAAQS in some areas may be influenced by emissions sources located outside of the United States (U.S.), states have the authority under FCAA, §179B to seek regulatory relief by submitting to the EPA an analysis of the influence of international emissions in areas designated as nonattainment. Under FCAA, §179B, the EPA can approve attainment plans for areas that demonstrate attainment of the relevant NAAQS by the statutory attainment date “but for” emissions emanating from outside the U.S. For ozone nonattainment areas, if the EPA approved such a demonstration, the area would not be subject to certain nonattainment area requirements, including the mandatory reclassification provisions for areas that fail to attain an ozone NAAQS by the applicable attainment date.² EPA approval of this FCAA, §179B demonstration for the Bexar County 2015 eight-hour ozone nonattainment area could prevent the area from

¹ Because the attainment year ozone season is the ozone season immediately preceding a nonattainment area’s attainment deadline, the attainment year for marginal nonattainment areas under the 2015 eight-hour ozone NAAQS is 2020, meaning the areas are required to attain the standard by the end of 2020.
being reclassified to moderate nonattainment should the area fail to monitor attainment of the NAAQS by the end of 2020. Marginal ozone nonattainment area requirements would continue to apply until the area is formally redesignated to attainment.

In order to determine the influence of international emissions on the Bexar County 2015 eight-hour ozone nonattainment area, the Texas Commission on Environmental Quality (TCEQ) conducted a technical analysis that considered the area’s modeled 2020 future year design value (DVf), the estimated international anthropogenic contribution to the 2020 DVf, the relative contribution of local versus boundary conditions to the 2020 DVf, and the area’s current monitored design value. The results of the technical analysis show that “but for” international anthropogenic contributions, the Bexar County ozone nonattainment area would attain the 2015 eight-hour ozone NAAQS by the 2020 attainment year. The SIP revision submits this analysis to the EPA as a demonstration under FCAA, §179B for the Bexar County 2015 eight-hour ozone nonattainment area.

Scope of the SIP revision:

A.) Summary of what the SIP revision will do:
The SIP revision demonstrates that the Bexar County marginal ozone nonattainment area would attain the 2015 eight-hour ozone NAAQS by its attainment deadline “but for” anthropogenic emissions emanating from outside the U.S.

B.) Scope required by federal regulations or state statutes:
An FCAA, §179B demonstration SIP revision is not required by federal regulations or state statutes. Additionally, the FCAA does not require states to submit attainment plans to the EPA to demonstrate that marginal ozone nonattainment areas will attain the NAAQS by the attainment deadline for marginal areas. However, an FCAA, §179B demonstration submittal is an option available to states with ozone nonattainment areas.

FCAA, §179B(a) provides that the EPA shall approve an attainment plan for an area if:

(i) The attainment plan meets all other applicable requirements of the FCAA; and
(ii) The submitting state can satisfactorily demonstrate that, “but for emissions emanating from outside the United States,” the area would attain and maintain the relevant NAAQS.

Draft guidance related to the development of FCAA, §179B demonstrations was issued by the EPA on January 9, 2020, after the proposed Bexar County §179B SIP revision was already developed. It is not known when the draft guidance will be finalized.

C.) Additional staff recommendations that are not required by federal rule or state statute:
An FCAA, §179B demonstration SIP revision is not a required FCAA submittal and does not have a statutory deadline. However, staff recommends submitting this SIP revision in advance of the attainment deadline for the Bexar County 2015 eight-hour ozone nonattainment area to provide adequate time for EPA consideration and approval prior to any action to possibly reclassify the area to moderate.
Re: Docket No. 2019-0905-SIP

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.

Effect on the:

A.) Regulated community:
The SIP revision does not require rulemaking and no immediate effect on the regulated community is anticipated.

B.) Public:
This SIP revision has no new effect on the public.

C.) Agency programs:
This SIP revision has no new effect on agency programs.

Stakeholder meetings:
The TCEQ hosted a meeting on September 26, 2019 in San Antonio. Agenda topics included an air quality planning update, an introduction to photochemical modeling, and the results of the TCEQ's international transport analysis. Attendees included representatives from industry, county and city government, military, environmental groups, and the public.

Public comment:

During the comment period, staff received comments from the Alamo Area Council of Governments (AACOG), the Alamo Area Metropolitan Planning Organization (AAMPO), City of San Antonio District 10 Councilman Clayton Perry (Councilman Perry), Kendall County Judge Darrel Lux (Judge Lux), Habitat for Humanity of San Antonio, Bexar County Commissioner Kevin Wolff (Commissioner Wolff), Atascosa County Judge Robert Hurley (Judge Hurley), the San Antonio Area Group of the Lone Star Chapter of the Sierra Club (SAAG Sierra Club), the San Antonio Chamber of Commerce, the San Antonio Hispanic Chamber of Commerce, the San Antonio Mobility Coalition (SAMCo), Sierra Club and Environmental Defense Fund (EDF), and the EPA. AACOG, AAMPO, Councilman Perry, Judge Lux, Habitat for Humanity of San Antonio, Commissioner Wolff, Judge Hurley, the San Antonio Chamber of Commerce, the San Antonio Hispanic Chamber of Commerce, and SAMCo expressed support for the proposed SIP revision. SAAG Sierra Club, Sierra Club, EDF, and the EPA expressed opposition to the proposed SIP revision. Adverse comments primarily concerned the requirements of and regulatory relief provided by
FCAA, §179B, the validity and timing of the SIP revision, and the need for additional technical analyses, including a “retrospective" analysis of 2018 through 2020 monitoring data. A summary of the comments and the TCEQ's responses is provided as part of the SIP revision in the Response to Comments.

**Significant changes from proposal:**
None.

**Potential controversial concerns and legislative interest:**
On January 9, 2020 the EPA issued draft guidance on the development of FCAA, §179B demonstrations, just six days before the Bexar County FCAA, §179B SIP revision proposal was presented to the commission for approval to publish notice and solicit public comment. The TCEQ disagrees with the draft guidance and the EPA's interpretation of the statute that the regulatory relief provided under FCAA, §179B requires distinct submittals under FCAA, §179B(a) and §179B(b) and that only approval of a "retrospective" demonstration under FCAA, §179B(b) can prevent reclassification. Further, the EPA's new draft interpretation is not consistent with past actions by the EPA for the El Paso PM$_{10}$ nonattainment area in Texas.

On August 28, 2018, Governor Greg Abbott and Attorney General Ken Paxton filed a petition for the U.S. Court of Appeals for the Fifth Circuit to review the EPA's final action designating Bexar County as nonattainment for the 2015 eight-hour ozone NAAQS. Oral arguments on that petition were heard on October 9, 2019.

**Does 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 this SIP revision?**
The TCEQ could choose not to submit this SIP revision as it is not a required FCAA submittal. The TCEQ could also choose to develop and submit a “retrospective” §179B demonstration after 2020 monitoring data is complete, as outlined in the EPA's draft §179B guidance, in lieu of this SIP revision. However, development of a "retrospective" demonstration for Bexar County, based on the EPA's recommendations and draft guidance, would take approximately 15 months to complete. To submit the demonstration within the EPA's timeframe, the TCEQ would have to begin working on a "retrospective" demonstration before attainment year monitoring data are complete.

**Key points in the adoption SIP revision schedule:**
   **Anticipated adoption date:** July 1, 2020

**Agency contacts:**
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Jamie Zech, Agenda Coordinator, (512) 239-3935
June 12, 2020

Re: Docket No. 2019-0905-SIP

cc: Chief Clerk, 2 copies
    Executive Director's Office
    Jim Rizk
    Morgan Johnson
    Brody Burks
    Office of General Counsel
    Brian Foster
    Jamie Zech
    Terry Salem
REVISIONS TO THE STATE OF TEXAS AIR QUALITY IMPLEMENTATION PLAN FOR THE CONTROL OF OZONE AIR POLLUTION

BEXAR COUNTY 2015 EIGHT-HOUR OZONE STANDARD NONATTAINMENT AREA

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

FEDERAL CLEAN AIR ACT SECTION 179B DEMONSTRATION STATE IMPLEMENTATION PLAN REVISION FOR THE BEXAR COUNTY 2015 EIGHT-HOUR OZONE NATIONAL AMBIENT AIR QUALITY STANDARDS NONATTAINMENT AREA

PROJECT NUMBER 2019-106-SIP-NR

Adoption
July 1, 2020
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EXECUTIVE SUMMARY

In 2015, the United States Environmental Protection Agency (EPA) revised the primary and secondary National Ambient Air Quality Standard (NAAQS) for ozone to an eight-hour standard of 0.070 parts per million (80 Federal Register (FR) 65292, October 26, 2015). Effective September 24, 2018, the EPA designated Bexar County as marginal nonattainment for the 2015 eight-hour ozone NAAQS with a September 24, 2021 attainment deadline (83 FR 35136, July 25, 2018). Attainment of the ozone NAAQS is determined using three full years of monitoring data, and attainment of the 2015 eight-hour ozone standard for marginal nonattainment areas will be determined using monitoring data from 2018, 2019 and 2020.1

Because attainment of the NAAQS in some areas may be influenced by emissions sources located outside of the United States (U.S.), states have the authority under Federal Clean Air Act (FCAA), §179B to seek regulatory relief by submitting to the EPA an analysis of the influence of international emissions in areas designated as nonattainment. Under FCAA, §179B, the EPA shall approve plans for areas that demonstrate attainment of the relevant NAAQS by the statutory attainment date “but for” emissions emanating from outside the U.S. For ozone nonattainment areas, if the EPA approves such a demonstration, the area would not be subject to certain nonattainment area requirements, including the mandatory reclassification provisions for areas that fail to attain an ozone NAAQS by the applicable attainment date. EPA approval of an FCAA, §179B demonstration for Bexar County could prevent the area from being reclassified to moderate nonattainment should the area fail to monitor attainment of the NAAQS by its attainment deadline. Marginal ozone nonattainment area requirements would continue to apply until Bexar County is formally redesignated to attainment.

This SIP revision includes an analysis of international transport influence on the Bexar County ozone nonattainment area to determine whether the area would attain the 2015 eight-hour ozone NAAQS by the 2020 attainment year but for international emissions. In order to determine the influence of international emissions on the Bexar County 2015 eight-hour ozone nonattainment area, the Texas Commission on Environmental Quality conducted a technical analysis that considered the area's modeled 2020 future year design value (DVf), the estimated international anthropogenic contribution to the 2020 DVf, the relative contribution of local versus boundary conditions to the 2020 DVf, and the area's certified 2018 monitored design value. The results of the technical analysis, provided in Chapter 2: Federal Clean Air Act, §179B Technical Analysis, show that “but for” international anthropogenic contributions, the Bexar County ozone nonattainment area would attain the 2015 eight-hour ozone NAAQS by the 2020 attainment year. This SIP revision submits this analysis to the EPA as a demonstration under FCAA, §179B for the Bexar County 2015 eight-hour ozone nonattainment area.

1 Because the attainment year ozone season is the ozone season immediately preceding a nonattainment area's attainment date, the attainment year for marginal nonattainment areas under the 2015 eight-hour ozone NAAQS is 2020, meaning the areas are required to attain the standard by the end of 2020.

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.


Originally, the TCAA stated that the Texas Air Control Board (TACB) was the state air pollution control agency and was the principal authority in the state on matters relating to the quality of air resources. In 1991, the legislature abolished the TACB effective September 1, 1993, and its powers, duties, responsibilities, and functions were transferred to the Texas Natural Resource Conservation Commission (TNRCC). In 2001, the 77th Texas Legislature continued the existence of the TNRCC until September 1, 2013 and changed the name of the TNRCC to the TCEQ. In 2009, the 81st Texas Legislature, during a special session, amended section 5.014 of the Texas Water Code, changing the expiration date of the TCEQ to September 1, 2011, unless continued in existence by the Texas Sunset Act. In 2011, the 82nd Texas Legislature continued the existence of the TCEQ until 2023. With the creation of the TNRCC (and its successor the TCEQ), the authority over air quality is found in both the Texas Water Code and the TCAA. Specifically, the authority of the TCEQ is found in Chapters 5 and 7. Chapter 5, Subchapters A - F, H - J, and L, include the general provisions, organization, and general powers and duties of the TCEQ, and the responsibilities and authority of the executive director. Chapter 5 also authorizes the TCEQ to implement action when emergency conditions arise and to conduct hearings. Chapter 7 gives the TCEQ enforcement authority.

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

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

Subchapters G and H of the TCAA authorize the TCEQ to establish vehicle inspection and maintenance programs in certain areas of the state, consistent with the requirements of the Federal Clean Air Act; coordinate with federal, state, and local transportation planning agencies to develop and implement transportation programs and measures necessary to attain and maintain the NAAQS; establish gasoline volatility and low emission diesel standards; and fund and authorize participating counties to implement vehicle repair assistance, retrofit, and accelerated vehicle retirement programs.

**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, unless otherwise noted.

- **TEXAS HEALTH & SAFETY CODE, Chapter 382** September 1, 2019
- **TEXAS WATER CODE** September 1, 2019

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

**Chapter 7: Enforcement**
- **Subchapter A: General Provisions (§§7.001, 7.002, 7.0025, 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, 7.179-7.183**
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

Chapter 19: Electronic Reporting
March 15, 2007

Chapter 35: Emergency and Temporary Orders and Permits;
Temporary Suspension or Amendment of Permit Conditions
Subchapter A: Purpose, Applicability, and Definitions December 10, 1998
Subchapter B: Authority of Executive Director December 10, 1998
Subchapter C: General Provisions March 24, 2016
Subchapter K: Air Orders July 20, 2006

Chapter 39: Public Notice
Subchapter H: Applicability and General Provisions, §§39.402(a)(1) - (6), (8), and (10) - (12), 39.405(f)(3) and (g), (h)(1)(A) - (4), (6), (8) - (11), (i) and (j), 39.407, 39.409, 39.411(a), (e)(1) - (4)(A)(i) and (iii), (4)(B), (5)(A) and (B), and (6) - (10), (11)(A)(i) and (iii) and (iv), (11)(B) - (F), (13) and (15), and (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)(l) and (II), (D)(ii), (c)(2), (d) - (e), and (h), and Subchapter K: Public Notice of Air Quality Permit Applications, §§39.601 - 39.605 May 14, 2020

Chapter 55: Requests for Reconsideration and Contested Case Hearings; Public Comment, all of the chapter, except §55.125(a)(5) and (6) May 14, 2020

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 August 3, 2017

Chapter 112: Control of Air Pollution from Sulfur Compounds July 16, 1997

Chapter 113: Standards of Performance for Hazardous Air Pollutants and for Designated Facilities and Pollutants May 14, 2009

Chapter 114: Control of Air Pollution from Motor Vehicles April 26, 2018

Chapter 115: Control of Air Pollution from Volatile Organic Compounds March 26, 2020

Chapter 116: Control of Air Pollution by Permits for New Construction or Modification May 14, 2020
Chapter 117: Control of Air Pollution from Nitrogen Compounds     March 26, 2020
Chapter 118: Control of Air Pollution Episodes               March 5, 2000
Chapter 122: §122.122: Potential to Emit                   February 23, 2017
Chapter 122: §122.215: Minor Permit Revisions             June 3, 2001
Chapter 122: §122.216: Applications for Minor Permit Revisions     June 3, 2001
Chapter 122: §122.217: Procedures for Minor Permit Revisions     December 11, 2002
Chapter 122: §122.218: Minor Permit Revision Procedures for Permit Revisions Involving the Use of Economic Incentives, Marketable Permits, and Emissions Trading June 3, 2001
SECTION VI: CONTROL STRATEGY

A. Introduction (No change)
B. Ozone (Revised)
   1. Dallas-Fort Worth (No change)
   2. Houston-Galveston-Brazoria (No change)
   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 (Revised)
   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)
TABLE OF CONTENTS

Executive Summary
Section V-A: Legal Authority
Section VI: Control Strategy
Table of Contents
List of Acronyms
List of Tables
List of Figures
List of Appendices
Chapter 1: General
  1.1 Background
  1.2 Introduction
  1.3 Health Effects
  1.4 Public Hearing and Comment Information
  1.5 Social and Economic Considerations
  1.6 Fiscal and Manpower Resources
Chapter 2: Federal Clean Air Act, §179B Technical Analysis
  2.1 Introduction
  2.2 Technical Analysis Framework
  2.3 Ozone Modeling Process
    2.3.1 Modeling Domain
    2.3.2 Modeling Episode
      2.3.2.1 Suitability of the 2012 Modeling Episode for the Bexar County 2015 Eight-Hour Ozone Nonattainment Area
    2.3.3 Meteorological Modeling
      2.3.3.1 San Antonio Area WRF Model Performance
    2.3.4 Emissions Modeling
      2.3.4.1 Base Case Modeling
      2.3.4.2 Future Year Modeling
    2.3.5 Initial Conditions and BC Development
    2.3.6 Photochemical Modeling
  2.4 FCAA, §179B Technical Analysis for the Bexar County 2015 Eight-Hour Ozone Nonattainment Area
    2.4.1 Estimation of International Anthropogenic Contribution to 2020 DV_f
    2.4.2 Source Apportionment of the 2020 DV_f
    2.4.3 Back-Trajectory Analysis
      2.4.3.1 Trajectory Model Details
2.4.3.2 Trajectory Pathway Analysis
2.4.3.3 Trajectory Frequency by Ozone Concentration

2.5 Conclusions
2.6 References

Chapter 3: Weight of Evidence

3.1 Introduction
3.2 Analysis of Ambient Trends and Emissions Trends
   3.2.1 Ozone Trends
      3.2.1.1 Ozone Design Value Trends
      3.2.1.2 Background Ozone Trends
   3.2.2 Emissions Trends for Major Source Categories
3.3 Literature Review
   3.3.1 Studies of United States (U.S.) Background Ozone and International Contributions
   3.3.2 Contribution to Ozone from Springtime Fires in Mexico and Central America
   3.3.3 Modeling Studies Comparable to the Modeling Performed by TCEQ for this SIP Revision
3.4 Existing Controls and Other Measures
   3.4.1 Existing Controls
   3.4.2 Additional Measures
      3.4.2.1 SmartWay Transport Partnership and the Blue Skyways Collaborative
      3.4.2.2 Clean Air Interstate Rule (CAIR) and Cross-State Air Pollution Rule (CSAPR)
      3.4.2.3 Texas Emissions Reduction Plan (TERP)
      3.4.2.4 Clean School Bus Program
      3.4.2.5 86th Texas Legislature, 2019
      3.4.2.6 Local Initiatives
      3.4.2.7 Voluntary Measures
3.5 Conclusions
3.6 References

Chapter 4: Ongoing and Future Initiatives

4.1 Introduction
4.2 Ongoing and Recent Work
   4.2.1 Emissions Inventory Improvement Projects
   4.2.2 Air Quality Research Program
   4.2.3 2016 Collaborative Modeling Platform Development
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AACOG</td>
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<td>Biogenic Emission Inventory System</td>
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<tr>
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<td>Clean Air Interstate Rule</td>
</tr>
<tr>
<td>CAMS</td>
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<td>EDAS</td>
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<td>Fire INventory of National Center for Atmospheric Research</td>
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<td>Global Emissions InitiAtive</td>
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<td>GEOS</td>
<td>Goddard Earth Observing System</td>
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<td>HGB</td>
<td>Houston-Galveston-Brazoria</td>
</tr>
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<td>HYSPLIT</td>
<td>Hybrid Single Particle Lagrangian Integrated Trajectory</td>
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<td>NOₓ</td>
<td>nitrogen oxides</td>
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<td>Optical Transient Detector</td>
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<td>PBL</td>
<td>planetary boundary layer</td>
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<td>path-integral method</td>
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<td>PM₂·₅</td>
<td>particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers</td>
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<td>PM₁₀</td>
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<td>United States</td>
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<td>Weather Research and Forecasting</td>
</tr>
</tbody>
</table>
ZROW  zero out the rest of the world
LIST OF TABLES

Table 2-1: Section 179B SIP Revision CAMx Modeling Domain Definitions
Table 2-2: Section 179B SIP Revision CAMx Modeling Domain Vertical Structure
Table 2-3: Section 179B SIP Revision WRF Modeling Domain Definitions
Table 2-4: Section 179B SIP Revision WRF Modeling Domain Vertical Structure
Table 2-5: WRF Model Configuration Parameters
Table 2-6: Emissions Processing Modules
Table 2-7: 2012 Sample Base Case Anthropogenic Emissions for Bexar County for an August Day
Table 2-8: Future Case Anthropogenic Emissions for Bexar County for a 2020 August Day
Table 2-9: 2012 and 2020 GEOS-Chem Emissions Inventories
Table 2-10: Emissions Inventories Used in ZROW Case GEOS-Chem Simulation
Table 2-11: Reference Case DV₈, RRF, and 2020 DV₉ for Bexar County Regulatory Monitors
Table 2-12: ZROW Case DV₈, RRF, and 2020 DV₉ for Bexar County Regulatory Monitors
Table 2-13: International Anthropogenic Contribution at Bexar County Regulatory Monitors
Table 2-14: Percentage of All Trajectories from Mexico but Not the Four Texas Metropolitan Areas
Table 2-15: Statistics for Trajectory Scenarios that Traversed Mexico and Not One of Four Texas Metropolitan Areas
Table 3-1: Estimated U.S. Background Ozone in the San Antonio Area
Table 3-2: Existing Ozone Control Measures Applicable to Bexar County
LIST OF FIGURES

Figure 2-1: Map of §179B SIP Revision CAMx Modeling Domain
Figure 2-2: Map of §179B SIP Revision GEOS-Chem Modeling Domain
Figure 2-3: SAN Area Regulatory and Non-Regulatory Monitors
Figure 2-4: SAN Number of Days MDA8 Ozone Concentrations Greater than 70 ppb by Year from 2000 through 2018
Figure 2-5: May 2012 MDA8 Ozone Concentrations at Regulatory and Non-Regulatory SAN Monitors
Figure 2-6: June 2012 MDA8 Ozone Concentrations at Regulatory and Non-Regulatory SAN Monitors
Figure 2-7: July 2012 MDA8 Ozone Concentrations at Regulatory and Non-Regulatory SAN Monitors
Figure 2-8: August 2012 MDA8 Ozone Concentrations at Regulatory and Non-Regulatory SAN Monitors
Figure 2-9: September 2012 MDA8 Ozone Concentrations at Regulatory and Non-Regulatory SAN Monitors
Figure 2-10: Map of WRF Modeling Domains
Figure 2-11: WRF and the Corresponding CAMx Modeling Domains
Figure 2-12: Matching of WRF and CAMx Vertical Layers
Figure 2-13: 2012 San Antonio Area Meteorological Modeling Performance Statistics
Figure 2-14: Reference Case versus ZROW Case 2020 Future Year Anthropogenic Emissions in CAMx
Figure 2-15: Reference Case versus ZROW Case 2020 Future Year Anthropogenic Emissions in GEOS-Chem
Figure 2-16: South BC on June 26 at 12:00 p.m. for Reference Case’s 2020 Model Year
Figure 2-17: South BC on June 26 at 12:00 p.m. for ZROW Case’s 2020 Model Year
Figure 2-18: South BC on June 26 at 12:00 p.m. for the 2012 Model Year
Figure 2-19: Components of DVB for the §179B SIP Revision
Figure 2-20: APCA Geographic Regions for the §179B SIP Revision
Figure 2-21: Source Category Contribution to 2020 DVₙ at Bexar County Monitors
Figure 2-22: HYSPLIT Trajectories Terminating at Elm Creek Elementary
Figure 2-23: Mean MDA8 Ozone Concentrations by Trajectory Scenario at the Elm Creek Elementary Monitor
Figure 2-24: Number of Trajectories by Scenario at the Elm Creek Elementary Monitor
Figure 2-25: Maximum MDA8 Ozone Concentrations by Trajectory Scenario at the Elm Creek Elementary Monitor
Figure 2-26: Density Analysis of Trajectories when MDA8 Ozone Concentration is 70 ppb or Less (Left) and when MDA8 Ozone Concentration is Greater than 70 ppb (Right)
Figure 3-1: One-Hour and Eight-Hour Ozone Design Values in the Bexar County Area from 2009 through 2018
Figure 3-2: Ozone Season Trends in Background Ozone in the Bexar County Area for High versus Low Ozone Days
Figure 3-3: On-Road Activity and Emissions Trends in Bexar County from 1999 through 2050
Figure 3-4: Non-Road Activity and Emission Trends in Bexar County from 1999 to 2050
Figure 3-5: Electrical Generation and NOx Emissions Trends in Bexar County from 1997 to 2018
Figure 3-6: Map of Satellite-Derived NO2 Trends in China
Figure 3-7: Trends in Three-Year Average NO2 Column Densities, Normalized to Mean of 2005 through 2007
Figure 3-8: Changing Baseline Ozone Trends Measured on the Pacific Coast of the U.S.
Figure 3-9: Non-Urban Fourth-High MDA8 Ozone Concentration Trends Measured from 2000 through 2014 at Surface Monitoring Sites
Figure 3-10: Zero-Out Modeling Analysis Showing June through August Mean MDA8 Ozone
Figure 3-11: Relative Contributions in Percent to the Anthropogenic Component of the 10 Highest Ozone Days
Figure 3-12: Estimated Contribution from Different Geographic Source Categories to Houston MDA8 Ozone
Figure 3-13: Estimated Contribution from Different Geographic Source Categories to Dallas MDA8 Ozone
Figure 3-14: Contributions to the Seasonal Average MDA8 Ozone from BC
Figure 3-15: BC Ozone Contributions
Figure 3-16: Source Apportionment for Simulated Ozone Seasons from 1970-2020 in Fort Worth
# LIST OF APPENDICES

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Appendix Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appendix A</td>
<td>Meteorological Modeling of Central and Eastern Texas</td>
</tr>
<tr>
<td>Appendix B</td>
<td>Emissions Modeling</td>
</tr>
<tr>
<td>Appendix C</td>
<td>Regional and Global Photochemical Model Performance Evaluation</td>
</tr>
<tr>
<td>Appendix D</td>
<td>Photochemical Modeling Protocol</td>
</tr>
<tr>
<td>Appendix E</td>
<td>Conceptual Model for the Bexar County Nonattainment Area for the 2015 Eight-Hour Ozone National Ambient Air Quality Standard</td>
</tr>
</tbody>
</table>
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 (http://www.tceq.texas.gov/airquality/sip) on the Texas Commission on Environmental Quality's (TCEQ) website (http://www.tceq.texas.gov/).

1.2 INTRODUCTION
In 2015, the United States Environmental Protection Agency (EPA) revised the primary and secondary National Ambient Air Quality Standard (NAAQS) for ozone to an eight-hour standard of 0.070 parts per million (80 Federal Register (FR) 65292, October 26, 2015). Effective September 24, 2018, the EPA designated Bexar County as marginal nonattainment for the 2015 eight-hour ozone NAAQS with a September 24, 2021 attainment deadline (83 FR 35136, July 25, 2018). Attainment of the ozone NAAQS is determined using three full years of monitoring data, and attainment of the 2015 eight-hour ozone standard for marginal nonattainment areas will be determined using monitoring data from 2018, 2019 and 2020.3

The Federal Clean Air Act (FCAA) Amendments of 1990 incorporated §179B, which requires the EPA to approve plans or plan revisions for nonattainment areas that are affected by emissions emanating from outside the United States (U.S.). In the EPA’s Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area State Implementation Plan Requirements; Final Rule (2015 eight-hour ozone standard SIP requirements rule, 83 FR 62998, December 6, 2018), the EPA stated that it maintained the approach to evaluating potential impacts of international transport of ozone and ozone precursors under FCAA, §179B established in the 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, 80 FR 12264, March 6, 2015). Specifically, the EPA maintained that the §179B demonstration option is not limited to nonattainment areas adjoining international borders and that a state may submit a §179B demonstration to the EPA for a marginal nonattainment area. On January 9, 2020, the EPA made available for comment its non-binding draft guidance “DRAFT Guidance on the Preparation of Clean Air Act Section 179B Demonstrations for Nonattainment Areas Affected by International Transport of Emissions.” The guidance remains draft and open for revision at this time, and it is unknown when it will be finalized.

In order to determine the influence of international emissions on the Bexar County 2015 eight-hour ozone nonattainment area, the TCEQ conducted the technical analysis discussed in Chapter 2: Federal Clean Air Act, §179B Technical Analysis. The results of the technical analysis show that the Bexar County ozone nonattainment area would attain the 2015 eight-hour ozone NAAQS by the 2020 attainment year “but for” anthropogenic emissions emanating from outside the U.S.

3 Because the attainment year ozone season is the ozone season immediately preceding a nonattainment area's attainment date, the attainment year for marginal nonattainment areas under the 2015 eight-hour ozone NAAQS is 2020, meaning the areas are required to attain the standard by the end of 2020.
1.3 HEALTH EFFECTS
On October 1, 2015, the EPA revised the primary and secondary eight-hour ozone NAAQS to 70 parts per billion (ppb) (80 FR 65292). To support the 2015 eight-hour ozone NAAQS, the EPA provided information that suggested that health effects may potentially occur at levels lower than the 2008 eight-hour ozone standard of 75 ppb. Breathing relatively high levels of ground-level ozone can cause acute respiratory problems like coughing 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 high ozone levels are typically recorded. Adults most at risk from exposures to elevated ozone levels are people working or exercising outdoors and individuals with preexisting respiratory diseases.

1.4 PUBLIC HEARING AND COMMENT INFORMATION
The commission offered a public hearing for this SIP revision on February 18, 2020 at 2:00 p.m. in San Antonio at the Alamo Area of Governments (AACOG). Notice of the public hearing was published in the Texas Register as well as the San Antonio Express-News newspaper.

The public comment period opened on January 17, 2020 and closed on February 19, 2020. Written comments were accepted via mail, fax, and through the eComments (https://www6.tceq.texas.gov/rules/ecomments/) system. During the comment period, staff received comments from AACOG, the Alamo Area Metropolitan Planning Organization, City of San Antonio District 10 Councilman Clayton Perry, Kendall County Judge Darrel Lux, Habitat for Humanity of San Antonio, Bexar County Commissioner Kevin Wolff, Atascosa County Judge Robert Hurley, the San Antonio Area Group of the Lone Star Chapter of the Sierra Club, the San Antonio Chamber of Commerce, the San Antonio Hispanic Chamber of Commerce, the San Antonio Mobility Coalition, Sierra Club and Environmental Defense Fund, and the EPA. A summary of the comments and the TCEQ’s responses is provided as part of this SIP revision in the Response to Comments.

1.5 SOCIAL AND ECONOMIC CONSIDERATIONS
Because rulemaking is not a part of this SIP revision, there are no changes that would directly impact society or the economy.

1.6 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: FEDERAL CLEAN AIR ACT, §179B TECHNICAL ANALYSIS

2.1 INTRODUCTION

In 2015, the United States Environmental Protection Agency (EPA) revised the eight-hour ozone National Ambient Air Quality Standard (NAAQS) to 0.070 parts per million (ppm) or 70 parts per billion (ppb). In the Federal Register (FR) notice finalizing the 2015 eight-hour ozone NAAQS, the EPA discussed the role of international pollution transport and background on United States (U.S.) ozone concentrations. The EPA also discussed the mechanisms available to states to address the influence of international pollution transport and background as part of their state implementation plans (SIP). Specifically, the EPA stated that the Federal Clean Air Act (FCAA), §179B allows states “… to consider in their attainment plans and demonstrations whether an area might meet the ozone NAAQS by the attainment date 'but for' emissions contributing to the area originating outside the U.S.” (80 FR 65444).

The EPA affirmed the interpretation that demonstrations under FCAA, §179B are not limited to nonattainment areas adjoining international borders and are applicable to nonattainment areas with a marginal classification. As part of the EPA’s Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area State Implementation Plan Requirements; Final Rule (2015 eight-hour ozone standard SIP requirements rule, 83 FR 62998, December 6, 2018), the EPA stated, “... contributions to U.S. ozone concentrations from sources outside of the U.S., which can be from nearby sources in a bordering country or from sources many thousands of miles away, can affect to varying degrees the ability of some areas to attain and maintain the 2015 ozone NAAQS” (83 FR 63009). In the 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, 80 FR 12264, March 6, 2015), the EPA had previously stated that “…if a Marginal area (which is not otherwise required to submit an attainment demonstration) were to submit to the EPA a demonstration that they could attain the standard but for international emissions, the EPA would be able to evaluate that demonstration similarly to demonstrations submitted by higher classified areas.”

As discussed previously, Bexar County was designated a marginal nonattainment area for the 2015 eight-hour ozone NAAQS effective September 24, 2018. Bexar County is required to attain the 2015 eight-hour ozone NAAQS no later than September 24, 2021. Because the attainment year ozone season is the ozone season immediately preceding a nonattainment area’s attainment date, the attainment year for marginal nonattainment areas under the 2015 eight-hour ozone NAAQS is 2020, meaning the Bexar County 2015 eight-hour ozone nonattainment area is required to attain the standard by the end of 2020. In this FCAA, §179B demonstration SIP revision for the 2015 eight-hour ozone NAAQS, referred to hereafter as the §179B SIP revision, the Texas Commission on Environmental Quality (TCEQ) demonstrates that “but for” international anthropogenic emissions, the Bexar County ozone nonattainment area would attain the 2015 eight-hour ozone NAAQS by the 2020 attainment year.

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2.2 TECHNICAL ANALYSIS FRAMEWORK

The TCEQ used a technical analysis framework that included a literature review on efforts to quantify the role of background ozone on U.S. air quality, photochemical modeling, and data analysis to characterize the influence of international anthropogenic emissions and to demonstrate that “but for” international anthropogenic emissions, the Bexar County ozone nonattainment area would attain the 2015 eight-hour ozone NAAQS by the 2020 attainment year.

The TCEQ developed the technical framework utilized in the §179B SIP revision based on a review of notices in the Federal Register related to the 2008 and 2015 eight-hour ozone NAAQS, an EPA white paper about background ozone, and a TCEQ study on international emissions. Due to the absence of official guidance from the EPA on the requirements of an FCAA, §179B demonstration in advance of work performed to develop this SIP revision, the TCEQ relied on the EPA’s comments, analysis, and presentations related to FCAA, §179B, background ozone, and the influence of international emissions in various forums, particularly the designation of the Bexar County nonattainment area for the 2015 eight-hour ozone standard. On January 9, 2020, the EPA made available for comment its non-binding draft guidance “DRAFT Guidance on the Preparation of Clean Air Act Section 179B Demonstrations for Nonattainment Areas Affected by International Transport of Emissions.” Though the EPA’s non-binding draft guidance identifies the types of analyses that would be expected in a FCAA, §179B demonstration, it fails to provide adequate guidance on how the types of analyses recommended can be adapted to non-border nonattainment areas such as the Bexar County ozone nonattainment area. The TCEQ submitted comments highlighting these deficiencies in the EPA’s draft guidance. No changes were made to this SIP revision based on the EPA’s draft guidance since it does not preclude alternate approaches and, being draft, it is uncertain in nature and open for revision.

The main technical tasks in this §179B SIP revision included the following:

- Estimating the contribution of international anthropogenic emissions (international anthropogenic contribution) to the future year design values at regulatory ambient air quality monitors in Bexar County. International anthropogenic contribution is estimated using a combination of global and regional chemical transport models (CTM). This contribution is calculated as the difference between a Reference (Ref)
Case future year design value ($D_{V,F}^{\text{Ref}}$) and a “zero-out the rest of the world” (ZROW) Case future year design value ($D_{V,F}^{\text{ZROW}}$) at each regulatory monitor in Bexar County.

- Determining the relative contributions of emissions from various geographic regions to the future year design value at regulatory monitors in Bexar County using the Anthropogenic Precursor Culpability Assessment (APCA) source apportionment tool.
- Characterizing transport patterns to Bexar County and the San Antonio metropolitan area from Mexico using the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model.10

The TCEQ used photochemical modeling, in accordance with the EPA’s 2018 Modeling Guidance for Demonstrating Air Quality Goals for Ozone, PM$_{2.5}$, and Regional Haze (EPA Modeling Guidance)11 for this §179B SIP revision for Bexar County. The photochemical modeling was conducted on the TCEQ’s extensively tested 2012 modeling platform. Section 2.3: Ozone Modeling Process provides details of the 2012 modeling platform and updates made to the platform for the §179B SIP revision. Section 2.4: FCAA, §179B Technical Analysis provides details and results of the technical analysis, and Section 2.5: Conclusions provides conclusions of the analysis.

2.3 OZONE MODELING PROCESS

Photochemical modeling for ozone12 consists of using a CTM with appropriate meteorological and emissions inputs to simulate the formation and transport of ozone. To assess the future attainment status at regulatory monitors, the EPA Modeling Guidance recommends using modeling results in a relative sense rather than the absolute sense, i.e., modeled future concentrations are not considered representations of future design values and instead an assessment of how the model responds to the change in emissions between a modeled base year and modeled future year are used in conjunction with monitored values to estimate the future design values. For this §179B SIP revision, the TCEQ used a 2012 base year and a 2020 future year. The 2012 base year was chosen based on the availability of the well-tested 2012 Modeling Platform and the modeling episode selection criteria provided in the EPA Modeling Guidance as discussed in Section 2.3.2: Modeling Episode. A future year of 2020 was selected since it is the attainment year – the last complete ozone season prior to the attainment date of September 24, 2021.

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8 $D_{V,F}^{\text{Ref}}$ is determined by multiplying the base design value ($D_V$) with a relative response factor (RRF), calculated from a pair of base and future year regional CTM simulations which have all emissions (natural and anthropogenic) non-U.S. sources represented within the regional CTM modeling domain. These regional CTM simulations use boundary conditions that were derived from global CTM simulations that have all emissions (natural and anthropogenic) non-U.S. sources represented.

9 $D_{V,F}^{\text{ZROW}}$ is determined by multiplying the $D_V$ with an RRF calculated from a base year regional CTM simulation which has all emissions (natural and anthropogenic) from non-U.S. within the regional CTM modeling domain zeroed-out. The future year, ZROW Case 2020, CTM simulation also uses boundary conditions derived from a global CTM simulation that has anthropogenic emissions from non-U.S. sources in the future year zeroed out.


For this §179B SIP revision, the TCEQ prepared the inputs for and completed the following three regional CTM and three global CTM simulation runs:

- 2012 Reference Case regional and global CTM simulation;
- 2020 Reference Case regional and global CTM simulations; and
- 2020 ZROW Case regional and global CTM simulations.

The Reference Case refers to simulations in which, in addition to emissions from all U.S. sources, both natural and anthropogenic emissions from non-U.S. sources are represented within the regional and global CTM. The ZROW Case refers to a simulation in which all non-U.S. anthropogenic emissions were zeroed out in the 2020 future year in both the regional and global CTM. Anthropogenic emissions sources refer to sources such as power plants, refineries, dry cleaners, gas stations, cars, trucks, construction equipment, lawn mowing equipment, locomotives, commercial marine vessels, aircraft, off-shore oil rigs and ocean-going vessels, etc. Natural emissions refer to sources such as trees, wildfires, volcanoes, etc. The photochemical modeling process began with domain and episode selection, as discussed in Section 2.3.1: Modeling Domain and 2.3.2: Modeling Episode.

### 2.3.1 Modeling Domain

Since the technical analysis conducted is to demonstrate that Bexar County would attain the 2015 eight-hour ozone standard by the attainment year of 2020 “but for” international anthropogenic emissions, a key component of this §179B SIP revision is the estimation of the international anthropogenic contribution to the 2020 future year design value (2020 DVF). The international anthropogenic contribution is estimated using the combination of a regional CTM and a global CTM. The CTMs used in this SIP revision are three-dimensional grid-based Eulerian models. The regional CTM used for this §179B SIP revision is the Comprehensive Air Quality Model with Extensions (CAMx), version 6.5. The global CTM used for this §179B SIP revision is the global atmospheric chemistry model driven by assimilated meteorological observations from the Goddard Earth Observing System (GEOS-Chem), version 12.2.0.

The geographic extent of the CAMx modeling domain used for this §179B SIP revision is shown in Figure 2-1: Map of §179B SIP Revision CAMx Modeling Domain. Figure 2-1 depicts the three CAMx domains of different grid resolution specified in kilometers (km). A fine resolution 4 km domain covers central and eastern Texas, a medium resolution 12 km domain covers all of Texas plus some or all of surrounding states, and a coarse resolution 36 km domain covers the continental U.S. plus southern Canada and northern Mexico. The 4 km is nested within the 12 km domain, which, in turn, is nested within the 36 km domain. All three domains were defined using a Lambert Conformal Conic (LCC) projection with the origin at 97 degrees west and 40 degrees north.

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dimensional grid, boundary conditions (BC) are derived from the global model, GEOS-Chem. BC include the following:

- natural and anthropogenic ozone and ozone precursors from sources outside the regional modeling domain; and
- natural and anthropogenic ozone and ozone precursors that originated within the regional modeling domain and were transported out and recirculated back into the regional modeling domain.

Figure 2-1: Map of §179B SIP Revision CAMx Modeling Domain

The geographic extent of the GEOS-Chem modeling domain used for this §179B SIP revision is shown in Figure 2-2: Map of §179B SIP Revision GEOS-Chem Modeling Domain. The GEOS-Chem used a grid resolution of 2 degrees (°) by 2.5° (~200 km).
Figure 2-2: Map of §179B SIP Revision GEOS-Chem Modeling Domain

The domain definitions, details such as domain name, grid size, the number of grid cells in the east-west and north-south direction, and coordinates of the domain corners, for CAMx are provided in Table 2-1: Section 179B SIP Revision CAMx Modeling Domain Definitions.

Table 2-1: Section 179B SIP Revision CAMx Modeling Domain Definitions

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<tr>
<th>Domain Name</th>
<th>Domain Cell Size</th>
<th>Dimensions (grid cells)</th>
<th>Lower left-hand corner</th>
<th>Upper right-hand corner</th>
</tr>
</thead>
<tbody>
<tr>
<td>rpo_36km</td>
<td>36 by 36 km</td>
<td>148 by 112</td>
<td>(-2736, -2088)</td>
<td>(2592, 1944)</td>
</tr>
<tr>
<td>tx_12km</td>
<td>12 by 12 km</td>
<td>149 by 110</td>
<td>(-984, -1632)</td>
<td>(804, -312)</td>
</tr>
<tr>
<td>Tx_4km</td>
<td>4 by 4 km</td>
<td>191 by 218</td>
<td>(-328, -1516)</td>
<td>(436, -644)</td>
</tr>
</tbody>
</table>

CAMx is a 3D model with specific higher altitudes of the atmosphere up to the outer edge of the troposphere being represented as specific vertical layers. Table 2-2: Section 179B SIP Revision CAMx Modeling Domain Vertical Structure provides details of the modeling domain vertical layers such as the top and center height in meters above ground level (m AGL) and thickness in meters (m).

Table 2-2: Section 179B SIP Revision CAMx Modeling Domain Vertical Structure

<table>
<thead>
<tr>
<th>CAMx Layer</th>
<th>Top (m AGL)</th>
<th>Center (m AGL)</th>
<th>Thickness (m)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>16445</td>
<td>3611</td>
</tr>
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<td>28</td>
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<td>13632</td>
<td>2015</td>
</tr>
<tr>
<td>27</td>
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<td>10786</td>
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<tr>
<td>26</td>
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<td>7891</td>
<td>2115</td>
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<tr>
<td>CAMx Layer</td>
<td>Top (m AGL)</td>
<td>Center (m AGL)</td>
<td>Thickness (m)</td>
</tr>
<tr>
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</tr>
<tr>
<td>1</td>
<td>34</td>
<td>17</td>
<td>34</td>
</tr>
</tbody>
</table>

### 2.3.2 Modeling Episode

The modeling episode used for this SIP revision was the May 1 through September 30, 2012 period (2012 Modeling Episode). A robust modeling platform was developed for this 2012 Modeling Episode as part of the Houston-Galveston Brazoria (HGB) Attainment Demonstration (AD) SIP Revision for the 2008 Eight-Hour Ozone NAAQS that was adopted by the commission on December 15, 2016 and submitted to the EPA on December 29, 2016 (2016 HGB AD SIP revision). The 2012 Modeling Episode platform was updated for the Dallas-Fort Worth (DFW) Serious Classification AD SIP Revision for the 2008 Eight-Hour Ozone NAAQS (2020 DFW AD SIP revision) and the HGB 2008 Serious Classification AD SIP Revision for the 2008 Eight-Hour Ozone NAAQS (2020 HGB AD SIP revision) adopted on March 4, 2020.\(^{16}\) The 2012 Modeling Episode was selected in accordance with the episode selection criteria specified in the EPA Modeling Guidance, details of which are documented in Section 3.4: Episode

Selection of the 2016 HGB AD SIP revision. As part of this §179B SIP revision, the TCEQ evaluated the suitability of the 2012 Modeling Episode for Bexar County, the details of which are provided in Section 2.3.2.1: Suitability of the 2012 Modeling Episode for the Bexar County 2015 Eight-Hour Ozone Nonattainment Area below.

2.3.2.1 Suitability of the 2012 Modeling Episode for the Bexar County 2015 Eight-Hour Ozone Nonattainment Area

To evaluate the suitability of the 2012 Modeling Episode for the Bexar County 2015 eight-hour ozone nonattainment area, the TCEQ looked at ozone trends at regulatory and non-regulatory monitors in the broader San Antonio (SAN) area, which includes Comal, Guadalupe, and Wilson Counties in addition to the Bexar County nonattainment area. The trends were analyzed for each of the five months, May through September. Figure 2-3: SAN Area Regulatory and Non-Regulatory Monitors shows the location of the regulatory and non-regulatory monitors in the SAN area. The locations of regulatory monitors are marked using a star while the locations of non-regulatory monitors are marked using a circle.

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A summary of the days the SAN area measured a maximum daily average eight-hour (MDA8) ozone concentration above 70 ppb at the three regulatory monitors, Camp Bullis (C58), San Antonio Northwest (C23), and Calaveras Lake (C59), is shown in Figure 2-4: SAN Number of Days MDA8 Ozone Concentrations Greater than 70 ppb by Year from 2000 through 2018. The number of exceedance days (days with monitored MDA8 greater than 70 ppb) for the SAN area in 2012 is greater than the 10-year average during the years of 2009 through 2018.
The 2012 Modeling Episode was characterized by several one- to four-day periods of ozone concentrations above the 2015 eight-hour ozone NAAQS. The elevated ozone concentrations were usually confined to a few monitors per each high ozone day. All regulatory monitors that operated the entire 2012 ozone season and for which 2020 future year design values were estimated, recorded more than 10 days above 60 ppb, as recommended by the EPA Modeling Guidance.

Figure 2-5: May 2012 MDA8 Ozone Concentrations at Regulatory and Non-Regulatory SAN Monitors shows the monitored ozone trends for May 2012 at the SAN monitors. The regulatory monitors, identified in the figure by an asterisk next to their Continuous Ambient Monitoring System (CAMS) number, are Camp Bullis (C58), San Antonio Northwest (C23), and Calaveras Lake (C59).
May 2012 had one high ozone day, May 17, that had four SAN monitors exceeding the 2015 eight-hour ozone NAAQS. San Antonio Northwest (C23) monitored 76 ppb, Fair Oaks Ranch (C502) monitored 76 ppb, Bulverde Elementary (C503) monitored 83 ppb and City of Garden Ridge (C505) monitored 73 ppb.

Figure 2-6: *June 2012 MDA8 Ozone Concentrations at Regulatory and Non-Regulatory SAN Monitors* shows the monitored ozone trends for June 2012 at the SAN monitors.
June 2012 had three high ozone periods, a high ozone day on June 9 followed by two
two-day high ozone periods, June 22 to June 23 and June 26 to June 27. On June 9, the
Camp Bullis (C58) and Fair Oaks Ranch (C502) monitors exceeded the 2015 eight-hour ozone NAAQS. During the June 22 to June 23 high-ozone period, the San Antonio Northwest (C23) and Camp Bullis (C58) monitors exceeded the 2015 eight-hour ozone NAAQS. During the June 26 to June 27 high-ozone period, exceedances were monitored at seven monitors in the area, with the MDA8 reaching 90 ppb.

Figure 2-7: July 2012 MDA8 Ozone Concentrations at Regulatory and Non-Regulatory SAN Monitors shows the monitored ozone trends for July 2012 at the SAN monitors. July typically sees relatively low ozone concentrations in the eastern Texas metropolitan areas, and that also holds true for the SAN area. July 2012 did not see any exceedances at the SAN area monitors.
Figure 2-7: July 2012 MDA8 Ozone Concentrations at Regulatory and Non-Regulatory SAN Monitors

Figure 2-8: August 2012 MDA8 Ozone Concentrations at Regulatory and Non-Regulatory SAN Monitors shows the monitored ozone trends for August 2012 at the SAN monitors. August 2012 had one four day high-ozone period from August 20 to August 23.
As shown in Figure 2-8, the August high-ozone period saw ozone exceedances at several monitors on August 20 (five monitors) and 21 (eight monitors) followed by fewer monitors on August 22 (two monitors) and an exceedance only at the Camp Bullis (C58) monitor on August 23. The highest MDA8 monitored during this episode was 87 ppb at the Camp Bullis (C58) monitor on August 21.

Figure 2-9: September 2012 MDA8 Ozone Concentrations at Regulatory and Non-Regulatory SAN Monitors shows the monitored ozone trends for September 2012 at the SAN monitors. Like metropolitan areas in eastern Texas, the SAN area in 2012 shows a second peak of eight-hour ozone exceedances during the latter part of the ozone episode in September.
September 2012 saw two high-ozone periods, a two-day period from September 10 to September 11 followed by a three-day period from September 19 to September 21. The September high-ozone periods also saw exceedances at more than one monitor. A high of 90 ppb MDA8 was observed on September 10 at the Camp Bullis (C58) monitor, the same monitor that saw the June peak of 90 ppb.

Based on the evaluation of the number of exceedance days and the monitored trends at the SAN area monitors in 2012, it was determined that the 2012 Modeling Episode is a suitable modeling episode for this §179B SIP revision.

### 2.3.3 Meteorological Modeling

The TCEQ used the Weather Research and Forecasting Model (WRF) version 3.7.1 to create the 2012 Modeling Episode meteorological inputs. Figure 2-10: Map of WRF Modeling Domains shows the WRF modeling domains. Three nested domains of increasing grid resolutions of 36 km for North America (na_36km), 12 km for Texas plus portions of surrounding states (tx_12km), and 4 km for the eastern portion of Texas (tx_4km) were used to create the 2012 Modeling Episode meteorological inputs.
The WRF model domain definitions are provided in Table 2-3: Section 179B SIP Revision.

### Table 2-3: Section 179B SIP Revision WRF Modeling Domain Definitions

<table>
<thead>
<tr>
<th>Domain</th>
<th>Easting Range (km)</th>
<th>Northing Range (km)</th>
<th>East/West Grid Points</th>
<th>North/South Grid Points</th>
<th>Grid Cell Size (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>na_36 km</td>
<td>(-2916, 2916)</td>
<td>(-2304, 2304)</td>
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</tr>
<tr>
<td>sus_12k m</td>
<td>(-1188, 900)</td>
<td>(-1800, -144)</td>
<td>175</td>
<td>139</td>
<td>12</td>
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<td>tx_4km</td>
<td>(-396, 468)</td>
<td>(-1620, -468)</td>
<td>217</td>
<td>289</td>
<td>4</td>
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</table>

The geographic extent of the WRF modeling domain was chosen to accommodate the embedding of the corresponding air quality modeling domain, as shown in Figure 2-11: WRF and the Corresponding CAMx Modeling Domains.
Table 2-4:  
Section 179B SIP Revision WRF Modeling Domain Vertical Structure provides details of the WRF model domain vertical layers, such as heights and thickness.

Table 2-4:  
Section 179B SIP Revision WRF Modeling Domain Vertical Structure

<table>
<thead>
<tr>
<th>WRF Layer</th>
<th>Sigma Level</th>
<th>Top (m AGL)</th>
<th>Center (m AGL)</th>
<th>Thickness (m)</th>
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<td>Thickness (m)</td>
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</table>

Figure 2-12: Matching of WRF and CAMx Vertical Layers shows how the vertical layers of WRF shown in Table 2-4 are matched to the vertical layers of CAMx shown in Table 2-2.
The meteorological modeling configuration for May through September 2012 resulted from numerous sensitivity tests and associated model performance evaluation. The final WRF parameterization schemes and options selected are shown in Table 2-5: \textit{WRF Model Configuration Parameters}. The selection of these schemes and options was
based on extensive testing of model configurations that built upon experience from previous SIP revisions and other modeling exercises. Details regarding WRF modeling process as well as the sensitivity tests conducted to determine the final configuration are presented in Appendix A: *Meteorological Modeling of Central and Eastern Texas*.

### Table 2-5: WRF Model Configuration Parameters

<table>
<thead>
<tr>
<th>Domain</th>
<th>Nudging Type</th>
<th>PBL</th>
<th>Cumulus</th>
<th>Radiation</th>
<th>Land-Surface</th>
<th>Microphysics</th>
</tr>
</thead>
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<td>3-D Analysis, and Observations</td>
<td>YSU</td>
<td>Multi-scale Kain-Fritsch</td>
<td>RRTM / Dudhia *</td>
<td>Pleim-Xiu</td>
<td>WSM5 †</td>
</tr>
<tr>
<td>4 km</td>
<td>3-D, Surface Analysis, Soil, and Observations</td>
<td>YSU</td>
<td>Multi-scale Kain-Fritsch</td>
<td>RRTM / Dudhia *</td>
<td>Pleim-Xiu</td>
<td>WSM6 †</td>
</tr>
</tbody>
</table>

* RRTM = Rapid Radiative Transfer Model  
† WSM6 = WRF Single-Moment 5 or 6-Class Microphysics Scheme

#### 2.3.3.1 San Antonio Area WRF Model Performance

For optimal photochemical model performance, low-level wind speed and direction are of greater importance than surface temperature. Wind speed and direction determine the placement of emissions while temperature has a minor contribution to ozone formation reactions. Additional meteorological features of critical importance for air quality modeling include cloud coverage and the depth of the planetary boundary layer (PBL). The WRF modeling was evaluated by comparing the hourly modeled and measured wind speed, wind direction, and temperature for all monitors in TCEQ Region 13, the broader San Antonio area that includes the Bexar County 2015 eight-hour ozone nonattainment area. Figure 2-13: *2012 San Antonio Area Meteorological Modeling Performance Statistics* exhibits the percent of hours for which the average absolute difference between the modeled and measured wind speed and direction was within the specified accuracy benchmarks for the average of SAN area monitors by 2012 Modeling Episode month. These benchmarks are less than 30 degrees for wind direction, less than 2 meters per second (m/s) for wind speed, and less than 2 degrees Fahrenheit for temperature.

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18 *Air Monitoring Sites (Regional Map)*, available at [https://www.tceq.texas.gov/airquality/monops/sites/monitors_map.html].
As Figure 2-13 shows, the WRF model performed well for wind speed and temperature, and reasonably well for wind direction in the San Antonio area. Appendix A provides additional detail regarding the model performance evaluation of the meteorological modeling for the May through September 2012 period.

WRF model output was post-processed using the WRFCAMx version 4.3 utility to convert the WRF meteorological fields to the appropriate CAMx grid and input format. The WRFCAMx generates several alternative vertical diffusivity ($K_v$) files based upon multiple methodologies for estimating mixing given the same WRF meteorological fields. The Community Multi-Scale Air Quality modeling system $K_v$ option was used to create the meteorological input for the 2012 CAMx runs. The vertical diffusivity coefficients were modified on a land-use basis to maintain vertical mixing within the first 100 meters (m) of the model overnight using the KVPATCH program (Ramboll Environ, 2012). The diagnosis of sub-grid stratiform clouds was turned on for the 36 km and 12 km domains.

WRF inputs to CAMx were kept constant between the base and future years for both the Reference Case as well as the ZROW Case.

2.3.4 Emissions Modeling

Emissions modeling is the process of creating CAMx-ready emissions inputs used by the CAMx model. An overview is provided in this section of the emission inputs used for the 2012 base case and 2020 future case. Emissions modeling includes preparing emissions inventories for anthropogenic emissions source categories such as stationary point sources (power plants, refineries, etc.), area sources (dry cleaners, gas stations, etc.), and mobile sources (automobiles, trucks, etc.).
stations, etc.), on-road mobile sources (cars, trucks, etc.), non-road mobile sources (construction vehicles, lawn mowing equipment, etc.), off-road mobile sources (locomotives, commercial marine, aircraft, etc.), and oceanic sources (off-shore oil rigs and ocean-going vessels). In addition to anthropogenic emissions, emissions from natural sources such as biogenic emissions and wildfire emissions were also developed.

As part of emissions modeling, precursor emissions inputs were chemically speciated, temporally allocated, and spatially distributed for each domain for the 2012 Modeling Episode. Version 3.22 of the Emissions Processor System (EPS3) was used to prepare the gridded emissions inputs. Table 2-6: *Emissions Processing Modules* summarizes many of the steps taken to prepare the required emissions files needed by CAMx and the software modules in EPS3 that were used for each step.

### Table 2-6: Emissions Processing Modules

<table>
<thead>
<tr>
<th>EPS3 Module</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREAM</td>
<td>Prepare area and non-link based area and mobile source emissions for further processing</td>
</tr>
<tr>
<td>LBASE</td>
<td>Spatially allocate link-based mobile source emissions among grid cells</td>
</tr>
<tr>
<td>PREPNT</td>
<td>Group point source emissions into elevated and low-level categories for further processing</td>
</tr>
<tr>
<td>CNTLEM</td>
<td>Apply controls to model strategies, apply adjustments, make projections, etc.</td>
</tr>
<tr>
<td>TMPRL</td>
<td>Apply temporal profiles to allocate emissions by day type and hour</td>
</tr>
<tr>
<td>SPCEMS</td>
<td>Chemically speciate emissions into nitrogen oxide (NO), nitrogen dioxide (NO₂), and various Carbon Bond 6 (CB6) volatile organic compounds (VOC) species</td>
</tr>
<tr>
<td>GRDEM</td>
<td>Spatially distribute emissions by grid cell using source category surrogates</td>
</tr>
<tr>
<td>MRGUAM</td>
<td>Merge and adjust multiple gridded files for model-ready input</td>
</tr>
<tr>
<td>PIGEMS</td>
<td>Assign Plume-in-Grid (PiG) emissions and merge elevated point source files</td>
</tr>
</tbody>
</table>

For this §179B SIP revision, emissions inputs that were prepared as part of the 2020 DFW AD SIP revision and the 2020 HGB AD SIP revision adopted on March 4, 2020 were used with minor updates as discussed in this section. An overview of the 2012 base case as well as the 2020 future case emissions, along with updates made for this §179B SIP revision, are presented below. Appendix B: *Emissions Modeling* contains more detail on the development and processing of the emissions inputs used in this §179B SIP revision.

#### 2.3.4.1 Base Case Modeling

Base case modeling is used to evaluate the CTM's ability to replicate measured ozone and precursor concentrations during the 2012 Modeling Episode. The adequacy of the model in replicating observations was assessed statistically and graphically. Satisfactory model performance in base case modeling provides a degree of confidence in the use of the model to predict future ozone concentrations and to evaluate international anthropogenic contribution. Day-specific emissions were developed for each of the three CAMx domains for each anthropogenic emissions category.

Typical base case weekday emissions in tons per day (tpd), for major anthropogenic source categories in the Bexar County 2015 eight-hour ozone nonattainment area are...
summarized in Table 2-7: 2012 Sample Base Case Anthropogenic Emissions for Bexar County for an August Day. The pollutants provided include nitrogen oxides (NO\textsubscript{x}), volatile organic compounds (VOC), carbon monoxide (CO), sulfur dioxide (SO\textsubscript{2}), ammonia (NH\textsubscript{3}), and particulate matter of size 2.5 and 10 micrograms (PM\textsubscript{2.5} and PM\textsubscript{10}). The electric generating unit (EGU) emissions presented in Table 2-7 are specific to an August episode day and are different for each of the remaining 152 episode days of the 2012 Modeling Episode.

Table 2-7: 2012 Sample Base Case Anthropogenic Emissions for Bexar County for an August Day

<table>
<thead>
<tr>
<th>Emissions Source Type</th>
<th>NO\textsubscript{x} (tpd)</th>
<th>VOC (tpd)</th>
<th>CO (tpd)</th>
<th>SO\textsubscript{2} (tpd)</th>
<th>NH\textsubscript{3} (tpd)</th>
<th>PM\textsubscript{2.5} (tpd)</th>
<th>PM\textsubscript{10} (tpd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-Road</td>
<td>53.99</td>
<td>26.74</td>
<td>299.63</td>
<td>0.37</td>
<td>1.43</td>
<td>1.21</td>
<td>0.00</td>
</tr>
<tr>
<td>Non-Road</td>
<td>10.63</td>
<td>9.25</td>
<td>97.61</td>
<td>0.01</td>
<td>0.02</td>
<td>1.02</td>
<td>0.00</td>
</tr>
<tr>
<td>Off-Road - Airports</td>
<td>1.15</td>
<td>0.89</td>
<td>8.77</td>
<td>0.14</td>
<td>0.00</td>
<td>0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>Off-Road - Locomotives</td>
<td>2.44</td>
<td>0.15</td>
<td>0.47</td>
<td>0.00</td>
<td>0.00</td>
<td>0.07</td>
<td>0.08</td>
</tr>
<tr>
<td>Area Sources</td>
<td>3.63</td>
<td>70.48</td>
<td>7.87</td>
<td>0.73</td>
<td>7.54</td>
<td>15.06</td>
<td>117.16</td>
</tr>
<tr>
<td>Oil and Gas - Drilling</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Oil and Gas - Production</td>
<td>1.71</td>
<td>8.24</td>
<td>2.60</td>
<td>0.00</td>
<td>0.00</td>
<td>0.07</td>
<td>0.00</td>
</tr>
<tr>
<td>Point - EGUs (August 7, 2012 Episode Day)</td>
<td>26.44</td>
<td>1.28</td>
<td>21.52</td>
<td>43.46</td>
<td>0.14</td>
<td>2.15</td>
<td>26.44</td>
</tr>
<tr>
<td>Point - Non-EGUs (Ozone Season Average)</td>
<td>11.41</td>
<td>6.16</td>
<td>6.55</td>
<td>1.82</td>
<td>0.05</td>
<td>0.67</td>
<td>1.22</td>
</tr>
<tr>
<td>Bexar County Total</td>
<td>111.4</td>
<td>123.19</td>
<td>445.02</td>
<td>46.53</td>
<td>9.18</td>
<td>20.27</td>
<td>144.93</td>
</tr>
</tbody>
</table>

The TCEQ used version 3.61 of the Biogenic Emission Inventory System (BEIS) (Bash et al., 2016) to develop biogenic emissions. The WRF model provided the meteorological data needed to run the BEIS model for each 2012 Modeling Episode day. The National Center for Atmospheric Research's (NCAR) Fire INventory from NCAR (FINN), was used to estimate day specific fire emissions for each 2012 Modeling Episode day. The TCEQ did not differentiate between the emissions of wildfires and prescribed fires for this §179B SIP revision.

2.3.4.2 Future Year Modeling

Future year modeling is used to predict ozone concentrations and calculate a DV\textsubscript{o} at each regulatory monitor in Bexar County for the 2020 future year. In future year modeling, the 2012 Modeling Episode is used, but with projected future anthropogenic emissions. Future year modeling answers the question: what would the ozone concentrations be in the future if the same meteorological and natural conditions that resulted in a high ozone episode in the past were to recur?
Since biogenic emissions are dependent upon the meteorological conditions on a given day, the same day-specific biogenic emissions were used in both the 2012 base case and 2020 future case modeling scenarios. Similarly, since fires, especially wildfires, cannot be predicted, the same day-specific fire emissions were used in both the 2012 base case and the 2020 future case.

Similar to the base case, future year emissions inputs to CAMx are speciated, spatially distributed, and gridded using version 3.22 of EPS3. Growth in emissions for the 2020 future year is based on projected economic growth. The 2020 emissions also account for reductions due to state, local, and federal control programs.

The future year emissions inventory that was developed for the 2020 DFW AD SIP revision and the 2020 HGB AD SIP revision was used for this §179B SIP revision. Day-specific future year emissions were developed for the EGU source category based on the 2018 data from the EPA’s Air Markets Program Data¹⁹ database and the Cross-State Air Pollution Program State Budgets.²⁰ Further details of the 2020 emissions inventory development are provided in Appendix B.

Typical future case weekday emissions in tpd for major anthropogenic source categories in the Bexar County 2015 eight-hour ozone nonattainment area are summarized in Table 2-8: Future Case Anthropogenic Emissions for Bexar County for a 2020 August Day.

<table>
<thead>
<tr>
<th>Emissions Source Type</th>
<th>NOₓ (tpd)</th>
<th>VOC (tpd)</th>
<th>CO (tpd)</th>
<th>SO₂ (tpd)</th>
<th>NH₃ (tpd)</th>
<th>PM₂.₅ (tpd)</th>
<th>PM₁₀ (tpd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-Road</td>
<td>21.15</td>
<td>15.21</td>
<td>201.97</td>
<td>0.14</td>
<td>1.07</td>
<td>0.47</td>
<td>0.00</td>
</tr>
<tr>
<td>Non-Road</td>
<td>6.15</td>
<td>6.19</td>
<td>92.98</td>
<td>0.01</td>
<td>0.02</td>
<td>0.54</td>
<td>0.00</td>
</tr>
<tr>
<td>Off-Road - Airports</td>
<td>2.10</td>
<td>0.45</td>
<td>4.39</td>
<td>0.22</td>
<td>0.00</td>
<td>0.06</td>
<td>0.07</td>
</tr>
<tr>
<td>Off-Road - Locomotives</td>
<td>1.91</td>
<td>0.10</td>
<td>0.51</td>
<td>0.00</td>
<td>0.00</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Area Sources</td>
<td>5.73</td>
<td>87.16</td>
<td>6.52</td>
<td>0.83</td>
<td>7.97</td>
<td>17.59</td>
<td>137.52</td>
</tr>
<tr>
<td>Oil and Gas - Drilling</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Oil and Gas - Production</td>
<td>1.39</td>
<td>4.61</td>
<td>2.11</td>
<td>0.00</td>
<td>0.00</td>
<td>0.06</td>
<td>0.00</td>
</tr>
<tr>
<td>Point - EGU's (August 7, 2012 Episode Day)</td>
<td>36.03</td>
<td>0.64</td>
<td>16.21</td>
<td>53.12</td>
<td>0.12</td>
<td>1.73</td>
<td>2.24</td>
</tr>
<tr>
<td>Point - Non-EGUs (Ozone Season Average)</td>
<td>11.83</td>
<td>6.00</td>
<td>7.01</td>
<td>1.59</td>
<td>0.04</td>
<td>0.69</td>
<td>1.34</td>
</tr>
<tr>
<td>Bexar County Total</td>
<td>86.29</td>
<td>120.36</td>
<td>331.7</td>
<td>55.91</td>
<td>9.22</td>
<td>21.19</td>
<td>141.22</td>
</tr>
</tbody>
</table>

¹⁹ EPA’s Air Markets Program Data, available at [https://ampd.epa.gov/ampd/](https://ampd.epa.gov/ampd/).
²⁰ Final Cross-State Air Pollution Rule Update, available at [https://www.epa.gov/airmarkets/final-cross-state-air-pollution-rule-update](https://www.epa.gov/airmarkets/final-cross-state-air-pollution-rule-update). Additional information on the Cross-State Air Pollution Rule can be found in Section 3.4.2.2: *Clean Air Interstate Rule (CAIR) and Cross-State Air Pollution Rule (CSAPR)* of this §179B SIP revision.
From 2012 through 2020, total anthropogenic NOx emissions in Bexar County decreased by roughly 22.5% while anthropogenic VOC emissions decreased by roughly 2.3%.

For this §179B SIP revision, both natural and anthropogenic emissions were represented in the CAMx domain in the 2020 future year for the Reference Case. For the ZROW Case, the 2020 future year anthropogenic emissions from Southern Canada and Northern Mexico within the 36km CAMx modeling domain were zeroed out. Figure 2-14: Reference Case versus ZROW Case 2020 Future Year Anthropogenic Emissions in CAMx is a pictorial representation of the difference in the anthropogenic emissions inventories used in the Reference Case and ZROW Case 2020 future year CAMx simulations.

Figure 2-14: Reference Case versus ZROW Case 2020 Future Year Anthropogenic Emissions in CAMx

2.3.5 Initial Conditions and BC Development
In addition to emissions and meteorological inputs, CAMx requires input of initial conditions (IC) and BC. IC refers to the state of the atmosphere at the start of the modeling episode. BC refers to the state of the atmosphere at the five edges (north, south, east, west, and top) of the 36km CAMx domain.

The inputs for IC and BC were derived from the output of a three-dimensional global CTM, GEOS-Chem. The GEOS-Chem model simulates atmospheric chemical and physical processes driven by assimilated meteorological observations from the National Aeronautics and Space Administration’s (NASA) Goddard Earth Observing System (GEOS). Version 12.2.0 of GEOS-Chem was used for the development of the IC and BC required for this §179B SIP revision. The TCEQ contracted with Ramboll to perform the necessary GEOS-Chem model runs. The Modern-Era Retrospective analysis

for Research and Applications (MERRA)-2 reanalysis meteorology was used in both the 2012 base case and 2020 future case GEOS-Chem simulations. Table 2-9: 2012 and 2020 GEOS-Chem Emissions Inventories provides details of the emissions inventories used and the data year of the inventories.

Table 2-9: 2012 and 2020 GEOS-Chem Emissions Inventories

<table>
<thead>
<tr>
<th>Region/Emissions Type</th>
<th>Inventory Used</th>
<th>Inventory Year for the 2012 Simulation</th>
<th>Inventory Year for the 2020 Simulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continental United States</td>
<td>National Emissions Inventory (NEI) monthly</td>
<td>2011</td>
<td>2011</td>
</tr>
<tr>
<td>Canada</td>
<td>Air Pollution Emission Inventory (APEI)</td>
<td>2012</td>
<td>2014</td>
</tr>
<tr>
<td>Mexico</td>
<td>Community Emissions Data System (CEDS)</td>
<td>2012</td>
<td>2014</td>
</tr>
<tr>
<td>China</td>
<td>Multi-Resolution Emissions Inventory for China (MEIC)</td>
<td>2012</td>
<td>2017</td>
</tr>
<tr>
<td>Rest of World (including Alaska and Hawaii)</td>
<td>CEDS</td>
<td>2012</td>
<td>2014</td>
</tr>
<tr>
<td>U.S. Coast Shipping</td>
<td>NEI Monthly</td>
<td>2011</td>
<td>2011</td>
</tr>
<tr>
<td>Europe Coast Shipping</td>
<td>Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)</td>
<td>2012</td>
<td>2012</td>
</tr>
<tr>
<td>Rest of the World Shipping</td>
<td>CEDS</td>
<td>2012</td>
<td>2014</td>
</tr>
<tr>
<td>Aircraft</td>
<td>Aviation Emissions Inventory Code (AEIC)</td>
<td>2005</td>
<td>2005</td>
</tr>
<tr>
<td>Biomass Burning</td>
<td>FINN</td>
<td>2012</td>
<td>2012</td>
</tr>
<tr>
<td>Ethane (C₂H₆) from oil, gas, and biofuel</td>
<td>Tzompa-Sosa et al., 2017</td>
<td>2010</td>
<td>2010</td>
</tr>
<tr>
<td>Volcanic Degassing Sulfur Dioxide (SO₂)</td>
<td>Aerosol Comparisons between Observations and Models (AeroCom)</td>
<td>2009</td>
<td>2009</td>
</tr>
<tr>
<td>Lightning</td>
<td>NASA Lightning Imaging Sensor (LIS) / Optical Transient Detector (OTD) High Resolution Monthly Climatology</td>
<td>2012</td>
<td>2012</td>
</tr>
<tr>
<td>Natural Ammonia (NH₃)</td>
<td>Global Emissions Initiative (GEIA)</td>
<td>1990</td>
<td>1990</td>
</tr>
<tr>
<td>Region/Emissions Type</td>
<td>Inventory Used</td>
<td>Inventory Year for the 2012 Simulation</td>
<td>Inventory Year for the 2020 Simulation</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------</td>
<td>--------------------------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>Bromocarbon and Iodocarbon</td>
<td>In-line Calculations and Global Emission Estimates from Literature</td>
<td>GEOS-Chem default</td>
<td>GEOS-Chem default</td>
</tr>
<tr>
<td>Methane (CH₄) Concentrations</td>
<td>Climate Monitoring and Diagnostics Laboratory (CMDL) Flask Observations</td>
<td>2012</td>
<td>2012</td>
</tr>
<tr>
<td>Meteorology-Driven Natural Emissions</td>
<td>In-line Calculations</td>
<td>2012</td>
<td>2012</td>
</tr>
</tbody>
</table>

Inventories that had a data year different from 2012 were scaled using a factor to 2012 when possible.²² Ramboll also conducted the 2020 ZROW Case GEOS-Chem simulation needed for this §179B SIP revision. In the ZROW Case simulations, all non-U.S. anthropogenic emissions were zeroed out. Table 2-10: Emissions Inventories Used in ZROW Case GEOS-Chem Simulation provides details of the emissions inventories used in the ZROW Case run.

Table 2-10: Emissions Inventories Used in ZROW Case GEOS-Chem Simulation

<table>
<thead>
<tr>
<th>Region/Emissions Type</th>
<th>Inventory</th>
<th>Used in ZROW Case Simulation?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continental United States</td>
<td>NEI monthly</td>
<td>Yes</td>
</tr>
<tr>
<td>Canada</td>
<td>APEI</td>
<td>No</td>
</tr>
<tr>
<td>Mexico</td>
<td>CEDS</td>
<td>No</td>
</tr>
<tr>
<td>China</td>
<td>MEIC</td>
<td>No</td>
</tr>
<tr>
<td>Rest of World (including Alaska and Hawaii)</td>
<td>CEDS</td>
<td>Yes²³</td>
</tr>
<tr>
<td>U.S. Coast Shipping</td>
<td>NEI Monthly</td>
<td>Yes</td>
</tr>
<tr>
<td>Europe Coast Shipping</td>
<td>EMEP</td>
<td>No</td>
</tr>
<tr>
<td>Rest of the World Shipping</td>
<td>CEDS</td>
<td>Yes²⁴</td>
</tr>
<tr>
<td>Aircraft</td>
<td>AEIC</td>
<td>Yes²⁴</td>
</tr>
<tr>
<td>Biomass Burning</td>
<td>FINN³</td>
<td>Yes</td>
</tr>
<tr>
<td>C₂H₆ from oil, gas, and biofuel</td>
<td>Tzompa-Sosa et al., 2017</td>
<td>Yes²⁵</td>
</tr>
<tr>
<td>Volcanic Degassing SO₂</td>
<td>AeroCom</td>
<td>Yes</td>
</tr>
<tr>
<td>Lightning</td>
<td>NASA LIS/OTD High Resolution Monthly Climatology</td>
<td>Yes</td>
</tr>
<tr>
<td>Natural NH₃</td>
<td>GEIA</td>
<td>Yes</td>
</tr>
</tbody>
</table>

²³ CEDS only used in Alaska and Hawaii in ZROW Case simulations.
²⁴ CEDS ship and AEIC aircraft emissions only used in rectangular regions surrounding the CONUS and Alaska in ZROW Case simulations.
²⁵ Global C₂H₆ emissions only used in rectangular regions surrounding the CONUS and Alaska in ZROW Case simulations.
<table>
<thead>
<tr>
<th>Region/Emissions Type</th>
<th>Inventory</th>
<th>Used in ZROW Case Simulation?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bromocarbon and Iodocarbon</td>
<td>In-line Calculations and Global Emission Estimates from Literature</td>
<td>Yes</td>
</tr>
<tr>
<td>CH₄ Concentrations</td>
<td>CMDL flask observations</td>
<td>Yes</td>
</tr>
<tr>
<td>Meteorology-Driven Natural Emissions</td>
<td>In-line Calculations</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Figure 2-15: Reference Case versus ZROW Case 2020 Future Year Anthropogenic Emissions in GEOS-Chem is a pictorial representation of the difference in the anthropogenic emissions inventories used in the Reference Case and the ZROW Case 2020 future year GEOS-Chem simulations.

The natural emissions were kept constant between the Reference Case and ZROW Case GEOS-Chem runs. Ramboll used the geos2aqm version 5.9 tool to extract the IC and BC needed as inputs for the 2012 and 2020 CAMx Reference Case simulations as well as the 2020 ZROW Case simulation. Figure 2-16: South BC on June 26 at 12:00 p.m. for Reference Case’s 2020 Model Year shows the South BC on June 26 at 12:00 p.m. for the 2020 model year in the Reference Case while Figure 2-17: South BC on June 26 at 12:00 p.m. for ZROW Case’s 2020 Model Year shows the BC at the exact date, time and model year for the ZROW Case. Comparing Figure 2-16 and Figure 2-17 at the exact episode date, time, and model year, as expected, shows that the BCs have lower ozone concentration in the ZROW Case than in the Reference Case, indicating that less ozone is entering the CAMx domain when anthropogenic emissions from non-U.S. are removed.
Figure 2-16: South BC on June 26 at 12:00 p.m. for Reference Case's 2020 Model Year

Figure 2-17: South BC on June 26 at 12:00 p.m. for ZROW Case's 2020 Model Year

Figure 2-18: South BC on June 26 at 12:00 p.m. for the 2012 Model Year shows the south BC on June 26 at 12PM for the 2012 model year which remains the same in both the Reference Case as well as the ZROW Case.
Figure 2-18: South BC on June 26 at 12:00 p.m. for the 2012 Model Year

2.3.6 Photochemical Modeling
The TCEQ used CAMx version 6.50 with the following options:

- revised gridded file formats for meteorology inputs, IC and BC, emission inputs, output concentration values, and deposition fields;
- photolysis rate updates based on inputs for surface albedo, height above ground, terrain height, solar zenith, clouds, temperature, and barometric pressure;
- new gas-phase chemistry mechanisms for CB6 speciation and CB6 “revision 4”, which added condensed halogen chemistry and inline sea salt emissions; and
- Wesely dry deposition scheme.

In addition to the meteorological, emissions, and IC and BC inputs, CAMx also requires spatially resolved surface characteristic parameters, spatially resolved albedo, haze, ozone (i.e., opacity) and photolysis rates, and a chemistry parameters file. Surface characteristic parameters, including topographic elevation, leaf area index (LAI), vegetative distribution, and water and land boundaries are input to CAMx via a land-use file. The land-use file provides the fractional contribution (zero to one) of 26 land-use categories, as defined by Zhang et al (2003). For the 36 km domain, the TCEQ developed the land-use file using version 3 of the Biogenic Emissions Land-Use Database for areas outside the U.S. and the 2006 National Land Cover Dataset (NLCD) for the U.S. For the 4 km and 12 km domains, the TCEQ used updated land-use files developed by Texas A&M University (Popescu et al., 2012), which were derived from more highly resolved data collected by the Texas Parks and Wildlife Department, Landscape Fire and Resource Management Planning Tools Project, Landsat, National Institute of Statistics and Geography, and the NLCD. Monthly averaged LAI was created from the eight-day 1 km resolution Moderate-Resolution Imaging Spectroradiometer (MODIS) MCD15A2 product.

The chemistry parameters file specifies the chemical mechanism and associated details of species properties and reaction rates and types. For this §179B SIP revision, the chemical parameters file was specific to the CB6 mechanism. Spatially resolved opacity and photolysis rates are input to CAMx via a photolysis rates file and an opacity file. The TCEQ used episode-specific satellite data from the Total Ozone Mapping Spectrometer to prepare the clear-sky photolysis rates and opacity files. Photolysis
rates are internally adjusted by CAMx according to cloud and aerosol properties using the inline Tropospheric Ultraviolet Visible model.

For this §179B SIP revision, three CAMx simulations were conducted: the 2012 base year Reference Case simulation, the 2020 future year Reference Case simulation, and the 2020 future year ZROW Case simulation. Outputs from the three simulations were used to estimate the international anthropogenic contribution. The TCEQ further conducted model performance evaluation for both CAMx and GOES-Chem 2012 base year Reference Case simulations. This provided a degree of confidence in the modeling analysis used to determine the influence of international anthropogenic emissions on the attainment status of Bexar County. Details of the model performance analysis are provided in Appendix C: *Regional and Global Photochemical Model Performance Evaluation*.

### 2.4 FCAA, §179B TECHNICAL ANALYSIS FOR THE BEXAR COUNTY 2015 EIGHT-HOUR OZONE NONATTAINMENT AREA

The TCEQ used a series of technical analyses to demonstrate that “but for” international anthropogenic emissions, the Bexar County ozone nonattainment area would attain the 2015 eight-hour ozone NAAQS. This section details the results of the various technical analyses.

#### 2.4.1 Estimation of International Anthropogenic Contribution to 2020 DV_f

The international anthropogenic contribution is estimated as the difference between a Reference Case 2020 future year design value (DV_f^{\text{Ref}}) and ZROW Case 2020 future year design value (DV_f^{\text{ZROW}}). Equation 2-1: *International Anthropogenic Contribution Calculation* shows the methodology used to determine the international anthropogenic contribution.

\[
\text{International Anthropogenic Contribution} = DV_f^{\text{Ref}} - DV_f^{\text{ZROW}}
\]

where: \(DV_f^{\text{Ref}} = DV_B \times RRF_{\text{Ref}}\) and \(DV_f^{\text{ZROW}} = DV_B \times RRF_{\text{ZROW}}\)

In Equation 2-1, the base design value (DV_B) and relative response factor (RRF) is used to calculate the future year design value (DV_f) at a monitor per the EPA Modeling Guidance. An RRF, as shown in Equation 2-2: *RRF Calculation*, is calculated from a pair of base and future year runs as the ratio of the average future year modeled MDA8 ozone concentrations and the average base year modeled MDA8 ozone concentrations on the top 10 modeled MDA8 base year days.

\[
RRF = \frac{\text{Average of modeled MDA8 on the top ten base year days in a future year simulation}}{\text{Average of modeled MDA8 on the top ten base year days in a base year simulation}}
\]

For RRF_{\text{Ref}}, the base and future year modeled MDA8 ozone concentrations were from the Reference Case 2012 base year and 2020 future year simulations. For RRF_{\text{ZROW}}, the future year modeled MDA8 ozone concentrations were from the ZROW Case 2020 simulation while the base year modeled MDA8 concentration remained the same as the Reference Case 2012 simulation. In accordance with the EPA Modeling Guidance, the
maximum concentration of the three-by-three grid cell array surrounding each monitor on the top 10 base year days was used to calculate the RRFs for each monitor in both the Reference Case and ZROW Case.

The $D_{V_b}$ is the average of the monitored regulatory design values$^{26}$ for the three consecutive years containing the 2012 base year, as shown in Figure 2-19: Components of $D_{V_b}$ for the §179B SIP Revision.

![Figure 2-19: Components of $D_{V_b}$ for the §179B SIP Revision](image)

Average of 2012, 2013, and 2014 Design Values weights the 2012 4th high eight-hour ozone value as most influential

Table 2-11: Reference Case $D_{V_b}$, RRF, and 2020 $D_{V_f}$ for Bexar County Regulatory Monitors shows the $D_{V_b}$, RRF, and 2020 $D_{V_f}$ for each regulatory monitor in the Bexar County 2015 eight-hour ozone nonattainment area for the Reference Case.

<table>
<thead>
<tr>
<th>Site Name and CAMS Number</th>
<th>$D_{V_b}$ (ppb)</th>
<th>$RRF_{Ref}$</th>
<th>$D_{V_f}^{Ref}$ (ppb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camp Bullis (C58)</td>
<td>80.33</td>
<td>0.8709</td>
<td>69.96</td>
</tr>
<tr>
<td>Calaveras Lake (C59)</td>
<td>68.67</td>
<td>0.8703</td>
<td>59.77</td>
</tr>
<tr>
<td>San Antonio Northwest (C23)</td>
<td>76.67</td>
<td>0.8740</td>
<td>67.01</td>
</tr>
</tbody>
</table>

Table 2-12: ZROW Case $D_{V_b}$, RRF, and 2020 $D_{V_f}$ for Bexar County Regulatory Monitors shows the base design value, RRF, and 2020 future design value for each regulatory

$^{26}$ TCEQ’s Compliance with Eight-Hour Ozone Standard webpage (https://www.tceq.texas.gov/cgi-bin/compliance/monops/8hr_attainment.pl).
monitor in the Bexar County 2015 eight-hour ozone nonattainment area for the ZROW Case.

Table 2-12: ZROW Case $DV_{B}$, RRF, and 2020 $DV_{F}$ for Bexar County Regulatory Monitors

<table>
<thead>
<tr>
<th>Site Name and CAMS Number</th>
<th>$DV_{B}$ (ppb)</th>
<th>RRF$_{ZROW}$</th>
<th>$DV_{F}^{ZROW}$ (ppb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camp Bullis (C58)</td>
<td>80.33</td>
<td>0.831</td>
<td>66.75</td>
</tr>
<tr>
<td>Calaveras Lake (C59)</td>
<td>68.67</td>
<td>0.8325</td>
<td>57.17</td>
</tr>
<tr>
<td>San Antonio Northwest (C23)</td>
<td>76.67</td>
<td>0.8414</td>
<td>64.51</td>
</tr>
</tbody>
</table>

Table 2-13: *International Anthropogenic Contribution at Bexar County Regulatory Monitors* shows the international anthropogenic contribution$^{27}$ at the three regulatory monitors in the Bexar County 2015 eight-hour ozone nonattainment area.

Table 2-13: *International Anthropogenic Contribution at Bexar County Regulatory Monitors*

<table>
<thead>
<tr>
<th>Site Name and CAMS Number</th>
<th>International Anthropogenic Contribution (ppb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camp Bullis (C58)</td>
<td>3</td>
</tr>
<tr>
<td>Calaveras Lake (C59)</td>
<td>2</td>
</tr>
<tr>
<td>San Antonio Northwest (C23)</td>
<td>2</td>
</tr>
</tbody>
</table>

The average international anthropogenic contribution to the Bexar County 2015 eight-hour ozone nonattainment area is 2.33 ppb. The countywide average includes the estimated contribution at the three regulatory monitors. The maximum contribution is 3 ppb while the minimum contribution is 2 ppb.

2.4.2 Source Apportionment of the 2020 $DV_{F}$

The TCEQ conducted source apportionment using CAMx’s APCA tool. APCA is a probing tool in CAMx that is used to apportion the modeled ozone concentration at each grid cell at each simulation hour to specific user-defined geographic regions and/or source categories. APCA does this by keeping track of the origin of the NO$_x$ and VOC precursors creating the ozone in each grid cell for each time step during the model run.

The APCA contribution categories chosen were to facilitate better understanding of the relative importance of local versus transported ozone. For this §179B SIP revision the following source and geographic tags were used in the CAMx APCA model run.

- Bexar County Anthro (NO$_x$ and VOC emissions from Bexar County anthropogenic sources);
- DFW Anthro (NO$_x$ and VOC emissions from 2015 eight-hour ozone NAAQS DFW area anthropogenic sources);
- HGB Anthro (NO$_x$ and VOC emissions from 2015 eight-hour ozone NAAQS HGB area anthropogenic sources);

$^{27}$ Rounded and truncated per the EPA Modeling Guidance.
• Other Texas Anthro (NO\textsubscript{x} and VOC emissions from Texas anthropogenic sources that are not located in Bexar County, DFW, and HGB areas);
• Non-Texas U.S. Anthro (NO\textsubscript{x} and VOC emissions from anthropogenic sources in the 47 other states of the continental U.S.);
• Non-U.S. Anthro (NO\textsubscript{x} and VOC emissions from southern Canadian and northern Mexican anthropogenic sources included in the rpo\textsubscript{12km} domain);
• Ocean Anthro (NO\textsubscript{x} and VOC emissions from ocean-going vessels and off-shore oil and gas platforms);
• Biogenic Emissions;
• Fires; and
• IC and BC.

Figure 2-20: APCA Geographic Regions for the §179B SIP Revision is a map of the APCA contribution categories.

Figure 2-20: APCA Geographic Regions for the §179B SIP Revision

An APCA run was done for both the 2020 Reference Case as well as the 2020 ZROW Case. Figure 2-21: Source Category Contribution to 2020 DV\textsubscript{i} Source Apportionment at Bexar County Monitors shows the contribution of each APCA contribution category to
the 2020 DV$_i$ at each of the three regulatory monitors in Bexar County for both the Reference Case and the ZROW Case.

![Source Category Contribution to 2020 DV$_i$ at Bexar County Monitors](image)

**Figure 2-21: Source Category Contribution to 2020 DV$_i$ at Bexar County Monitors**

For all three monitors, the BC contribution to the 2020 DV$_i$ is almost the same in magnitude as the local contribution, indicating that transported contributions play a critical role in Bexar County’s nonattainment status. It should be noted that BC are not entirely composed of international anthropogenic contributions since they include both natural and anthropogenic international components as well as emissions emitted within the CAMx modeling domain that left the modeling domain and are being recirculated back into the domain. The change in the BC contribution and the contribution from the parts of southern Canada and northern Mexico included in the 36km CAMx modeling domain between the Reference Case and ZROW Case corresponds approximately (not the same due to nonlinearity in ozone formation) to the international anthropogenic contribution estimated in Section 2.4.1: *Estimation of International Anthropogenic Contribution to 2020 DV$_i$*. This provides greater confidence in the estimated anthropogenic contribution.

2.4.3 Back-Trajectory Analysis

A discussion of possible international transport of ozone to Bexar County and the San Antonio area requires a description of how air is transported into the area on high ozone days. A commonly used method to identify wind patterns related to high ozone
days is a back-trajectory analysis. Back-trajectory analyses estimate the most likely path of air parcels arriving at a location of interest over a specified length of time. While trajectory analysis can provide information regarding the common pathways or directions that air parcels are estimated to travel, it cannot be used to identify the pollutants or the contributors to the pollutants present in the air parcel. Due to this limitation, the TCEQ limited its back-trajectory analysis to qualitatively analyze the transport patterns from Mexico, the closest international border, on the Bexar County nonattainment area. The back-trajectory analysis is intended to provide context to the modeling analysis presented in previous sections and cannot be used to quantify international anthropogenic contribution.

2.4.3.1 Trajectory Model Details
The HYSPLIT model28 was run for every day from January 1, 2010 through December 31, 2018, producing 72-hour backward trajectories. The trajectories plot the path of the air parcel that arrived at 13:00 Local Standard Time (LST) at 500 meters altitude at the Elm Creek Elementary ozone monitor (C501) over the previous 72 hours. The Elm Creek Elementary monitor (C501) is located southwest of the Bexar County. 13:00 LST was used as the approximate hour each day when eight-hour ozone reaches a peak. The meteorological input files used in HYSPLIT were the 40-km National Weather Service’s National Centers for Environmental Prediction (NCEP) Eta Data Assimilation System. Backward trajectories were restricted to 72 hours (three days) as uncertainty in model output increases with longer timeframes.

The Elm Creek Elementary (C501) monitor was chosen to more easily differentiate between trajectories arriving from outside Bexar County and those traversing or originating from within the Bexar County. If the trajectories ended within Bexar County, it would be difficult to determine whether local sources contributed to observed concentrations or whether air pollution was being transported into the area. The HYSPLIT trajectories were not filtered to exclude trajectories that originated at altitudes above the troposphere.

2.4.3.2 Trajectory Pathway Analysis
Geographic Information System software was used to identify trajectory endpoints falling within Mexico and four major central and eastern Texas metropolitan areas: San Antonio (which includes Bexar County), DFW, HGB, and Beaumont-Port Arthur (BPA), as shown in Figure 2-22: HYSPLIT Trajectories Terminating at Elm Creek Elementary. Sums were calculated for endpoints falling within Mexico and/or the metropolitan areas for trajectories in the following four scenarios:

- a trajectory that traversed Mexico and at least one Texas metropolitan area (San Antonio, DFW, HGB, or BPA);
- a trajectory that traversed Mexico but not a Texas metropolitan area;
- a trajectory that did not traverse Mexico but traversed a Texas metropolitan area; or
- a trajectory that did not traverse Mexico or a Texas metropolitan area.

---

Table 2-14: Percentage of All Trajectories from Mexico but Not the Four Texas Metropolitan Areas shows that over the nine-year period from 2010 through 2018, 36% of trajectories arriving at the Elm Creek Elementary monitor on the southern periphery of Bexar County traversed some part of Mexico, but did not traverse any of the four major central and eastern Texas metropolitan areas: San Antonio (which includes Bexar County), BPA, DFW, and/or HGB. Annual percentages ranged between 32% and 43% of trajectories, depending on the year.

**Table 2-14: Percentage of All Trajectories from Mexico but Not the Four Texas Metropolitan Areas**

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>34%</td>
</tr>
<tr>
<td>2011</td>
<td>43%</td>
</tr>
<tr>
<td>2012</td>
<td>37%</td>
</tr>
<tr>
<td>2013</td>
<td>32%</td>
</tr>
<tr>
<td>2014</td>
<td>35%</td>
</tr>
<tr>
<td>2015</td>
<td>37%</td>
</tr>
<tr>
<td>2016</td>
<td>33%</td>
</tr>
</tbody>
</table>
The trajectories were filtered to include days when quality-assured, valid eight-hour ozone concentration data existed from the Elm Creek Elementary monitor, which only operates during the months of May through October. Of the filtered trajectories, 42% traversed Mexico but not one of the four Texas metropolitan areas, as shown in Table 2-15: Statistics for Trajectory Scenarios that Traversed Mexico and Not One of Four Texas Metropolitan Areas. The values in the table are rounded to the nearest ppb. The nine-year mean of annual mean of MDA8 ozone was 33 ppb while the nine-year maximum of the annual maximum of the MDA8 ozone was 76 ppb. When the trajectories traversed one of the four Texas metropolitan areas but not Mexico, the nine-year mean of annual mean of MDA8 ozone concentration was 49 ppb while the nine-year maximum of the annual maximum of the MDA8 ozone was 89 ppb.

Table 2-15: Statistics for Trajectory Scenarios that Traversed Mexico and Not One of Four Texas Metropolitan Areas

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage</th>
<th>Mean MDA8 Ozone (ppb): In Mexico, Not in Texas Metro</th>
<th>Max MDA8 Ozone (ppb): In Mexico, Not in Texas Metro</th>
<th>Percentage of Ozone Season Trajectories: In Texas Metro, Not in Mexico</th>
<th>Mean MDA8 Ozone (ppb): In Texas Metro, Not in Mexico</th>
<th>Max MDA8 Ozone (ppb): In Texas Metro, Not in Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>44%</td>
<td>24</td>
<td>46</td>
<td>27%</td>
<td>43</td>
<td>67</td>
</tr>
<tr>
<td>2011</td>
<td>51%</td>
<td>38</td>
<td>67</td>
<td>22%</td>
<td>55</td>
<td>89</td>
</tr>
<tr>
<td>2012</td>
<td>36%</td>
<td>37</td>
<td>76</td>
<td>28%</td>
<td>51</td>
<td>81</td>
</tr>
<tr>
<td>2013</td>
<td>37%</td>
<td>35</td>
<td>58</td>
<td>27%</td>
<td>49</td>
<td>79</td>
</tr>
<tr>
<td>2014</td>
<td>39%</td>
<td>35</td>
<td>72</td>
<td>26%</td>
<td>50</td>
<td>72</td>
</tr>
<tr>
<td>2015</td>
<td>43%</td>
<td>31</td>
<td>66</td>
<td>26%</td>
<td>48</td>
<td>70</td>
</tr>
<tr>
<td>2016</td>
<td>35%</td>
<td>28</td>
<td>51</td>
<td>32%</td>
<td>43</td>
<td>66</td>
</tr>
<tr>
<td>2017</td>
<td>40%</td>
<td>36</td>
<td>69</td>
<td>29%</td>
<td>49</td>
<td>77</td>
</tr>
<tr>
<td>2018</td>
<td>51%</td>
<td>36</td>
<td>60</td>
<td>22%</td>
<td>53</td>
<td>79</td>
</tr>
<tr>
<td>Nine-Year Mean</td>
<td>42%</td>
<td>33</td>
<td>63</td>
<td>27%</td>
<td>49</td>
<td>76</td>
</tr>
<tr>
<td>Maximum Over Nine-Year Period</td>
<td>51%</td>
<td>38</td>
<td>76</td>
<td>32%</td>
<td>55</td>
<td>89</td>
</tr>
</tbody>
</table>

In the years 2010 through 2018, on average, MDA8 ozone was higher when trajectories travelled through one of the Texas metropolitan areas and not Mexico before arriving at the Elm Creek Elementary monitor, compared to only traversing Mexico but not any of the four metropolitan areas, as shown in Figure 2-23: Mean MDA8 Ozone Concentrations by Trajectory Scenario at the Elm Creek Elementary Monitor. However, the analysis does show that a significant percentage of trajectories that reached the Elm Creek Elementary monitor traversed through Mexico but not any of the four Texas Metropolitan Areas.
metropolitan areas (see Figure 2-24: *Number of Trajectories by Scenario at the Elm Creek Elementary Monitor*).


**Figure 2-23: Mean MDA8 Ozone Concentrations by Trajectory Scenario at the Elm Creek Elementary Monitor**
Figure 2-24: Number of Trajectories by Scenario at the Elm Creek Elementary Monitor

In addition, the analysis also shows that trajectories that traversed Mexico but not any Texas metropolitan areas included days when the maximum MDA8 ozone concentration observed at Elm Creek Elementary monitor exceeded the 2015 eight-hour ozone NAAQS (see Figure 2-25: Maximum MDA8 Ozone Concentrations by Trajectory Scenario at the Elm Creek Elementary Monitor, specifically the years 2012 and 2014).
Figure 2-25: Maximum MDA8 Ozone Concentrations by Trajectory Scenario at the Elm Creek Elementary Monitor

This analysis shows that air flow from Mexico with the potential to contribute to ozone exceedances in the San Antonio metropolitan area is possible and provides context to the photochemical modeling analysis presented in Section 2.4.2: Source Apportionment of the 2020 DV.

2.4.3.3 Trajectory Frequency by Ozone Concentration

To qualitatively analyze the influence of transport from Mexico, back trajectories were generated for each day of the May through September months for the years 2010 through 2018 ozone seasons. Trajectories were grouped as above or below the 2015 eight-hour ozone NAAQS of 70 ppb based on the maximum MDA8 for Bexar County (i.e., the maximum across all monitors in Bexar County). The grouped trajectories were plotted separately as frequency of endpoints, which shows the common trajectory paths conditioned on ozone.

Figure 2-26: Density Analysis of Trajectories when MDA8 Ozone Concentration is 70 ppb or Less (Left panel) and when MDA8 Ozone Concentration is Greater than 70 ppb (Right panel).


2-41
shows a density analysis of the HYSPLIT back trajectories from Elm Creek Elementary for days less than or equal to 70 ppb (left panel) and for days above 70 ppb (right panel). Warmer colors indicate more trajectory endpoints, signifying more common air flow pathways. The results show predominant flow for both high and low ozone days is anti-cyclonic (clockwise), bringing air masses in from the Gulf of Mexico. Trajectories ending in San Antonio usually pass from the Gulf of Mexico over northeastern Mexico and over southern Texas. Flows from the west and the north are rare.

Days when the Bexar County MDA8 ozone concentration was 70 ppb or less show longer trajectories, which extend into the Gulf of Mexico (Figure 2-26, left panel). The longer trajectories translate to faster winds, which can dilute pollutant concentrations. These trajectories also pass over Mexico more frequently. This is in agreement with several studies that have reported that when winds flow briskly from the Gulf of Mexico into southeast Texas, ozone concentrations are usually low (Sullivan (2009), Smith et al. (2014), and Souri et al. (2015)).

For days when the MDA8 ozone concentration was above 70 ppb in Bexar County, the back trajectories were generally shorter (Figure 2-26, right panel), indicating slower winds. Figure 2-26 shows that incoming air masses are less likely to travel from the Gulf of Mexico and instead are more likely to come from areas along the coast of Texas or from a northeasterly direction. Though it occurs with less frequency, air masses can pass over Mexico on days with elevated ozone in Bexar County.

Figure 2-26: Density Analysis of Trajectories when MDA8 Ozone Concentration is 70 ppb or Less (Left) and when MDA8 Ozone Concentration is Greater than 70 ppb (Right)

The trajectory analysis discussed in this section shows that air flow from Mexico to Bexar County is possible. In a majority of the instances, trajectories that traverse Mexico are associated with below 70 ppb MDA8 ozone concentrations. However, there were a few instances where a monitor in Bexar County had trajectories that traversed Mexico and had a MDA8 ozone concentration that exceeded the 70 ppb 2015 eight-hour ozone NAAQS.
2.5 CONCLUSIONS

Based on the technical analysis conducted, the TCEQ concluded that but for international anthropogenic contribution, the Bexar County ozone nonattainment area would attain the 2015 eight-hour ozone NAAQS by 2020. Due to the absence of timely EPA guidance on the requirements for a §179B demonstration, the TCEQ based its conclusion on the modeled 2020 DVi, the estimated international anthropogenic contribution to the 2020 DVi, the relative contribution of local versus BC to the 2020 DVi, and the area’s current monitored design value.

- The modeled 2020 DVi, including the international anthropogenic contribution, at Camp Bullis is 70 ppb.
- The estimated modeled international anthropogenic contribution to Bexar County is in the 2 to 3 ppb range.
- Source apportionment of the 2020 DVi showed that BC, which includes both natural and anthropogenic international emissions, is a large contributor to the 2020 DVi in Bexar County.
- The certified 2018 design value at the San Antonio Northwest monitor was 72 ppb.

The contribution from BC to the future design value is equal in magnitude to the local contribution indicating that international transport is influential in the attainment status and air quality of the Bexar County 2015 eight-hour ozone nonattainment area. The most recent design value for the nonattainment area, based on certified monitoring data, is 72 ppb which, when combined with the estimated modeled international anthropogenic contribution of 2 to 3 ppb, is sufficient to bring Bexar County into attainment of the 2015 eight-hour ozone NAAQS. These factors collectively provide the TCEQ confidence that, but for international anthropogenic contribution, the Bexar County ozone nonattainment area would attain the 2015 eight-hour ozone NAAQS.

2.6 REFERENCES


CHAPTER 3: WEIGHT OF EVIDENCE

3.1 INTRODUCTION
The corroborative analyses presented in this chapter demonstrate the progress towards attainment of the 2015 eight-hour ozone National Ambient Air Quality Standard (NAAQS) that the Bexar County ozone nonattainment area continues to make. This corroborative information supplements the Federal Clean Air Act (FCAA), §179B technical analysis presented in Chapter 2: Federal Clean Air Act, §179B Technical Analysis to support a conclusion that the Bexar County ozone nonattainment area would attain the 2015 eight-hour ozone standard by the 2020 attainment year but for international anthropogenic emissions. The United States Environmental Protection Agency’s (EPA) Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM$_{2.5}$, and Regional Haze (EPA, 2018; hereafter referred to as EPA Modeling Guidance) recommends the inclusion of supplemental evidence that the conclusions from modeling analysis are supported by other independent sources of information. This chapter details the supplemental evidence, i.e., the corroborative analyses, for this FCAA, §179B demonstration state implementation plan (SIP) revision (§179B SIP revision).

This chapter describes analyses that corroborate the conclusions of Chapter 2. First, information regarding trends in ambient concentrations of ozone and ozone precursors in the Bexar County 2015 eight-hour ozone nonattainment area is presented. Second, this chapter discusses the results of additional air quality studies and their relevance to this §179B SIP revision. Third, 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 modeling discussed in Chapter 2.

3.2 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 in a nonattainment area. Declining trends in observed concentrations of ozone and its precursors and in emissions (past and projected) are consistent with progress toward attainment. The strength of evidence produced by emissions and air quality trends is increased if an extensive monitoring network exists. In 2018, the Bexar County 2015 eight-hour ozone nonattainment area had three regulatory and five non-regulatory ozone monitors, four nitrogen oxides (NO$_x$) monitors, and one automated gas chromatograph (auto-GC) for volatile organic compounds (VOC). More detail on the specific locations and pollutants measured per monitor can be found on the Texas Commission on Environmental Quality (TCEQ) Air Monitoring Sites webpage (https://www.tceq.texas.gov/airquality/monops/sites/air-mon-sites).

This section examines both emissions trends as well as the ambient trends from the extensive ozone and ozone precursor monitoring network in the Bexar County 2015 eight-hour ozone nonattainment area.

The conceptual model for the ozone nonattainment area provides an extensive set of graphics that detail ozone trends in the region. The graphics and analyses also illustrate the wealth of monitoring data examined including regulatory ozone monitors.
and a network of auto-GCs. The one-hour and the eight-hour ozone design values both have overall sustained decreasing trends over the past 10 years. The Bexar County 2015 eight-hour ozone nonattainment area's conceptual model is described in Appendix E: Conceptual Model for the Bexar County Nonattainment Area for the 2015 Eight-Hour Ozone National Ambient Air Quality Standard.

3.2.1 Ozone Trends
Because ozone varies both temporally and spatially, there are several ways that trends in ozone concentrations are analyzed. This section discusses ozone design value trends and background ozone trends. These trends provide evidence to support the conclusion that the Bexar County 2015 eight-hour ozone nonattainment area is making progress toward attainment and the local contribution is decreasing. Ozone data used in this section is only from regulatory monitors that report to the EPA's Air Quality System, unless otherwise noted.

3.2.1.1 Ozone Design Value Trends
A design value is the statistic used to determine compliance with the NAAQS. For the 2015 eight-hour ozone NAAQS, design values for each year are calculated by averaging the fourth-highest daily-maximum eight-hour averaged ozone value at each monitor site over three years. The eight-hour ozone design value for a metropolitan area is the maximum design value from all the area's monitors' individual design values. Design values of 71 ppb and greater exceed the 2015 eight-hour ozone NAAQS of 70 ppb and design values of 76 ppb or greater exceed the 2008 eight-hour ozone NAAQS of 75 ppb. Although this SIP revision focuses on eight-hour ozone, the one-hour ozone design values can also be useful to determine ozone trends. The one-hour ozone design values are calculated differently than the eight-hour ozone design values. The one-hour ozone design value is calculated for each year by determining the fourth-highest daily-maximum one-hour ozone value over three years at each monitor. Like the eight-hour ozone design values, the one-hour ozone design value for a metropolitan area is the maximum design value from all the monitors within that area.

The one-hour and eight-hour ozone design value trends for Bexar County are displayed in Figure 3-1: One-Hour and Eight-Hour Ozone Design Values in the Bexar County Area from 2009 through 2018. The area-wide trends use data only from the three regulatory monitors in Bexar County. The trends show that both the eight-hour ozone design values and the one-hour ozone design values have decreased by 2 ppb (or 3% and 2% respectively) over the past ten years, meaning that overall trends in the Bexar County area are relatively flat.

One-hour ozone design values showed an increasing trend from 2010 through 2017, after which the one-hour ozone design values dropped to below those observed in 2009. One-hour ozone in Bexar county is well below the one-hour ozone NAAQS of 124 ppb, with the area measuring a design value of 92 ppb in 2018. Eight-hour ozone design values showed an increase from 2012 through 2015, when they measured above the 2008 ozone NAAQS of 75 ppb. After 2015, the area measured below the 75 ppb eight-hour ozone NAAQS. The 2018 eight-hour ozone design value of 72 ppb is the lowest design value ever measured in the Bexar County area. Despite this success, progress still must be made for the area to attain the 2015 eight-hour ozone NAAQS of 70 ppb.
Figure 3-1: One-Hour and Eight-Hour Ozone Design Values in the Bexar County Area from 2009 through 2018

3.2.1.2 Background Ozone Trends

Ozone levels in a nonattainment area are the sum of the background ozone entering the area and the locally produced ozone. Background ozone reflects the ozone produced from all sources outside of the nonattainment area. Determining the background ozone concentrations in an area will indicate how much ozone is produced from local emissions. The local component of ozone formation is then the amount of ozone that the area could potentially control to meet the 2015 eight-hour ozone NAAQS. EPA estimates of seasonal mean United States background ozone concentrations can be as high as 40 to 50 ppb depending upon location and time of year (EPA, 2015). Detailed descriptions of the technique used to estimate background are described in Appendix E.

Bexar County has three regulatory ozone monitors; therefore, both the regulatory and the non-regulatory ozone monitors were used for the background ozone analysis. There are also four non-regulatory monitors located in counties surrounding Bexar County (Comal and Guadalupe counties) that were used in this analysis. The Continuous Ambient Monitoring Stations (CAMS) used to calculate the background ozone were Calaveras Lake (CAMS 59), Elm Creek Elementary (CAMS 501), Fair Oaks Ranch (CAMS 502), Heritage Middle School (CAMS 622), Government Canyon (CAMS 1610), Bulverde Elementary (CAMS 503), City of Garden Ridge (CAMS 505), New
Braunfels Airport (CAMS 504), and Seguin Outdoor Learning Center (CAMS 506). The background ozone is then calculated as the lowest daily-maximum eight-hour average ozone observed at the subset of sites. This technique is conservative, in that if a gradient exists in background ozone, the technique will choose the low end of the gradient. Based on observational data, the background ozone cannot be lower than the chosen value.

The trends observed in background ozone for the months of March through October, months that typically see high ozone, from 2009 through 2018 in the Bexar County area were further separated into high ozone days and low ozone days. High ozone days are defined as days with a daily-maximum eight-hour ozone value greater than 70 ppb, and low ozone days are defined as days with a daily-maximum eight-hour ozone value less than or equal to 70 ppb. Results are shown in Figure 3-2: *Ozone Season Trends in Background Ozone in the Bexar County Area for High versus Low Ozone Days*.

Background ozone does appear to change from year to year for both high and low ozone days. Overall background ozone trends are flat, with the average background at 34 ppb on low ozone days and 57 ppb on high ozone days. For low ozone days, the locally produced ozone has very little change from year to year and averages around 11 ppb. The locally produced ozone on high ozone days has more year-to-year variability, but overall trends remain flat. The amount of locally produced ozone on high ozone days, 20 ppb on average, is almost double that produced on low ozone days. Although the amount of locally produced ozone is higher on high ozone days, the background ozone is also higher. Both increase almost proportionally from high to low ozone days, indicating that there may be meteorological conditions that affect the entire central Texas area causing increases in both background and locally produced ozone. Trends in background ozone for both high and low ozone days very closely correlate with trends in the daily maximum ozone. This may indicate that trends in ozone concentrations for the Bexar County area are driven more by changes in the background ozone rather than changes in locally produced ozone.

Figure 3-2: Ozone Season Trends in Background Ozone in the Bexar County Area for High versus Low Ozone Days
3.2.2 Emissions Trends for Major Source Categories

The categories of on-road, non-road, and electric generating units (EGU) have historically been primary sources of anthropogenic NO\textsubscript{x} emissions in ozone nonattainment areas. The TCEQ funded a study by the Texas Transportation Institute (TTI) to estimate on-road emissions trends throughout Texas from 1999 through 2050 using the 2014a version of the Motor Vehicle Emission Simulator (MOVES2014a) model (TTI, 2015). Non-road emissions trends analysis performed by the TCEQ using the Texas NONROAD (TexN) model (TCEQ, 2015) show a similar pattern. Operational data for EGUs from 1997 through 2018 were extracted from the EPA's Air Markets Program Data (AMPD) tool and used to analyze EGU emissions trends in each nonattainment area.

This section provides details on trends in these major categories for the Bexar County 2015 eight-hour ozone nonattainment area. From the late 1990s to the present, Federal, state, and local measures have resulted in significant NO\textsubscript{x} reductions from these source categories within the Bexar County nonattainment area. Overall, despite a continuous increase in the population, a strong economic development pattern, and growth in vehicle miles traveled (VMT), the observed trends are declining for ozone concentrations and NO\textsubscript{x} and VOC precursor emissions.

For the Bexar County 2015 eight-hour ozone nonattainment area, Figure 3-3: On-Road Activity and Emissions Trends in Bexar County from 1999 through 2050, shows that on-road emissions were estimated to be 126.47 NO\textsubscript{x} tons per day (tpd) in 2000 and decreased roughly 79% by 2018, even as daily vehicle miles traveled (VMT) is estimated to have increased by roughly 21% during this period. Figure 3-3: On-Road Activity and Emissions Trends in Bexar County from 1999 through 2050 also shows that this reduction in on-road NO\textsubscript{x} is projected to continue as older higher-emitting vehicles are removed from the fleet and are replaced with newer lower-emitting ones.
Figure 3-3: On-Road Activity and Emissions Trends in Bexar County from 1999 through 2050

Figure 3-4: Non-Road Activity and Emission Trends in Bexar County from 1999 to 2050, shows that non-road NO\textsubscript{x} emissions were estimated to be 26.91 tpd in 2001 and have decreased roughly 72% by 2018, even as the number of non-road engines (equipment population) has increased by roughly 39% during this period.
Figure 3-4: Non-Road Activity and Emission Trends in Bexar County from 1999 to 2050

Figure 3-5: Electrical Generation and NO\textsubscript{x} Emissions Trends in Bexar County from 1997 to 2018, shows that Bexar County’s average EGU NO\textsubscript{x} emissions were 87 tpd during the summer of 1997 and were reduced by roughly 64% through 2018. The amount of electricity generated during this time increased by 19%.
These trends in on-road, non-road, and EGU sources demonstrate the substantial progress in reducing Bexar County NO\textsubscript{X} emissions that has already occurred and will be sustained in the future.

### 3.3 LITERATURE REVIEW

#### 3.3.1 Studies of United States (U.S.) Background Ozone and International Contributions

The lowering of the ozone NAAQS and the increasing development of Asian economies has raised questions about the level of background ozone entering the U.S. and the origins of that ozone. U.S. background ozone (USB) is defined as ozone “...formed from sources or process other than U.S. man-made emissions of nitrogen oxides (NO\textsubscript{X}), volatile organic compounds (VOC), methane (CH\textsubscript{4}), and carbon monoxide (CO).”\textsuperscript{29} USB includes ozone due to natural events such as stratospheric intrusions, wildfires, and ozone from non-U.S. anthropogenic sources and is not a measurable quantity; it can only be estimated from modeling analyses. Ozone measured on the Pacific coast of the U.S. is called “baseline” ozone, because it is not clear whether it includes any


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Figure 3-5: Electrical Generation and NO\textsubscript{X} Emissions Trends in Bexar County from 1997 to 2018

This figure shows the electrical generation and NO\textsubscript{X} emissions trends in Bexar County from 1997 to 2018. The trends indicate substantial progress in reducing NO\textsubscript{X} emissions, which will be sustained in the future.
contributions from U.S. or North American emissions. Since U.S. background ozone can only be ascertained through modeling, there is an inherent uncertainty in its estimation.

The TCEQ has reviewed many modeling and observational studies that have been performed to estimate USB ozone concentrations. The following is a summary of some of the findings about background ozone.

- Background ozone concentrations on the west coast of the U.S. and the intermountain west have been increasing, especially in the spring. The spring increase is linked to two factors: transport of pollutants across the Pacific Ocean, which occurs more efficiently in the spring than in the summer; and enhanced stratosphere-troposphere exchange (Cooper et al., 2011, 2012, 2014; Jaffe et al., 2003; Lefohn et al., 2012, 2014; Oltmans et al., 2008).
- Regional background ozone has been decreasing in the eastern U.S., as measured by Clean Air Status and Trends Network and other networks (Fleming et al., 2018). Modeling studies indicate that North American background (NAB) and USB have been increasing, however, even in the eastern U.S., but NAB is not correlated with high ozone days in the east, unlike in the west (Cooper et al., 2012; Fiore et al., 2014; Zhang et al., 2011).
- Chinese NOx emissions increased dramatically from 1995 through 2010 but have been decreasing since 2010 (see Figure 3-6: Map of Satellite-Derived NO2 Trends in China and Figure 3-7: Trends in Three-Year Average NO2 Column Densities, Normalized to Mean of 2005 through 2007. These trends have been observed by satellite, i.e., they are not bottom-up emissions inventory (EI) estimates, but top-down observations of NO2 columns (Souri et al., 2016; Liu et al., 2017). Modeling studies of NOx emission sources within China have found that manufacture and transport of goods for China-to-U.S. trade account for 21% of the emissions (Lin, J. et al., 2014).
- Asian pollutants are transported across the Pacific by two routes, northern and southern. The southern route is the most important in bringing ozone to the continental U.S. Pollutants are transported in the form of peroxyacetylinitrates and related compounds, and when they descend from the free troposphere and thermally decompose, they create ozone. This finding is not only based upon modeling exercises, but also upon aircraft observations during field studies designed to investigate this phenomenon (Pfister et al., 2010; Heald et al., 2003; Hudman et al., 2009; Huang et al., 2013).
- Modeling studies show that the greatest impact from Asian emissions on ozone concentrations has been occurring in the intermountain west, including western Texas, but the impacts from Asian emissions in the eastern half of the U.S. are low. The impacts of Asian emissions throughout the U.S. occur primarily in the spring and are not strongly linked to the highest ozone days in the eastern U.S., though they are linked in the intermountain west (Lin et al. 2012).
- The U.S. baseline ozone concentrations had been increasing since the 1980s, but reached a peak in the mid-2000s, and have begun to decrease since then (see Figure 3-8: Changing Baseline Ozone Trends Measured on the Pacific Coast of the U.S.; Parish et al., 2017).
• Background ozone concentrations created by natural emissions emanating from the U.S. have been increasing due to higher biogenic emissions. (Koo et al., 2010; Lin et al., 2008; Lin et al., 2017; Fiore et al., 2014).
• Measured background ozone trends are decreasing, but modeled background ozone (i.e., natural origin) is increasing (Lin et al., 2017).
• Background ozone in eastern Texas is behaving like the background ozone in the eastern half of the U.S., not the western half. The western U.S. has experienced background ozone increases, and the days with the highest MDA8 ozone concentrations are much more strongly affected by background ozone than the eastern half of the U.S. (e.g., Fleming et al., 2018). Figure 3-9: Non-Urban Fourth-High MDA8 Ozone Concentration Trends Measured from 2000 through 2014 at Surface Monitoring Sites shows ozone trends at rural monitoring sites throughout the U.S. from 2000 through 2014; the only sites with increases are in the western U.S., and the southeastern Texas trend is sharply and significantly downward, like most of the eastern U.S. sites.

Figure 3-6: Map of Satellite-Derived NO$_2$ Trends in China

Left: Overall NO$_2$ trend from 2005 through 2014; Center: NO$_2$ trend from 2005 through 2010; Right: NO$_2$ trend from 2010 through 2014 (from Souri et al., 2016)
Figure 3-7: Trends in Three-Year Average NO$_2$ Column Densities, Normalized to Mean of 2005 through 2007
Figure 3-8: Changing Baseline Ozone Trends Measured on the Pacific Coast of the U.S.

From Parrish et al., 2017
Jaffe et al. (2018) conducted the most recent comprehensive review of the background ozone literature and synthesized the results of many studies into several consensus findings. One of their most critical findings is that seasonal mean U.S. background estimates (which must be determined by modeling) have an uncertainty of ±10 ppb. Since the modeled estimates of seasonal U.S. background ozone (see Table 3-1: Estimated U.S. Background Ozone in the San Antonio Area) in the three Texas ozone nonattainment areas is about 25 to 32 ppb (e.g., Nopmongcol et al., 2016; Dunker et al., 2017), this is a substantial degree of uncertainty.

Maps of estimated U.S. background ozone (Figure 3-10: Zero-Out Modeling Analysis Showing June through August Mean MDA8 Ozone) and the anthropogenic contributions to different background components (Figure 3-11: Relative Contributions in Percent to the Anthropogenic Component of the 10 Highest Ozone Days) show that contributions from Mexico, Canada, and other countries are all less than 10 ppb. Further, Jaffe et al. conclude that for an average of fewer days than an entire season (approximately 90 days), the uncertainty of U.S. background ozone estimates is even higher.

**Table 3-1: Estimated U.S. Background Ozone in the San Antonio Area**

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<tbody>
<tr>
<td>San Antonio</td>
<td>Summer MDA8</td>
<td>26.5</td>
<td>27.2</td>
<td>27.9</td>
<td>28.4</td>
<td>28.7</td>
<td>29.7</td>
</tr>
<tr>
<td>San Antonio</td>
<td>Top 30 MDA8</td>
<td>32.0</td>
<td>32.9</td>
<td>33.9</td>
<td>34.6</td>
<td>35.1</td>
<td>36.1</td>
</tr>
<tr>
<td>San Antonio</td>
<td>H4 MDA8</td>
<td>38.3</td>
<td>39.7</td>
<td>41.0</td>
<td>41.7</td>
<td>42.1</td>
<td>42.8</td>
</tr>
</tbody>
</table>

Summer MDA8 is June, July, and August annual average MDA8; Top 30 MDA8 is the average from the top 30 MDA8 ozone concentration days per year; H4 MDA8 is the annual average of the fourth-highest MDA8 (from Nopmongcol et al., 2016)
(a) North American background (Policy Relevant Background (PRB)); (b) U.S. background; (c) Contributions from Canada and Mexico (from Wang, H. et al., 2009)

**Figure 3-10: Zero-Out Modeling Analysis Showing June through August Mean MDA8 Ozone**
3.3.2 Contribution to Ozone from Springtime Fires in Mexico and Central America

During the spring of most years, agricultural fires are set in Mexico and Central America to prepare fields for planting. The smoke from these fires often reaches the eastern half of Texas. Fires such as these emit ozone precursor gases as well as particulate matter (Andrae, 2019; Mendoza et al., 2005; Yokelson et al. 2009, 2011; Koss et al., 2018; Gilman et al., 2015; Sekimoto et al., 2018; Coggan et al., 2019). In order for the spring agricultural burning in Mexico and Central America to affect the ozone design values in the eastern half of Texas, ozone or ozone precursors must be formed and persist long enough to be transported into Texas; the smoke plume must be transported to eastern Texas; emissions must be mixed down to the surface by the time it arrives at the city of interest; and the ozone must be high enough on that day in that city to affect the ozone design value. Although some of these conditions are met each year, there have been few instances when all the conditions have been met.

The Mexican/Central American smoke strongly affected air quality in eastern Texas during two events, in the spring months of 1998 (Cheng and Lin, 2001; Peppler et al. 2000; Rogers and Bowman, 2001; In et al., 2007; Tanner et al., 2001) and 2003 (Wang et...
A recent study has examined the effects of springtime burning more systematically for a long period. Wang et al. (2018) examined the effect of Mexican springtime agricultural burning upon eastern Texas ozone in April and May from 2002 to 2015. Transport of smoke from Mexico was tracked with meteorological observations, satellite observations of smoke and CO, and chemical transport modeling, and the estimated enhancement of ozone above clean conditions was estimated. The researchers found that when fires were present, and their plumes were carried to Houston, MDA8 ozone increased by 9.7±1.7 parts per billion by volume above the concentrations observed during clean maritime flow from the Gulf. But only fifteen ozone exceedance days occurred under the influence of Mexican fires during April-May 2002-2015; only one of those 15 days affected the design value (18 May 2003). The transport pattern which brings fire plumes from Mexico and Central America usually occurs under meteorological regimes that are not conducive to ozone formation.

Wang et al. (2018) show that the Mexican and Central American agricultural fires can affect Texas air quality. However, these fires affected the ozone design value very rarely, i.e., a single day out of 854 days, or 0.12% of the time.

### 3.3.3 Modeling Studies Comparable to the Modeling Performed by TCEQ for this SIP Revision

There have been many modeling studies that have examined how international emissions may contribute to ozone in the U.S. Three studies, Dunker et al., 2017; Nopmongcol et al., 2017a; and Nopmongcol et al., 2017b, are particularly relevant to the question of how international emissions affect Texas cities.

Dunker et al. (2017) modeled the spring and summer of 2010 to show how much international anthropogenic emissions contributed to ozone throughout the U.S. To simulate the ozone in the U.S. without most international emissions, they ran the global model GEOS-Chem both with and without anthropogenic emissions and estimated the anthropogenic portion of boundary conditions (BC) for a Comprehensive Air Quality Model with Extensions (CAMx) run that was run with the path-integral method (PIM) tool activated. The PIM is a combination source apportionment and sensitivity tool that can provide information on the contribution of certain emissions categories at each point in the modeling domain. In addition, Dunker et al. also conducted zero-out runs to estimate U.S. background.

The modeling showed that across the U.S. the base case scenario (which includes all emissions) produced similar high ozone concentrations in both eastern and western states, but background modeling produced higher ozone concentrations in the western U.S. than in the eastern U.S., with the highest concentrations in the mountainous regions of the west. The contributions for three additional categories (U.S. anthropogenic emissions, Canadian and Mexican emissions, and international emissions that enter the domain through the boundaries) were all calculated for each grid cell in the U.S. for spring, summer, and for the 10 highest days in both the base case and background scenarios. The contributions most relevant to policy were calculated for the 10 highest days in the base case scenario because these days are the most likely to be exceedance days. In eastern Texas, U.S. anthropogenic emissions contributed the most ozone on high ozone days, adding about 50% of the total on those days, whereas anthropogenic boundary contributions were only 5 to 7% of the
total, and Canadian/Mexican emissions contributed 0%. These days were the 10 highest
days in the base case scenario.

Since the CAMx domain used by Dunker et al. did not include all of Canada or Mexico,
the contribution attributed to Canada and Mexico is incomplete. Though the paper did
not focus on San Antonio monitors, it did provide estimations of international
anthropogenic emissions for the Houston-Galveston- Brazoria (HGB) and Dallas-Fort
Worth (DFW) areas. Figure 3-12: *Estimated Contribution from Different Geographic
Source Categories to Houston MDA8 Ozone* shows the (incomplete) Canada/Mexico
contributions at Manvel Croix in HGB, the contribution is virtually zero. During the
highest ozone days, the lateral BC anthropogenic contribution, which includes the rest
of the international contribution, tends to be lower than on modestly-high ozone days
in the spring. Figure 3-13: *Estimated Contribution from Different Geographic Source
Categories to Dallas MDA8 Ozone* shows the impact of Canada/Mexico and lateral BC
anthropogenic contribution for a monitor in DFW. Another source of uncertainty in
this analysis is that there are no wildfire emissions included for the U.S., Canada,
Mexico, or any other nation. These emissions vary considerably from year to year. The
scope of the Dunker et al. study was limited to anthropogenic and non-fire natural
emissions. Large contributions by fire emissions may be considered an exceptional
event, whereas this study was intended to examine non-exceptional emissions.

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**Figure 3-12: Estimated Contribution from Different Geographic Source Categories
to Houston MDA8 Ozone**
Two other relevant papers performed photochemical grid modeling for the U.S. and estimated the BC contributions: Nopmongcol et al., 2017a and 2017b (referred to as N2017a and N2017b, respectively). The first Nopmongcol paper used an emissions inventory developed for the Air Quality Model Evaluation International Initiative (AQMEII) Phase 3 and shows that BC contributed 20 to 35 ppb to the seasonal average MDA8 ozone in eastern Texas for spring and summer, with summer contributions on the low end, and spring on the upper end (Figure 3-14. Contributions to the Seasonal Average MDA8 Ozone from BC).
Nopmongcol et al. 2017a also examined BC contributions to the top 30 ozone days at several U.S. major cities. Figure 3-15. BC Ozone Contributions shows the BC contribution to the 4th high MDA8 as a blue circle, average MDA8 ozone for the highest 30 days as a red triangle, and summer average MDA8 as a green square for 22 metropolitan U.S. cities. An orange box highlights values for Dallas and Houston. From Figure 3-15, it can be seen that for Houston and Dallas the contribution from BC is roughly 24 to 27 ppb.
The second Nopmongcol paper estimated source contributions to United States ozone over five decades from 1970 through 2020. BCs, natural emissions, and Canadian and Mexican emissions contributions are all quantified. Although the modeling was for the entire continental U.S. detailed contribution data was provided for only a few selected cities; Fort Worth was the only Texas city included. Figure 3-16: Source Apportionment for Simulated Ozone Seasons from 1970-2020 in Fort Worth shows the source apportionment for Fort Worth from 1970 through 2020.
According to this analysis, among U.S. source categories, the largest contributor is on-road mobile emissions, and its decreasing contribution since 1970 is the primary reason for lower ozone in Fort Worth. In addition, the natural contribution has also decreased, even though the biogenic VOC emissions remained the same during all model runs at 2005 levels. Since the biogenic contribution decreased in spite of constant emissions, it can be inferred that the ozone must be responding to the interactions between biogenic VOC emissions and NOx from on-road mobile and EGUs. Contributions from Mexican sources within the CAMx domain are steady at 0.3 ppbv since 1990; Canadian contributions have decreased to the same level (0.3 ppbv) since peaking at 0.5 ppbv from 1980 through 2000. BCs have steadily contributed 23 to 24 ppbv since 1970; the BC component includes natural emissions from outside the CAMx domain, anthropogenic and biogenic emissions from the parts of Canada and Mexico not included in the CAMx domain, and wildfire emissions from outside the CAMx domain, held steady at 2005 levels.

These studies show that on high ozone days, contributions of roughly 20 to 25 ppb are from BC. Spring BC contributions are higher than summer contributions. Geographic distribution of BC contribution shows high BC contributions in the western half of the U.S., and low contributions in the eastern U.S., with the dividing line bisecting Texas, such that the Panhandle and west Texas are similar to the western U.S., and the eastern half of Texas is much like the rest of the eastern U.S. (See Figure 3-14).
3.4 EXISTING CONTROLS AND OTHER MEASURES

3.4.1 Existing Controls

The only county in the San Antonio area designated nonattainment for the 2015 eight-hour ozone NAAQS is Bexar County. The TCEQ has adopted a variety of regulations in 30 Texas Administrative Code (TAC) Chapter 115 that address emissions of VOC and in 30 TAC Chapter 117 that address emissions of NOX from sources in the area.

The measures that currently apply in the Bexar County 2015 eight-hour ozone nonattainment area are described in Table 3-2: Existing Ozone Control Measures Applicable to Bexar County. These existing ozone control measures were adopted at the request of local governments and to fulfill prior FCAA requirements in the San Antonio area, including Bexar County, and other nonattainment areas within the state.

Table 3-2: Existing Ozone Control Measures Applicable to Bexar County

<table>
<thead>
<tr>
<th>Measure</th>
<th>Description</th>
<th>Start Date(s)</th>
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<tbody>
<tr>
<td>VOC Control Measures – Storage Tanks</td>
<td>Controls on tanks storing VOC liquids other than crude oil or condensate based on size and vapor pressure of contents</td>
<td>12/31/1973</td>
</tr>
<tr>
<td>VOC Control Measures – General Vent Gas</td>
<td>Limits VOC emissions from process vents using one of the specified control measures or vapor control systems</td>
<td>12/31/2001 and earlier</td>
</tr>
<tr>
<td>VOC Control Measures – Water Separation</td>
<td>Limits VOC emissions from water separators that receive materials from any equipment that processes, refines, treats, stores, or handles VOCs</td>
<td>01/26/1972</td>
</tr>
<tr>
<td>VOC Control Measures – Loading and Unloading of VOCs</td>
<td>Limits VOC emissions from land-based loading and unloading transfer operations and transport vessels</td>
<td>06/30/1999 and earlier</td>
</tr>
<tr>
<td>VOC Control Measures – Transport Vessels</td>
<td>Testing, recordkeeping, and inspection requirements for gasoline tank-truck tanks</td>
<td>04/30/2000</td>
</tr>
<tr>
<td>VOC Control Measures – Degreasing Processes</td>
<td>Limits VOC emissions through work practices from each degreasing process type</td>
<td>12/31/2005 and earlier</td>
</tr>
<tr>
<td>VOC Control Measures – Automotive Windshield Washer Fluid</td>
<td>Limits the VOC content of automotive windshield washer fluid to 23.5% by weight (statewide rules)</td>
<td>01/01/1995</td>
</tr>
<tr>
<td>Refueling – Stage I</td>
<td>Requires capture and return of gasoline vapors to tank truck when filling gasoline storage tanks</td>
<td>1979</td>
</tr>
<tr>
<td>Measure</td>
<td>Description</td>
<td>Start Date(s)</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>NOx Control Measures – Cement Kilns</td>
<td>Requires limiting NOx emissions from Portland cement kilns</td>
<td>05/01/2005</td>
</tr>
<tr>
<td>30 TAC Chapter 117, Subchapter E, Division 2</td>
<td>NOx 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 (statewide rules)</td>
<td>07/01/2002</td>
</tr>
<tr>
<td>NOx Control Measures – Small Boilers, Process Heaters, and Water Heaters</td>
<td>NOx 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 (statewide rules)</td>
<td>07/01/2002</td>
</tr>
<tr>
<td>30 TAC Chapter 117, Subchapter E, Division 3</td>
<td></td>
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</tr>
<tr>
<td>Texas Low Emission Diesel</td>
<td>Requires all diesel fuel for both on-road and non-road use to have a lower aromatic content and a higher cetane number</td>
<td>Phased in from October 31, 2005 through January 31, 2006</td>
</tr>
<tr>
<td>30 TAC Chapter 114, Subchapter H, Division 2</td>
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<tr>
<td>Texas Low Reid Vapor Pressure (RVP) Gasoline</td>
<td>Requires all gasoline for both on-road and non-road use to have RVP of 7.8 pounds per square inch or less from May 1 through October 1 each year</td>
<td>May 1, 2000</td>
</tr>
<tr>
<td>30 TAC Chapter 114, Subchapter H, Division 1</td>
<td></td>
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</tr>
<tr>
<td>California Gasoline Engines</td>
<td>California standards for non-road gasoline engines 25 horsepower and larger</td>
<td>May 1, 2004</td>
</tr>
<tr>
<td>30 TAC Chapter 114, Subchapter H, Division 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal On-Road Measures</td>
<td>Series of emissions limits implemented by the EPA for on-road vehicles</td>
<td>Phase in through 2010 Tier 3 phase in from 2017 through 2025</td>
</tr>
<tr>
<td>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</td>
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<td></td>
</tr>
<tr>
<td>Federal Area/Non-Road Measures</td>
<td>Series of emissions limits implemented by the EPA for area and non-road sources</td>
<td>Phase in through 2018</td>
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<tr>
<td>Examples: diesel and gasoline engine standards for locomotives and leaf-blowers</td>
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### 3.4.2 Additional Measures

#### 3.4.2.1 SmartWay Transport Partnership and the Blue Skyways Collaborative

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

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

There are over 3,700 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 280 million
barrels. Between 2009 and 2016, the SmartWay Truck Carrier Partners prevented the release of 1,700,000 tons of NO\textsubscript{x} and 70,000 tons of particulate matter into the atmosphere.\(^{30}\) Approximately 192 Texas companies are SmartWay partners, 10 of which are in the Bexar County area.\(^{31}\) The SmartWay Transport Partnership will continue to benefit Bexar County by reducing emissions as more companies and affiliates join and additional idle reduction, trailer aerodynamic kits, low-rolling resistance tire, and retrofit technologies are incorporated into SmartWay-verified technologies.

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

### 3.4.2.2 Clean Air Interstate Rule (CAIR) and Cross-State Air Pollution Rule (CSAPR)

In March 2005, the EPA issued CAIR to address EGU emissions that transport from one state to another. The rule incorporated the use of three cap and trade programs to reduce SO\textsubscript{2} and NO\textsubscript{x}: the ozone season NO\textsubscript{x} trading program; the annual NO\textsubscript{x} trading program; and the annual SO\textsubscript{2} trading program.

Texas was not included in the ozone season NO\textsubscript{x} program but was included for the annual NO\textsubscript{x} and SO\textsubscript{2} programs. As such, Texas was required to make necessary reductions in annual SO\textsubscript{2} and NO\textsubscript{x} emissions from new and existing EGUs to demonstrate that emissions from Texas do not contribute to nonattainment or interfere with maintenance of the 1997 particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers (PM\textsub{2.5}) NAAQS in another state. CAIR consisted of two phases for implementing necessary NO\textsubscript{x} and SO\textsubscript{2} reductions. Phase I addressed required reductions from 2009 through 2014. Phase II was intended to address reductions in 2015 and thereafter.

In July 2006, the commission adopted a SIP revision to address how the state would meet emissions allowance allocation budgets for NO\textsubscript{x} and SO\textsubscript{2} established by the EPA to meet the federal obligations under CAIR. The commission adopted a second CAIR-related SIP revision in February 2010. This revision incorporated various federal rule revisions that the EPA had promulgated since the TCEQ's initial submittal. It also incorporated revisions to 30 TAC Chapter 101 resulting from legislation during the 80th Texas Legislature, 2007.

A December 2008 court decision found flaws in CAIR but kept CAIR requirements in place temporarily while directing the EPA to issue a replacement rule. In July 2011, the EPA finalized CSAPR to meet FCAA requirements and respond to the court's order to issue a replacement program. Texas was included in CSAPR for ozone season NO\textsubscript{x}, annual NO\textsubscript{x}, and annual SO\textsubscript{2} due to the EPA's determination that Texas significantly contributes to nonattainment or interferes with maintenance of the 1997 eight-hour 

\(^{30}\) [https://www.epa.gov/smartway/smartway-program-successes](https://www.epa.gov/smartway/smartway-program-successes).


\(^{32}\) [https://www.epa.gov/smartway/smartway-partner-list](https://www.epa.gov/smartway/smartway-partner-list).
ozone NAAQS and the 1997 PM$_{2.5}$ NAAQS in other states. As a result of numerous EGU emission reduction strategies already in place in Texas, the annual and ozone season NO$_x$ reduction requirements from CSAPR were relatively small but still significant. CSAPR required an approximate 7% reduction in annual NO$_x$ emissions and less than 5% reduction in ozone season NO$_x$ emissions.

On August 21, 2012, the U.S. Court of Appeals for the District of Columbia (D.C.) Circuit vacated CSAPR. Under the D.C. Circuit Court’s ruling, CAIR remained in place until the EPA developed a valid replacement.

The EPA and various environmental groups petitioned the Supreme Court of the United States to review the D.C. Circuit Court’s decision on CSAPR. On April 29, 2014, a decision by the Supreme Court reversed the D.C. Circuit and remanded the case. On October 23, 2014, the D.C. Circuit lifted the CSAPR stay and on November 21, 2014, the EPA issued rulemaking, which shifted the effective dates of the CSAPR requirements to account for the time that had passed after the rule was stayed in 2011. Phase 1 of CSAPR took effect January 1, 2015 and Phase 2 began January 1, 2017. On July 28, 2015, the D.C. Circuit Court ruled that the 2014 annual SO$_2$ budgets and the 2014 ozone season NO$_x$ budgets for Texas were invalid because they required over control of Texas emissions, and remanded these budgets back to the EPA without vacatur.

On June 27, 2016, the EPA issued a memorandum outlining the agency’s approach for responding to the D.C. Circuit’s July 2015 remand of the Phase 2 SO$_2$ emissions budgets, providing a choice of two paths for states with remanded budgets. Under the first path, states could voluntarily continue to participate in CSAPR at the state’s current Phase 2 SO$_2$ and annual NO$_x$ budget levels through a SIP revision. Under the second path, if a state did not choose to participate in CSAPR, the EPA would initiate rulemaking by fall of 2016 to remove the state’s sources from CSAPR’s SO$_2$ and annual NO$_x$ programs and address any remaining interstate transport or regional haze obligations on a state-by-state basis. On November 10, 2016, the EPA published a proposed rule to remove Texas sources from the CSAPR SO$_2$ and annual NO$_x$ trading programs. The EPA also proposed to determine that, following withdrawal of the federal implementation plan (FIP) requirements, sources in Texas would not contribute significantly to nonattainment or interfere with maintenance of the 1997 PM$_{2.5}$ NAAQS in any other state and that the EPA would have no obligation to issue new FIP requirements for Texas sources to address transport for the 1997 PM$_{2.5}$ NAAQS (81 FR 78954). The rule was finalized, effective immediately, on September 29, 2017 (82 FR 45481).

On September 7, 2016, the EPA signed the final CSAPR Update Rule for the 2008 eight-hour ozone standard. The EPA’s modeling showed that emissions from within Texas no longer significantly contribute to downwind nonattainment or interference with maintenance for the 1997 eight-hour ozone NAAQS even without implementation of the original CSAPR ozone season NO$_x$ emissions budget. Accordingly, sources in Texas are no longer subject to the emissions budget calculated to address the 1997 eight-hour ozone NAAQS. However, this rule finalized a new ozone season NO$_x$ emissions budget for Texas to address interstate transport with respect to the 2008 eight-hour ozone NAAQS. This new budget became effective for the 2017 ozone season, the same period in which the Phase 2 budget that was invalidated by the court was scheduled to become effective. On July 10, 2018, the EPA published a proposed close-out of CSAPR,
proposing to determine that the CSAPR Update Rule fully addresses interstate pollution transport obligations for the 2008 eight-hour ozone NAAQS in 20 covered states, including Texas. The EPA’s modeling analysis projects that by 2023 there will be no remaining nonattainment or maintenance areas for the 2008 eight-hour ozone NAAQS in the CSAPR Update region and therefore the EPA would have no obligation to establish additional control requirements for sources in these states. As a result, these states would not need to submit SIP revisions establishing additional control requirements beyond the CSAPR Update. The final rule was published on December 21, 2018 with an effective date of February 19, 2019 (83 FR 65878). On September 13, 2019, the D.C. Circuit Court remanded the CSAPR Update back to the EPA after finding that the rule is inconsistent with the FCAA and allows upwind states to continue their significant contributions to downwind air quality problems beyond the attainment dates for those downwind areas. On October 1, 2019, the D.C. Circuit Court vacated the CSAPR close-out rule. The EPA has yet to issue any guidance regarding the impact of these latest court rulings on the CSAPR program, therefore, at this time, the TCEQ has no information regarding potential future changes of the CSAPR program.

3.4.2.3 Texas Emissions Reduction Plan (TERP)

The TERP was created in 2001 by the 77th Texas Legislature to provide grants to offset the incremental costs associated with reducing NOx 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 grants are awarded to projects to replace, repower, or retrofit eligible vehicles and equipment to achieve NOx emission reductions in Texas ozone nonattainment areas and other counties identified as affected counties under the TERP where ground-level ozone is a concern.

From 2001 through August 2019, $1,153,991,148 in DERI grants were awarded for projects projected to help reduce an estimated 184,207 tons of NOx in the period over which emissions reductions are reported for each project under the program. This includes $89,306,882 going to activities in the San Antonio area, which includes Bexar, Comal, Guadalupe, and Wilson Counties, with an estimated 11,349 tons of NOx reduced in the period over which emissions reductions are reported for each project under the program. The TCEQ expects to award an additional $60.4 million in grants under the DERI program in fiscal year (FY) 2020 through FY 2021.

Three other incentive programs under the TERP, described below, will result in the reduction in NOx emissions in the San Antonio area.

The Drayage Truck Incentive Program was established in 2013 to provide grants for the replacement of drayage trucks operating in and from seaports and rail yards located in nonattainment areas. The name of this program was recently changed to the Seaport and Rail Yard Areas Emissions Reduction (SPRY) program, and replacement or repower of cargo handling equipment was added to the eligible project list. Through August 2019, the program awarded $15.5 million, with an estimated 773.45 tons of NOx reduced in the period over which emissions reductions are reported for each project under the program. In the San Antonio area, the funding totaled $198,385, with projects estimated to reduce up to 7.94 tons of NOx in the period over which emissions
reductions are reported for each project under the program. The TCEQ expects to award an additional $9.3 million in grants in Texas under the SPRY Program in FY 2020.

The Texas Clean Fleet Program (TCFP) was established in 2009 to provide grants for the replacement of light-duty and heavy-duty diesel vehicles with vehicles powered by alternative fuels, including: natural gas, liquefied petroleum gas, hydrogen, methanol (85% by volume), or electricity. This program is for larger vehicle fleets; therefore, applicants must commit to replacing at least 10 eligible diesel-powered vehicles with qualifying alternative fuel or hybrid vehicles. From 2009 through August 2019, over $62 million in TCFP grants were awarded for projects to help reduce an estimated 671 tons of NOx in the period over which emissions reductions are reported for each project under the program. Over $6 million in TCFP grants were awarded to projects in the San Antonio area, with an estimated 63.6 tons of NOx reduced in the period over which emissions reductions are reported for each project under the program. The TCEQ expects to award an additional $7.7 million in grants in Texas under the TCFP in FY 2020.

The Texas Natural Gas Vehicle Grant Program (TNGVGP) was established in 2011 to provide grants for the replacement of medium-duty and heavy-duty diesel vehicles with vehicles powered by natural gas. This program may include grants for individual vehicles or multiple vehicles. From 2011 through August 2019, over $55.9 million in TNGVGP grants were awarded for projects to help reduce an estimated 1,685.6 tons of NOx in the period over which emissions reductions are reported for each project under the program. Approximately $4.6 million in TNGVGP grants were awarded to projects in the San Antonio area, with an estimated 140.6 tons of NOx reduced in the period over which emissions reductions are reported for each project under the program. The TCEQ expects to award an additional $15.4 million in grants in Texas under the TNGVGP in FY 2020.

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.

3.4.2.4 Clean School Bus Program
House Bill (HB) 3469, 79th Texas Legislature, 2005, Regular Session, established the Clean School Bus Program, which provides monetary incentives for school districts in the state for reducing emissions of diesel exhaust from school buses through retrofit of older school buses with diesel oxidation catalysts, diesel particulate filters, and closed crankcase filters. As a result of legislative changes in 2017, this program also includes replacement of older school buses with newer, lower-emitting models. Through August 2019, the TCEQ Clean School Bus Program had reimbursed approximately $40.6 million in grants for nearly 7,700 retrofit and replacement activities across the state. This amount included $4.7 million in federal funds. Of the total amount, approximately $2 million was used for 718 school bus retrofit projects and eight school bus replacement projects in the San Antonio area. The TCEQ expects
to award an additional $6.2 million in projects in Texas under the Clean School Bus Program in FY 2020.

3.4.2.5 86th Texas Legislature, 2019
Summaries of the bills passed during the 86th Texas Legislature, 2019, Regular Session, that have the potential to impact the Bexar County area are discussed in this section.

House Bill 1346
HB 1346 gives the TCEQ authority to set the minimum usage of TERP grant funded equipment in nonattainment and affected areas under the DERI program lower than the current 75%, but not lower than 55%. This could increase the number of projects funded, though the NOx emissions reductions for projects that include equipment used less than 75% in the eligible areas could be lower than projects to date.

House Bill 3745
HB 3745 creates a TERP Trust Fund, effective September 1, 2021, and extends the TERP fees until attainment, effective August 30, 2019. This fund would exist outside of the state treasury and would allow the TCEQ to expend all the revenue from the TERP fees that accrue over the state biennium. HB 3545 could potentially result in the TCEQ funding more TERP projects and potentially achieving greater NOx emissions reductions.

3.4.2.6 Local Initiatives
Local strategies in the Bexar County 2015 eight-hour ozone nonattainment area are being coordinated and implemented by the City of San Antonio and the Alamo Area Council of Governments (AACOG). Due to the continued progress of these measures, additional air quality benefits are expected to be gained that will further reduce precursors to ground level ozone formation. Information on local measures is available on the City of San Antonio website (https://www.sanantonio.gov/sustainability/AirQuality) and the AACOG website (https://www.aacog.com/97/Air-Quality---Natural-Resources).

3.4.2.7 Voluntary Measures
While the oil and natural gas industry is required to install controls either due to state or federal requirements, the oil and natural gas industry has in some instances voluntarily implemented additional controls and practices to reduce VOC emissions from oil and natural gas operations in the Bexar County ozone nonattainment area as well as other areas of the state. Examples of these voluntary efforts can include: installing vapor recovery units on condensate storage tanks; using low-bleed natural gas actuated pneumatic devices; installing plunger lift systems in gas wells to reduce gas well blowdown emissions; and implementing practices to reduce VOC emissions during well completions (i.e., “Green Completions”). The EPA’s Natural Gas STAR Program provides details on these and other practices recommended by the EPA as voluntary measures to reduce emissions from oil and natural gas operations and improve efficiency. Additional information on the EPA Natural Gas STAR Program may be found on the EPA’s Natural Gas STAR Program webpage (https://www.epa.gov/natural-gas-star-program/natural-gas-star-program).
3.5 CONCLUSIONS
The TCEQ's analysis of design value and local emissions trends shows that design values in Bexar County have been holding steady despite reductions in local emissions. The TCEQ's analysis of background ozone in Bexar County, which includes the international anthropogenic contribution, shows that there is an increase in background ozone on high-ozone days. Based on these trends, there is indication that background ozone might play a role on high ozone days in Bexar County. In addition, the TCEQ's literature review provides a snapshot of the latest research related to international transport and background ozone. The studies reviewed by TCEQ provide context and validate the TCEQ's technical approach. Together, the trends analysis and literature review provide additional weight to the conclusion that, but for international anthropogenic emissions, the Bexar County ozone nonattainment area would attain the 2015 eight-hour ozone NAAQS by the attainment deadline.

3.6 REFERENCES


Yokelson, R.J. et al., 2011, Trace gas and particle emissions from open biomass burning in Mexico, Atmos. Chem. Phys., 11, 6787-6808, doi:10.5194/acp-11-6787-2011.


CHAPTER 4: ONGOING AND FUTURE INITIATIVES

4.1 INTRODUCTION
The Texas Commission on Environmental Quality (TCEQ) is committed to maintaining healthy air quality in the Bexar County 2015 eight-hour ozone nonattainment area and continues to work toward this goal. Texas continues to invest resources in air quality scientific research and the advancement of pollution control technology, refining quantification of emissions, and improving the science for ozone modeling and state implementation plan (SIP) analysis. Additionally, the TCEQ is working with the United States Environmental Protection Agency (EPA), local area leaders, and the scientific community to evaluate new measures for addressing ozone precursors. This chapter describes ongoing technical work that will be beneficial to improving air quality in Texas and in the 2015 eight-hour ozone standard nonattainment areas.

4.2 ONGOING AND RECENT WORK

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

4.2.2 Air Quality Research Program
The specific goal of the State of Texas Air Quality Research Program (AQRP) is to support scientific research related to Texas air quality in the areas of EI development, atmospheric chemistry, meteorology, and air quality modeling. Research topics are identified and prioritized by the Independent Technical Advisory Committee (ITAC). Projects to be funded by the AQRP are selected from the list of ITAC recommended projects by the TCEQ and the Advisory Council. The Texas AQRP is administered by the University of Texas at Austin and is funded by the TCEQ through the Texas Emissions Reduction Plan (TERP) program. To help ensure that air quality strategies in Texas are effective in improving air quality, a portion of the TERP funding is used to improve our scientific understanding of air pollution in Texas.

More information on the strategic research plan of the AQRP, lists of the current members of the ITAC and Advisory Council, and reports from completed projects can be found at the AQRP webpage (http://aqrp.ceer.utexas.edu/).

4.2.3 2016 Collaborative Modeling Platform Development
The TCEQ joined a collaborative group, which includes the EPA, states, tribes, and multi-jurisdictional organizations, to create a 2016 national emissions modeling platform that can be used as the basis for future regulatory modeling activities. Workgroups for key emission sectors were formed to create 2016 EIs for photochemical modeling input, including on-road, non-road, electric generating units (EGU) point, non-EGU point, area, and biogenic sources. The beta version of the 2016 platform was released on March 13, 2019. Version 1.0 is planned for release in Fall 2019. Details on the 2016 collaborative inventory are on the Inventory Collaborative...
Appendices Available Upon Request

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RESPONSE TO COMMENTS RECEIVED CONCERNING THE
BEXAR COUNTY 2015 EIGHT-HOUR OZONE
NONATTAINMENT AREA FEDERAL CLEAN AIR ACT
(FCAA) SECTION 179B DEMONSTRATION STATE
IMPLEMENTATION PLAN (SIP) REVISION

The Texas Commission on Environmental Quality (TCEQ or commission) conducted a public hearing in San Antonio on February 18, 2020 at 2:00 p.m. at the Alamo Area Council of Governments (AACOG). During the comment period, which closed on February 19, 2020, the commission received comments from AACOG, the Alamo Area Metropolitan Planning Organization (AAMPO), City of San Antonio District 10 Councilman Clayton Perry (Councilman Perry), Kendall County Judge Darrel Lux (Judge Lux), Habitat for Humanity of San Antonio, Bexar County Commissioner Kevin Wolff (Commissioner Wolff), Atascosa County Judge Robert Hurley (Judge Hurley), the San Antonio Area Group of the Lone Star Chapter of the Sierra Club (SAAG Sierra Club), the San Antonio Chamber of Commerce, the San Antonio Hispanic Chamber of Commerce, the San Antonio Mobility Coalition (SAMCo), Sierra Club and Environmental Defense Fund (EDF), and the United States Environmental Protection Agency (EPA).

TABLE OF CONTENTS
General Comments
Technical Analysis

GENERAL COMMENTS
AACOG, AAMPO, Councilman Perry, Judge Lux, Habitat for Humanity of San Antonio, Commissioner Wolff, Judge Hurley, the San Antonio Chamber of Commerce, the San Antonio Hispanic Chamber of Commerce, and SAMCo commented that they were grateful to the TCEQ for their efforts in developing the technical analysis and for acknowledging the work that local air quality partners have undertaken to help reduce ground level ozone over the years. The commenters stated that they agreed with the TCEQ’s conclusion that Bexar County would attain the 2015 eight-hour ozone National Ambient Air Quality Standard (NAAQS) by the deadline for marginal areas but for international anthropogenic contributions.

The TCEQ appreciates the support and is committed to working with local entities and interested parties to improve air quality.

The San Antonio Chamber of Commerce commented that Bexar County’s nonattainment designation is unjust because only 20% of ozone emissions are from local sources and 38% are from foreign sources. Additionally, Bexar County has a proven history, as a community, of lowering emissions into compliance through voluntary and local measures despite increasing population. The nonattainment designation creates unwarranted regulatory intervention that negatively impacts local businesses.

The EPA’s actions to designate Bexar County as a nonattainment area for the 2015 eight-hour ozone NAAQS are outside the scope of this SIP revision.
Judge Hurley stated that the regulatory monitors in Bexar County are unfairly located in areas with egregious traffic and that the EPA was loading this against the region. Judge Hurley suggested that the EPA put three other monitors equally apportioned geographically around Bexar County and then take the composite of the entire county.

Comments relating to the location and siting of ambient monitors are outside the scope of this SIP revision.

SAAG Sierra Club commented that it is opposed to the TCEQ’s efforts to minimize Bexar County’s ozone problems on the basis of foreign emissions. The commenter also stated that this approach would raise the acceptable ozone standard to 73 parts per billion (ppb) instead of 70 ppb.

The TCEQ disagrees with these comments. In the 1990 Clean Air Act Amendments, Congress recognized that in some areas, the ability to attain the NAAQS may be impacted by emissions sources from outside of the United States. FCAA, §179B was established to provide the EPA with the authority to address the impact of international emissions in areas designated nonattainment. The EPA’s 2015 eight-hour ozone standard SIP requirements rule\(^1\) affirmed that states may submit a §179B demonstration for nonattainment areas under the 70 ppb eight-hour ozone NAAQS. This SIP revision assesses the impact of international emissions on the ability of the Bexar County nonattainment area to attain the 70 ppb ozone standard, consistent with §179B, and to demonstrate that the estimated, modeled international anthropogenic contribution to the nonattainment area is 2 to 3 ppb. The EPA has the authority under §179B to evaluate whether the Bexar County nonattainment area would attain the 70 ppb ozone standard but for international emissions, and the results of the TCEQ’s technical analysis do not mean that the acceptable ozone standard would raise to 73 ppb. No changes were made in response to this comment.

SAAG Sierra Club commented that the TCEQ’s study supports the status quo and that the purpose of this activity is to protect people’s health.

The TCEQ takes its commitment to protect the environment and public health seriously. The commission prepares and implements air quality plans in accordance with both state and federal law. As part of its evaluation of air quality in the Bexar County area, the commission determined that it was appropriate to assess the impact of international emissions, as discussed in this SIP revision. The TCEQ remains committed to working with area stakeholders to attain the 2015 eight-hour ozone standard as expeditiously as practicable, in accordance with EPA rules and guidance under the FCAA. No changes were made in response to this comment.

The EPA, Sierra Club, and EDF commented that because the Bexar County nonattainment area is classified as marginal, an attainment demonstration is not required and, therefore, the provisions of §179B(a) do not apply. The commenters also stated that the FCAA provides for two distinct forms of regulatory relief through

§179B(a) and §179B(b) and that only an EPA-approved “retrospective” demonstration, as outlined in the EPA's draft §179B guidance, may provide relief from reclassification through §179B(b). The EPA further requested clarification that that the TCEQ is seeking relief from reclassification to moderate for the Bexar County nonattainment area.

The TCEQ disagrees with the EPA’s draft §179B guidance and the commenters’ interpretation of the statute that the regulatory relief provided under §179B requires distinct submittals under §179B(a) and §179B(b). The FCAA does not limit the information that a state can provide in a §179B demonstration, regardless of the time at which the information is presented to the EPA. That includes the submittal of a “prospective” demonstration for an area that does not require an attainment demonstration, like the Bexar County 2015 eight-hour ozone marginal nonattainment area. In its 2008 eight-hour ozone standard SIP requirements rule, the EPA stated that, “if a Marginal area (which is not otherwise required to submit an attainment demonstration) were to submit to the EPA a demonstration that they could attain the standard but for international emissions, the EPA would be able to evaluate that demonstration similarly to demonstrations submitted by higher classified areas.” The EPA’s 2015 eight-hour ozone standard SIP requirements rule affirmed that states may submit a §179B demonstration for a marginal ozone nonattainment area and did not set any restrictions on the type or timing of the demonstration that could be submitted. The EPA did not issue draft §179B guidance until January 9, 2020, after the TCEQ developed the proposed Bexar County §179B SIP revision, and during development of the proposed SIP revision, the EPA did not indicate that future guidance would be based on a new interpretation of the statute.

The TCEQ disagrees that only approval of a “retrospective” demonstration under §179B(b) can prevent reclassification. There is precedent for a “prospective” submittal under §179B(a) to also provide relief from reclassification under §179B(b). The TCEQ submitted, and the EPA approved, a §179B demonstration for the El Paso nonattainment area for the coarse particulate matter (PM$_{2.5}$) standard. The demonstration was included as part of an attainment demonstration SIP revision and was approved by the EPA prior to the area's attainment date (see 59 Federal Register (FR) 2532, January 18, 1994). The EPA's approval of this “prospective” demonstration prevented reclassification of the El Paso PM$_{2.5}$ nonattainment area under the EPA's previous interpretation of the statute, as discussed in the EPA's approval of an FCAA, §182(f) nitrogen oxides (NO$_x$) waiver for the El Paso one-hour ozone nonattainment area (see 59 FR 44386-44387, August 29, 1994). The TCEQ was not additionally required to submit a “retrospective” analysis to prevent reclassification of the El Paso area upon failure to attain for either PM$_{10}$ or ozone. The TCEQ developed the Bexar County §179B SIP revision as a “prospective” demonstration that the area will attain by its attainment date but for international emissions and is requesting that the EPA approve the SIP revision and provide relief from reclassification of the area to moderate if the area fails to attain by its marginal attainment date.

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The EPA, Sierra Club, and EDF commented that the Bexar County §179B SIP revision is premature for seeking relief from reclassification under §179B(b) and stated that a retrospective evaluation of 2018 through 2020 data is necessary. The EPA further commented that the FCAA limits its flexibility regarding the difficult timeframe to evaluate a retrospective §179B demonstration following the area’s September 24, 2021 attainment deadline and prior to the EPA’s reclassification deadline of March 2022.

As discussed elsewhere in this Response to Comments document, the TCEQ disagrees that a “retrospective” demonstration is necessary. Further, it is impractical to develop and submit a supplemental "retrospective" demonstration for the EPA to evaluate and act on in time to prevent reclassification from marginal to moderate.

Additionally, the EPA’s new draft interpretation is not consistent with past actions by the EPA for the El Paso PM10 nonattainment area for which the EPA approved a “prospective” demonstration prior to the area’s attainment deadline and prevented reclassification of the area without requiring submittal of an additional “retrospective” analysis. The TCEQ also notes that the FCAA does not limit the EPA’s ability to review demonstrations; it is the EPA’s new (draft) interpretation and application of the FCAA that is limiting, as illustrated by the EPA’s previous actions approving “prospective” demonstrations that prevented reclassification. The TCEQ developed the Bexar County §179B SIP revision as a “prospective” demonstration due to the difficult timeframe that would be created by waiting to evaluate the impact of international emissions on the area until after the area fails to attain.

SAAG Sierra Club commented that the real need is to lower emissions to reduce local ozone pollution. The commenter suggested closing coal-fired power generation, electrifying transportation, recognizing the impacts of pollution from oil and gas activity, investing in onsite renewable energy generation, expanding the Save for Tomorrow Energy Program, and real transportation reform to reduce vehicle miles traveled and single occupancy vehicle use.

Sierra Club and EDF commented that the TCEQ should, at a minimum, include reasonably available control technology (RACT) revisions that address some of the largest sources of ozone precursor emissions in the Bexar County area and that the proposed §179B SIP revision fails to include any RACT correction provisions. The commenters further stated that the SIP fails to meet other basic requirements, such as vehicle inspection and maintenance (I/M) provisions, permitting provisions, updated emissions inventories, and emissions offset provisions. The commenters concluded that the proposed SIP was unlawful and could not be approved and that the TCEQ should instead prepare a SIP that includes all of the elements required for a marginal plan under Section 182(a) of the FCAA.

The purpose of the Bexar County §179B SIP revision is to demonstrate that the nonattainment area would attain by its marginal attainment date but for international emissions. The requirement to evaluate control strategies, including RACT and reasonably available control measures (RACM), does not apply to marginal nonattainment areas and is outside the scope of this SIP revision. The EPA stated in its 2015 eight-hour ozone standard SIP requirements rule that “the Act
does not require states to implement RACM/RACT in Marginal ozone nonattainment areas” (see 83 FR 62998, 63010, December 6, 2018). The EPA confirmed in its draft §179B guidance that FCAA, §182(a) does not require states to implement RACT and RACM in marginal ozone nonattainment areas and that “nothing in section 179B alters the statutory requirements with respect to RACM/RACT obligations.” With respect to RACT corrections, newly designated nonattainment areas like Bexar County are not subject to the RACT “fix-ups” required by FCAA, §182(a)(2)(A) because they were not subject to section 172(b) under the FCAA as it existed prior to enactment of the Clean Air Act Amendments of 1990 (see 57 FR 13498, 13503, April 16, 1992).

The Sierra Club and EDF’s comments regarding I/M provisions are also outside the scope of this SIP revision as I/M programs are not required for marginal ozone nonattainment areas. The commenters incorrectly referenced the requirement under FCAA, §182(a)(2)(B) for corrections to pre-1990 I/M programs, which does not apply to the Bexar County nonattainment area. Requirements related to permitting provisions, updated emissions inventories, and emissions offset provisions for the Bexar County marginal nonattainment area are addressed in the 2015 Eight-Hour Ozone NAAQS Emissions Inventory SIP Revision (Non-Rule Project No. 2019-111-SIP-NR), scheduled for the commission’s consideration for adoption on June 10, 2020. No changes were made in response to these comments.

TECHNICAL ANALYSIS

Habitat for Humanity of San Antonio stated that the calculations and reasoning supporting the analysis were sound.

The TCEQ appreciates the support.

AACOG stated that the results of the TCEQ’s technical analysis supports Governor Abbott’s position with the EPA before designations for the 2015 eight-hour ozone NAAQS were made.

The TCEQ acknowledges that the findings of the technical analysis are supportive of Governor Abbott’s position regarding the impact of foreign emissions on Bexar County, as stated in his letter to the EPA dated May 11, 2018.

The EPA commented that the proposed §179B demonstration could be strengthened if it could be shown that San Antonio is impacted by international emissions in a way that distinguishes it from other marginal areas.

FCAA, §179B does not require that a demonstration show that an area is impacted by international emissions in a way that distinguishes it from other areas, nor is this consideration discussed or recommended in the EPA’s draft §179B guidance. Further, the EPA did not provide clear metrics or acceptable procedures that the TCEQ should use to distinguish the Bexar County nonattainment area’s air quality impacts due to international emissions from other marginal areas. In addition, there are 38 nonattainment areas classified as marginal for the 2015 eight-hour ozone NAAQS, and requiring that the TCEQ conduct technical analyses to characterize the impacts of international emissions on 38 other areas and then show that Bexar
County is impacted in a manner that distinguishes it from other marginal areas creates an inordinately high burden of proof for Texas’ §179B demonstration. No changes were made in response to this comment.

Sierra Club and EDF commented that a valid §179B demonstration must specify sources from which international emissions are emanating.

The TCEQ disagrees that in the context of §179B, identifying a particular contributing international source is required. Identification of specific contributing international sources has not been required historically by the EPA and is also not required in the EPA’s draft §179B guidance, which states that identification of a specific international contributing source is optional. Therefore, the TCEQ’s approach of quantifying the impact of anthropogenic emissions from the “rest of the world” in aggregate, using Chemical Transport Models, is appropriate.

Sierra Club and EDF commented that a valid §179B demonstration must show that international emissions are a substantial factor contributing to nonattainment.

The TCEQ disagrees with this characterization of what is required for a valid §179B demonstration. As described in §179B(a), the EPA will approve a state’s demonstration if it shows that an area would attain and maintain the relevant standard by the attainment date but for emissions emanating from outside of the United States. The commenters interpreted the language in §179B as requiring a demonstration that shows that international emissions are a substantial factor contributing to nonattainment. This interpretation does not consider the scenario in which international anthropogenic emissions contribute to high background in the nonattainment area, thereby playing a role in causing exceedances. In addition, this characterization of a valid demonstration would not be appropriate even for border areas such as El Paso, where all days are likely influenced by international emissions due to the proximity of Juarez, Mexico. Any magnitude of international anthropogenic contribution is relevant in the context of §179B, and identification of specific exceedance days that were primarily caused by international anthropogenic emissions is not required.

AACOG commented that the TCEQ should provide justification for using 500 meters (m) above ground level (AGL) instead of 100 m AGL as the starting altitude for the back-trajectory analysis.

The TCEQ used a higher starting altitude in the back-trajectory analysis in order to examine the long-range wind transport patterns into the San Antonio area. The starting height of 500 m AGL is typically within the mixing layer, and a higher starting height ensures that fewer long-range trajectories hit the ground before reaching the San Antonio area, in turn producing more usable trajectories for the analysis. No changes were made in response to this comment.

AAGOC commented that the TCEQ should explain why trajectories were not filtered to exclude trajectories that originated at altitudes above the troposphere and state whether trajectories of this type constituted a significant portion of all trajectories,
which would indicate that stratospheric-tropospheric intrusions had greater relative influence on ozone exceedances.

The TCEQ did not filter trajectories for those originating above the troposphere because stratospheric-tropospheric intrusions are outside the scope of this SIP revision. The back-trajectory analysis was intended to explore the possibility that air could arrive in the San Antonio area from outside of the United States. The analysis was completed to provide context for the air modeling and to provide a more complete analysis of air patterns in the San Antonio area. The analysis was not intended to locate specific sources outside of the United States. No changes were made in response to this comment.

AACOG commented that the TCEQ should include a scatter plot of local ozone production versus daily-maximum eight-hour ozone in the conceptual model to bolster the claim that background ozone is an indicator of peak ozone levels.

The TCEQ thoroughly examined the relationship between regional background ozone, locally produced ozone, and daily maximum eight-hour ozone. As explained in the conceptual model, trends in background ozone are the driving force behind trends in daily-maximum eight-hour ozone; however, locally produced ozone can contribute a large amount to daily-maximum eight-hour ozone at higher concentrations. The TCEQ does not claim in the conceptual model that background ozone is an indicator for high ozone, only that trends in ozone are driven by trends in background ozone. No changes were made in response to this comment.

The Sierra Club and EDF commented that the TCEQ modeling analysis is flawed due to the use of “zero out” modeling in the determination of the international anthropogenic contribution to Bexar County's future year design values.

The TCEQ disagrees that the modeling is flawed due to the use of “zero out” modeling. Estimating the impact of many disparate sources collectively using the difference of two model runs—a reference run with all sources of interest present and a “zero-out” run in which the sources of interest have been removed—is a form of sensitivity analysis called brute-force method. Brute-force methods are an acceptable peer-reviewed form of sensitivity analysis that are also recommended in the EPA’s “Modeling Guidance for Demonstrating Air Quality Goals for Ozone, PM$_{2.5}$, and Regional Haze” (Modeling Guidance). Brute-force methods are the only options available when using global scale models, as done by the TCEQ in this SIP revision, since global models currently do not have source apportionment capabilities. The approach used by the TCEQ is designed to quantify the contribution of all non-United States anthropogenic sources collectively using a combination of global and regional scale models and has been used extensively in the context of background contributions.

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ozone and international contribution estimation\textsuperscript{4,5,6}. No changes were made in response to this comment.

The Sierra Club and EDF commented that the TCEQ did not provide a margin of error for the 2020 Reference Case design value.

The TCEQ followed the EPA's Modeling Guidance in determining the 2020 Reference Case design value, which does not require the determination of a margin of error for modeled future year design values. No changes were made in response to this comment.

The Sierra Club and EDF commented that the TCEQ's source apportionment modeling contained discrepancies and therefore the estimated international anthropogenic contribution could be inaccurate. The commenters based their conclusion on increased attribution to Bexar County in the “zero-out the rest of the world” (ZROW) Case source apportionment model run when international anthropogenic emissions were removed.

The TCEQ used source apportionment to identify the relative importance of local versus transported contributions and not to estimate international anthropogenic contributions. Due to the non-linear nature of ozone formation, changes in attribution to source categories is possible when emissions from other source categories are removed. Such changes do not invalidate the source apportionment modeling. As stated in the EPA's Modeling Guidance, “Source apportionment methods and model sensitivity studies are two complementary approaches that can be used to identify emissions sources that contribute to high pollutant concentrations. While these tools do not directly diagnose the model’s ability to replicate the real world, they are useful in their ability to further characterize the sources that are most important to high pollutant concentrations within the model.” The TCEQ appropriately used sensitivity modeling (brute-force method) to provide a representation of ozone concentrations in Bexar County with and without international anthropogenic emissions and the source apportionment modeling to characterize the source categories that are important under the two scenarios. No changes were made in response to this comment.

The Sierra Club and EDF commented that the TCEQ designed the back-trajectory analysis in a way that created a bias in favor of finding greater contributions from Mexico.

The TCEQ's back-trajectory analysis portion of the §179B SIP revision was intended to provide context to the modeling and to assess air transport patterns in the San Antonio area. The TCEQ was not attempting to determine contributions from only Mexico. The back-trajectory analysis was completed in order to determine if it is

\textsuperscript{5}EPA, Integrated Science Assessment for Ozone and Related Photochemical Oxidants, February 2013, EPA/600/R-10/076F
possible for international air to arrive into the San Antonio area, in order to provide a complete evaluation. No changes were made in response to this comment.

The Sierra Club and EDF commented that the TCEQ used only the one-year design value in 2018 although the one-year design value for 2019, 75 ppb, was available.

The eight-hour ozone design value used to determine compliance is the three-year average of the fourth-highest eight-hour ozone value, calculated for each monitor within an area. For San Antonio, the 2018 design value was 72 ppb, which was calculated using data from 2016, 2017, and 2018. Certified data for 2019 was not available until May 2020. The certified 2019 fourth-highest eight-hour ozone value for the San Antonio area is 75 ppb; however, the certified 2019 design value is 73 ppb, which was calculated using data from 2017, 2018, and 2019. The TCEQ did not use 2019 data in this SIP revision because a full year of certified data was not available at the time the SIP revision was being developed. No changes were made in response to this comment.

The Sierra Club and EDF commented that there are attaining monitors lying between the San Antonio area and international borders with Mexico and Canada; therefore, there is no meaningful impact from international emissions in Bexar County.

The TCEQ disagrees that the existence of attaining monitors between Bexar County and Mexico means that emissions from Mexico have no impact on ozone levels in Bexar County. As the mixing layer height changes throughout the day, transported air may pass over an area before mixing down towards the surface in another location, resulting in different air quality measurements along a parcel of air. Additionally, the EPA has not accepted the type of analysis referenced by the commenters as conclusive. No changes were made in response to this comment.

The Sierra Club and EDF commented that the conclusion that international anthropogenic emissions are a substantial factor in causing nonattainment in Bexar County has been discredited based on various flaws in the TCEQ’s technical analysis and the studies from Dunker et al., (2017)7 and Nopmongcoal et al., (2017b)8.

The TCEQ disagrees with the commenters’ conclusions. The §179B SIP revision concludes that “but for” international anthropogenic emissions, Bexar County would attain the 2015 ozone NAAQS and does not evaluate whether international anthropogenic emissions are a substantial factor in causing nonattainment in Bexar County. Further, the TCEQ disagrees that its technical analysis is flawed, as addressed in this SIP revision and in responses to other comments concerning this SIP revision. The results from Dunker et al. (2017) and Nopmongcoal et al., (2017b) do not contradict the TCEQ’s conclusion, rather, they corroborate the TCEQ’s approach and the magnitude of the TCEQ’s estimated international anthropogenic emissions.

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contribution to Bexar County monitors. As stated in this SIP revision, the contribution attributed to Canada and Mexico in the analysis by Dunker et al., is incomplete since the modeling domain did not include all of Canada or Mexico and the analysis did not include Bexar County. In fact, the Dunker et al. analysis estimated that the anthropogenic lateral boundary condition contribution (which is similar to the TCEQ’s definition of international anthropogenic contribution) for Dallas was 3.5 ppb and the Canada/Mexico contribution was 0.6 ppb - values that are similar in magnitude to the TCEQ’s estimates for Bexar County. Similarly, the estimation of 0.3 ppb from Mexico to the Fort Worth area in Nopmongcoal et al. is also in line with the TCEQ’s estimates. Contrary to the commenters’ claim, the studies cited provide context and corroboration of the TCEQ’s conclusions. No changes were made in response to this comment.

The EPA specifically recommended a supplemental analysis of how transport patterns on high ozone days from the 2012 modeling period compare to those during the 2018 through 2020 period.

The TCEQ disagrees that such a supplemental analysis is required in the context of §179B demonstrations. The TCEQ utilized the modeled attainment test recommended in the EPA’s Modeling Guidance to determine the attainment status of the Bexar County nonattainment area in the future year 2020 with and without international anthropogenic contribution. The TCEQ also ensured, as detailed in Section 2.3.2: Modeling Episode of this SIP revision, that the 2012 base year meets the base year selection criteria outlined in the EPA’s Modeling Guidance. The EPA has not required, recommended, or conducted such a comparative meteorological analysis in other modeling applications evaluating the attainment status of nonattainment areas such as interstate transport modeling and attainment demonstration modeling. Requiring such an analysis for §179B demonstrations is unnecessary and arbitrary. No changes were made in response to this comment.

SAAG Sierra Club commented that background levels on non-high emission days have been constant for 10 to 15 years and that on high ozone days, local emissions have been constant and are about 20 ppb. Despite trends, local ozone production has not declined.

The TCEQ acknowledges that the local contribution to eight-hour ozone in the San Antonio area has not declined over the past 10 years, and that it is about 20 ppb on high ozone days. However, with the lowering of the ozone standard, the role of background is more critical in determining the attainment status of marginal nonattainment areas such as Bexar County. The EPA has acknowledged the critical role of background and how states can use mechanisms such as §179B demonstrations to understand and mitigate the impacts of background ozone on the attainment status of nonattainment areas. The background ozone analysis in the weight of evidence and the conceptual model shows: on high ozone days, though local ozone production increases, background ozone also increases; trends in ozone concentrations in the San Antonio area are highly correlated to trends in background ozone; and background is a large part of the total ozone concentration. The background ozone analysis in the weight of evidence and the conceptual model do not negate the conclusions of the modeling analysis but rather provide limited,
but corroborative, evidence that international anthropogenic emissions contributions, which are part of regional background, play an important role in Bexar County’s attainment status. No changes were made in response to this comment.
ORDER ADOPTING REVISION TO THE STATE IMPLEMENTATION PLAN

Docket No. 2019-0905-SIP
Project No. 2019-106-SIP-NR

On July 1, 2020, the Texas Commission on Environmental Quality (Commission), during a public meeting, considered adoption of a Federal Clean Air Act (FCAA), §179B Demonstration for the Bexar County 2015 Eight-Hour Ozone National Ambient Air Quality Standard (NAAQS) Nonattainment Area (Bexar County FCAA, §179B Demonstration) and revision to the State Implementation Plan (SIP). The Commission adopts this Bexar County FCAA, §179B Demonstration and corresponding revision to the SIP. The SIP revision includes a technical analysis and weight-of-evidence analysis to demonstrate that the Bexar County marginal ozone nonattainment area would attain the 2015 eight-hour ozone NAAQS by its attainment date “but for” anthropogenic emissions emanating from outside the United States, in accordance with FCAA, §179B. Under Tex. Health & Safety Code Ann. §§ 382.011, 382.012, and 382.023 (West 2016), the Commission has the authority to control the quality of the state’s air and to issue orders consistent with the policies and purposes of the Texas Clean Air Act, Chapter 382 of the Tex. Health & Safety Code. Notice of hearing for the proposed Bexar County FCAA, §179B Demonstration was published in the January 17, 2020 issue of the San Antonio Express-News and in the January 31, 2020, issue of the Texas Register (45 TexReg 783).

Pursuant to 40 Code of Federal Regulations § 51.102 and after proper notice, the Commission conducted a public hearing to consider the Bexar County FCAA, §179B Demonstration and revision to the SIP. Proper notice included prominent advertisement in the areas affected at least 30 days prior to the date of the hearing. A public hearing was held in San Antonio, Texas, on February 18, 2020.

The Commission circulated hearing notices of its intended action to the public, including interested persons, the Regional Administrator of the EPA, and all applicable local air pollution control agencies. The public was invited to submit data, views, and recommendations on the proposed Bexar County FCAA, §179B Demonstration and SIP revision, either orally or in writing, at the hearing or during the comment period. Prior to the scheduled hearing, copies of the proposed Bexar County FCAA, §179B Demonstration and SIP revision were available for public inspection at the Commission’s central office and on the Commission’s website.

Data, views, and recommendations of interested persons regarding the proposed Bexar County FCAA, §179B Demonstration and SIP revision were submitted to the Commission during the comment period and were considered by the Commission as reflected in the analysis of testimony incorporated by reference to this Order. The Commission finds that the analysis of testimony includes the names of all interested groups or associations offering comment on the proposed Bexar County FCAA, §179B Demonstration and the SIP revision and their position concerning the same.
IT IS THEREFORE ORDERED BY THE COMMISSION that the Bexar County FCAA, §179B Demonstration and revision to the SIP incorporated by reference to this Order are hereby adopted. The adopted Bexar County FCAA, §179B Demonstration and the revision to the SIP are incorporated by reference in this Order as if set forth at length verbatim in this Order.

IT IS FURTHER ORDERED BY THE COMMISSION that on behalf of the Commission, the Chairman should transmit a copy of this Order, together with the adopted Bexar County FCAA, §179B Demonstration and revision to the SIP, to the Regional Administrator of EPA as a proposed revision to the Texas SIP pursuant to the Federal Clean Air Act, codified at 42 U.S. Code Ann. §§ 7401 - 7671q, as amended.

If any portion of this Order is for any reason held to be invalid by a court of competent jurisdiction, the invalidity of any portion shall not affect the validity of the remaining portions.

TExAS COMMISSION ON ENVIRONMENTAL QUALITY

Jon Niermann, Chairman

Date Signed