Work Order No. 582-22-30580-022
Contract No. 582-19-90500
Tracking No. 2022-01

Prepared for:

Texas Commission on Environmental Quality
12100 Park 35 Circle MC 164
Austin, TX 78753

Prepared by:

Ramboll US Consulting, Inc.
7250 Redwood Blvd., Suite 105
Novato, California 94945

February 28, 2022

Federal Clean Air Act El Paso County §179B Demonstration: El Paso-Las Cruces, Texas-New Mexico Nonattainment Area

Final Report

PREPARED UNDER A CONTRACT FROM THE
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

The preparation of this document was financed through a contract from the State of Texas through the Texas Commission on Environmental Quality.

RAMBOLL

Federal Clean Air Act El Paso County §179B Demonstration: El Paso-Las Cruces, Texas-New Mexico Nonattainment Area

Final Report

Ramboll
7250 Redwood Boulevard
Suite 105
Novato, CA 94945
USA

T +1 415 899 0700
https://ramboll.com

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LIST OF ACRONYMS AND ABBREVIATIONS

°F	Degrees Fahrenheit
AQS	Air Quality System
Auto-GC	Automatic Gas Chromatograph
BC	Boundary conditions
CEMS	Continuous emissions monitoring system
CPF	Conditional probability function
CSAPR	Cross-State Air Pollution Rule
DERI	Diesel Emissions Reduction Incentive Program
DV	Design value
DVB	Design value, base year
DVF	Design value, future year
EPA	US Environmental Protection Agency
EPLC NAA	El Paso-Las Cruces, Texas-New Mexico Nonattainment Area
ft	Feet
FCAA	Federal Clean Air Act
HYSPLIT	Hybrid Single Particle Lagrangian Integrated Trajectory model
I/M	Inspection/maintenance
in	Inch
km	Kilometer
LDAR	Leak detection and repair
mi	Mile
mph	Miles per hour
MDA8	Maximum daily 8-hour average
MST	Mountain Standard Time
NAAQS	National Ambient Air Quality Standards
NAM	North American Model forecasting system
NEI	National Emission Inventory
NMED	New Mexico Environment Department
NMOAI	New Mexico Ozone Attainment Initiative
NOAA ARL	National Oceanic and Atmospheric Administration, Air Resources Laboratory
NOx	Nitrogen oxides
O_3	Ozone
O&G	Oil and gas
p/mi^2	Persons per square mile
PCA	Principal component analysis
ppb	Parts per billion by volume
ppbC	Parts per billion carbon by volume
PdN	Paso del Norte
psi	Pounds per square inch
READY	Real-time Environmental Applications and Display sYstem
RRF	Relative response factor
RVP	Reid Vapor Pressure
SIP	State Implementation Plan
SNMOS	Southern New Mexico Ozone Study
SP NAA	Sunland Park Nonattainment Area
TAC	Texas Administrative Code
TAMIS	Texas Air Monitoring Information System
TCEQ	Texas Commission on Environmental Quality
TERP	Texas Emissions Reduction Plan
TNMOC	Total non-methane organic carbon
TPY	Tons per year
US	United States
UTEP	University of Texas, El Paso
VOC	Volatile organic compounds
WRAP	Western Regional Air Partnership

1 OVERVIEW

This report documents data and analyses that support a federal Clean Air Act (FCAA) §179B(b) retrospective demonstration to the United States (US) Environmental Protection Agency (EPA) for the portion of the El Paso-Las Cruces, Texas-New Mexico Nonattainment Area (EPLC NAA) containing El Paso County, Texas. This demonstration shows that El Paso County would have attained the 2015 ozone National Ambient Air Quality Standard (NAAQS) by the marginal attainment date of August 3, 2021 "but for" international contributions from neighboring Ciudad Juárez in Mexico.

In June 2021, the New Mexico Environment Department (NMED) submitted a separate 179B(b) ozone demonstration for Sunland Park, in southern Doña Ana County, New Mexico (NMED, 2021). Sunland Park was originally designated as the Sunland Park Nonattainment Area (SP NAA) prior to the EPA combining El Paso County and Sunland Park into the EPLC NAA. Analysis and weight-of-evidence methods reported here parallel the NMED (2021) demonstration and follow recommendations specified in the EPA (2020) 179B demonstration guidance.

1.1 Introduction

On October 1, 2015, the EPA revised the ozone NAAQS from 75 to 70 parts per billion by volume (ppb) (Federal Register, 2015). Nonattainment of the NAAQS occurs when the 3-year average of monitored annual 4th-high daily maximum 8-hour average (MDA8) ozone exceeds 70 ppb. This statistical form of determining nonattainment is referred to as the "design value" (DV). The EPA designates areas as nonattainment based on certified, quality-assured air quality monitoring data or if the EPA determines that an area contributes to the nonattainment status of a nearby area.

As a first step in implementing the 2015 ozone NAAQS, the EPA requested states to submit their designation recommendations, including appropriate area boundaries. After considering Texas' recommendations, the EPA originally designated El Paso County as attainment/unclassifiable in its list of nationwide designations promulgated on April 30, 2018 (Federal Register, 2018a). In August 2018, the City of Sunland Park, New Mexico, and environmental petitioners challenged the EPA's attainment/unclassifiable designation for El Paso County. On July 10, 2020, the District of Columbia Circuit Court of Appeals issued its opinion to remand (without vacatur) the El Paso County attainment/unclassifiable designation to the EPA and require the EPA to issue a revised El Paso County designation as expeditiously as practicable for the 2015 ozone NAAQS. After its reevaluation, on November 30, 2021 the EPA expanded the preexisting SP NAA to include all of El Paso County and renamed the area the El Paso-Las Cruces, Texas-New Mexico Nonattainment Area (EPLC NAA; Federal Resister, 2021). The EPA further required that Sunland Park's attainment date (August 3, 2021) also applies to El Paso County based on Sunland Park's original 2018 marginal ozone nonattainment designation. However, the EPA granted Texas one year from the effective date of the nonattainment designation to submit the required State Implementation Plan (SIP) revision. Marginal SIP provisions include General and Transportation Conformity, Nonattainment New Source Review, Emissions Inventory, and Emissions Statement requirements. The EPA is expected to reclassify the EPLC NAA from marginal to moderate in 2022, triggering additional planning requirements (Federal Register, 2018b).

The FCAA §179B provides some regulatory relief to nonattainment areas if states can sufficiently demonstrate to the EPA that an area would attain the NAAQS but for contributions from international sources that are outside federal and state jurisdictions. While §179B allows an area to avoid reclassification, it does not relieve the area of meeting the remaining applicable planning or emission reduction requirements of the FCAA. In December 2020, the EPA formalized guidance and a set of recommended procedures for developing 179B demonstrations (EPA, 2020).

The City of El Paso (also referred to herein as El Paso to distinguish it from El Paso County) and Sunland Park share the US/Mexico international border with Ciudad Juárez, Mexico (Figure 1-1). Ciudad Juárez is the governmental seat of Municipio de Juárez, which covers an area extending beyond Ciudad Juárez in the north-central portion of the Mexican State of Chihuahua. Nearly all the population, vehicles, and industry within the Municipio exist in Ciudad Juárez. The most recent certified ozone monitoring data (2018 through 2020) for the EPLC NAA exceed the NAAQS with maximum DVs of 76 and 78 ppb, respectively, at the El Paso UTEP and Desert View (Sunland Park, New Mexico) monitoring sites. The NMED (2021) "retrospective" 179B(b) demonstration shows how emissions from neighboring Ciudad Juárez prohibited the SP NAA from attaining the 2015 ozone NAAQS by the marginal attainment date of August 3, 2021. The demonstration included a conceptual model of air pollution in the area, air parcel back-trajectory analyses, a comprehensive emissions analysis, findings from previous air quality studies, and source apportionment photochemical modeling to show an overwhelming cross-border contribution from Ciudad Juárez.

In the past, Texas has successfully demonstrated, via §179B, that El Paso County would attain previous air quality standards but for contributions from Ciudad Juárez (Federal Register, 1994; 2003; 2004). Based on the previous demonstrations, current information, and analyses, and due to the size and proximity of Ciudad Juárez relative to El Paso, the Texas Commission on Environmental Quality (TCEQ) recognizes that El Paso County's air quality remains heavily impacted by Ciudad Juárez. This retrospective 179B(b) demonstration follows methodologies described in the EPA (2020) 179B guidance document.

1.2 Summary of Findings

The following lines of evidence demonstrate that El Paso County would have attained the 2015 ozone NAAQS by the marginal attainment date of August 3, 2021 but for international contributions from neighboring Ciudad Juárez in Mexico.

- **Physical setting**: El Paso and Ciudad Juárez occupy the same airshed basin and are adjoined at the US border along the Rio Grande, with no topographical barriers separating or blocking airflow between the cities (see Section 2.1, Conceptual Model).
- **Comparative statistics**: The population of Ciudad Juárez is two times larger than El Paso, while the population density of Ciudad Juárez's urban core is more than six times higher than El Paso. The border crossing is the second busiest port of entry in the US (see Section 2.1, Conceptual Model). The Municipio de Juárez contributes roughly two thirds of the Paso del Norte (PdN) regional ozone precursor emissions inventory, while El Paso County comprises less than 25% (see Section 3.1, Emission Analysis).
- **Emission trends**: According to TCEQ reported emission inventories for El Paso County, nitrogen oxide (NOx) and volatile organic compound (VOC) emissions have decreased by 43% and 15%, respectively, over the last 10 years while El Paso County ozone DVs have not decreased. The EPA has estimated NOx increases of 21% and VOC decreases of 12% for Municipio de Juárez between 2011 and 2023. Most recently, however, the EPA estimates that Municipio de Juárez NOx and VOC emissions will both increase from 2016 to 2023, while El Paso County NOx and VOC emissions will continue to decrease over the same period (see Section 3.2, Emissions Analysis).
- **Chemistry considerations**: Analyses show that the ozone environment at the El Paso Chamizal monitoring site very near the border has remained VOC-sensitive over the past decade. Ambient VOC concentrations measured at that site during this time have increased despite VOC emission reductions in El Paso County. This provides evidence that continuing ozone exceedances are influenced by increasing VOC emissions emanating from Ciudad Juárez,

which are projected to more than counteract VOC reductions in El Paso County out to 2023 (see Section 3.3, Emissions Analysis).

- **Wind directions during ozone exceedances**: Ozone pollution roses and cluster analyses show consistent southerly wind directions at the El Paso UTEP, El Paso Chamizal, and Skyline Park monitors during ozone exceedance days from 2016 through 2020, while non-exceedance days are associated with westerly through northerly wind directions. Furthermore, analysis of pollution roses provides evidence that on-road vehicles emissions from traffic at the Bridge of the Americas can contribute to elevated ozone in El Paso County (see Sections 4.1 and 4.2, Wind Analysis).
- **Trajectory analyses**: Most exceedance days from 2016 through 2020 involve air parcel transport over Mexico prior to arriving at the El Paso UTEP (85%), El Paso Chamizal (85%) and Skyline Park (61%) monitors (see Section 4.3, Wind Analysis).
- **Ozone on days with no international transport**: Measured ozone concentrations are substantially lower on days without a clear transport contribution from Ciudad Juárez, resulting in 2020 El Paso County DVs that attain the 2015 ozone NAAQS (see Section 5, Transport Effect on Ozone Design Values).
- **Source apportionment modeling**: As weight of evidence, results from three recent independent source apportionment photochemical modeling studies show large anthropogenic ozone contributions to El Paso County monitors from north-central Mexico (8 to 11%), and even larger contributions from all international regions within the North American modeling domains (20 to 32%). In contrast, total US anthropogenic contributions range from 8% to 17% over all three studies. With the removal of the international anthropogenic contributions, the recalculated 2020 El Paso County DVs are well below the 2015 ozone NAAQS. Although these studies modeled different years and used different modeling platforms, the results consistently find a significant international contribution to high ozone in El Paso County (see Section 6, Source Apportionment Modeling).

This demonstration addresses ozone contributions from the entirety of Ciudad Juárez, rather than pinpointing specific major sources. Based on these results, it is clear that emissions from Ciudad Juárez contribute to ozone exceedances in El Paso County and have prevented the area from attaining the 2015 ozone NAAQS by the marginal attainment date of August 3, 2021. Measured ozone concentrations are substantially lower on days without a clear transport contribution from Ciudad Juárez, resulting in 2020 El Paso County DVs that attain the 2015 ozone NAAQS. Furthermore, measures documented in the Texas SIP applicable to El Paso County are adequate to attain and maintain the NAAQS but for emissions emanating from Ciudad Juárez. The most recent approved El Paso SIP was adopted on January 11, 2006 and was approved by the EPA as published January 15, 2009 (Federal Register, 2009. 74 Fed. Reg. 2387). Appendix A of this 179B(b) demonstration describes existing control measures applicable to the El Paso Nonattainment Area.

1.3 Report Organization

This section presents historical context and summarizes results from this El Paso County 179B(b) demonstration. Section 2 provides a description of the Paso del Norte airshed, recent design values for each El Paso County monitoring site, and a conceptual model of meteorological conditions that generally lead to high ozone events. Section 3 presents an emissions analysis, tabulating current annual ozone precursor emissions for El Paso County and Municipio de Juárez, and comparing trends in emissions and measured air quality at El Paso County monitors. Section 4 presents a meteorological analysis that specifically assesses the frequency of winds from Ciudad Juárez on ozone exceedance days, including pollution roses and air parcel trajectories. Section 5 differentiates ozone exceedance days with international transport versus those without and the related impacts to El Paso County DVs. Section 6 summarizes photochemical modeling and ozone source apportionment results from three previous independent studies as further weight of evidence for substantial transport from Mexico to El Paso County. Appendix A describes emissions control measures applicable to the El Paso Nonattainment Area. Appendix B describes the TCEQ's response to comments submitted during the public review for the draft demonstration.

2 CONCEPTUAL MODEL

This section provides a general description of the physical, population, and climate characteristics of the Paso del Norte (PdN) airshed, current ozone DVs, and their recent trends for each El Paso County monitoring site, along with a conceptual model of meteorological conditions that generally lead to high ozone events. Comparative analyses of US and Mexican emission inventories are presented in Section 3. More specific analyses that address wind patterns associated with transport from Ciudad Juárez on ozone exceedance days and their impacts on El Paso County DVs are presented in Sections 4 and 5.

2.1 The Paso Del Norte Airshed

The PdN is a tri-state, binational airshed that includes the City of El Paso, Texas (also referred to herein as El Paso), the City of Sunland Park, New Mexico, and Ciudad Juárez, Mexico. Figure 2-1 shows a map of the PdN with locations of El Paso County air quality monitoring sites operated by the TCEQ. The six sites monitoring ozone are coded with light blue color in the site marker: El Paso UTEP, El Paso Chamizal, Skyline Park, Ascarate Park, Ivanhoe, and Socorro Hueco. The Rio Grande flows through the PdN generally from northwest to southeast along the Mesilla Valley and serves as the international border between Texas and Mexico. The PdN is bordered by the Franklin Mountains to the north in Texas and the Sierra de Juárez to the south in Mexico. The Franklin Mountains rise more than 3,280 ft above the valley floor and are approximately 14.4 miles long and 3.1 miles wide, separating the western third of El Paso from the eastern two-thirds of the city.

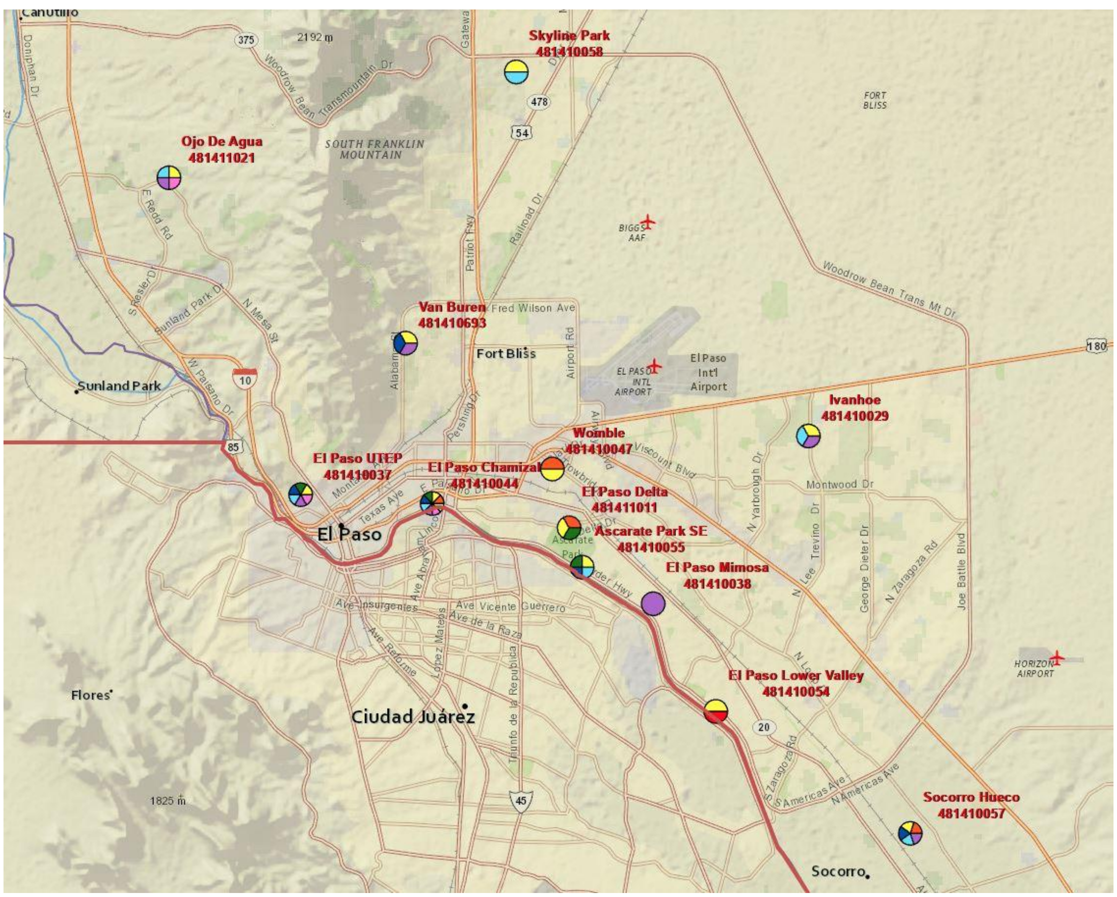

Figure 2-1. Map of El Paso, Texas and Sunland Park, New Mexico showing proximity to the US/Mexico border (heavy solid red line) and Ciudad Juárez, Mexico. The Texas/New Mexico border is shown as the solid purple line at the left-center of the map.

The total population of the greater PdN airshed exceeds 2.5 million, with 1.5 million in Ciudad Juárez (Population Stat, 2021), 840,000 in El Paso County (US Census Bureau, 2019), and 218,000 in Doña Ana County (US Census Bureau, 2019). In the central PdN, the City of El Paso's population is 682,000 (US Census Bureau, 2019) while the City of Sunland Park is considerably smaller with 18,000 (US Census Bureau, 2019). The City of El Paso spans 258 square miles (mi^2) with a population density of 2,663 persons per square mile (p/mi^2) (World Population Review, 2021). The urban core of Ciudad Juárez covers 95.5 mi^2 with 16,754 p/mi^2 (Regional Stakeholders Committee, 2009).

The border crossing in El Paso is the second busiest port of entry into the US from Mexico, with approximately 811,000 commercial trucks and 12 million passenger vehicles crossing northbound each year (Texas Comptroller, 2018). The PdN comprises the junction of three major transportation routes in North America: the east-west US trade route, the north-south Canada/Mexico trade route, and the US/Mexico trade route as part of the North/South America trade route.

The PdN is within the Chihuahuan Desert, which extends across western Texas into New Mexico, Arizona, and the Mexican state of Chihuahua. Therefore, the climate of the PdN is hot and arid (Table 2-1), with 306 sunny days and over 15 days above 100 degrees Fahrenheit (°F) per year. Annual rainfall averages under 9 inches but is highly variable year to year. Despite hot and sunny summer months, the PdN receives much of its annual rainfall during July and August.

Table 2-1. Monthly meteorological conditions in El Paso (Climatedata.org, 2021).

	1	2	3	4	5	6	7	8	9	10	11	12
Average Temperature (°F)	44.7	49.8	57.8	65.9	74.1	83.6	83.2	81.9	75.7	65.4	53.5	44.3
Minimum Temperature (°F)	33.8	37.3	43.7	51.1	58.9	69.1	71.4	70.2	64.1	53.5	42.2	34.2
Maximum Temperature (°F)	58.3	64.4	72.6	80.5	87.7	96.1	94.1	92.7	87.2	78.3	66.5	57.0
Rainfall (in)	0.6	0.5	0.3	0.2	0.3	0.4	1.3	1.2	1.4	0.8	0.5	0.7
Humidity (%)	43	34	24	18	17	19	34	37	38	37	40	47
Rain days	2	2	1	1	1	2	4	4	3	3	2	3
Average Sun Hours	8.7	9.5	10.5	11.5	12.3	12.7	12.3	11.7	10.6	9.7	8.9	8.4

Wind roses are a common way to graphically depict climatic wind patterns by plotting the frequency distribution of wind speed separately for each direction from which the wind is blowing. Figure 2-2 presents a wind rose for the El Paso International Airport based on data from 2011 through 2020 during April through September when all ozone exceedances occurred. As shown in Figure 2-1, the airport is located about 7 miles to the northeast of central El Paso. Figure 2-2 shows that winds most commonly exceed 10 miles per hour (mph) from the west-southwest, but that low-speed winds (<10 mph) conducive to high ozone days are most commonly from the south-southeast (see Section 2.3.1 for a complete wind analysis on ozone exceedance days). The topographic features of the PdN greatly influence wind patterns in the basin during low wind speed conditions by funneling air from the southeast to the northwest. Winds from the northwest through the north and east are much less frequent during April through September, ranging from less than 0.5% to about 2.5%.

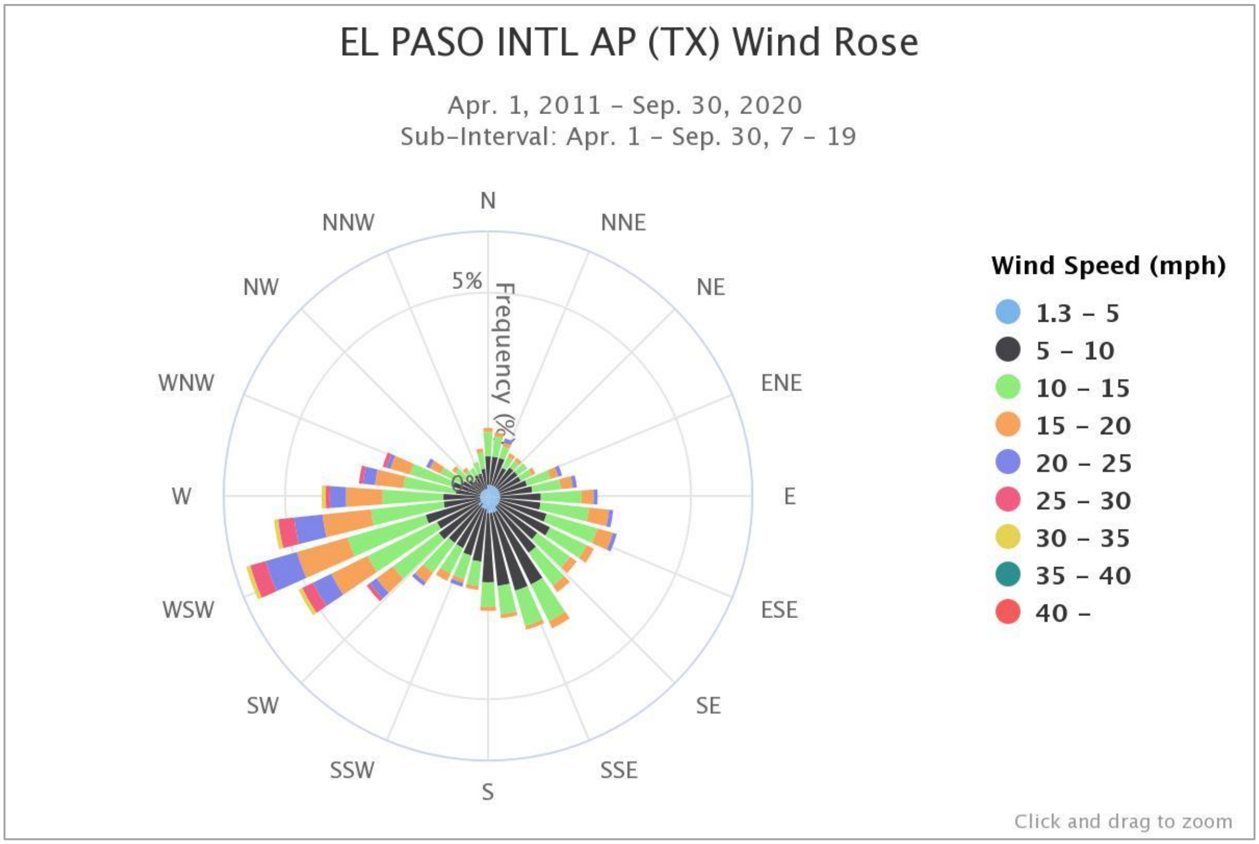

Figure 2-2. Wind rose at the El Paso International Airport based on wind data from 2011 through 2020 during April through September when all ozone exceedances occurred (Midwestern Regional Climate Center, 2021).

2.2 Ozone Air Quality in El Paso County

Table 2-2 lists the 2020 8-hour ozone DV at each of the six El Paso County monitors. DVs are based on the most recent certified measurements of MDA8 ozone over the three years spanning 2018 through 2020.

Table 2-2. 2020 ranked DV at El Paso County monitoring sites, based on the 3-year average (2018 through 2020) of annual 4th-high MDA8 ozone at each site. The 2015 ozone NAAQS is 70 ppb.

Monitoring Site	2020 DV (ppb)
El Paso UTEP	76
El Paso Chamizal	74
Skyline Park	73
Ivanhoe	70
Socorro Hueco	70
Ascarate Park	69

Three sites, El Paso UTEP, El Paso Chamizal, and Skyline Park, currently exceed the 2015 ozone NAAQS. El Paso UTEP represents the 2020 area wide maximum DV at 76 ppb. Based on uncertified monitoring data through December 2021, the 2019 through 2021 El Paso UTEP DV will continue to exceed the NAAQS at 75 ppb. Figure 2-3 shows 8-hour ozone DV trends at all six El Paso County monitors from 2011 through 2020.

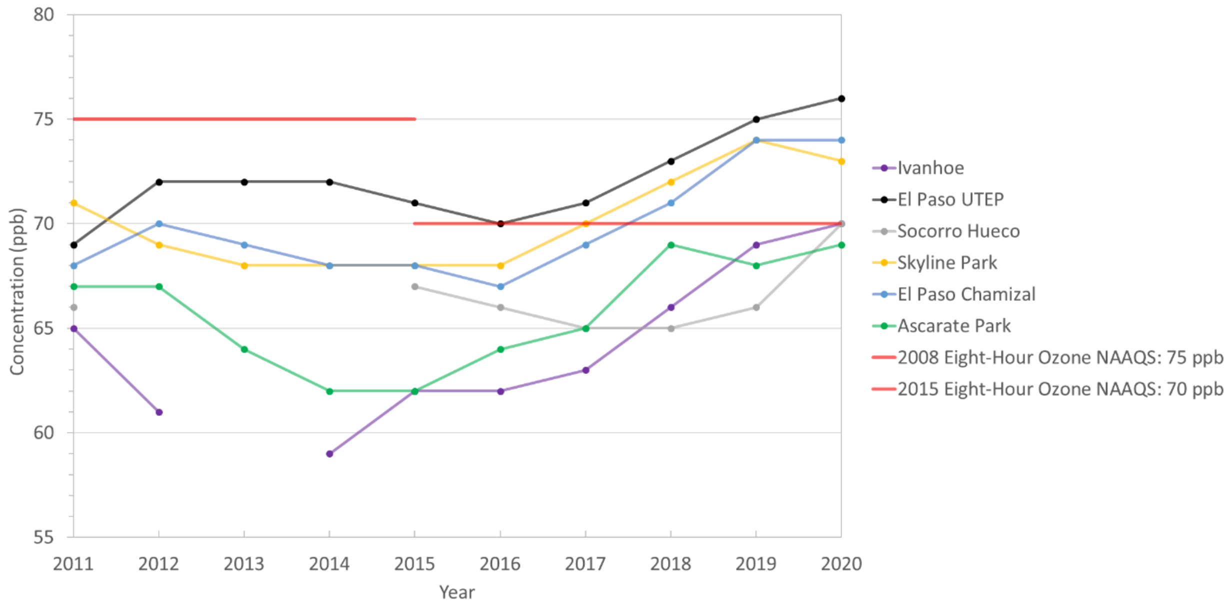

Figure 2-3. 8-hour ozone DV trends at all six El Paso County monitors from 2011 through 2020. Current and previous ozone NAAQS are also shown for reference.

Officially, the ozone season for El Paso County spans the entire year. This demonstration focuses on the April through September period when the highest ozone concentrations were measured in El Paso County from 2011 through 2020. An exceedance day occurs when at least one monitor measures MDA8 ozone concentration above the 70 ppb standard. If more than one monitor exceeds in one day, that day is counted just once. Table 2-3 presents the number of all El Paso County exceedance days by month and year without any consideration for whether international transport played a role (see Section 5 for the breakdown of international versus locally-generated ozone exceedance days). The greatest number of exceedance days from 2011 through 2020 were recorded from June through August, with a relatively equal distribution of days among these three months for all years except 2020. Despite variations in the number of exceedance days, including a notable increase in frequency since 2016, the months comprising ozone exceedances have largely remained the same.

Table 2-3. Number of all days by month and year when MDA8 ozone exceeded the 2015 NAAQS of 70 ppb at any of six El Paso County monitoring sites. All six monitors operated over the entire ten-year period. Blank entries indicate no exceedance days.

Month	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
January										
February										
March										
April			1							
May			1				1	1		2
June	2	3	1	2	3	2	5	4		1
July	4	3	1	2	1	1	2	3	4	3
August	1	4	2	1	3	1	2	5	5	10
September	1	1					2	1		
October										
November										
December										
Total	**8**	**11**	**6**	**5**	**7**	**4**	**12**	**14**	**9**	**16**

Table 2-4 lists the specific exceedance dates each year from 2016 through 2020 (i.e., the years comprising the 2018, 2019, and 2020 El Paso County DVs) along with the peak MDA8 ozone among all sites. Figure 2-4 presents time series of all MDA8 ozone measurements at the six El Paso County monitoring sites throughout the years of 2016 through 2020.

Table 2-4. Ozone exceedance dates by year and associated peak MDA8 ozone (ppb) among all sites (UTP = El Paso UTEP, CHM = El Paso Chamizal, ASP = Ascarate Park, SKY = Skyline Park, IVN = Ivanhoe, SCR = Socorro Hueco).

2016	2017	2018	2019	2020
6/6 UTP 72	5/20 CHM 72	5/22 SKY 71	7/15 UTP 79	5/6 UTP 74
6/23 CHM 84	6/4 CHM 74	6/4 CHM 83	7/18 SKY 72	5/9 UTP 75
7/16 ASP 72	6/5 UTP 71	6/21 SKY 76	7/26 UTP 77	6/25 UTP 75
8/8 CHM 81	6/6 UTP 75	6/26 SKY 72	7/27 UTP 75	7/7 UTP 79
	6/7 SKY 80	6/27 SKY 75	8/5 UTP 83	7/14 SCR 71
	6/27 UTP 75	7/21 UTP 74	8/7 UTP 75	7/25 UTP 83
	7/10 UTP 71	7/25 SKY 83	8/8 SCR 71	8/1 UTP 81
	7/28 UTP 74	7/29 UTP 91	8/10 SKY 78	8/4 SKY 74
	8/17 UTP 74	8/1 SKY 76	8/15 UTP 75	8/8 UTP 85
	8/24 CHM 72	8/3 IVN 71		8/14 SCR 74
	9/7 SKY 75	8/4 CHM 87		8/18 SCR 71
	9/12 CHM 82	8/13 IVN 74		8/19 IVN 73
		8/30 UTP 71		8/21 SCR 102
		9/9 SKY 71		8/22 SCR 73
				8/27 UTP 71
				8/29 UTP 72

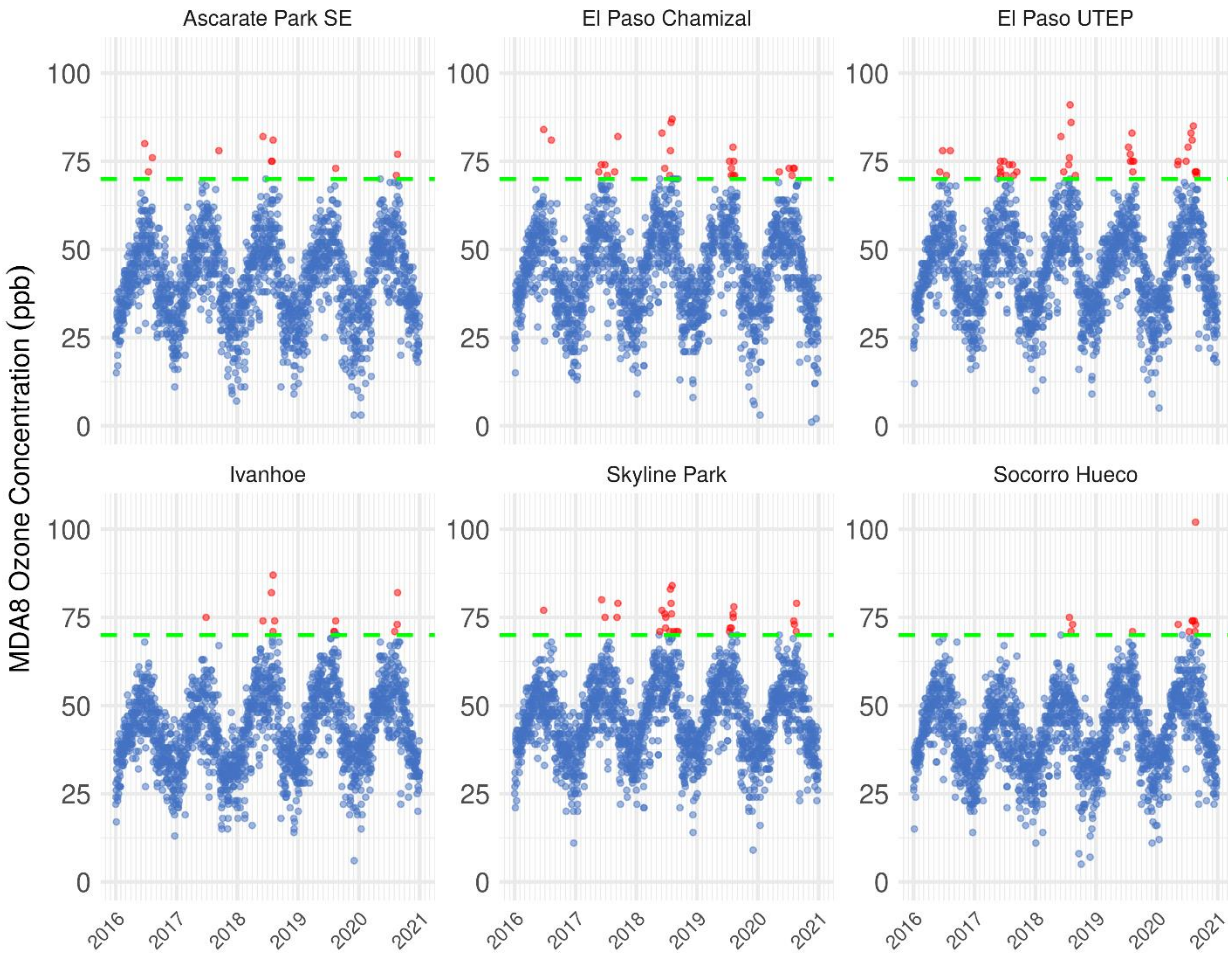

Figure 2-4. Time series of all MDA8 ozone measurements at six El Paso County monitoring sites throughout 2016 through 2020. Red dots represent days above the 70 ppb ozone NAAQS.

2.3 Conditions that Lead to Ozone Exceedances

Ozone is not directly emitted into the atmosphere but formed from a complex and non-linear series of chemical reactions among precursor emissions and intermediate products in the presence of sunlight. Precursor emissions include NOx and VOC. Intermediate products include oxidizing radicals and "reservoir" compounds such as organic nitrates that influence the availability of NOx and oxidizing radicals. Ozone production is heightened during weather conditions that produce relatively clear skies and abundant sunshine, light winds, warm temperatures, and shallow or weak vertical mixing. Typically, these meteorological conditions are associated with high pressure areas that migrate across the US during the summer season. In such cases, basin-wide emissions tend to accumulate and increase ozone production. An area's topography can further enhance stagnation when surrounding mountains and temperature inversions trap pollution within an airshed basin.

Research published by Karle et al. (2020) corroborates that high ozone events in the PdN occur during sunny, warm, stagnant conditions when high pressure systems propagate over the PdN and suppress the depth of planetary boundary layer mixing. Ozone typically reaches peak concentrations on weekday afternoon hours from the accumulation of ozone production from precursor emissions. Exceedance days can also occur on weekends.

2.3.1 Winds

Winds play an important role in ozone formation. Low wind speeds can allow accumulation of ozone and its precursors, and high winds can lead to dispersion of pollutants. Changing wind directions can cause recirculation of pollutants in an area, bring about transported ozone from other areas, or bring precursor concentrations from sources upwind to areas downwind. An examination of wind patterns in El Paso County helps determine if wind patterns during high ozone days are unique.

Figure 2-5 compares daytime-average (7:00 AM through 7:00 PM) wind speed and MDA8 ozone at the El Paso UTEP monitoring site on all April through September days from 2011 through 2020. Typically, higher ozone concentrations are observed on days with winds speeds below 6 mph. However, slower wind speeds do not always produce high ozone, indicating that there are other meteorological factors that influence ozone formation in El Paso County. No exceedance days occurred with wind speeds above 8 mph, while most exceedance days occurred with wind speeds below 5 mph.

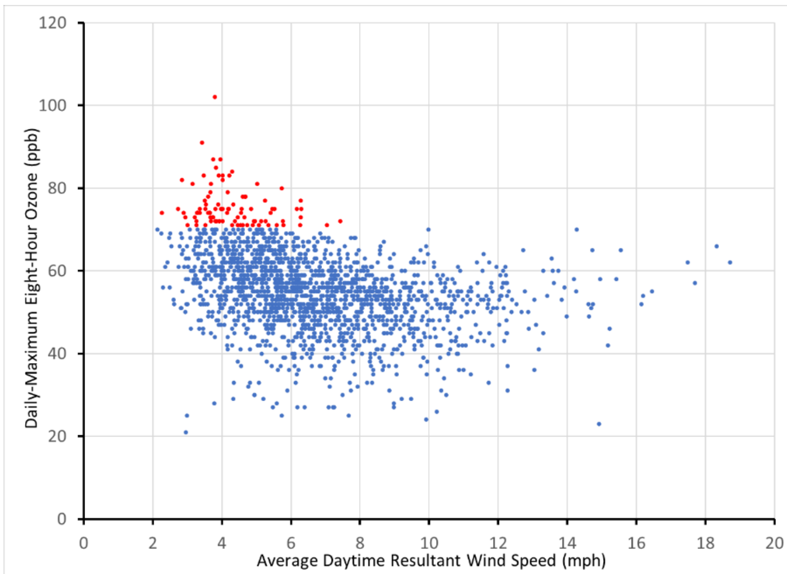

Figure 2-5. MDA8 ozone versus daily average wind speed in El Paso County during the ozone exceedance months of April through September during 2011 through 2020. Days above 70 ppb are highlighted in red.

Figure 2-6 presents a plot of the conditional probability function (CPF) for MDA8 ozone above 70 ppb by wind speed and direction during ozone exceedance days at the El Paso UTEP monitoring site from 2016 through 2020. The CPF plot shows the range of probability, as indicated by color, for MDA8 ozone to exceed 70 ppb at specific wind directions (radially) and wind speeds (concentric rings around the pole). The highest probabilities for exceedances (colored red) occur during southerly through easterly wind directions and wind speeds below 5 miles per hour. Probabilities associated with other speeds and directions are below 1%.

Section 4 provides a more in-depth analysis of wind patterns on ozone exceedance days specific to demonstrating consistent pollutant transport from Ciudad Juárez.

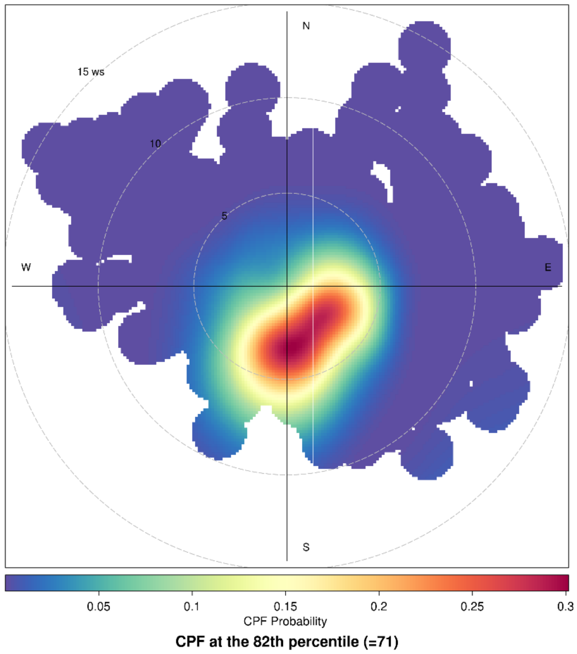

Figure 2-6. CPF polar plot showing the probability for MDA8 ozone above 70 ppb by wind speed and direction during ozone exceedance days at the El Paso UTEP monitoring site from 2016 through 2020.

2.3.2 Temperature

Figure 2-7 compares daily maximum temperature and MDA8 ozone concentrations at the El Paso UTEP monitoring site on all April through September days from 2011 through 2020. Typically, higher ozone concentrations are observed on days with temperature above 85°F; however, a much wider ozone range occurs at higher temperatures. No exceedance days occurred below 80°F.

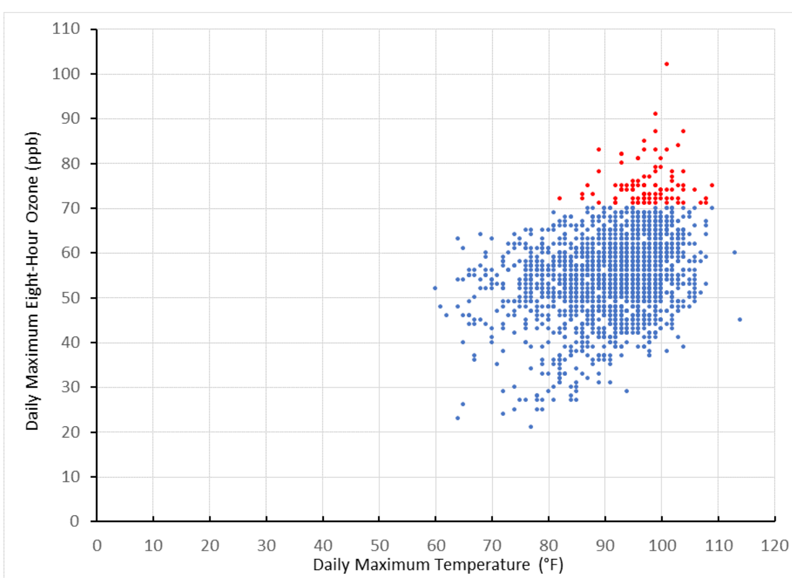

Figure 2-7. MDA8 ozone versus daily maximum temperature in El Paso County during the ozone exceedance months of April through September during 2011 through 2020. Days above 70 ppb are highlighted in red.

2.3.3 Relative Humidity

Figure 2-8 compares daytime-average (7:00 AM through 7:00 PM) relative humidity and MDA8 ozone at the El Paso UTEP monitoring site on all April through September days from 2011 through 2020 with at least 75% complete humidity data. Typically, higher ozone concentrations are observed on days with relative humidity below 40%. Low relative humidity does not necessarily indicate a low absolute amount of water vapor but rather is more the result of the highest temperatures on exceedance days. However, low relative humidity does indicate cloud-free conditions. No exceedance days occurred above 46% relative humidity, while most exceedance days occurred below 30% relative humidity.

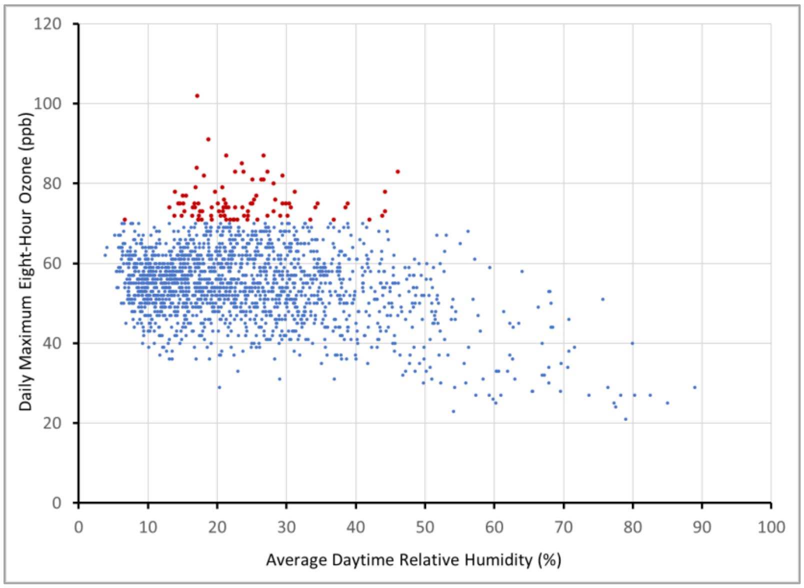

Figure 2-8. MDA8 ozone versus daytime average relative humidity in El Paso County during the ozone exceedance months of April through September during 2011 through 2020. Days above 70 ppb are highlighted in red.

3 EMISSIONS ANALYSIS

3.1 Summary

This section tabulates current annual ozone precursor emissions for El Paso County, Doña Ana County, and Municipio de Juárez. It also presents trends in emissions tabulated by the TCEQ and the EPA and compares those trends to measured air quality trends at El Paso County monitors. As noted in Section 1, this demonstration addresses ozone precursor emission contributions from the entirety of Ciudad and Municipio de Juárez, rather than pinpointing specific major sources. Details are discussed in the subsections below.

Based on analyses of 2016 emission inventories compiled by the EPA and the TCEQ, Municipio de Juárez contributes roughly two thirds of the PdN regional ozone precursor emission inventory, while El Paso County comprises less than 25% (Section 3.2). According to TCEQ reported emission inventories for El Paso County, NOx and VOC emissions have decreased by 43% and 15%, respectively, over the last 10 years while El Paso County ozone DVs have not decreased. Over 2016 through 2020, El Paso County NOx and VOC emissions have decreased by 23% and 5%, respectively (Section 3.3).

The EPA has estimated NOx increases of 21% and VOC decreases of 12% for Municipio de Juárez between 2011 and 2023. Most recently, however, the EPA estimates that Municipio de Juárez NOx and VOC emissions will both increase from 2016 to 2023, while El Paso County NOx and VOC emissions will continue to decrease over the same period (Section 3.3).

El Paso County ambient NOx concentrations have decreased consistently with El Paso County NOx emissions over the past 10 years, while El Paso County ambient VOC concentrations have increased over the same period, consistent with the EPA’s estimated increase in VOC emissions in Municipio de Juárez (Section 3.3). As detailed in Section 3.5, data analyses show that the ozone environment at the El Paso Chamizal site near the US border has remained VOC-sensitive over the past decade. Ambient VOC concentrations measured at El Paso Chamizal during this time have increased despite VOC emission reductions in El Paso County. This provides evidence that continuing ozone exceedances in El Paso County are influenced by increasing VOC emissions emanating from Municipio de Juárez, which are projected to more than counteract VOC reductions in El Paso County.

3.2 Emission Inventory Comparison

Geographic contributions to the PdN regional emission inventory are shown in Table 3-1, which lists 2016 anthropogenic NOx and VOC emission totals for Municipio de Juárez, El Paso County, and Doña Ana County. Biogenic emissions are not included in this comparison. These inventories are from the EPA’s 2016v2 North American Emissions Modeling Platform (EPA, 2021a).

Table 3-1. Geographic contributions to the 2016 PdN regional emission inventory in tons per year (TPY) according to the EPA (2021a).

Area	NOx (TPY)	NOx (%)	VOC (TPY)	VOC (%)
Municipio de Juárez*	39,744	64%	33,363	67%
El Paso County	14,640	23%	11,166	22%
Doña Ana County	7,968	13%	5,555	11%
Total	62,352	100%	50,084	100%

*Municipio de Juárez extends beyond Ciudad Juárez in the north-central portion of the State of Chihuahua, Mexico. Most emissions within the Municipio emanate from Ciudad Juárez.

The TCEQ’s reported 2016 emission inventory for El Paso County is very similar to the EPA 2016v2 inventory: 13,758 TPY for NOx and 12,609 TPY for VOC. Emissions from Municipio de Juárez contribute roughly two thirds of the PdN regional emission inventory for both NOx and VOC. El Paso County comprises less than 25% of the regional inventory, while Doña Ana County comprises less than 15%. This comparison provides evidence that El Paso County would be in attainment of the ozone NAAQS but for emissions from Ciudad Juárez.

NOx is primarily emitted by fossil fuel combustion from motor vehicle, industrial, commercial, residential, and other processes. VOCs are emitted from combustion sources as well as from evaporation from solvents, fuels, paints, and numerous consumer products.

3.3 Emissions and Ozone Trends

Trends in El Paso County anthropogenic NOx and VOC emissions over the past decade are shown in Figure 3-1 together with the trend in the El Paso County maximum ozone DV.

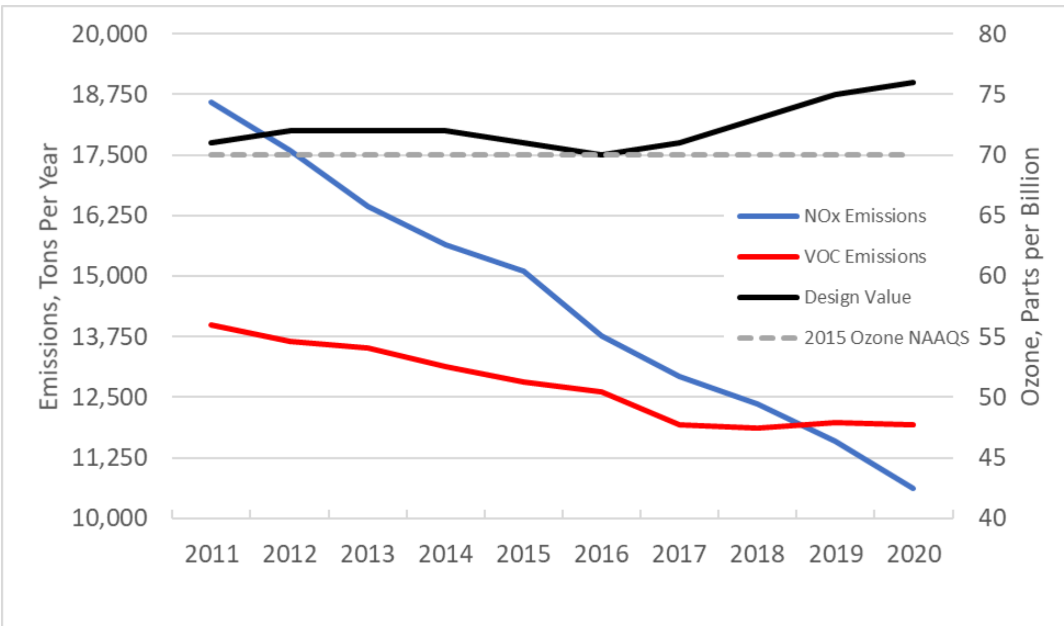

Figure 3-1. Trends in El Paso County anthropogenic NOx and VOC emissions from 2011 through 2020 together with the trend in El Paso County maximum ozone DV, reported by the TCEQ.

Despite large reductions in NOx (43%) and VOC (15%) from 2011 through 2020, the area's DV has increased by 9% over the same period[1]. Reductions in both NOx and VOC emissions have been achieved mainly among the on-road and non-road sectors even as TCEQ-reported vehicle activity and non-road equipment populations increased by 12% and 18%, respectively, over the same period. Over 2016 through 2020, El Paso County NOx and VOC emissions have decreased by 23% and 5%, respectively.

According to reported emissions in the EPA's 2011v3 platform (EPA, 2018) and 2016v2 platform (EPA, 2021a), NOx emissions for Municipio de Juárez increase by 21% between 2011 and 2023 (from 32,945 TPY to 39,909 TPY). The EPA platforms also indicate that VOC emissions decrease by 18% between 2011 and 2016 (from 40,901 TPY to 33,363 TPY) but increase by 8% from 2016 to 2023 (from 33,363 TPY to 36,138 TPY), for a net 2011 to 2023 VOC reduction of 12%. The inconsistent

[1] Emissions data are for the years 2011 through 2020. Point sources are from the Texas STARS database, area sources are from 2011, 2014, and 2017 base inventories grown using ERG 2015 growth factors, onroad-mobile sources are from MOVES2014 based trend inventories, aircraft are from AEDT based trend inventories from 2018 ERG project, locomotives are from ERG developed trends based on 2013 activity, non-road modeling is from TexN2.2.

patterns in the EPA's VOC emission estimates are likely the result of different methodologies among the platforms to approximate area-wide emissions within Municipio de Juarez.

Figure 3-2 shows projected NOx and VOC emissions from 2016 to 2023 for Doña Ana County, El Paso County, and Municipio de Juárez according to the EPA 2016v2 Emissions Modeling Platform (EPA, 2021a). El Paso County and Doña Ana County NOx emissions are both projected to decrease 33%. El Paso County VOC emissions are projected to decrease 3% while Doña Ana County VOC emissions are projected to decrease 10%. However, Municipio de Juárez NOx emissions are projected to hold steady to 2023, while VOC emissions are projected to increase 8%. Declining emissions in El Paso County and increasing emissions from Municipio Juárez further support that the El Paso County would be in attainment of the ozone NAAQS but for emissions from Ciudad Juárez.

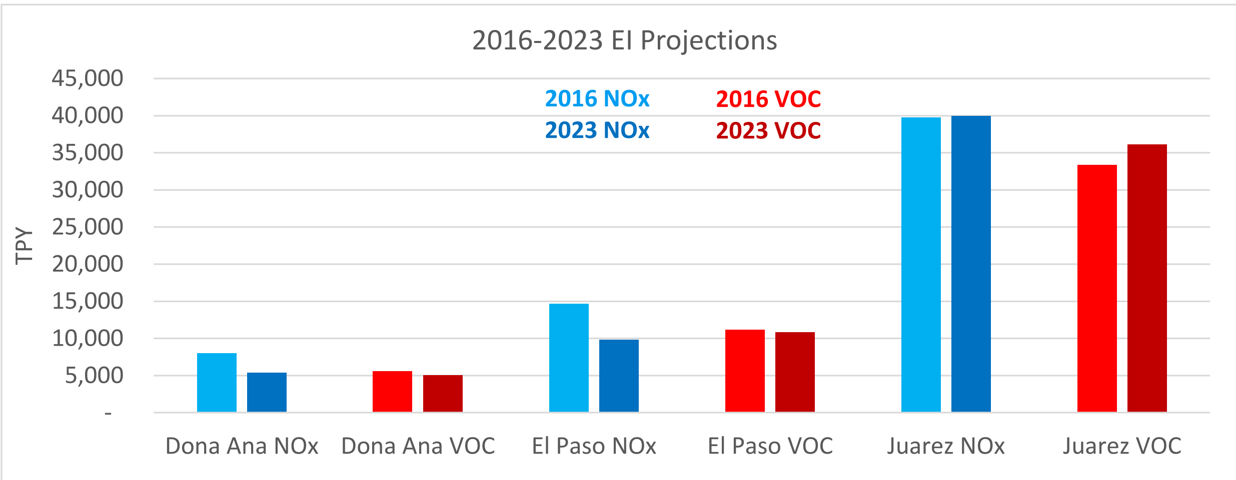

Figure 3-2. Projected NOx and VOC emissions from 2016 to 2023 for Doña Ana County, El Paso County, and Municipio de Juárez according to the EPA 2016v2 Emissions Modeling Platform (EPA, 2021a).

As shown in Figure 3-3, there is about a 30% decrease in measured ambient NOx concentrations in El Paso County from 2011 through 2020, or over 3% per year, which is consistent with the decline in El Paso County NOx emissions shown in Figure 3-1. The NOx concentration plotted each year represents an average over April through September and among three long-running El Paso County NOx monitors near the border: El Paso UTEP, El Paso Chamizal, and Ascarate Park.

In contrast to NOx, the monitored ambient total non-methane organic carbon (TNMOC) concentration trend in Figure 3-3 does not agree with declining anthropogenic VOC emissions for El Paso County (Figure 3-1). The TNMOC concentration plotted each year represents an average over April through September at the El Paso Chamizal automated gas chromatograph (auto-GC) monitor, the only long-term hydrocarbon measurement site in El Paso County. The definitions of VOC and TNMOC are different: TNMOC excludes methane whereas VOC excludes methane, ethane, and certain other organic compounds that generally are less abundant than ethane. Nevertheless, trends in VOC and TNMOC are expected to be consistent. TNMOC concentrations have fluctuated year-to-year but have generally trended upward by 17% from 2011 through 2020, or about 2% per year. According to the EPA projections in Figure 3-2, VOC growth in Municipio de Juárez more than counteracts VOC reductions in El Paso County, and this is consistent with ambient measurements to date.

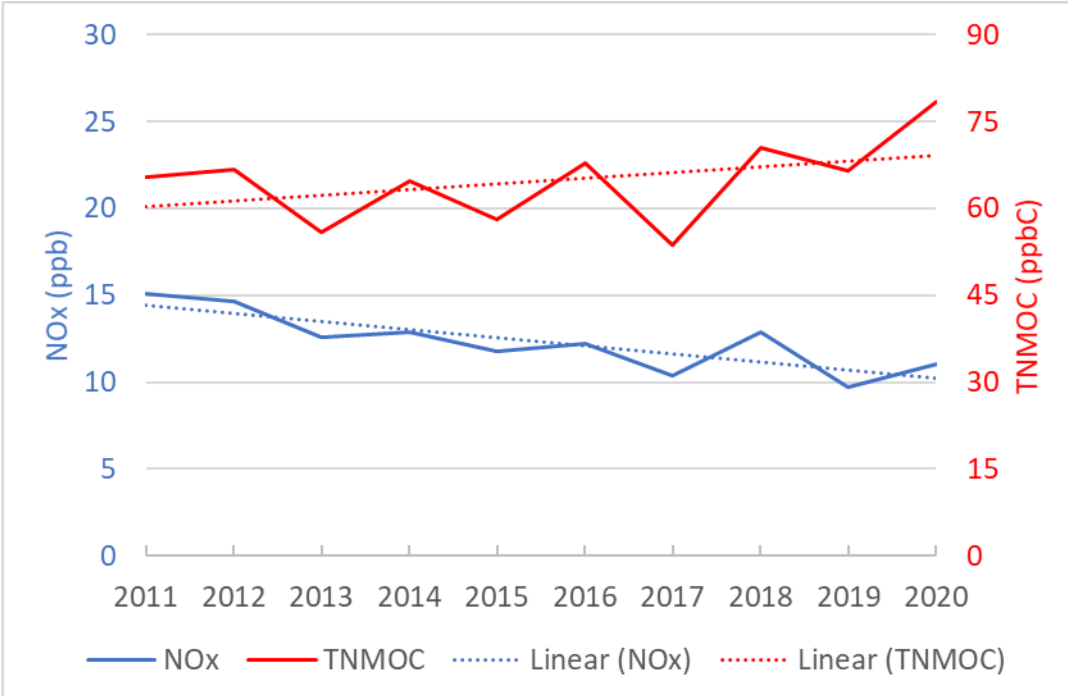

Figure 3-3. Observed and regressed trends in ambient NOx and TNMOC concentration measurements from 2011 through 2020. The NOx concentrations represent the average from three El Paso County monitoring sites during April through September each year. The TNMOC concentrations represent the average during April through September each year at the El Paso Chamizal auto-GC monitor.

3.4 Emissions and Ozone Chemistry Near the Border

The efficiency of ozone production depends on the relative abundance of NOx and VOC precursors in the atmosphere at a given time and location. In simple terms, ozone is generated from (but also destroyed by) NOx while VOCs provide the oxidants (radicals) that drive the reactions. Small amounts of NOx relative to VOC result in ozone production limited by (or sensitive to) available NOx. Conversely small amounts of VOC relative to NOx result in ozone production limited by available VOC. Under VOC-limited conditions, high NOx can also suppress ozone production. Understanding NOx vs. VOC sensitivity within an airshed can help determine how changes in either or both would affect ozone concentrations. Areas where ozone formation is sensitive to both VOC and NOx are considered transitional and altering either precursor by equivalent amounts would similarly impact ozone concentrations.

The auto-GC monitor has operated at El Paso Chamizal with a co-located NOx monitor since 2009. El Paso Chamizal is sited approximately a quarter of a mile from the international crossing at the Bridge of Americas, which has a high volume of daily vehicular traffic, much of it idling. According to the Texas-Mexico Border Transportation Master Plan (Texas Department of Transportation, 2021), there is strong evidence that the majority of idling traffic volume is associated with northbound crossings entering from Mexico. A few statistics of note include:

- Northbound commercial vehicle crossings increased 62% from 1996 to 2019, while information on southbound crossings is limited;
- Regionally, 25% of northbound commercial vehicle crossings take up to 90 minutes and 21% of northbound passenger vehicle crossings take up to 60 minutes; and

- At the Bridge of Americas, 25% of northbound passenger vehicle crossings take 30 to 60 minutes, while southbound crossings mostly take under 30 minutes.

Similar statistics are reported for the Ysleta-Zaragoza bridge.

The TCEQ calculated ratios of VOC to NOx (VOC:NOx) from hourly measurements at Chamizal and determined the median over all hours between April and September of each year. Figure 3-4 displays the resulting trend in median VOC:NOx ratios from 2009 through 2020. In general, VOC:NOx ratios above ~15 reflect NOx-limited conditions, while ratios below ~5 reflect VOC-limited conditions. Results show that the aggregated ratio has remained VOC-limited throughout the period, with an uptick toward transitional in 2020. This is not surprising given the close proximity of Chamizal to the large volume of NOx-heavy commercial road traffic. Therefore, results from this site may not be applicable to areas in El Paso County or Sunland Park that are well removed from the border, and therefore have a different ratio or mix of precursor sources.

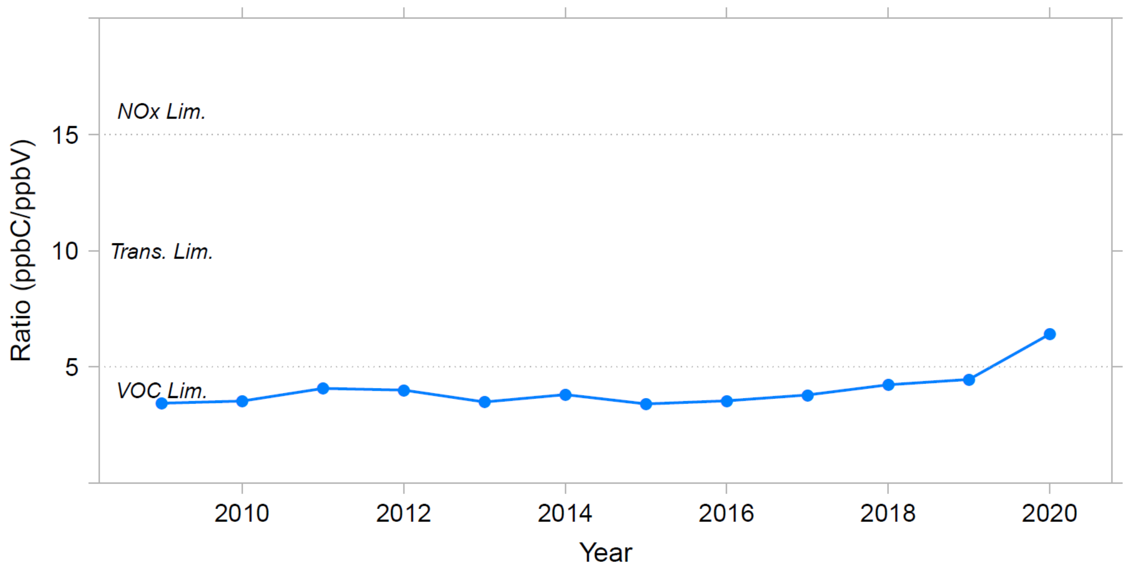

Figure 3-4. Observed trend in April through September median VOC:NOx ratio at the El Paso Chamizal monitoring site from 2009 through 2020.

To summarize, ambient TNMOC concentrations measured at the El Paso Chamizal site near the border from 2011 through 2020 (Figure 3-3) have not decreased despite VOC emission reductions in El Paso County (Figure 3-1). Long-term data analyses indicate the ozone environment at this site is VOC-sensitive (Figure 3-4). This provides evidence that continuing ozone exceedances are influenced by increasing VOC emissions emanating from Ciudad Juárez, which are projected to more than counteract VOC reductions in El Paso County out to 2023 (Figure 3-2).

4 METEOROLOGICAL ANALYSIS

4.1 Summary

This section presents meteorological analyses specific to ozone exceedance days in El Paso County that include ozone pollution roses, cluster analysis, and air parcel back trajectories, all of which provide evidence that high ozone days in El Paso County are most often associated with transport from Mexico. Ozone pollution roses and cluster analyses show consistent southerly wind directions at the three El Paso County nonattainment monitors (El Paso UTEP, El Paso Chamizal, Skyline Park; other sites attain the ozone NAAQS) based on ozone monitoring data during exceedance days from 2016 through 2020. Non-exceedance days are associated with westerly through northerly wind directions. Furthermore, analysis of pollution roses provides evidence that on-road vehicles emissions from traffic at the Bridge of the Americas can contribute to elevated ozone in El Paso County. Analyses of backward air parcel trajectories show that a vast majority of exceedance days from 2016 through 2020 involve air parcel transport over Mexico prior to arriving at the El Paso UTEP (85%), El Paso Chamizal (85%) and Skyline Park (61%) monitors. Section 5 synthesizes the information developed here to differentiate ozone exceedance days with international transport versus those without (i.e., locally influenced) and the related impacts to El Paso County DVs.

4.2 Ozone Pollution Roses

A summary of wind patterns associated with a range of observed ozone concentrations is graphically depicted with an ozone pollution rose, which shows the frequency distribution of ozone concentration separately for each direction from which the wind is blowing. Figure 4-1 shows ozone pollution roses for non-exceedance days (MDA8 ozone less than 71 ppb) and exceedance days (MDA8 ozone greater than or equal to 71 ppb) at El Paso UTEP, El Paso Chamizal, and Skyline Park over April through September 2016 through 2020. These plots cover all 24 hours of each day and exclude hours with missing data. Pollution roses have limitations for determining the source(s) of pollution in an airmass. The wind direction recorded when an airmass arrives at an ozone monitor may differ from the wind direction(s) that occurred upwind, earlier, when ozone was being formed in that airmass. However, given the close proximity of the El Paso UTEP and El Paso Chamizal monitors to the border, pollution roses are reliable indicators of whether elevated ozone concentrations arrived from Mexico. There may be less certainty in attributing sources from pollution roses at Skyline Park, which is farther from the border.

The ozone pollution roses for El Paso UTEP and El Paso Chamizal show that higher ozone concentrations tend to occur most often with easterly clockwise through southwesterly wind directions. Conversely, non-exceedance days are associated with westerly wind direction at these two monitors. At Skyline Park, hourly ozone greater than 70 ppb appears to be almost entirely associated with wind directions in the southwest and southeast quadrants. This is not surprising given Skyline Park's location to the north of central El Paso and Ciudad Juárez. In summary, the highest hourly ozone concentrations at all three El Paso County monitors are associated with wind directions from Mexico.

Furthermore, the pollution rose petals, especially the south facing petals for the El Paso Chamizal monitor and the southeast petals for the El Paso UTEP monitor, provide evidence that the Bridge of the Americas on-road vehicle emissions can contribute to El Paso County's elevated ozone, because of the higher ozone concentrations recorded from these directions. This is seen on elevated ozone days in Figure 4-1. Long wait times at the border can result in vehicles idling for hours just a short distance from these monitors.

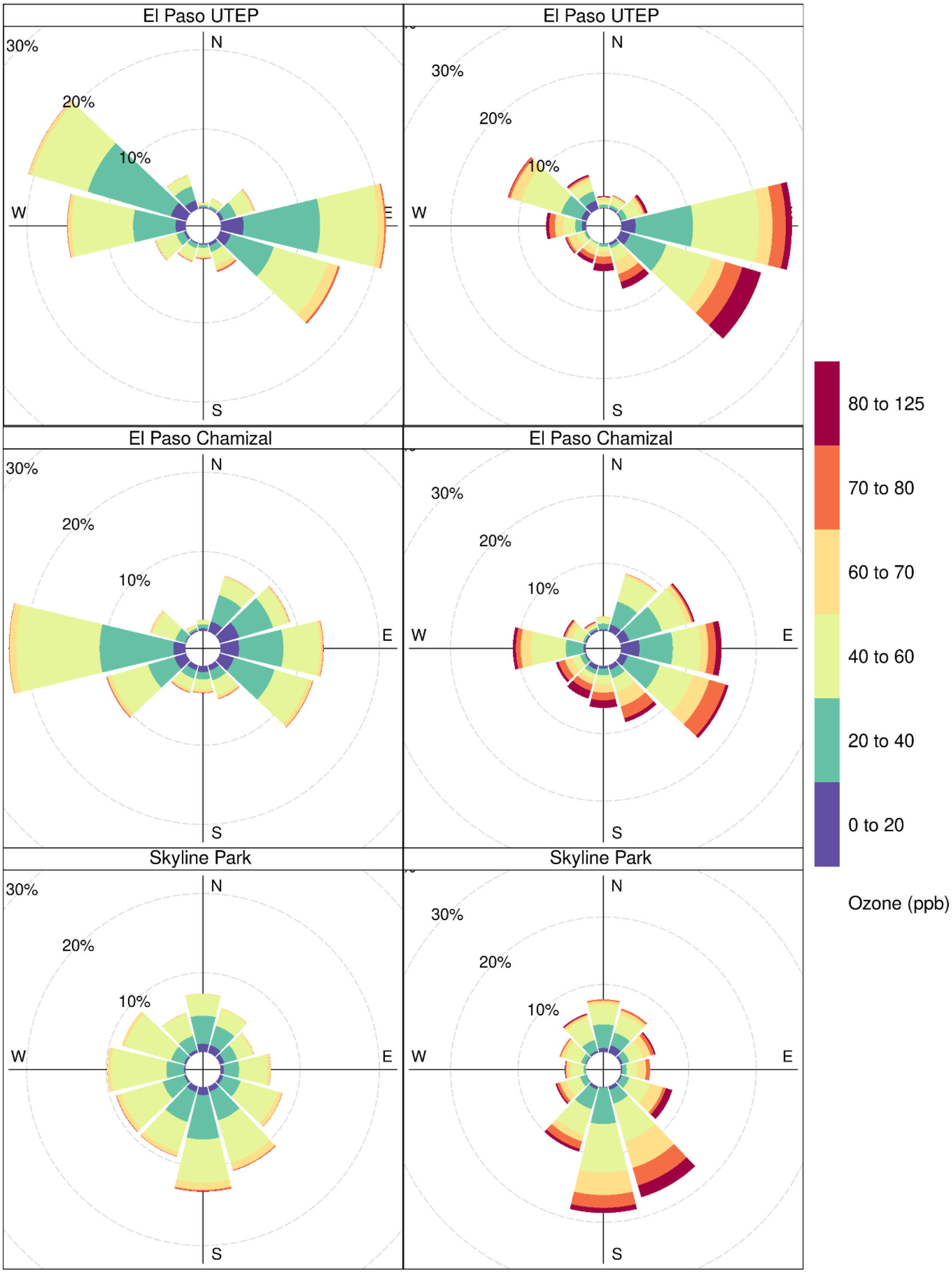

Figure 4-1. Ozone pollution roses for non-exceedance days (left) and exceedance days (right) at El Paso UTEP (top), El Paso Chamizal (middle) and Skyline Park (bottom) monitors during all April through September days from 2016 through 2020.

4.3 Ozone Cluster Analysis by Wind Direction

As another approach to understand the relationship between wind patterns and ozone in El Paso County, the TCEQ conducted a cluster analysis using data from the El Paso UTEP, El Paso Chamizal, and Skyline Park monitors. The cluster analysis objectively classified days in April through September based on their similarity in terms of daily wind patterns. These analyses concluded that a significant majority of exceedance days at each monitoring site were associated with winds arriving from the direction of Ciudad Juárez.

The cluster analysis relied on hourly resultant wind direction and wind speed obtained from the TCEQ's Texas Air Monitoring Information System (TAMIS) database for the months of April through September in years 2011 through 2020. Corresponding MDA8 ozone values at each monitor were obtained from the EPA Air Data website (https://www.epa.gov/outdoor-air-quality-data). Days with less than 21 hours of validated wind data were removed from the analyses. Any remaining missing data were filled with the hourly averages for the two-week period to which they belonged. By limiting the values used for imputation to the hour and two-week period surrounding the missing data point, the TCEQ was able to ensure the imputed value was appropriate to the year and specific time of year. Additionally, to only include days with 24 hours of validated wind data would eliminate many possible records otherwise available using the 21-hour method.

Table 4-1 summarizes the number of days used in the cluster analysis at each monitoring site.

Table 4-1. Number of days with valid hourly wind and MDA8 ozone data (out of a possible 1830 total) during April through September from 2011 through 2020 included in cluster analysis for each El Paso County monitor.

Air Quality Monitor	Included Days
El Paso UTEP	1821
El Paso Chamizal	1754
Skyline Park	1813

The TCEQ applied a two-stage cluster analysis, preceded by a principal component analysis (PCA) operation on the data set for each monitoring site. The TCEQ used the technique for meteorological data developed by Eder, et. al. (1994). Ngan and Byun (2011) note that: "This method is widely used and has been demonstrated as appropriate for studies relating meteorology to air pollution in terms of cluster cohesiveness (Davis and Kalkstein 1990; Eder, et al. 1994; Davis, et al. 1998)." The first stage of the cluster analyses relied on the Ward (1963) agglomerative hierarchical cluster analysis to determine the appropriate number of clusters for each monitor. The second stage of the cluster analyses used the non-hierarchical k-means algorithm (Milligan, 1980) to assign individual days to the recommended number of clusters.

Hierarchical cluster analyses suggested optimal solutions with two clusters at El Paso Chamizal, two clusters at El Paso UTEP, and four clusters at Skyline Park. Table 4-2 summarizes these results, showing the number of days in each cluster, the minimum, maximum, and average MDA8, as well as the number of exceedances of the 2015 ozone NAAQS associated with each cluster. There are modest differences among high MDA8 ozone between clusters at each monitor. However, there is one cluster at each of the three monitors that accounts for a large majority of exceedances from 2016 through 2020 (El Paso UTEP 1: 31/39 exceedances; El Paso Chamizal 2: 23/26; Skyline Park 2: 22/28). We refer to these clusters as the "exceedance cluster" at each monitor below for simplicity.

Table 4-2. Maximum MDA8 ozone statistics for each monitor-cluster pair.

Monitor - Cluster	MDA8 Count	Minimum MDA8	Maximum MDA8	Average MDA8	Exceedances (MDA8 > 70 ppb)
El Paso UTEP 1	453	22	91	55	31
El Paso UTEP 2	432	16	86	51	8
El Paso Chamizal 1	368	22	84	52	3
El Paso Chamizal 2	486	13	87	52	23
Skyline Park 1	201	28	78	52	2
Skyline Park 2	361	21	84	55	22
Skyline Park 3	264	22	83	52	4
Skyline Park 4	85	39	65	52	0

The TCEQ created average afternoon (13:00 through 16:00 MST) wind direction at each monitoring site for each day in April through September during 2016 through 2020 in order to associate clustered days to wind direction. This analysis focused on afternoon wind direction because peak ozone typically occurs during afternoon hours. Figure 4-2 at El Paso UTEP and Figure 4-3 at El Paso Chamizal both show that each cluster is strongly associated with distinct afternoon average wind directions.

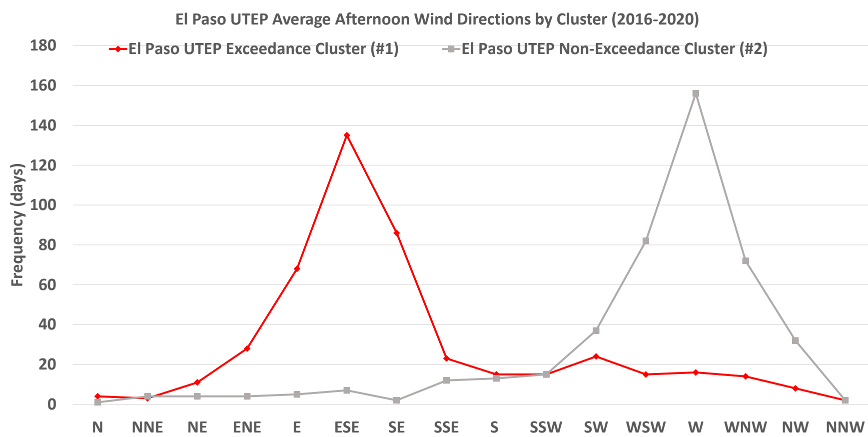

Figure 4-2. Frequency of average afternoon wind directions for each cluster at the El Paso UTEP monitor.

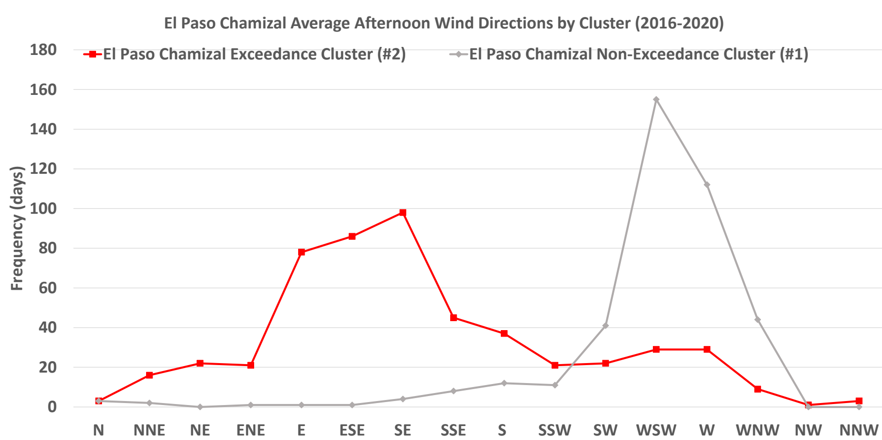

Figure 4-3. Frequency of average afternoon wind directions for each cluster at the El Paso Chamizal monitor.

Both sites had one cluster which was most strongly associated with wind directions from the southeast (El Paso UTEP 1 and El Paso Chamizal 2; the exceedance clusters shown in red) and one other cluster associated most strongly with average wind directions from the west (El Paso Chamizal 1 and El Paso UTEP 2; the clusters with far less exceedances shown in grey).

Figure 4-4 shows a similar breakdown of afternoon wind clusters at Skyline Park (the two clusters with the least distinct wind directions are removed for clarity). At this monitor, the most frequent cluster (Skyline Park 2) is most strongly associated with winds from the south-southeast and represents the exceedance cluster shown in red.

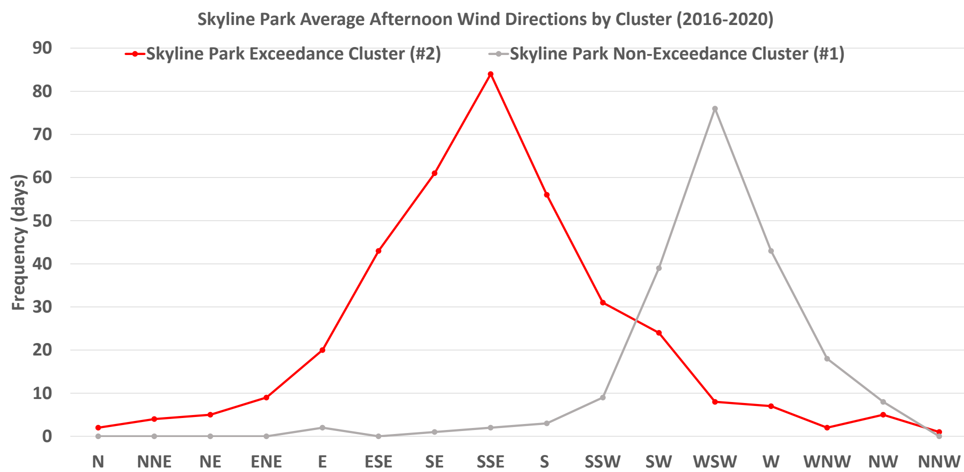

Figure 4-4. Frequency of average afternoon wind directions for each cluster at the Skyline Park monitor.

By associating the ozone levels with afternoon wind directions for each cluster of days identified, this analysis demonstrates and contributes to the evidence that most ozone exceedances are associated with southerly and easterly wind directions coming from the direction of Ciudad Juárez.

4.4 Back Trajectory Analysis

The TCEQ applied the Hybrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT; Stein et al., 2015) model, using the READY (Real-time Environmental Applications and Display sYstem) application on the National Oceanic and Atmospheric Administration, Air Resources Laboratory (NOAA ARL) web server, to trace the path of air parcels prior to arriving at El Paso County monitors on ozone exceedance days. HYSPLIT tracks air parcel paths in three dimensions using archived meteorological datasets generated by routine analysis and forecasting systems and reports each parcel's coordinates (or "trajectory points") at each hour. For each ozone exceedance day at the El Paso UTEP, El Paso Chamizal, and Skyline Park monitors from 2016 through 2020 (a total of 93 site-days), the TCEQ generated eight 72-hour back trajectories – one trajectory arriving at each of the eight hours comprising the MDA8 averaging period at a given monitor. All HSYPLIT back trajectories were set to arrive at 100 m height above ground and used the North American Model (NAM) reanalysis product at 12 km resolution as the meteorological data source.

Figure 4-5 shows an example of HYSPLIT back trajectories on June 6, 2016 from the El Paso UTEP monitor. Trajectories were initiated at each hour from 11:00 through 18:00 Mountain Standard Time (MST), covering the 8-hour ozone averaging period at El Paso UTEP on this day. In this example, all eight back trajectories transit over Ciudad Juárez in the hours prior to arriving at the monitor.

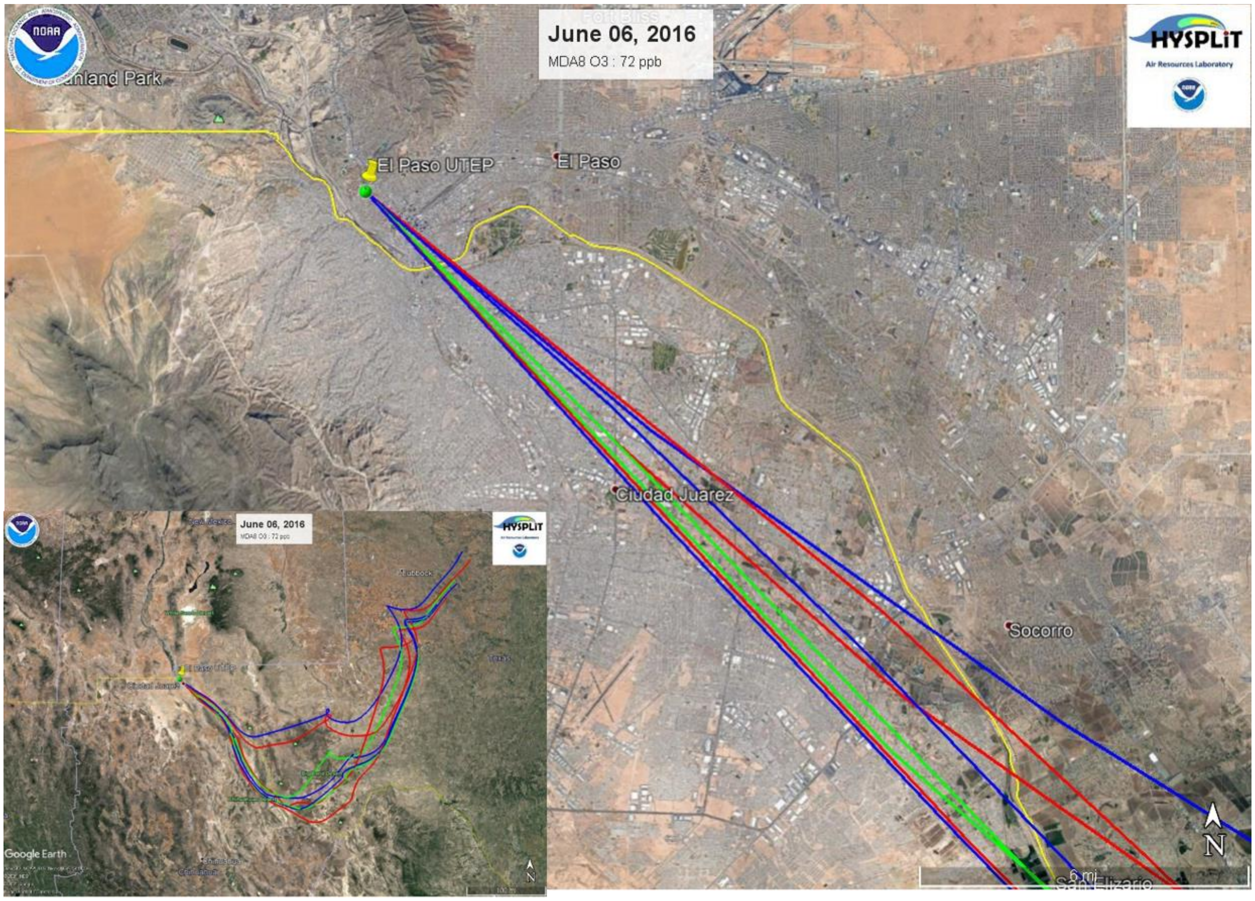

Figure 4-5. HYSPLIT back trajectories arriving at the El Paso UTEP monitor on June 6, 2016. Trajectories were initiated each hour from 11:00 through 18:00 MST, covering the 8-hour averaging period used in the MDA8 ozone calculation at this site on this day. Inset shows the entire 72-hour trajectories.

Table 4-3 lists the MDA8 ozone concentration at the El Paso UTEP monitor for each exceedance day from 2016 through 2020. For each of these days, the TCEQ reviewed the HYSPLIT back trajectories to determine whether at least 6 of the 8 trajectories (75%) traveled through Mexico (as noted with asterisks in Table 4-3). The 75% criterion was taken from examples in the EPA (2020) guidance to indicate that air parcels predominantly arrived from international emission sources over the 8-hour averaging period. In this particular analysis, the criteria defining "traveled through Mexico" is met when any part of a trajectory traverses any area of Ciudad Juárez, as evident from each trajectory overlaid on satellite photos as shown in Figure 4-5. The EPA (2020) guidance does not provide recommendations for determining the amount of time nor the distance beyond the border that a trajectory should be considered as passing over an international source. Days not noted with asterisks indicate more US influence (i.e., less than 6 of 8 trajectories traveled through Mexico). In total, 33 of 39 exceedance days (85%) involved international contributions at the El Paso UTEP monitor. Tables 4-4 and 4-5 show similar results at El Paso Chamizal and Skyline Park with 85% and 61% of days involving international contributions, respectively.

Table 4-3. MDA8 ozone (O_3) concentrations for each exceedance day at the El Paso UTEP monitor. Asterisks indicate days when at least 6 of 8 (75%) HYSPLIT trajectories travelled through Mexico.

2016	MDA8 O_3 (ppb)	2017	MDA8 O_3 (ppb)	2018	MDA8 O_3 (ppb)	2019	MDA8 O_3 (ppb)	2020	MDA8 O_3 (ppb)
Jun 23	78*	Jun 6	75*	Jul 29	91*	Aug 5	83*	Aug 8	85*
Aug 8	78*	Jun 27	75*	Aug 4	86	Jul 15	79*	Jul 25	83*
Jun 6	72*	Jul 28	74	Jun 4	82*	Jul 26	77*	Aug 1	81*
Jul 16	71*	Aug 17	74	Jul 25	76*	Jul 27	75*	Jul 7	79*
-----	-----	Jun 4	73*	Jul 21	74*	Aug 7	75	May 9	75*
-----	-----	Jun 7	72*	Jun 21	72*	Aug 15	75*	Jun 25	75*
-----	-----	Sep 12	72*	Aug 30	71*	Aug 10	72*	May 6	74*
-----	-----	Jun 5	71*	-----	-----	-----	-----	Aug 19	72*
-----	-----	Jul 10	71	-----	-----	-----	-----	Aug 22	72*
-----	-----	Aug 24	71*	-----	-----	-----	-----	Aug 29	72
-----	-----	-----	-----	-----	-----	-----	-----	Aug 27	71*

Table 4-4. MDA8 ozone (O_3) concentrations for each exceedance day at the El Paso Chamizal monitor. Asterisks indicate days when at least 6 of 8 (75%) HYSPLIT trajectories travelled through Mexico.

2016	MDA8 O_3 (ppb)	2017	MDA8 O_3 (ppb)	2018	MDA8 O_3 (ppb)	2019	MDA8 O_3 (ppb)	2020	MDA8 O_3 (ppb)
Jun 23	84*	Sep 12	82*	Aug 4	87	Aug 5	79*	Jul 7	73*
Aug 8	81*	Jun 4	74*	Jul 29	86*	Jul 15	75*	Aug 1	73*
-----	-----	Jun 27	74*	Jun 4	83*	Aug 10	75*	Aug 8	73*
-----	-----	May 20	72	Jul 25	78*	Jul 27	73*	May 9	72*
-----	-----	Aug 24	72*	Jun 21	73*	Jul 26	71*	Jul 25	71*
-----	-----	Jul 10	71	Jul 21	71*	Aug 7	71	-----	-----
-----	-----	-----	-----	-----	-----	Aug 15	71*	-----	-----

Table 4-5. MDA8 ozone (O_3) concentrations for each exceedance day at the Skyline Park monitor. Asterisks indicate days when at least 6 of 8 (75%) HYSPLIT trajectories travelled through Mexico.

2016	MDA8 O_3 (ppb)	2017	MDA8 O_3 (ppb)	2018	MDA8 O_3 (ppb)	2019	MDA8 O_3 (ppb)	2020	MDA8 O_3 (ppb)
June 23	77	Jun 7	80	Aug 4	84*	Aug 10	78	Aug 21	79
-----	-----	Sep 12	79*	Jul 25	83	Aug 5	76	Aug 4	74
-----	-----	Jun 27	75*	Jul 29	79*	Aug 7	75	Aug 8	73*
-----	-----	Sep 7	75*	Jun 4	77	Jul 18	72*	Aug 19	71
-----	-----	-----	-----	Jun 21	76*	Jul 26	72	-----	-----
-----	-----	-----	-----	Aug 1	76*	Jul 15	71*	-----	-----
-----	-----	-----	-----	Jun 27	75*	-----	-----	-----	-----
-----	-----	-----	-----	Jun 26	72*	-----	-----	-----	-----
-----	-----	-----	-----	May 22	71*	-----	-----	-----	-----
-----	-----	-----	-----	Jul 21	71*	-----	-----	-----	-----
-----	-----	-----	-----	Aug 13	71*	-----	-----	-----	-----
-----	-----	-----	-----	Aug 30	71*	-----	-----	-----	-----
-----	-----	-----	-----	Sep 9	71*	-----	-----	-----	-----

To better visualize and quantify in a single graphic where all air parcels most often travel en-route to the El Paso County monitors during exceedance days, a 0.1 degree (~10 km) resolution grid was created centered over the PdN region. This choice of resolution is consistent with the horizontal scale of the HYSPLIT meteorology (NAM 12 km). Next, the number of hourly parcel trajectory points within each grid cell was counted and the result was expressed as a percentage of total trajectory points, producing the trajectory density plots shown in Figure 4-6 (El Paso UTEP), Figure 4-7 (El Paso Chamizal) and Figure 4-8 (Skyline Park). Each figure contains 6 panels that show the spatial distribution of trajectory points at a specific number of hours *before arriving* at the monitor (i.e., labeled in negative time). The left column of panels includes all trajectory points at -1 hour (top left), -2 hours (middle left) and -3 hours (bottom left). The right column of panels continues the time evolution at -4 hours (top right), -5 hours (middle right) and -6 hours (bottom right). Trajectory points at hours earlier than -6 are excluded to focus on spatial patterns over the immediate PdN region.

Both the El Paso UTEP and El Paso Chamizal density plots at -1 hour (top left panels of Figure 4-6 and Figure 4-7) show maxima centered over the border with contours elongated southward into Mexico at all hours. The Skyline Park -1 hour density plot (top left panel of Figure 4-8) shows a very similar pattern, but the maximum density is shifted about 8 km north of the U.S./Mexico border, and again contours extend southward toward Mexico. Across all monitors, maximum percentages are highest in the -1 hour plots and are progressively smaller in the -2 through -6 hour plots as the back trajectories exhibit more spatial variation with time. Thus, air parcel back trajectory analyses are consistent with the other meteorological analyses presented here in providing evidence that high ozone days in El Paso County are most often associated with transport from Mexico.

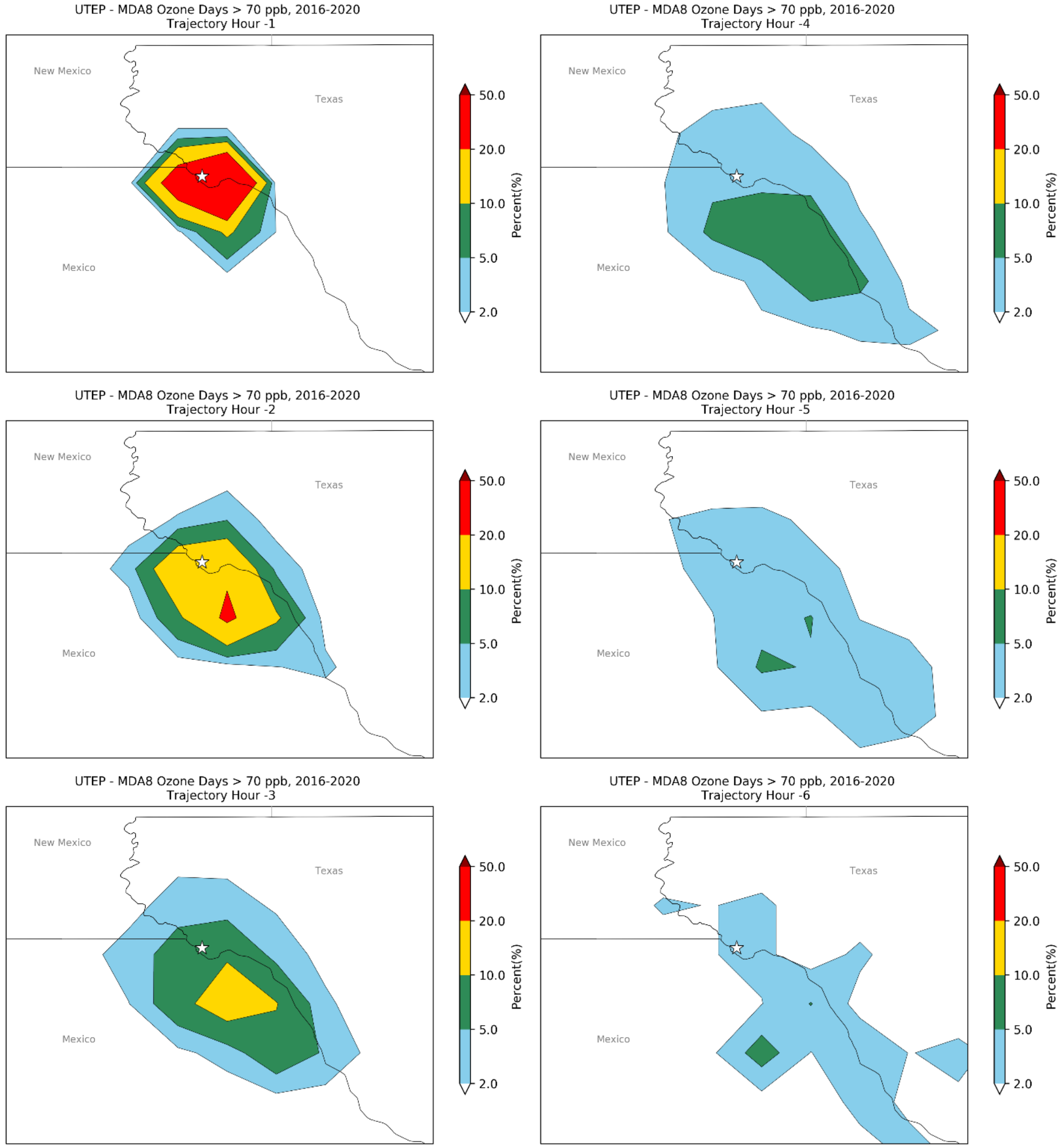

Figure 4-6. HYSPLIT back trajectory density plots for hours -1 (top left) through -6 (bottom right) prior to arriving at the El Paso UTEP monitor during exceedance days from 2016 through 2020.

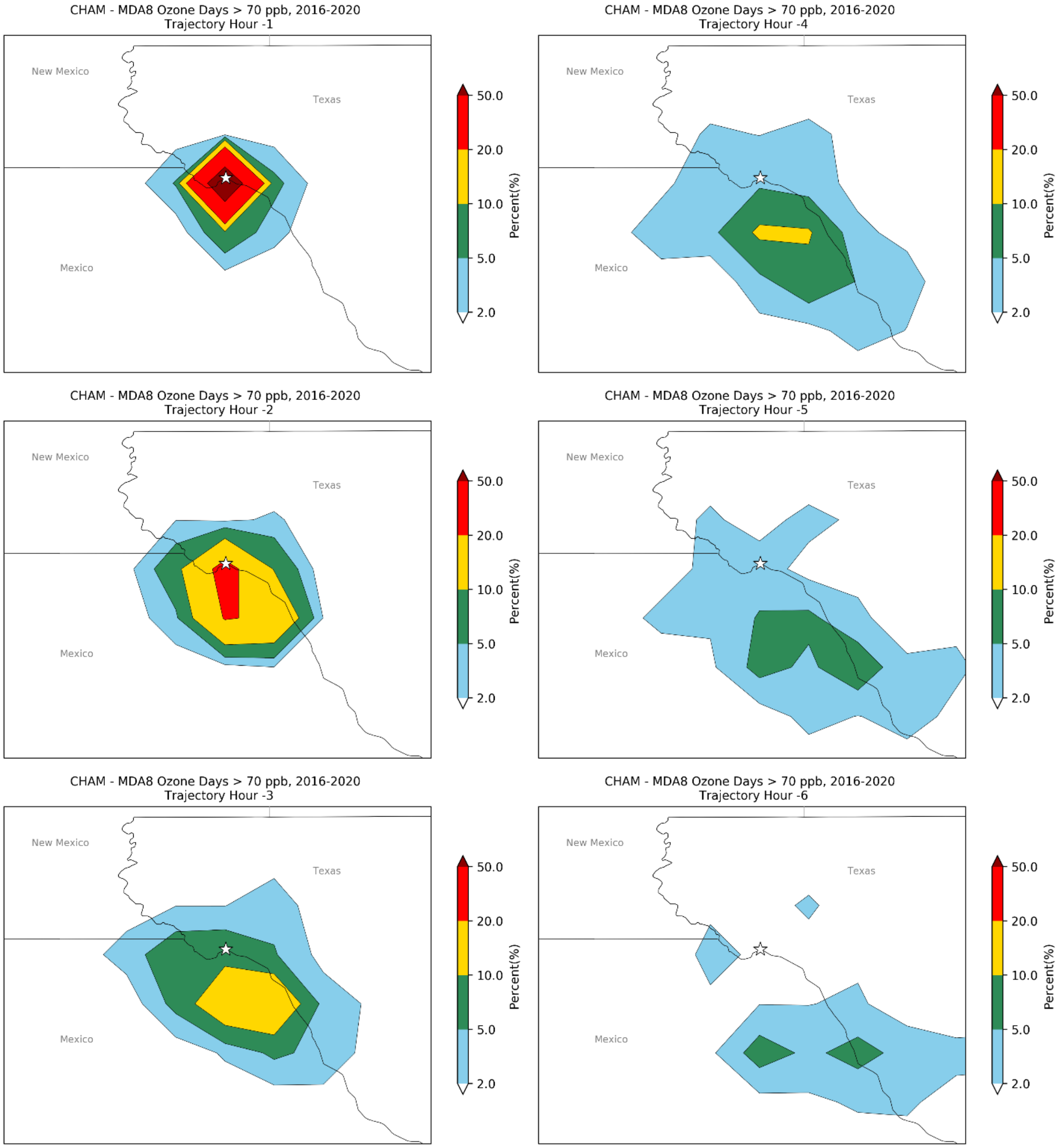

Figure 4-7. HYSPLIT back trajectory density plots for hours -1 (top left) through -6 (bottom right) prior to arriving at the El Paso Chamizal monitor during exceedance days from 2016 through 2020.

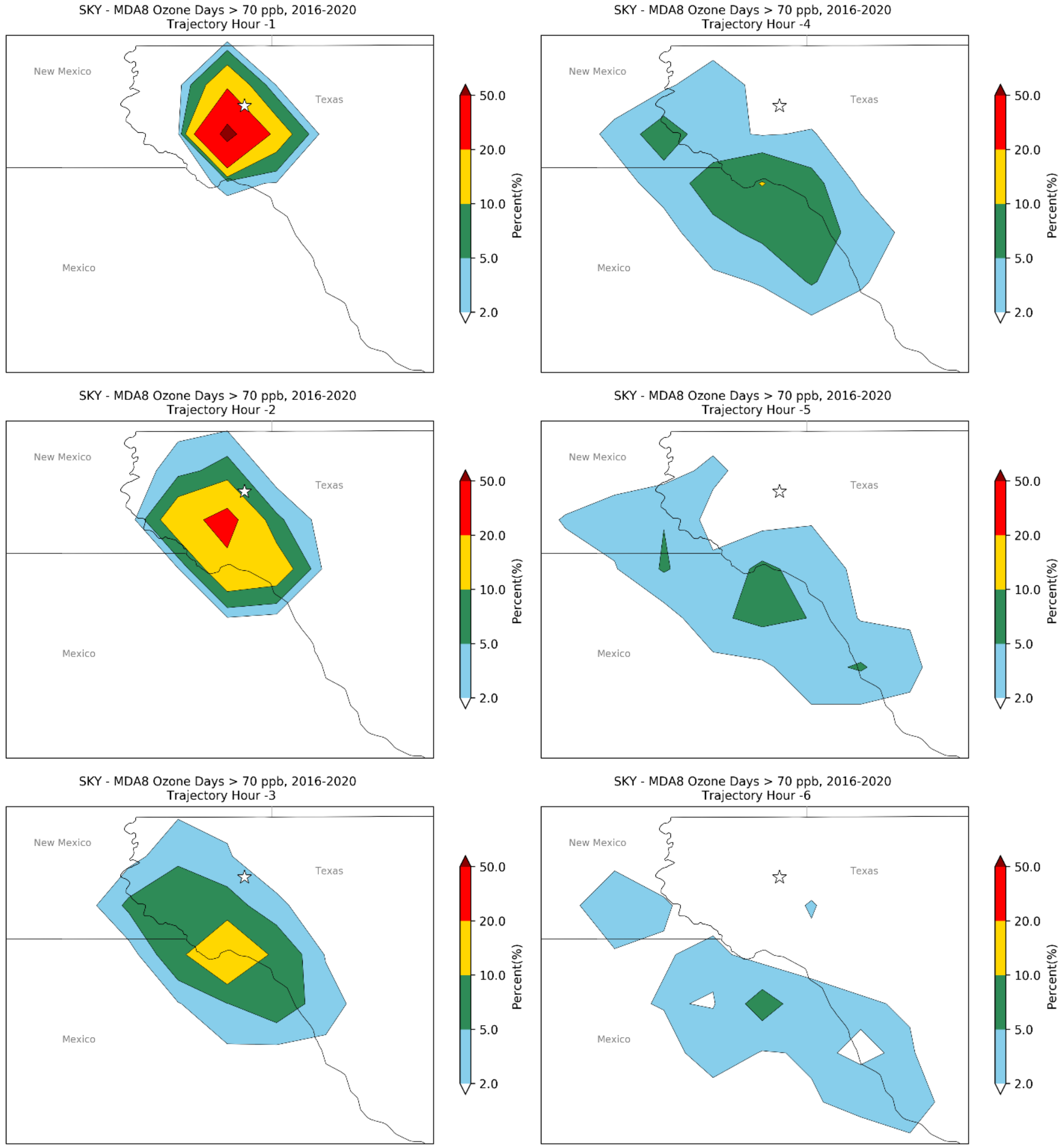

Figure 4-8. HYSPLIT back trajectory density plots for hours -1 (top left) through -6 (bottom right) prior to arriving at the Skyline Park monitor during exceedance days from 2016 through 2020.

5 TRANSPORT EFFECT ON OZONE DESIGN VALUES

5.1 Summary

This section synthesizes the information developed from the wind analyses in Section 4 to differentiate ozone exceedance days with international transport versus those without (i.e., locally influenced) and the related impacts to El Paso County DVs. The results tabulated below show that measured ozone concentrations are substantially lower on days without a clear transport contribution from Ciudad Juárez, resulting in 2020 El Paso County DVs that attain the 2015 ozone NAAQS.

5.2 Details

Tables 5-1 through 5-3 list the ranked MDA8 ozone concentrations during 2016 through 2020 at the El Paso UTEP, El Paso Chamizal, and Skyline Park monitors, respectively. Days above 70 ppb that were determined by the TCEQ to have been influenced by transport from Mexico are noted with asterisks exactly as in Tables 4-3 through 4-5. Revised 4^{th} high MDA8 ozone concentrations for each year, listed in the bottom row of each table, were identified by ignoring the flagged transport days and considering only the top four days determined not to be influenced by transport from Mexico (i.e., days not noted with asterisks in the tables). Revised 4^{th} high MDA8 ozone concentrations resulting from this method range from 63 ppb to 70 ppb over all years and all sites. The only exception occurs in 2019 at Skyline Park where the revised 4^{th} high remains at 72 ppb.

Table 5-4 lists the actual and revised 4^{th} high MDA8 ozone concentrations during 2016 through 2020, and associated actual and revised DVs, at the El Paso UTEP, El Paso Chamizal, and Skyline Park monitors. Current values are compared with revised values resulting from excluding days with transport from Mexico. Whereas actual DVs exceed the 2015 ozone NAAQS in all years and at all three sites, all revised DVs from excluding international transport days attain the NAAQS with a range of 67 to 70 ppb.

Table 5-1. Ranked MDA8 ozone (O_3) concentrations during 2016 through 2020 at the El Paso UTEP monitor. Asterisks indicate days above 70 ppb when at least 6 of 8 (75%) HYSPLIT trajectories travelled through Mexico. The revised 4th high MDA8 each year from removing days affected by Mexico is shown in the bottom row of the table.

2016	MDA8 O_3 (ppb)	2017	MDA8 O_3 (ppb)	2018	MDA8 O_3 (ppb)	2019	MDA8 O_3 (ppb)	2020	MDA8 O_3 (ppb)
Jun 23	78*	Jun 6	75*	Jul 29	91*	Aug 5	83*	Aug 8	85*
Aug 8	78*	Jun 27	75*	Aug 4	86	Jul 15	79*	Jul 25	83*
Jun 6	72*	Jul 28	74	Jun 4	82*	Jul 26	77*	Aug 1	81*
Jul 16	71*	Aug 17	74	Jul 25	76*	Jul 27	75*	Jul 7	79*
Jun 24	69	Jun 4	73*	Jul 21	74*	Aug 7	75	May 9	75*
Jun 3	68	Jun 7	72*	Jun 21	72*	Aug 15	75*	Jun 25	75*
Jun 21	68	Sep 12	72*	Aug 30	71*	Aug 10	72*	May 6	74*
Aug 6	68	Jun 5	71*	Jul 28	70	Aug 27	68	Aug 19	72*
-----	-----	Jul 10	71	Jun 25	69	Aug 19	67	Aug 22	72*
-----	-----	Aug 24	71*	Jul 24	69	Apr 19	66	Aug 29	72
-----	-----	May 20	70	-----	-----	-----	-----	Aug 27	71*
-----	-----	-----	-----	-----	-----	-----	-----	Jun 15	69
-----	-----	-----	-----	-----	-----	-----	-----	Jun 24	68
-----	-----	-----	-----	-----	-----	-----	-----	Aug 3	68
4th high	68	4th high	70	4th high	69	4th high	66	4th high	68

Table 5-2. Ranked MDA8 ozone (O_3) concentrations during 2016 through 2020 at the El Paso Chamizal monitor. Asterisks indicate days above 70 ppb when at least 6 of 8 (75%) HYSPLIT trajectories travelled through Mexico. The revised 4th high MDA8 each year from removing days affected by Mexico is shown in the bottom row of the table.

2016	MDA8 O_3 (ppb)	2017	MDA8 O_3 (ppb)	2018	MDA8 O_3 (ppb)	2019	MDA8 O_3 (ppb)	2020	MDA8 O_3 (ppb)
Jun 23	84*	Sep 12	82*	Aug 4	87	Aug 5	79*	Jul 7	73*
Aug 8	81*	Jun 4	74*	Jul 29	86*	Jul 15	75*	Aug 1	73*
May 7	67	Jun 27	74*	Jun 4	83*	Aug 10	75*	Aug 8	73*
Jun 21	65	May 20	72	Jul 25	78*	Jul 27	73*	May 9	72*
Jun 18	64	Aug 24	72*	Jun 21	73*	Jul 26	71*	Jul 25	71*
May 28	63	Jul 10	71	Jul 21	71*	Aug 7	71	May 6	69
-----	-----	Jun 6	69	May 22	70	Aug 15	71*	Aug 29	69
-----	-----	Jun 2	68	Aug 3	70	Apr 19	67	Aug 19	68
-----	-----	-----	-----	Aug 13	70	Jul 25	67	Aug 21	68
-----	-----	-----	-----	-----	-----	Jun 24	66	-----	-----
4th high	63	4th high	68	4th high	70	4th high	66	4th high	68

Table 5-3. Ranked MDA8 ozone (O_3) concentrations during 2016 through 2020 at the Skyline Park monitor. Asterisks indicate days above 70 ppb when at least 6 of 8 (75%) HYSPLIT trajectories travelled through Mexico. The revised 4th high MDA8 each year from removing days affected by Mexico is shown in the bottom row of the table.

2016	MDA8 O_3 (ppb)	2017	MDA8 O_3 (ppb)	2018	MDA8 O_3 (ppb)	2019	MDA8 O_3 (ppb)	2020	MDA8 O_3 (ppb)
June 23	77	Jun 7	80	Aug 4	84*	Aug 10	78	Aug 21	79
Aug 8	68	Sep 12	79*	Jul 25	83	Aug 5	76	Aug 4	74
Jul 16	67	Jun 27	75*	Jul 29	79*	Aug 7	75	Aug 8	73*
Aug 22	66	Sep 7	75*	Jun 4	77	Jul 18	72*	Aug 19	71
-----	-----	Jul 21	68	Jun 21	76*	Jul 26	72	May 9	70
-----	-----	Jul 11	67	Aug 1	76*	Jul 15	71*	-----	-----
-----	-----	Jul 2	66	Jun 27	75*	-----	-----	-----	-----
-----	-----	-----	-----	Jun 26	72*	-----	-----	-----	-----
-----	-----	-----	-----	May 22	71*	-----	-----	-----	-----
-----	-----	-----	-----	Jul 21	71*	-----	-----	-----	-----
-----	-----	-----	-----	Aug 13	71*	-----	-----	-----	-----
-----	-----	-----	-----	Aug 30	71*	-----	-----	-----	-----
-----	-----	-----	-----	Sep 9	71*	-----	-----	-----	-----
-----	-----	-----	-----	May 18	70	-----	-----	-----	-----
-----	-----	-----	-----	Jul 14	69	-----	-----	-----	-----
4th high	66	4th high	66	4th high	69	4th high	72	4th high	70

Table 5-4. Fourth high MDA8 ozone concentrations during 2016 through 2020 and associated DVs at the three nonattainment monitoring sites: El Paso UTEP, El Paso Chamizal, and Skyline Park. Current values are compared with revised values resulting from excluding Mexico affected days.

Year	El Paso UTEP 4th High (ppb)	El Paso UTEP 4th High Excluding Mexico Affected Days	El Paso Chamizal 4th High (ppb)	El Paso Chamizal 4th High Excluding Mexico Affected Days	Skyline Park 4th High (ppb)	Skyline Park 4th High Excluding Mexico Affected Days
2016	71	68	65	63	66	66
2017	74	70	72	68	75	66
2018	76	69	78	70	77	69
2019	75	66	73	66	72	72
2020	79	68	72	68	71	70
2016-2018 DV	73	69	71	67	72	67
2017-2019 DV	75	68	74	68	74	69
2018-2020 DV	76	67	74	68	73	70

6 SOURCE APPORTIONMENT MODELING

6.1 Summary

This section provides additional weight of evidence for substantial international ozone contributions to high ozone days in El Paso County. Three recent photochemical modeling studies estimated source region and sector contributions to high ozone levels in the PdN airshed. The EPA's 2021 Revised Cross-State Air Pollution Rule (CSAPR; EPA, 2021b) modeled ozone contributions from upwind states and international regions in 2021, 2023, and 2028. The 2016 Southern New Mexico Ozone Study (SNMOS; WRAP, 2016) modeled contributions from west Texas, New Mexico, and north-central Mexico in 2025. The 2020 New Mexico Ozone Attainment Initiative (NMOAI; WRAP, 2020) modeled contributions from Texas, New Mexico, and international regions in 2028. Table 6-1 summarizes the range of percent international and US anthropogenic contributions to ozone at El Paso County monitors from each of the studies. The table also shows how much the 2020 DV of 76 ppb at the El Paso UTEP monitor is reduced by scaling the DV by the international contribution. Details are explained in the sub-sections below. Although these studies modeled different years and used different modeling platforms, the results consistently find a significant international contribution to high ozone in El Paso County. These findings affirm that, without international emissions, El Paso County would have attained the ozone NAAQS by 2021.

Table 6-1. Summary of anthropogenic international and US ozone contributions (percent) estimated by three recent photochemical modeling studies. The scaled 2020 DV shows how the El Paso UTEP DV of 76 ppb is reduced by removing the international contributions.

Study	Year	International Regions Tracked	International Contribution	US Contribution	Scaled 2020 DV: Removed International
EPA CSAPR	2021	Mexico, Gulf, Caribbean, Canada	26 to 32%	13 to 15%	56 ppb
SNMOS	2025	North-central Mexico	8 to 11%	10 to 17%	68 ppb
NMOAI	2028	Mexico, Gulf, Caribbean, Canada	20 to 23%	8 to 16%	59 ppb

Source apportionment is a numerical technique implemented within photochemical grid models that tracks the amount of ozone formation and destruction caused by a user-defined set of emission sources, regions and/or sectors. This tracking is conducted in a manner that is completely consistent with the model mechanisms used to emit, transport, chemically evolve, and remove ozone from the atmosphere. Irrespective of which specific emission regions or sectors are individually tracked, the total of all sources and sinks of ozone must be tracked for consistency with the host model, including emissions, chemical production/loss, depositional loss, as well as global ozone and precursor emissions entering through the limited-area modeling domain boundary (referred to as boundary conditions or BCs).

6.2 EPA Recommended Ozone Design Value Projection Procedure

The EPA (2018) modeling guidance recommends using modeling results in a relative way to estimate a future year ozone design value (DVF) based on the observed current base year ozone design value (DVB) for each monitor. DVB is calculated as the average of three consecutive ozone DVs centered on a current year, which typically coincides with the modeled base year. A model-derived scaling factor, called the Relative Response Factor (RRF), is applied to the DVB to compute the DVF. The RRF represents the ratio of modeled future to base year MDA8 ozone averaged over modeled high ozone days.

For example, a DVF for 2021 (DVF_{2021}) is computed from the three DVs covering 2014 to 2018 (DVB_{2016}) using model results for 2016 and 2021 ($Model_{2016}$ and $Model_{2021}$) as follows:

$$DVB_{2016} = (DV_{2014\text{-}2016} + DV_{2015\text{-}2017} + DV_{2016\text{-}2018}) / 3$$

$$RRF = \Sigma\ Model_{2021} / \Sigma\ Model_{2016}$$

$$DVF_{2021} = DVB_{2016} \times RRF$$

where the summations in the RRF are over the top ten days with a minimum at least 5 days when modeled base year MDA8 ozone exceeds 60 ppb within a set of grid cells around the monitor. All three studies presented below used the EPA's DV scaling procedure.

6.3 EPA CSAPR Update

The EPA developed 2021 DVF and associated source contributions using the methods described in the Technical Support Document for the CSAPR Update (EPA, 2021b). The EPA simulated a 2016 base year and projected future-year emissions and air quality for 2023 and 2028. As shown in Figure 6-1, the EPA modeled a continental-scale domain with 36-km grid resolution covering the 48 contiguous states and most of Canada and Mexico. The EPA also applied a nested grid with 12-km resolution covering all 48 states and parts of Canada and Mexico. The 2021 DVF was obtained by linear interpolation between the 2016-centered measured DVB and the 2023 modeled DVF at each location. The 2021 source contribution estimates were obtained by apportioning the 2021 DVF using modeled source contributions for the 2023 DVF. Three of the six El Paso County ozone monitors met the criteria for developing an RRF (i.e., at least 5 days with MDA8 ozone greater or equal to 60 ppb) and were included in the EPA analysis.

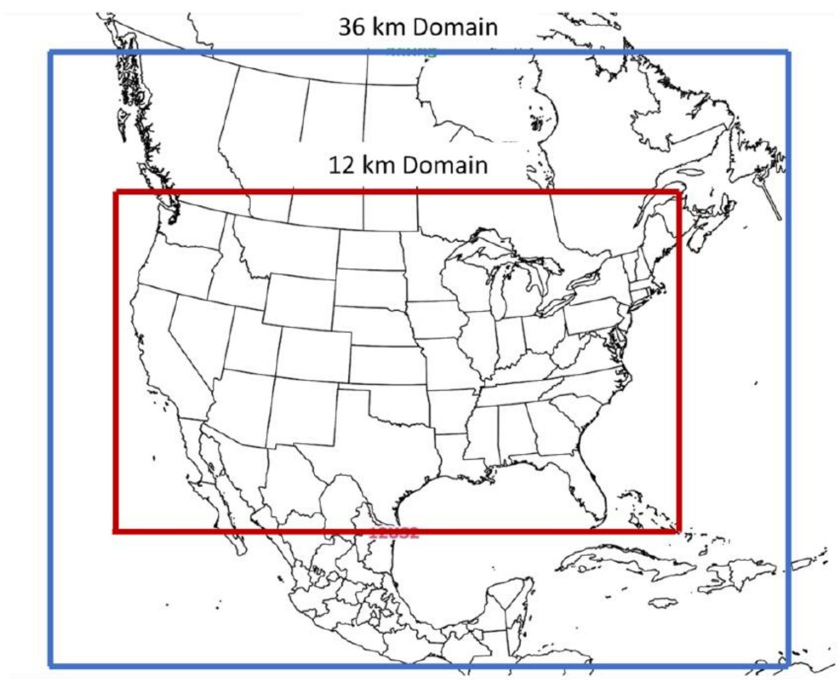

Figure 6-1. The EPA CSAPR nested modeling domains with 36-km resolution (outer grid) and 12-km resolution (inner grid). Image taken from the EPA (2021b).

Table 6-2 shows that estimated international anthropogenic contributions (i.e., from portions of Mexico, Canada, the Gulf of Mexico, and the Caribbean within the 12 and 36-km modeling domains) to El Paso County 2021 DVFs range from 16.6 to 20.6 ppb (26 to 32%). Modeled 2021 anthropogenic contributions to El Paso County DVFs from the continental US (including Texas) range 7.8 to 9.9 ppb (13 to 15%) and from the State of Texas range from 3.9 to 6.8 ppb (7 to 10%). The estimated 2023 source contributions in Table 6-3 are similar to 2021 as expected from the EPA's methodology summarized above. Since the EPA's modeled 2021 DVFs underestimate current observed conditions, the absolute international, US and Texas contributions are potentially too low and should be viewed as lower bounds, while the relative contributions may still be representative. When the 2020 DV of 76 ppb at the El Paso UTEP monitor is scaled to reflect the removal of the smallest international contribution of 26%, the resulting DV would be 56 ppb. These results indicate that ozone concentrations in El Paso County are significantly impacted by anthropogenic emissions from international sources.

Table 6-2. 2016 DVB at three El Paso County monitoring sites reported by the EPA CSAPR study (EPA, 2021b) and 2021 modeled ozone DVF, international anthropogenic contributions (from portions of Mexico, Canada, the Gulf of Mexico, and the Caribbean within the 12 and 36-km modeling domains), US anthropogenic contributions from continental States and Tribal Lands, and Texas anthropogenic contributions.

Site Name	2016 DVB (ppb)	2021 DVF (ppb)	2021 International (ppb)	2021 US (ppb)	2021 TX (ppb)
Ivanhoe	63.7	62.0	16.6	7.8	4.4
Socorro Hueco	65.3	63.8	20.6	8.2	3.9
Skyline Park	70.0	67.9	17.8	9.9	6.8

Table 6-3. 2016 DVB at three El Paso County monitoring sites reported by the EPA CSAPR study (EPA, 2021b) and 2023 modeled ozone DVF, international anthropogenic contributions (from portions of Mexico, Canada, the Gulf of Mexico, and the Caribbean within the 12 and 36-km modeling domains), US anthropogenic contributions from continental States and Tribal Lands, and Texas anthropogenic contributions.

Site Name	2016 DVB (ppb)	2023 DVF (ppb)	2023 International (ppb)	2023 US (ppb)	2023 TX (ppb)
Ivanhoe	63.7	61.4	16.4	7.7	4.3
Socorro Hueco	65.3	63.2	20.4	8.2	3.9
Skyline Park	70.0	67.1	17.6	9.8	6.7

6.4 SNMOS

The SNMOS conducted modeling for a 2011 base year and 2025 future year (WRAP, 2016). Base year emissions were derived from the EPA 2011 National Emission Inventory (NEI) and were projected to 2025 future emissions. SNMOS employed two relatively small grids with 12 and 4 km resolution (Figure 6-2), which were run together. The 12-km domain encompassed all of New Mexico, extended west to Phoenix, covered much of West Texas, and extended south to include a major power plant in Coahuila, Mexico. The 4-km domain covered southern New Mexico, the western tip of Texas, and Municipio de Juárez. Source apportionment determined the ozone contributions from all of New Mexico across both grids, portions of Texas across both grids, and portions of Mexico across both grids. Source apportionment also tracked ozone contributions from the total of all remaining areas within the 12-km domain (portions of Arizona, Utah, Colorado, and Oklahoma). It also tracked the total of all natural (biogenic) and fire sources over both grids.

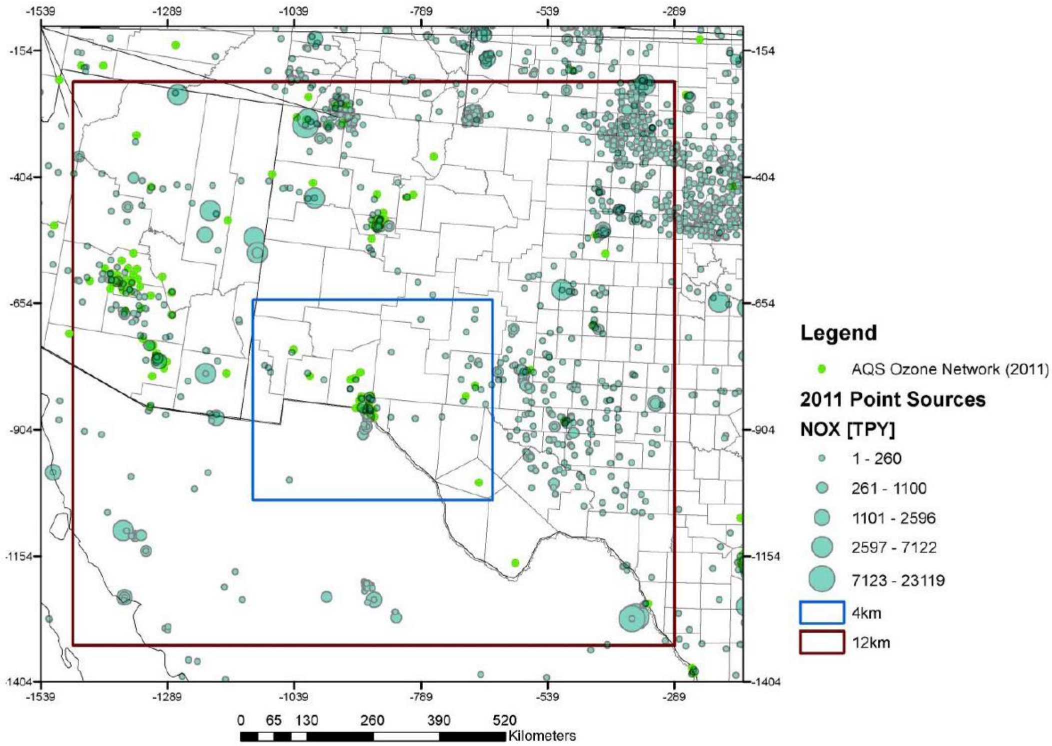

Figure 6-2. SNMOS nested modeling domains with 12-km resolution (outer grid) and 4-km resolution (inner grid), which were run together. The plot is annotated with locations of ozone monitors that submit data to the national EPA Air Quality System (AQS) database (light green dots) and the locations of point sources from the 2011 NEI (dark green circles sized according to their reported NOx emissions). Image taken from the WRAP (2016).

Contributions from regions of the US and Mexico outside of the 12-km domain, and from all other global natural and anthropogenic sources, were included in the sector referred to as "boundary conditions."

Geographic and sector contributions to ozone DVs at six El Paso County monitors are shown in Figure 6-3. Boundary conditions contribute most of the ozone (~70%) at all El Paso County monitors. Anthropogenic emissions from the portion of north-central Mexico within the domain contribute 5.3 to 6.8 ppb (8 to 10%) to the 2011 DVB and 5.1 to 7.0 ppb (8 to 11%) to the 2025 DVF. The percent contribution from Mexico increases from 2011 to 2025 at all sites. Anthropogenic emissions from the portion of Texas within the domain contribute 6.4 to 8.6 ppb (9 to 12%) to the 2011 DVB and 4.4 to 5.9 ppb (7 to 10%) to the 2025 DVF. Anthropogenic emissions from New Mexico contribute 0.9 to 1.8 ppb (2 to 3%) to the 2011 DBV and 2025 DVF. Anthropogenic emissions from all other US areas of the 12 km domain (portions of Arizona, Utah, Colorado, and Oklahoma) contribute 1 ppb or less (1 to 2%). In aggregate, all US areas within the 4 and 12-km domains contribute 10-17%.

Results for 2025 show that DVF contributions from north-central Mexico remain higher than from Texas at all El Paso County monitors except Skyline Park. Apportioned ozone contributions from portions of Mexico within the SNMOS domain are smaller than those reported by CSAPR or NMOAI because the latter studies tracked international contributions from a much broader region (Mexico, Gulf, Caribbean, Canada) contained within their more expansive modeling domains. Apportioned ozone contributions from portions of Texas within the SNMOS domain are similar to those reported by

CSAPR and NMOAI as the bulk of Texas contributions to El Paso County emanate locally and from the western half of the state.

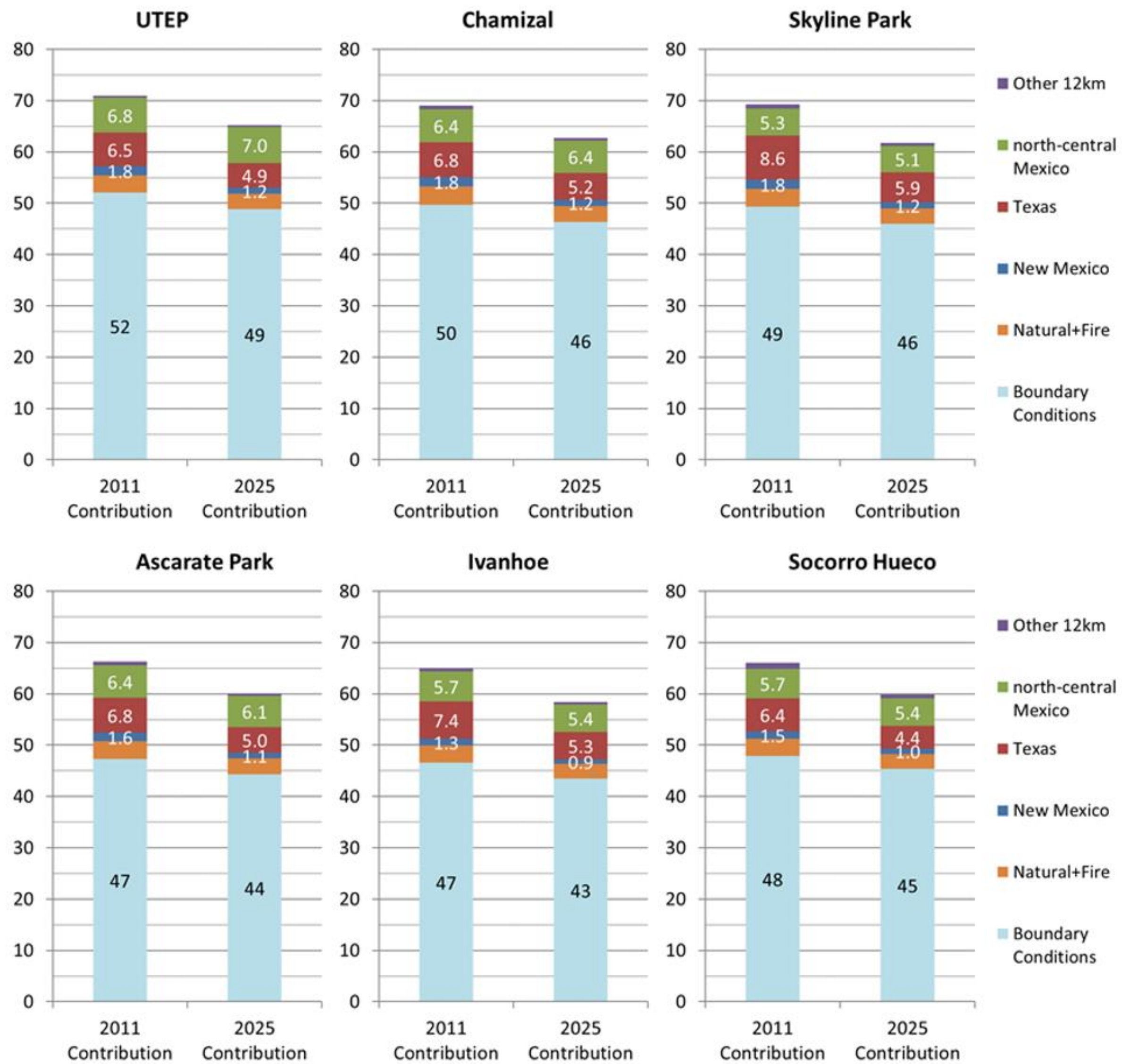

Figure 6-3. SNMOS modeled ozone contributions by geographic region and sector to 2011 and 2025 ozone DVs (ppb) at six El Paso County monitors. Anthropogenic contributions from "Other 12km" include portions of Arizona, Utah, Colorado, and Oklahoma within the 12-km grid. Contributions from "Boundary Conditions" include all other North American and global natural and anthropogenic sources from outside the 12-km grid.

Scaling the current 2020 DVs (based on monitored data from 2018 through 2020) according to the 2025 percent contribution from north-central Mexico, El Paso County would have attained the ozone NAAQS with the highest ozone DV of 68 ppb at the El Paso UTEP monitoring site (Table 6-4).

Table 6-4. Current 2020 ozone DVs (based on monitored data from 2018 through 2020) at El Paso County monitoring sites and estimated 2020 DVs from excluding the anthropogenic contribution from north-central Mexico, based on SNMOS 2025 source apportionment modeling.

Monitoring Site	2020 DV (ppb)	2020 DV excluding north-central Mexico (ppb)
El Paso UTEP	76	68
El Paso Chamizal	74	66
Skyline Park	73	67
Ivanhoe	70	63
Socorro Hueco	70	64
Ascarate Park	69	62

6.5 NMOAI

The NMOAI modeling was conducted for a 2014 base year and 2028 future year (WRAP, 2020). The study leveraged the Western Air Quality Study modeling platform comprising a North American domain with 36-km resolution (including portions of Mexico and Canada) and a western US domain with 12-km resolution (Figure 6-4). The NMOAI modeling added a 4-km resolution domain covering New Mexico, western Texas, and a small portion of north-central Mexico. The 2028 future year modeling included an Oil and Gas (O&G) Control Strategy scenario, which implemented O&G controls in the San Juan basin in northwest New Mexico and the portion of the Permian basin in southeast New Mexico. NMOAI applied source apportionment only for the 2028 Control Strategy scenario, although this case did not significantly alter El Paso County DVFs relative to the 2028 Base scenario.

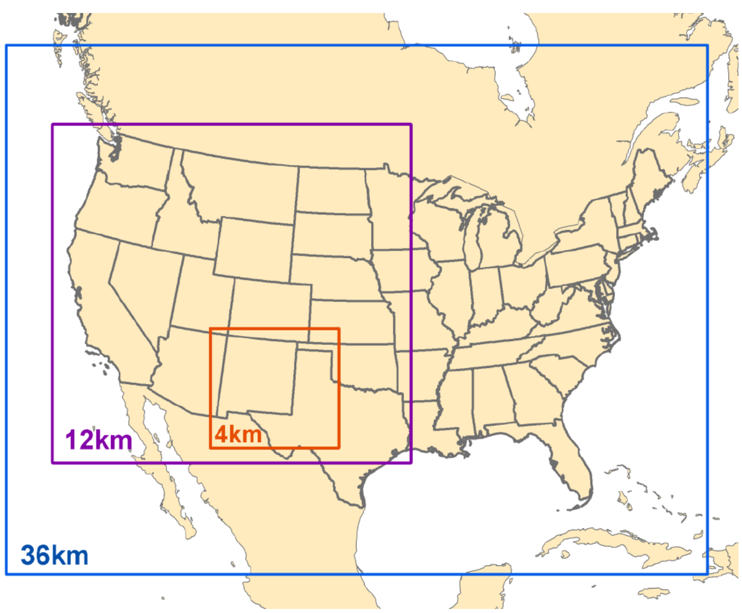

Figure 6-4. NMOAI nested modeling domains with 36-km resolution (outer grid), 12-km resolution (middle grid) and 4-km resolution (inner grid). Image taken from the WRAP (2020).

Relative contributions to 2028 Control Strategy ozone DVFs at six El Paso County monitors are shown in Figure 6-5. International anthropogenic contributions are from the portions of Mexico, Canada, the Gulf of Mexico, and the Caribbean within the North American modeling domain. Contributions from outside the North American domain (labeled BC) are largest (48 to 57%), followed by international anthropogenic emissions (20% to 23%). Anthropogenic emissions from Texas contribute from 2.9% (Socorro Hueco) to 8.2% (Skyline Park), while anthropogenic emissions from the rest of the US range from 4.0% (Socorro Hueco) to 5.8% (El Paso UTEP). Adding anthropogenic contributions from Texas, New Mexico, and the remaining US results in a total US contribution in El Paso County ranging from 7.6% (Socorro Hueco) to 16.1% (Skyline Park).

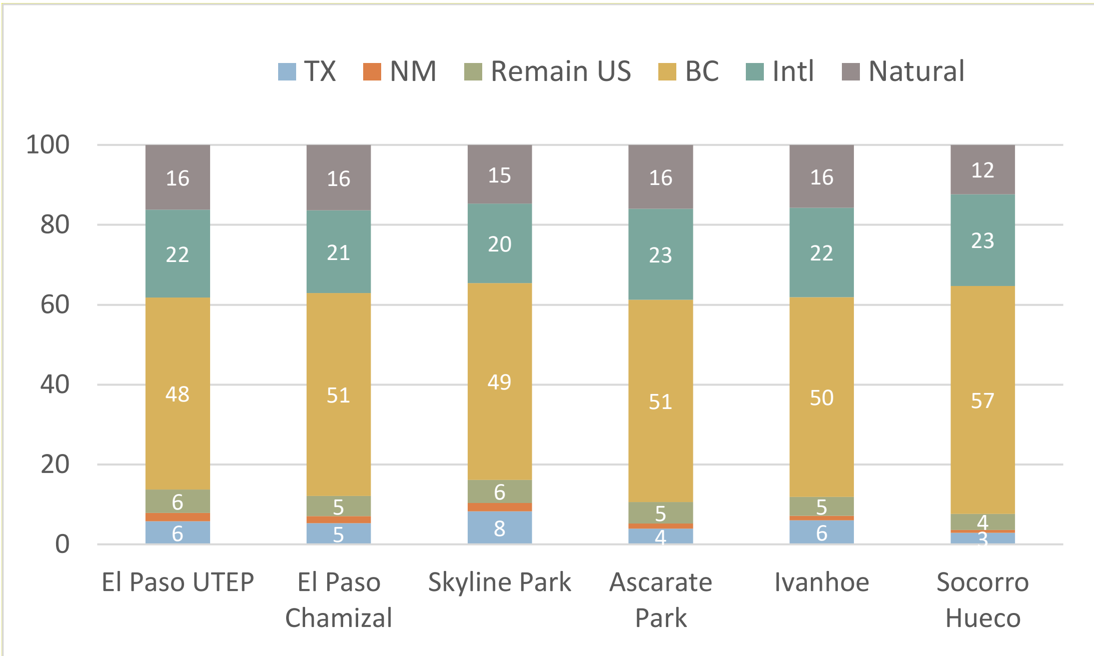

Figure 6-5. NMOAI modeled relative ozone contributions (percent) by geographic region and sector to the 2028 ozone DVF at six El Paso County monitors. International anthropogenic contributions are from the portions of Mexico, Canada, the Gulf of Mexico, and the Caribbean within the North American modeling domain.

Scaling the current 2020 DVs according to the 2028 percent contribution from international anthropogenic emissions shown in Figure 6-5, El Paso County would have attained the ozone NAAQS with the highest ozone DV of 59 ppb at the El Paso UTEP monitoring site (Table 6-5). The international anthropogenic influence is larger than the SNMOS study (Table 6-4) because of the larger international area explicitly included within in the NMOAI modeling domain. The NMOAI results indicate that ozone concentrations in El Paso County are, and will continue to be, significantly impacted by emissions from Mexico, which agrees with results from the CSAPR and SNMOS studies discussed above.

Table 6-5. Current 2020 ozone DVs (based on monitored data from 2018 through 2020) at El Paso County monitoring sites and estimated 2020 DVs from excluding the anthropogenic contribution from international sources, based on NMOAI 2028 source apportionment modeling.

Monitoring Site	2020 DV (ppb)	2020 DV excluding International (ppb)
El Paso UTEP	76	59
El Paso Chamizal	74	59
Skyline Park	73	58
Ivanhoe	70	54
Socorro Hueco	70	54
Ascarate Park	69	53

7 REFERENCES

Climatedata.org, 2021. https://en.climate-data.org/north-america/united-states-of-america/texas/el-paso-943/.

Davis, J.M., B.K. Eder, D. Nychka, Q. Yang, 1998. Modeling the Effects of Meteorology on Ozone in Houston Using Cluster Analysis and Generalized Additive Models. *Atmospheric Environment,* 32(14), 2505–20. Https://doi.org/10.1016/S1352-2310(98)00008-9.

Davis, R.E., and L.S. Kalkstein, 1990. Using a Spatial Synoptic Climatological Classification to Assess Changes in Atmospheric Pollution Concentrations. *Physical Geography*, 11(4), 320–42. https://doi.org/10.1080/02723646.1990.10642410.

Eder, B.K., J.M. Davis, P. Bloomfield, 1994. An Automated Classification Scheme Designed to Better Elucidate the Dependence of Ozone on Meteorology. *Journal of Applied Meteorology and Climatology*, 33(10), 1182–99. https://doi.org/10.1175/1520-0450(1994)033<1182:AACSDT>2.0.CO;2.

EPA, 2018. Modeling Guidance for Demonstrating Air Quality Goals for Ozone, PM2.5, and Regional Haze. Prepared by the Environmental Protection Agency, Office of Air Quality Planning and Standards, Air Quality Assessment Division, Research Triangle Park, NC. (EPA 454/R-18-009, November 29). https://www3.epa.gov/ttn/scram/guidance/guide/O3-PM-RH-Modeling_Guidance-2018.pdf.

EPA, 2018. 2011 Version 6.3 Platform, Data Files and Summaries. https://gaftp.epa.gov/air/emismod/2011/v3platform/.

EPA, 2020. Guidance on the Preparation of Clean Air Act Section 179B Demonstrations for Nonattainment Areas Affected by International Transport of Emissions. Prepared by the Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC (December 2020). https://www.epa.gov/sites/production/files/2020-01/documents/draft_179b_guidance-final_draft_for_posting.pdf.

EPA, 2021a. Technical Support Document (TSD): Preparation of Emissions Inventories for the 2016v2 North American Emissions Modeling Platform. Prepared by the Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC (September 2021). https://www.epa.gov/air-emissions-modeling/2016v2-platform.

EPA, 2021b. Cross-State Air Pollution Rule 2016 Update. Prepared by the Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. (January 2021). https://www.epa.gov/csapr/revised-cross-state-air-pollution-rule-update.

Federal Register, 1994. Approval and Promulgation of Air Quality Implementation Plans; Texas; Revision to the State Implementation Plan (SIP) Addressing PM-10 for El Paso. 59 FR (January 1994). https://www.govinfo.gov/content/pkg/FR-1994-01-18/html/94-1062.htm.

Federal Register, 2003. Approval and Promulgation of Implementation Plans for Texas; Approval of Section 179B Demonstration of Attainment, Carbon Monoxide Motor Vehicle Emissions Budget for Conformity, and Contingency Measure for El Paso Carbon Monoxide Nonattainment Area. 68 FR 39457 (July 2, 2003). https://www.govinfo.gov/content/pkg/FR-2003-07-02/pdf/03-16579.pdf#page=1.

Federal Register, 2004. Approval and Promulgation of Implementation Plans for Texas; Approval of Section 179B Demonstration of Attainment, Volatile Organic Compounds and Nitrogen Oxides Motor Vehicle Emissions Budgets for Conformity for the El Paso Ozone Nonattainment Area. 69 FR 32450 (June 10, 2004). https://www.govinfo.gov/app/details/FR-2004-06-10/04-13175.

Federal Register, 2009. Approval and Promulgation of Air Quality Implementation Plans; Texas; Approval of the Section 110(a)(1) Maintenance Plan for the 1997 8-Hour Ozone Standard for El Paso County. 74 FR 2387 (January 15, 2009). https://www.federalregister.gov/documents/2009/01/15/E9-708/approval-and-promulgation-of-air-quality-implementation-plans-texas-approval-of-the-section-110a1.

Federal Register, 2015. National Ambient Air Quality Standards for Ozone. 80 FR 65292 (October 26, 2015). https://www.govinfo.gov/app/details/FR-2015-10-26/2015-26594.

Federal Register, 2018a. Additional Air Quality Designations for the 2015 Ozone National Ambient Air Quality Standards. 83 FR 25820 (June 4, 2018). https://www.govinfo.gov/content/pkg/FR-2018-06-04/pdf/2018-11838.pdf.

Federal Register, 2018b. Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area State Implementation Plan Requirements. 83 FR 62998 (December 6, 2018). https://www.govinfo.gov/app/details/FR-2018-12-06/2018-25424.

Federal Register, 2021. Additional Revised Air Quality Designations for the 2015 Ozone National Ambient Air Quality Standards: El Paso County, TX and Weld County, CO. 86 FR 6784 (November 30, 2021). https://www.govinfo.gov/content/pkg/FR-2021-11-30/pdf/2021-25451.pdf.

Karle, N.N., Mahmud, S., Sakai, R.K., Fitzgerald, R.M., Morris, V.R., Stockwell, W.R., 2020. Investigation of the Successive Ozone Episodes in the El Paso–Juarez Region in the Summer of 2017. *Atmosphere*, 532. https://doi.org/10.3390/atmos11050532.

Midwestern Regional Climate Center, 2021. MRCC Application Tools Environment (Cli-Mate). https://mrcc.purdue.edu/CLIMATE/.

Milligan, G.W., 1980. An examination of the effect of six types of error perturbation on fifteen clustering algorithms. *Psychometrika*, 45, 325–342. https://doi.org/10.1007/BF02293907.

Ngan, F., and D. Byun, 2011. Classification of Weather Patterns and Associated Trajectories of High-Ozone Episodes in the Houston–Galveston–Brazoria Area during the 2005/06 TexAQS-II. *Journal of Applied Meteorology and Climatology*, 50(3), 485–99. https://doi.org/10.1175/2010JAMC2483.1.

NMED, 2021. Clean Air Act 179B Demonstration: Sunland Park Ozone Nonattainment Area. Prepared by the New Mexico Environment Department, Air Quality Bureau, Albuquerque, NM (June 2, 2021). https://www.env.nm.gov/air-quality/wp-content/uploads/sites/2/2017/02/Sunland-Park-179B-Final.pdf.

Population Stat, 2021. World Statistical Data. Ciudad Juárez, Mexico Population. https://populationstat.com/mexico/ciudad-juarez.

Regional Stakeholders Committee, 2009. The Paso del Norte Region, US-Mexico: Self-Evaluation Report. OECD Reviews of Higher Education in Regional and City Development, IMHE. https://www.oecd.org/unitedstates/44210876.pdf.

Stein, A.F., Draxler, R.R, Rolph, G.D., Stunder, B.J.B., Cohen, M.D., Ngan, F., 2015. NOAA's HYSPLIT atmospheric transport and dispersion modeling system. *Bull. Amer. Meteor. Soc.*, 96, 2059-2077. http://dx.doi.org/10.1175/BAMS-D-14-00110.1.

Texas Comptroller, 2018. Port of Entry: El Paso, Impact to the Texas Economy, 2018. https://comptroller.texas.gov/economy/economic-data/ports/el-paso.php.

Texas Department of Transportation, 2021. Texas-Mexico Border Transportation Master Plan (March 19, 2021). https://ftp.dot.state.tx.us/pub/txdot/tpp/btmp/btmp-final-report.pdf.

US Census Bureau, 2019. Quick Facts, Sunland Park city, New Mexico; El Paso city, Texas. https://www.census.gov/quickfacts/fact/table/sunlandparkcitynewmexico,elpasocitytexas/PST045219.

Ward, J.H., 1963. Hierarchical grouping to optimize an objective function. *Journal of the American Statistical Association*, 58, 236–244.

WRAP, 2016. Southern New Mexico Ozone Study (SNMOS). Western Regional Air Partnership (November 2016). https://www.wrapair2.org/SNMOS.aspx.

WRAP, 2020. Ozone Attainment Initiative (OAI). Western Regional Air Partnership (May 2020). https://www.wrapair2.org/nmoai.aspx.

World Population Review, 2021. https://worldpopulationreview.com/us-cities/el-paso-tx-population.

APPENDIX A: EL PASO EMISSION CONTROL MEASURES

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A.1 Permanent and Enforceable Emission Reductions

A.1.1 Control Strategies

El Paso County is home to a wide variety of major and minor industrial, commercial, and institutional entities. Regulations and voluntary programs are in place to address emissions of Nitrogen Oxides (NOx) and Volatile Organic Compounds (VOC) from these sources. This section describes existing ozone control measures for El Paso County.

A.1.2 List of Existing Control Measures

Since the early 1990s, a broad range of control measures have been implemented for ozone planning in El Paso County. Table A-1 lists the existing ozone control strategies.

Table A-1. Existing Ozone Control Measures Applicable to the El Paso Ozone Nonattainment Area.

Measure	Description
Vehicle Inspection/ Maintenance (I/M) 30 Texas Administrative Code (TAC) Chapter 114, Subchapter C	Yearly vehicle emissions testing.
Oxygenated Gasoline Program 30 TAC 114 Subchapter D	Requires gasoline in El Paso County to contain at least 2.7% oxygen by weight minimum from October 1 to March 31 each year.
El Paso low Reid vapor pressure (RVP) Program 30 TAC 115 Subchapter C, Div. 5	Program limits gasoline RVP to 7.0 psi maximum in El Paso County from May 1 to September 16 each year.
California Gasoline Engines	California standards for non-road gasoline engines 25 horsepower and larger.
Federal On-Road Measures	Series of emissions limits implemented by the Environmental Protection Agency (EPA) for on-road vehicles.
Refueling – Stage I 30 TAC, Chapter 115, Subchapter C, Division 2	Captures gasoline vapors that are released when gasoline is delivered to a storage tank. Vapors returned to tank truck as storage tank is filled with fuel, rather than released into ambient air.
VOC Control Measures – Storage Tanks 30 TAC Chapter 115, Subchapter B, Division 1	Controls on fixed and floating roof tanks storing VOC liquids based on the size of the tank and pressure of liquid being stored. Rule was updated to include monitoring requirements for certain vapor control systems.
VOC Control Measures – Vent Gas Control 30 TAC Chapter 115, Subchapter B, Division 2	Control of VOC emissions from process vents on a wide variety of industrial sources.
VOC Control Measures – Industrial Wastewater 30 TAC Chapter 115, Subchapter B, Division 4	Control of VOC emissions from industrial wastewater sources.
VOC Control Measures – Municipal Solid Waste Landfills 30 TAC Chapter 115, Subchapter B, Division 5	Controls for operating any municipal solid waste landfill that exceeds 150 megagrams of calculated non-methane gas concentration.
VOC Control Measures – Loading and Unloading of VOCs	Controls for VOC transfer operations and transport vessels during the loading and

Measure	Description
30 TAC Chapter 115, Subchapter C, Division 1	unloading of VOC and the disposal of transported vapors.
VOC Control Measures – Transport Vessels 30 TAC Chapter 115, Subchapter C, Division 3	Requirements for inspecting and maintaining records certifying that tank truck tanks carrying gasoline or non-gasoline VOC are vapor tight.
VOC Control Measures – Petroleum Refining, Natural Gas Processing, and Petrochemical Processes 30 TAC Chapter 115, Subchapter D, Divisions 1 and 3	Controls to reduce emissions from steam ejectors and mechanical pumps in petroleum refineries. Requirements for VOC component leak detection and repair (LDAR) at a petroleum refinery, natural gas processing operation, or a petrochemical process. Rule was updated to explain new requirements for repairs and inspections.
VOC Control Measures – Solvent-Using Processes 30 TAC Chapter 115, Subchapter E, Divisions 1-4	Control of VOC emissions from solvent-using processes: degreasing, surface coating, flexographic and rotogravure printing, and offset lithographic printing.
VOC Control Measures – VOC Miscellaneous Industrial Sources 30 TAC Chapter 115, Subchapter F, Divisions 1 and 2	VOC limits on cutback asphalt and pharmaceutical manufacturing.
NOx Control Measures – Water Heaters, Small Boilers, and Process Heaters 30 TAC Chapter 117, Subchapter E, Division 3	NOx emission limits imposed on small-scale water heaters, small boilers, and process heaters less than or equal to 2.0 million British thermal units per hour.
NOx Control Measures – Nitric Acid Manufacturing 30 TAC Chapter 117, Subchapter F, Division 3	NOx emission limits for nitric acid manufacturing facilities.

A.2 Additional Measures

This section outlines additional measures that are expected to further reduce ozone levels in El Paso County.

A.2.1 SmartWay Transport Partnership and the Blue Skyways Collaborative

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

Approximately 221 Texas companies are SmartWay partners, 29 of which are in El Paso County (https://www.epa.gov/smartway/smartway-partner-list). The SmartWay Transport Partnership will continue to benefit El Paso County by reducing emissions as more companies and affiliates join and additional technologies (such as trailer aerodynamic kits and low-rolling resistance tires) are SmartWay-verified.

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.

A.2.2 Consent Decrees with Refineries

The EPA's National Petroleum Refinery Initiative (https://www.epa.gov/enforcement/petroleum-refinery-national-case-results) has resulted in multi-issue settlement agreements with the nation's major petroleum refineries. As of 2018, 112 refineries representing more than 95% of total domestic refining capacity are under settlement. The consent decrees limit emissions from fluidized catalytic cracking units, sulfur recovery units, heaters and boilers, and flares. The EPA estimates that full implementation of the current settlements will result in more than 95,000 tons per year (tpy) of NO_X emission reductions. The EPA also anticipates VOC emission reductions from the consent decrees.

Western Refining Company in El Paso is subject to one of these consent decrees and the resulting NO_X and VOC emission reduction requirements. The EPA estimated that NO_X would be reduced by 509 tpy from the fluidized catalytic cracking unit and 481 tpy from the installation of controls such as ultra-low NO_X burners and Selective Reactive Catalyst at heaters and boilers. The consent decree also requires a site wide Leak Detection and Repair program to minimize or eliminate VOC fugitive emissions from valves and pumps. To minimize or eliminate VOC emissions from benzene waste, the consent decree requires compliance with the Benzene Waste Operations National Emission Standards for Hazardous Air Pollutants.

A.2.3 Texas Emissions Reduction Plan (TERP)

The TERP program was created in 2001 by the 77th Texas Legislature to provide grants to offset the incremental costs associated with reducing 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 Program (DERI), which funds projects to replace, repower, or retrofit eligible vehicles and equipment areas where ozone is a concern. Three other incentive programs are available to reduce NOx emissions in El Paso County: the Drayage Truck Incentive Program, the Texas Natural Gas Vehicle Grant Program, and the Clean School Bus Program. Together, these TERP incentives programs have encouraged voluntary emission reductions in El Paso County.

A.2.4 Local Initiatives

Local strategies in El Paso County are being implemented by the El Paso Metropolitan Planning Organization (http://www.elpasompo.org/), the Joint Advisory Committee (https://www.cccjac.org/), and the City of El Paso (https://www.elpasotexas.gov/environmental-services/air-quality). 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. More information on local measures is available on the websites provided.

A.3 Control Strategies Summary

The permanent and enforceable VOC and NOx control measures contained in Section A.1.2 have resulted in air quality improvement in El Paso County. These enforceable measures will remain in place to ensure continued maintenance of the ozone NAAQS in El Paso County. In addition, Section A.2 lists control measures that may not meet all the EPA's standard tests of SIP creditability (permanent, enforceable, surplus, and quantifiable) but are crucial to the success of the air quality plan in El Paso County. Implementation of these control measures will contribute to the continued maintenance of the ozone NAAQS.

APPENDIX B: TCEQ RESPONSE TO COMMENTS

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY RESPONSE TO COMMENTS RECEIVED CONCERNING THE FEDERAL CLEAN AIR ACT EL PASO COUNTY SECTION 179B DEMONSTRATION: EL PASO-LAS CRUCES, TEXAS-NEW MEXICO NONATTAINMENT AREA

The Texas Commission on Environmental Quality (TCEQ or commission) accepted public comment on a draft demonstration showing that the El Paso County portion of the El Paso-Las Cruces Nonattainment Area would have attained the 2015 eight-hour ozone standard by the attainment date of August 3, 2021 "but for" international contributions from neighboring Ciudad Juárez in Mexico. The draft federal Clean Air Act (FCAA) §179B(b) retrospective demonstration (§179B demonstration) was announced using the TCEQ's GovDelivery system and made available for public review from December 17, 2021 through January 21, 2022 via the TCEQ's website at https://www.tceq.texas.gov/downloads/air-quality/modeling/international-transport/179b-demonstration-for-el-paso-county.pdf.

During the comment period, the commission received comments from the following: Baake Law LLC on behalf of the Sierra Club (Sierra Club); Baake Law on behalf of the Sierra Club, Environmental Integrity Project, Texas RioGrande Legal Aid, Chaparral Community Coalition for Health and Environment, Familias Unidas del Chamizal, Earthworks, Sunrise El Paso, and Sunset Heights Neighborhood Improvement Association (Community and Environmental Groups); one individual; and the US Environmental Protection Agency (EPA).

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GENERAL COMMENTS

Sierra Club requested that the TCEQ publish certain supplemental data related to the draft demonstration and provide a ten-day extension to the public comment period, to allow commenters to consider the requested data.

The TCEQ published and announced the availability of the requested data on January 13, 2021 but declined to extend the comment period as the supplemental data did not change any of the conclusions or analyses summarized in the demonstration and over a week remained in the comment period.

One individual commented that the source of emissions was unimportant, that citizens were greatly impacted by pollution, and that the TCEQ should work with its counterparts in Mexico to decrease their emissions.

The commission prepares and implements air quality plans in accordance with both state and federal law. As shown in Appendix A of this §179B demonstration, the TCEQ has implemented regulations that address emissions of ozone precursors, oxides of nitrogen (NO_x) and volatile organic compounds (VOC) in El Paso County. In addition, the TCEQ follows state and federal requirements when permitting sources of air pollution.

As part of its evaluation of air quality in the El Paso County area, the TCEQ determined that it was appropriate to assess the impact of international emissions on the El Paso County portion of the El Paso-Las Cruces nonattainment area, as allowed under the FCAA. The US Congress recognized that it would be unfair for areas to be reclassified and required to implement more stringent controls if international emissions caused the area to not attain.

El Paso County alone cannot carry the weight of improving air quality of the greater Paso del Norte region. Thus, the TCEQ works closely with Mexico as administrator, liaison, and organizer of the Joint Advisory Committee on the Improvement of Air Quality in the Paso del Norte: https://www.cccjac.org.

The TCEQ pursues multiple approaches for working with Mexican partners to improve air quality in the greater Paso del Norte region. Examples include:

- **Funding air quality studies with leading universities in Ciudad Juárez;**
- **Entering into a Memorandum of Cooperation to improve collaboration on air quality management with the Secretary of Environment in the Mexican state of Chihuahua;**
- **Leading technical exchanges with Mexican partners on topics like vehicle emissions testing, air quality forecasting, emissions inventories, and other fundamental tools for protecting air quality; and**
- **Contributing to the creation of the Binational Air Quality Monitoring Fund, which unites local, state, and federal air quality agencies on both sides of the border to fill data gaps on the Mexican side of the region.**

The EPA stated that it would be helpful if the demonstration listed and/or provided a TCEQ web link for measures documented in the Texas State Implementation Plan applicable to El Paso County that are considered by the TCEQ to be adequate to attain and maintain the ozone standard but for emissions emanating from Ciudad Juárez.

This information was added to the demonstration in APPENDIX A: El Paso Emission Control Measures.

Community and Environmental Groups commented on several aspects related to the attainment status of the Desert View monitor in Sunland Park, including that the El Paso-Las Cruces area would fail to attain even if the emissions contribution from north-central Mexico were excluded.

These comments are outside the scope of this demonstration, which focuses on monitors in Texas. The New Mexico Environmental Department (NMED) FCAA, §179B demonstration contains technical analysis related to monitors in New Mexico.

Community and Environmental Groups commented that the TCEQ must limit its consideration to the emissions from Ciudad Juárez, rather than considering international emissions in aggregate; that TCEQ must show that Ciudad Juárez's contribution to nonattainment is "meaningfully larger" than Texas' contribution; and that EPA cannot approve Texas' demonstration unless the entire area would have attained "but for" emissions from Ciudad Juárez.

The TCEQ disagrees that the FCAA requires that an assessment of potential international contribution can *only* consider emissions from Ciudad Juárez in evaluating the potential impact of international emissions on El Paso County. Neither the statute, nor the EPA's guidance require such an interpretation. The TCEQ's analysis does evaluate emissions from Municipio de Juárez, as documented by the EPA in its 2016v2 North American Emissions Modeling Platform (EPA, 2021a) as compared to the emissions inventories in both the New Mexico and Texas portions of the El Paso-Las Cruces nonattainment area. In addition, the analysis discusses potential international transport as estimated by various source apportionment modeling studies, which provide a range of percentages of contribution from international regions. Such evaluations provide a useful and appropriate view of estimated contribution from international sources. The TCEQ also disagrees that it must show that the contribution from Ciudad Juárez is "meaningfully larger" than the contribution from Texas. Nothing in the statute nor the EPA's guidance requires such an interpretation. The EPA's guidance discussion merely notes that when international contributions are "meaningfully larger" the weight of evidence will be more compelling; not that it is required. The TCEQ also disagrees that Texas' demonstration must address exceedances at the New Mexico monitors as New Mexico has already provided a FCAA, §179B demonstration which addresses exceedances at the New Mexico monitors. In multi-state areas, each state is responsible to submit information relevant to the areas within their jurisdiction.

Community and Environmental Groups commented that the TCEQ should refrain from finalizing its §179B demonstration and instead promulgate a state implementation plan to reduce emissions from ozone-precursor sources in El Paso and other parts of west Texas to protect the health and welfare of individuals who live, work, and recreate in this region.

The TCEQ takes its commitment to protect the environment and public health seriously. As discussed elsewhere in this response to comments document, the TCEQ has adopted air quality controls required for El Paso County and works with area stakeholders to assess and develop air quality strategies in the area. As part of its current evaluation, the TCEQ determined that it was appropriate to assess the impact of international emissions on the El Paso County portion of the El Paso-Las Cruces nonattainment area. The U.S. Congress recognized that it would be unfair for areas to be reclassified and required to implement more stringent controls if international emissions caused the area to not attain.

TECHNICAL COMMENTS

The EPA commented that it would be good to note if there are exceedances outside the April to September months as the official ozone season for El Paso County is all year.

El Paso County did not experience ozone exceedances outside the months of April to September for the years assessed for this demonstration. This information is included in Section 2 of the §179B demonstration.

The EPA commented that references should be provided for some statistics regarding emissions inventory changes discussed in Section 3.1 of the §179B demonstration.

The TCEQ added the requested references to Section 3.1.

The EPA commented that it would be helpful to provide further explanation and support for the discussion of emission sources in this area and why mobile sources are singled out.

The TCEQ added further discussion of emission source information to Section 3.3 of the §179B demonstration.

The EPA commented that the demonstration would be strengthened with more information regarding traffic on both sides of the international bridges.

The TCEQ added further discussion of data that is available regarding traffic on the international bridges to Section 3 of the §179B demonstration.

The EPA recommended interpolating for missing hours using the available data for the Section 4.3 Ozone Cluster Analysis by Wind Direction for days with at least 21 hours, instead of using hourly averages for the two-week period.

No change was made in response to this comment. There are various ways to approach missing data in this analysis and TCEQ chose the method deemed to provide values most representative of likely data. By limiting the values used for imputation to the hour and two-week period surrounding the missing data point,

the TCEQ was able to ensure the imputed value was appropriate to the year and specific time of year.

The EPA suggested that the report discuss Gaussian dispersion distributions about the centerlines which represent some level of error/variance for each trajectory, which is more pronounced for upwind trajectories and trajectory points. The EPA also noted that the TCEQ should confirm the dates listed as having at least six of the eight trajectories passing through Mexico in Table 4-3, and that if there are errors, then the tables in Section 5.2 will need adjusting.

The TCEQ added the requested discussion. Table 4.3 is correct, but the commenter appears to have misunderstood the intended meaning of the asterisk in the table. Only the dates marked with an asterisk by the ozone concentration parts per billion (ppb) value met the criteria of at least six of the eight trajectories passing through Mexico.

The EPA suggested that the discussion of modeling studies have more detail, such as each study's potential error in the international ozone contributions, the relative parts of those that should be attributed to Mexico, and the Arizona and overall US contribution.

The TCEQ included the requested information to Section 3.4 of the §179B demonstration.

Community and Environmental Groups commented that the influence of Permian Basin oil and gas development contributes to rising ozone levels in the El Paso-Las Cruces area on the majority of exceedance days for the Desert View monitor.

Comments relating to the Desert View monitor are outside the scope of this demonstration, which focuses on monitors in Texas. The NMED §179B demonstration contains technical analysis related to monitors in New Mexico. For multi-state areas, states are required to coordinate planning requirements, but are independently responsible for submitting plans to address their portion of the multi-state area. Since the EPA redesignated El Paso County and changed the boundary of the existing Sunland Park nonattainment area to include El Paso County, retroactively applying the attainment date to El Paso County, coordination was not possible with New Mexico.

Community and Environmental Groups commented that Texas contributes more to nonattainment in the El Paso-Las Cruces area than Ciudad Juárez**.**

The TCEQ disagrees with this comment. The modeling studies in Section 6 show that Texas and U.S. domestic sources contribute less in recent years than Ciudad Juárez and other international sources, especially in 2020 and 2021. The EPA Cross-State Air Pollution Rule (CSAPR) Update modeling, which used the most comprehensive emission inventory of the included studies, showed an international contribution of about twice as much as domestic sources in 2021. This conclusion

agrees with the emission trends shown in Section 3.3, which indicate Ciudad Juárez emissions have increased while El Paso County and Doña Ana County emissions have decreased.

Community and Environmental Groups commented that the El Paso-Las Cruces area experiences multiple violations of the ozone standard each year that cannot be attributed to Ciudad Juárez, citing examples from Skyline Park in 2018, 2019, and 2020. The commenters questioned the demonstration's back trajectory methodology as being evidence of international transport and stated it is not a reliable way to distinguish emissions that incidentally travel through Ciudad Juárez from those that originate there.

The TCEQ disagrees that its §179B methodology was inappropriate. The TCEQ used the method recommended by the EPA's guidance, which, in this application, categorizes exceedance days as internationally influenced when 75% of the back trajectories pass through Mexico. Thus, under the EPA's guidance, if six of the eight hourly trajectories pass through international air for any portion of the trajectory, the day is considered internationally influenced. The EPA's guidance does not require a minimum distance or time for the trajectory crossing the international border, which appears to be a recognition of the complex, non-linear chemistry associated with ozone formation. Exceedance days that did not meet the EPA's threshold may also have had influence from Ciudad Juárez, but not for six of the eight hours necessary to meet the EPA criteria for being considered as internationally influenced.

As the EPA pointed out in its comments on this draft §179B demonstration, back trajectories are a representation of the centerline of an air parcel's movement. When a trajectory appears to "incidentally" travel across the border, the air parcels represented may actually pass further into Mexico. These trajectories also appear to represent a pattern in which air movement slows over Ciudad Juárez before turning toward El Paso County, allowing for mixing of emissions from Ciudad Juárez into the air parcel. The existence of some exceedance days not meeting the 75% (six of eight) threshold at all the El Paso County monitors does not negate that the area would have attained the standard "but for" international anthropogenic emissions.

Community and Environmental Groups commented that the TCEQ's analysis conflates "contribution" with "causation" by excluding all days deemed to have been influenced by emissions from Ciudad Juárez, without attempting to show that these emissions could explain the difference between the reported design value and the upper limit of the ozone standard. Instead of excluding such exceedance days, the commenter states that the TCEQ should have applied a downward adjustment of 7.0 ppb on days deemed influenced by emissions from Ciudad Juárez.

The TCEQ followed the EPA §179B guidance in developing the demonstration using a weight of evidence approach that incorporated monitored observations, emission trends, back trajectory analyses, and multiple modeling studies. Each modeling study had a unique configuration and applying absolute results from one study

(such as the referenced 7.0 ppb contribution) across the board would not be appropriate. The TCEQ compared the modeling results in a relative sense, evaluating the percent contribution of international sources within each study.

Community and Environmental Groups commented that El Paso and Doña Ana Counties contribute meaningfully to regional ozone levels.

The TCEQ agrees that domestic emission sources in El Paso and Doña Ana Counties contribute to ozone formation in the region; however, as noted in the §179B demonstration, emissions from El Paso County have decreased over the last ten years. The EPA estimated NO_x increases of 21% and VOC decreases of 12% for Ciudad Juárez between 2011 and 2023; while estimating that both NO_x and VOC emissions from Ciudad Juárez will increase between 2016 and 2023. Ciudad Juárez contributes roughly two thirds of the regional ozone precursor inventory. This is not surprising, given that Ciudad Juárez is two times larger than El Paso, with an urban core population density of six times greater than El Paso. Ozone pollution roses presented in Section 4.2 of the §179B demonstration show consistent southerly wind directions at the three El Paso County nonattainment monitors. As detailed in the TCEQ response on July 26, 2021, to the EPA 120-day letter[1], the significant emissions contribution to the proposed El Paso-Las Cruces ozone nonattainment area comes from Ciudad Juárez. The ozone precursor emissions sources in Ciudad Juárez are numerous and in proximity to the El Paso-Las Cruces area.

WEIGHT OF EVIDENCE

Community and Environmental Groups commented that the weight of the evidence does not indicate that the area would attain the ozone standard but for emissions emanating from Ciudad Juárez and that the demonstration cannot be approved unless the weight of the evidence shows that the entire area would have attained but for emissions from Ciudad Juárez. Commenters also contend that the demonstration must show that international emissions are a substantial factor contributing to nonattainment and that Ciudad Juárez's contribution to nonattainment is "meaningfully larger" than Texas's contribution.

The TCEQ disagrees with the commenters assessment of the weight of evidence and with the commentor's characterization of what is required for an approvable FCAA, §179B demonstration. As described in FCAA, §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 appear to have interpreted the language in FCAA, §179B as requiring a demonstration that shows that international emissions

1 https://www.tceq.texas.gov/downloads/air-quality/sip/ozone/designations/naaqs-2015/elp_2015ozonedesignation_120-day_response-to-epa_07262021.pdf

are a substantial factor contributing to nonattainment; however, neither the statute nor the EPA guidance requires or supports such an interpretation.

Community and Environmental Groups commented that worsening air quality in the El Paso-Las Cruces area since 2016 is part of a larger regional trend and that rising ozone levels are being caused by increasing emissions from the Permian Basin, while emissions from Ciudad Juárez have not increased substantially since 2016. Commenters pointed to design values at Carlsbad, Carlsbad Caverns National Park, Chaparral, and Guadalupe Mountains National Park as evidence of the regional emission trend. Commenters also noted that HYSPLIT trajectories prepared by the TCEQ and NMED show that transport over the Permian is common on exceedance days and that NMED source apportionment modeling shows a linkage between Permian emissions and ozone levels in the El Paso-Las Cruces area that is confirmed by other studies. Lastly, commenters note that other contributing factors to rising ozone levels are West Texas population growth, higher temperatures, and more frequent wildfires.

The portion of the comment regarding monitors in New Mexico and NMED's analysis is beyond the scope of this §179B demonstration and response to comment, as each state that is part of a multi-state area is responsible for addressing air quality planning within its own jurisdictional boundary. Additionally, design values at monitors outside the nonattainment area boundary are beyond the scope of this response.

The TCEQ acknowledges that a variety of emissions sources and geographical locations contribute to ozone formation in El Paso County. Section 6 of the §179B demonstration contains source apportionment information, including the relative contributions of US anthropogenic and international contributions to ozone concentrations in El Paso County. As noted in response to other comments, Section 3 of the §179B demonstration, and the TCEQ response on July 26, 2021, to the EPA 120-day letter, there are significant emissions from Municipio de Juárez that are within close proximity of the El Paso County nonattainment monitors. Oil and gas emissions from other geographic areas were included in the US anthropogenic emissions. To the extent that there were impacts from these US sources located further away from El Paso County, they do not negate that the El Paso-Las Cruces area would have attained but for nearby emissions contributions from Mexico.