Clean Air Act 179B Demonstration

Sunland Park Ozone Nonattainment Area

Air Quality Bureau **6/2/21** **Final Draft**

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Overview

On October 1, 2015 the U.S. Environmental Protection Agency (EPA) revised the primary and secondary 8-hour ozone (O_3) National Ambient Air Quality Standard (NAAQS) from 75 to 70 parts per billion (ppb) (80 FR 65292, October 26, 2015). The revised 2015 ozone NAAQS required the EPA to designate the Sunland Park area of southern Doña Ana County as a marginal nonattainment area (83 FR 25820, June 4, 2018). The Sunland Park O_3 Nonattainment Area (SLP O_3 NAA) violated the NAAQS with a 2014-2016 design value of 72 ppb at the New Mexico Environment Department's (NMED) Desert View monitoring site (AQS ID 35-013-0021).

The Clean Air Act (CAA) requires NMED to adopt certain provisions for emission sources in the SLP O_3 NAA within the State Implementation Plan (SIP) and demonstrate compliance with the 2015 O_3 NAAQS by August 3, 2021. Failure to attain the standard could result in a reclassification, or bump up, in nonattainment classification to moderate, entailing increased planning requirements (83 FR 62998, December 6, 2018). The SIP provisions include Transportation Conformity, Nonattainment New Source Review (NNSR), Emissions Inventory and Emissions Statement requirements. Transportation Conformity requirements were met by the El Paso Metropolitan Planning Organization (EP MPO) through a transportation conformity determination by the EPA and U.S. Department of Transportation for the *Destino 2045 Metropolitan Transportation Plan* and the *Destino FY 2019-2022 Transportation Improvement Program*. NNSR requirements will be met as 20.2.7.79 New Mexico Administrative Code (NMAC), Permits-Nonattainment Areas, is currently undergoing a rule amendment to incorporate language to meet 40 CFR 51.165(a)(11) before the August 3, 2021 deadline. NMED submitted an Emissions Inventory and Emissions Statement SIP revision in September of 2020 that is under review by EPA.

Although NMED is ensuring that the SIP contains the provisions required by the CAA for marginal O_3 nonattainment areas, the most recent certified O_3 monitoring data from the Desert View monitoring site does not show compliance with the NAAQS with a 2018-2020 design value of 78 ppb. Section 179B of the CAA allows EPA to consider the impact of international emissions on a state's ability to attain and maintain a specific NAAQS. While section 179B provides regulatory relief for the state, it does not relieve it of meeting the remaining applicable planning or emission reduction requirements of the CAA. Also, a state must submit and EPA approve a demonstration showing international impacts on air quality. If the demonstration is approved by EPA, the area will avoid reclassification to marginal. For the SLP O_3 NAA, this requires an analysis of past air quality and is referred to as a "retrospective" demonstration under Section 179B(b).

The SLP O_3 NAA sits adjacent to the U.S./Mexico international border with Ciudad Juárez (Figure 1) and the one air quality monitor located at the Desert View Elementary School in the City of Sunland Park, New Mexico, has set the O_3 design value for Doña Ana County since 2015. This CAA 179B(b) retrospective demonstration was developed in consultation with New Mexico's Regional EPA Office and followed the EPA guidance document for preparing demonstrations (EPA, 2020a). It provides the technical analyses for a "weight of evidence" demonstration to show the impact of the urban emissions from Ciudad Juárez, Mexico on air quality in New Mexico. NMED concludes that international emissions significantly contribute to high O_3 levels at the Desert View monitoring site, impacting its design value and the state's ability to comply with the NAAQS. Furthermore, the New Mexico SIP would be adequate to attain and maintain the NAAQS but for emissions emanating from Ciudad Juárez, Mexico.

Conceptual Model

Meteorology, topography, and emission sources are major factors for the efficient formation and transport of anthropogenic tropospheric O_3 in the SLP O_3 NAA and will be the focus of this demonstration's "weight of evidence" analysis. These factors contribute to the conditions that facilitate the transport and production of O_3 to the US from Mexico at concentrations that exceed the NAAQS. The focus of this document is the binational, tri-state shared airshed known as the Paso del Norte (PdN), which consists of the City of Sunland Park, the City of El Paso, and Ciudad Juárez, Mexico along the U.S./Mexico border.

The PdN, is a bowl shaped airshed that sits south of the Mesilla Valley and is saddled by both the Franklin Mountain Range and the Sierra de Juárez with Mount Cristo Rey sitting between them. The Franklin Mountain Range and the Sierra de Juárez combined act as a funnel facilitating the southeast directional airflow movement while Mount Cristo Rey acts as a barrier, facilitating efficient mixing and the decrease of air mass speed for O_3 to transport to the Desert View monitor site. The PdN is a prime example that air pollution cannot be confined by international borders and state lines, as the meteorological and topographical influences support the characteristics of a regional, tri-state, binational airshed. The Sunland Park area has a history of documented O_3 NAAQS exceedances resulting in a marginal nonattainment classification of the 1-hour 1990 CAA standard June 12, 1995, prompting NMED to obtain an nitrogen oxide (NO_x) waiver from the EPA as part of the July 11, 1997 State Implementation Plan (SIP) revision (67 FR 6148, February 8, 2002). The El Paso Area was declared a serious nonattainment classification of the 1-hour standard in 1990 prompting the Texas Commission of Environmental Quality to obtain a 179B demonstration approval from the EPA August 8, 2004 as part of their initial September 21, 1994 Texas SIP revision (69 FR 32450, June 10, 2004). Studies have established and continue to highlight the associations with high O_3 concentrations influenced by international emissions exclusive to the Sunland Park area monitors (Sisneros, Maria A., 2014).

The population of the City of Sunland Park is considerably smaller with 17,978 people (US Census, 2019) than the sister cities of El Paso with a population of 681,728 people (US Census, 2019) and Ciudad Juárez with 1.5 million people (Population Stat, 2021). The emission sources are disproportionately located in the sister cities, predominantly in Ciudad Juárez. The formation of high concentrations of O_3 that exceed the NAAQS are enhanced on days when precursor emission sources originate from upwind sources in Ciudad Juárez, which are influenced by meteorological, topographical, and high-density urban emission sources. The PdN international border at El Paso is the second busiest port of entry into the United States from Mexico after the San Diego/Tijuana port of entry, with approximately 811,000 trucks, 12 million cars (with 22 million passengers), and more than 7 million pedestrians crossing northbound each year (TX Comptroller, 2018). This area sits at the junction of three major trade routes for North America: I-10 providing the east-west US trade route, I-25 for the north-south Canada/Mexico trade route, and the US/Mexico Border international trade route as part of the North/South America trade route.

Figure 1 – Topographic map showing proximity of Sunland Park Ozone Nonattainment Area. Note the Desert View monitoring site location to the international border and the metropolitan area of Ciudad Juarez, Mexico.

The City of El Paso has a land area of 249 square miles (mi^2) with a population density of 2,416.5 people per square mile (ppl/mi^2), in comparison to Ciudad Juárez's urban core of 95.5 mi^2 with 16,753.9 ppl/mi^2. Combined, the population density equates to 6,391 ppl/mi^2 (Paso del Norte Group, 2009). The amount of light pollution emitted into the atmosphere during the night, used as an indicator of urban density, is provided as an aerial view image from the International Space Station of the PdN, which highlights the close proximity of the SLP O_3 NAA to the dense Ciudad Juárez metropolitan area in contrast to El Paso's sparse metropolitan area (Figure 2).

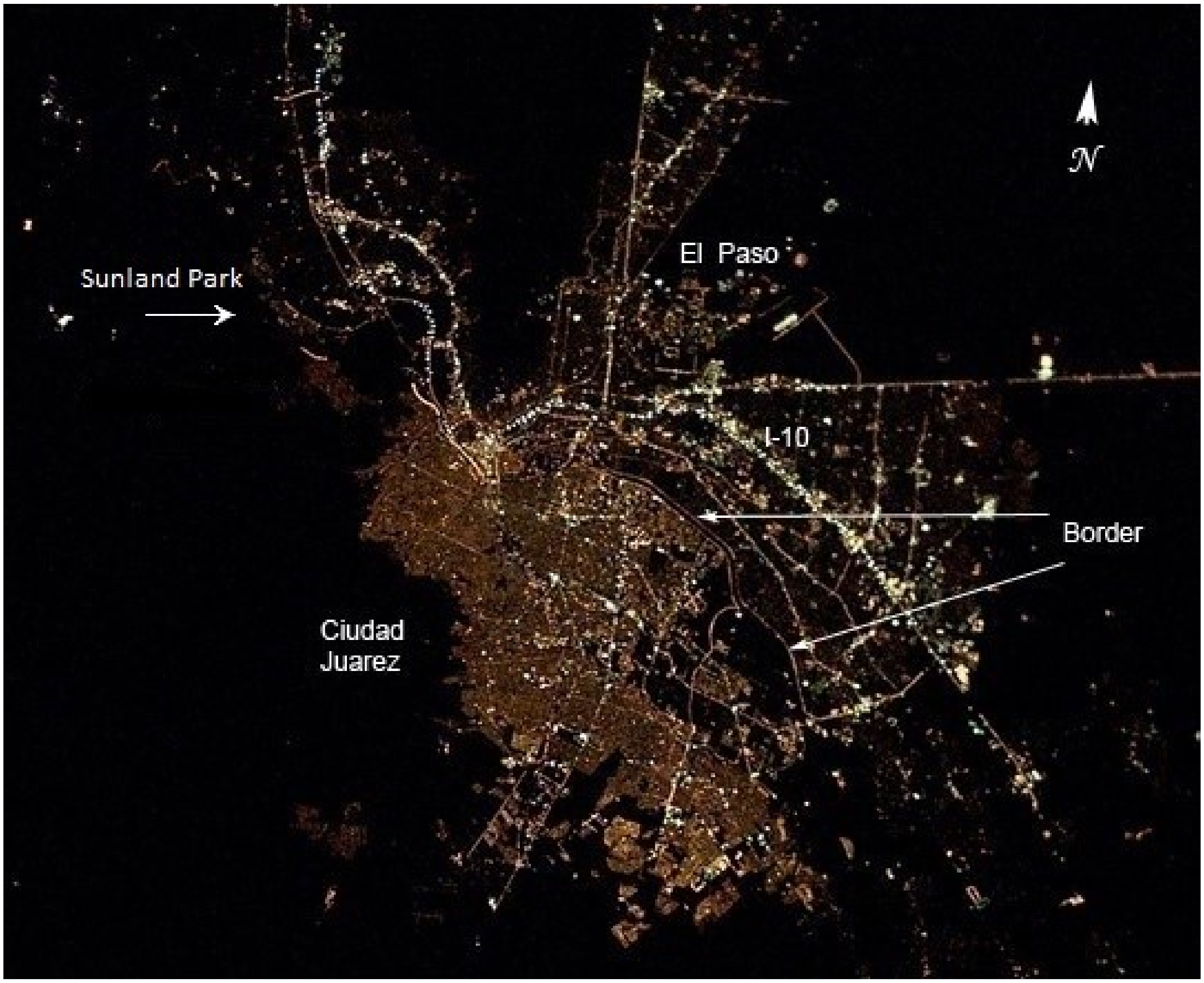

Figure 2 - Nighttime aerial image of the PdN showing the spatial urban density comparison of Ciudad Juárez, Mexico to the El Paso, TX metropolitan area with the City of Sunland Park located on the southern border of New Mexico. Image courtesy of the Earth Science and Remote Sensing Unit, NASA Johnson Space Center; *ISS006-E-44123*; *https://eol.jsc.nasa.gov/*.

Meteorology

The climate of the PdN is hot and arid with an average of less than nine inches of precipitation per year (Figure 3), 306 days of sunshine per year, and 15.4 days of daily high temperatures of 100˚F and above. El Paso lives up to its name as "The Sun City," as the highest UV indexes occur during the peak O_3 season months of May through August (US National Weather Service, 2021). These conditions are major influences to the photochemical reactions that occur in equilibrium, which are highly dependent on the source contribution's location in regards to wind speed; wind direction; relative humidity; temperature; UV intensity; and the amount of available precursor emissions nitrogen oxides (NO_X) and volatile organic compounds (VOC) to facilitate efficient O_3 production and transport to the Desert View monitoring site.

Research continues to support that when the atmosphere is stable and the planetary boundary layer is low (caused by high-pressure ridge systems centered over the PdN), the potential for pollutant accumulation at ground level on exceedance days is high due to the lack of vertical mixing; unlike when unstable low-pressure systems prevent the accumulation of pollutants near ground level on non-exceedance days due to increased vertical mixing through unstable windy conditions. O_3 concentrations typically peak in the summer months on weekday afternoon hours, lasting into the evening when the angle and distance of the sun is the most intense and the accumulation of precursors for efficient O_3 photosynthetic production are at peak concentrations to occur quickly. High exceedance days can also occur on weekends in the PdN, if the previous day's pollutants have not been dispersed and immediately start the photochemical reaction the following day. There is a correlation of high exceedance days occurring before or after a precipitation event, indicating an increase of relative humidity is needed for efficient O_3 production, and supports higher exceedances occurring during the monsoon season of July and August that falls within the peak O_3 season. The calm conditions that precede or follow a synoptic mesoscale event are perfect conditions for the accumulation and production of O_3 as the humidity increases with localized stable conditions. In addition, increased suspended particulate matter less than 10 microns in aerodynamic diameter (PM_{10}) also contributes to increased O_3 production during small scale synoptic events, as the precursors do fall within a fraction of suspended particulate matter. All these conditions combined create a uniquely efficient O_3 production and transport system that is exclusive to the PdN (Karle, Nakul N.; Mahmud, Suhail; Sakai, Ricardo K.; Fitzgerald, Rosa M.; Morris, Vernon R.; Stockwell, William R., 2020).

	Jan.	Feb.	March	April	May	June	July	August	Sep.	October	Nov.	Dec.
Avg. Temperature (°C)	6.5	9.1	12.5	17.6	22.1	26.8	27.9	26.9	23.6	18	11.1	7.3
Min. Temperature (°C)	-1.3	0.7	3.8	8.7	13	17.8	20.2	19.4	15.9	9.5	2.6	-0.7
Max. Temperature (°C)	14.4	17.6	21.2	26.6	31.3	35.8	35.7	34.5	31.4	26.5	19.6	15.3
Avg. Temperature (°F)	43.7	48.4	54.5	63.7	71.8	80.2	82.2	80.4	74.5	64.4	52.0	45.1
Min. Temperature (°F)	29.7	33.3	38.8	47.7	55.4	64.0	68.4	66.9	60.6	49.1	36.7	30.7
Max. Temperature (°F)	57.9	63.7	70.2	79.9	88.3	96.4	96.3	94.1	88.5	79.7	67.3	59.5
Precipitation / Rainfall (mm)	10	11	8	5	6	16	41	41	34	20	10	15

Figure 3 - El Paso average temperatures and precipitation obtained from https://en.climate-data.org/north-america/united-states-of-america/texas/el-paso-943/

Over 45 years of July wind data obtained from the El Paso Airport indicates that the wind direction predominates from the southeast (140°) with wind speeds of 5 meter per second (<10 knots) or less (Figure 4). Calm (< 6 m/s) southeasterly winds create a high potential for the production of O_3 and transport to the Desert View monitoring site from emission sources in Ciudad Juárez to occur (Figure 5).

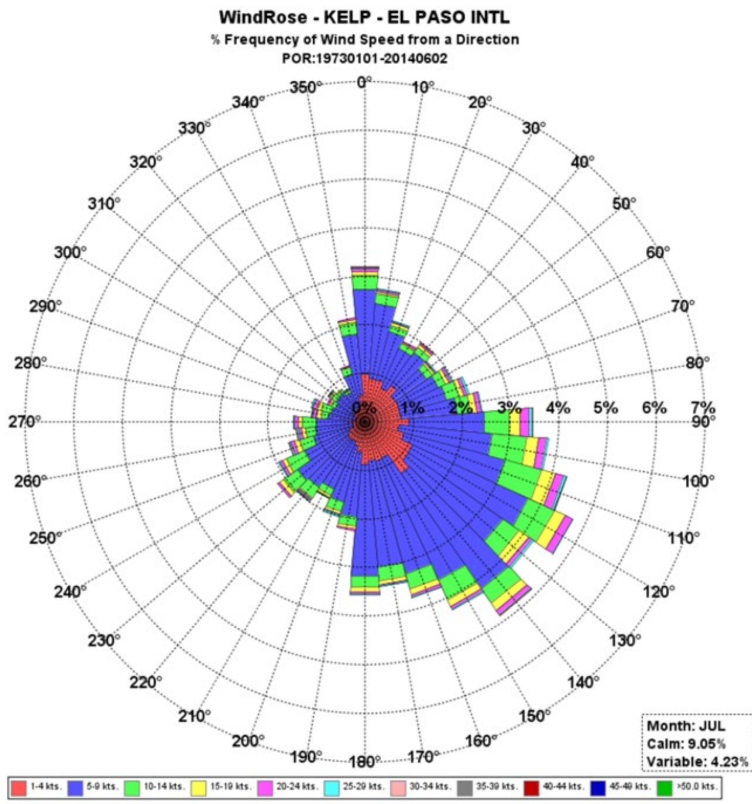

Figure 4 – Wind-Rose of over 45 years of El Paso Airport wind data for the month of July.

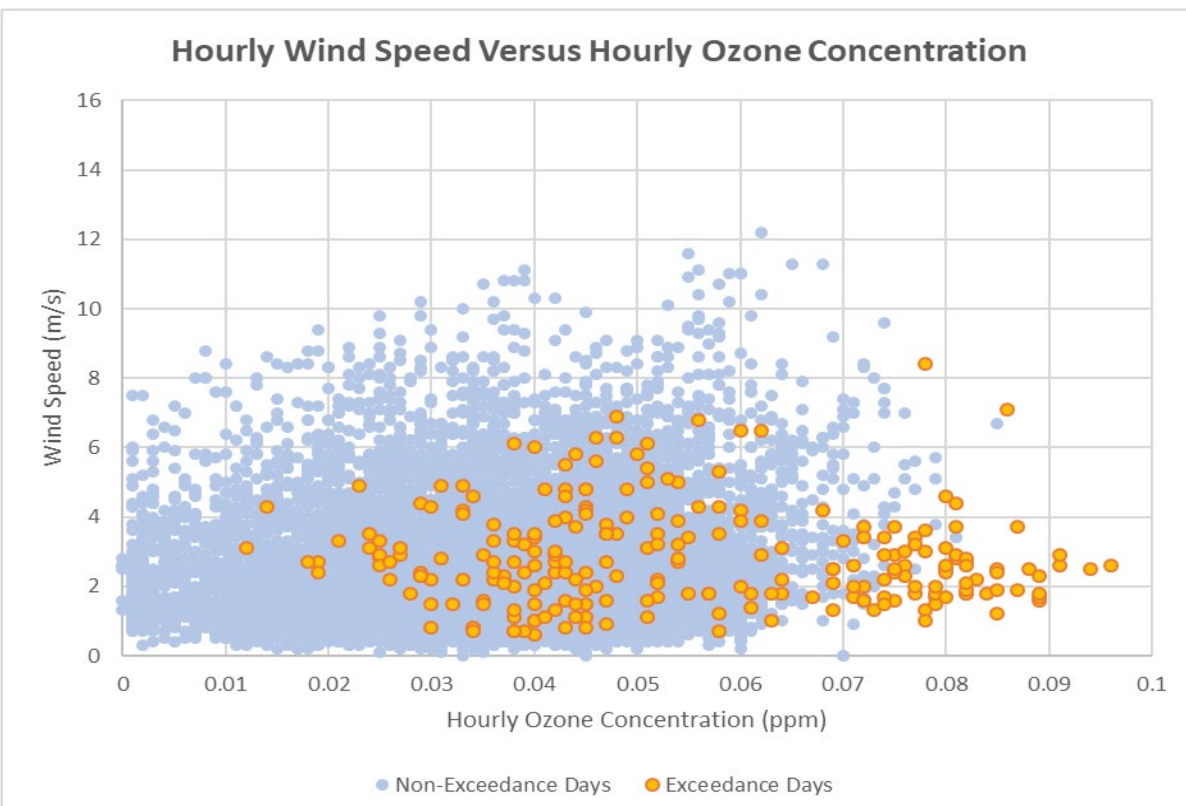

Figure 5 – Desert View monitoring site hourly O_3 concentrations versus hourly wind speeds from 2016-2020.

A series of four wind-roses were plotted for the Desert View monitoring site's exceedance days from 2016 through 2020 (Figure 6). The wind-roses support O_3 concentrations that exceed the NAAQS predominate from the southeast at least 60% of the time with low-wind speeds less than 4 m/s. The consistent directional low-speed airflow is indicative of stable atmospheric conditions during exceedance days.

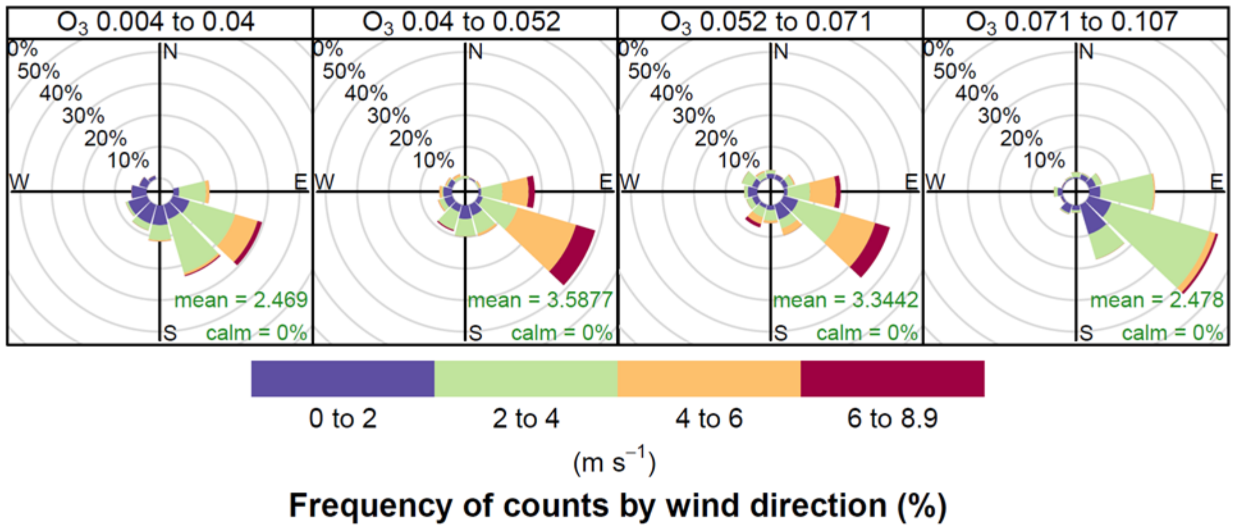

Figure 6 –Exceedance Days Wind-Rose for the Desert View monitoring site from 2016 through 2020.

Comparatively, a series of four wind-roses were plotted for the Desert View monitoring site's non-exceedance days from 2016 through 2020 (Figure 7). The wind-roses support multi-directional air movement with high-wind speeds consistent with unstable atmospheric conditions at times when high O_3 concentrations are not exceeding the NAAQS.

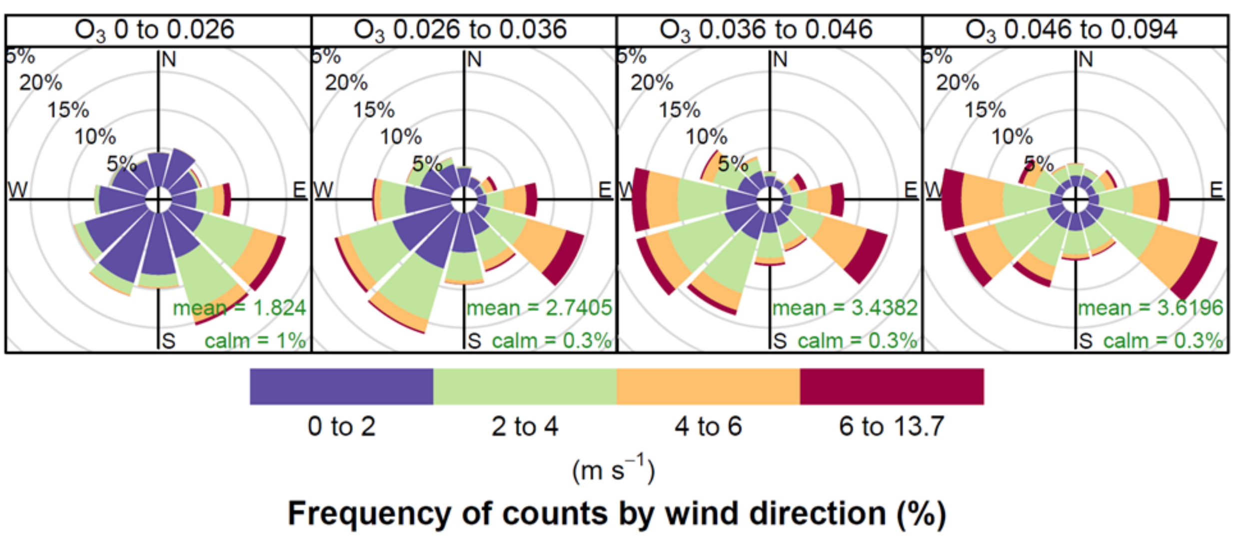

Figure 7 – Non-Exceedance Days Wind-Rose for the Desert View Monitoring site from 2016 through 2020.

A pollution rose was created for the Desert View monitoring site's exceedance days from 2016 through 2020 (Figure 8). The pollution rose shows high concentration levels (> 70 ppb) at the monitoring site when winds were predominately from the southeast quadrant (east to south-southwest wind direction). As shown in Figure 6, these high O_3 concentrations are recorded under stable atmospheric conditions with wind speeds less than 4 m/s.

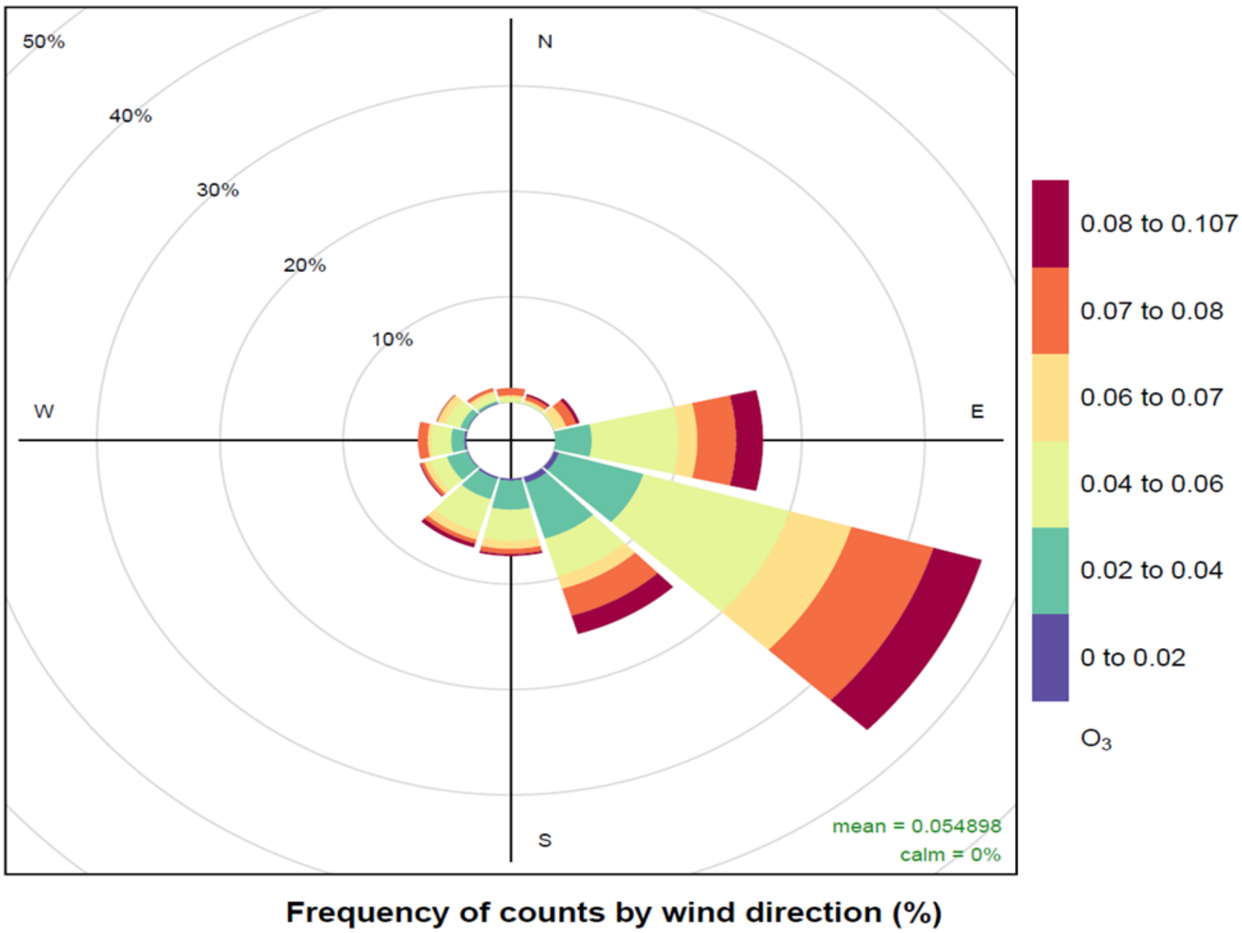

Figure 8 – Exceedance Days Pollution Rose for the Desert View monitoring site from 2016 through 2020.

A pollution rose was created for the Desert View monitoring site's non-exceedance days from 2016 through 2020 (Figure 9). The pollution rose shows that winds were predominately from the southern quadrants as multi-directional flows. O_3 concentrations rarely exceed the standards at these times and are associated with unstable atmospheric conditions and higher wind speeds (> 6m/s).

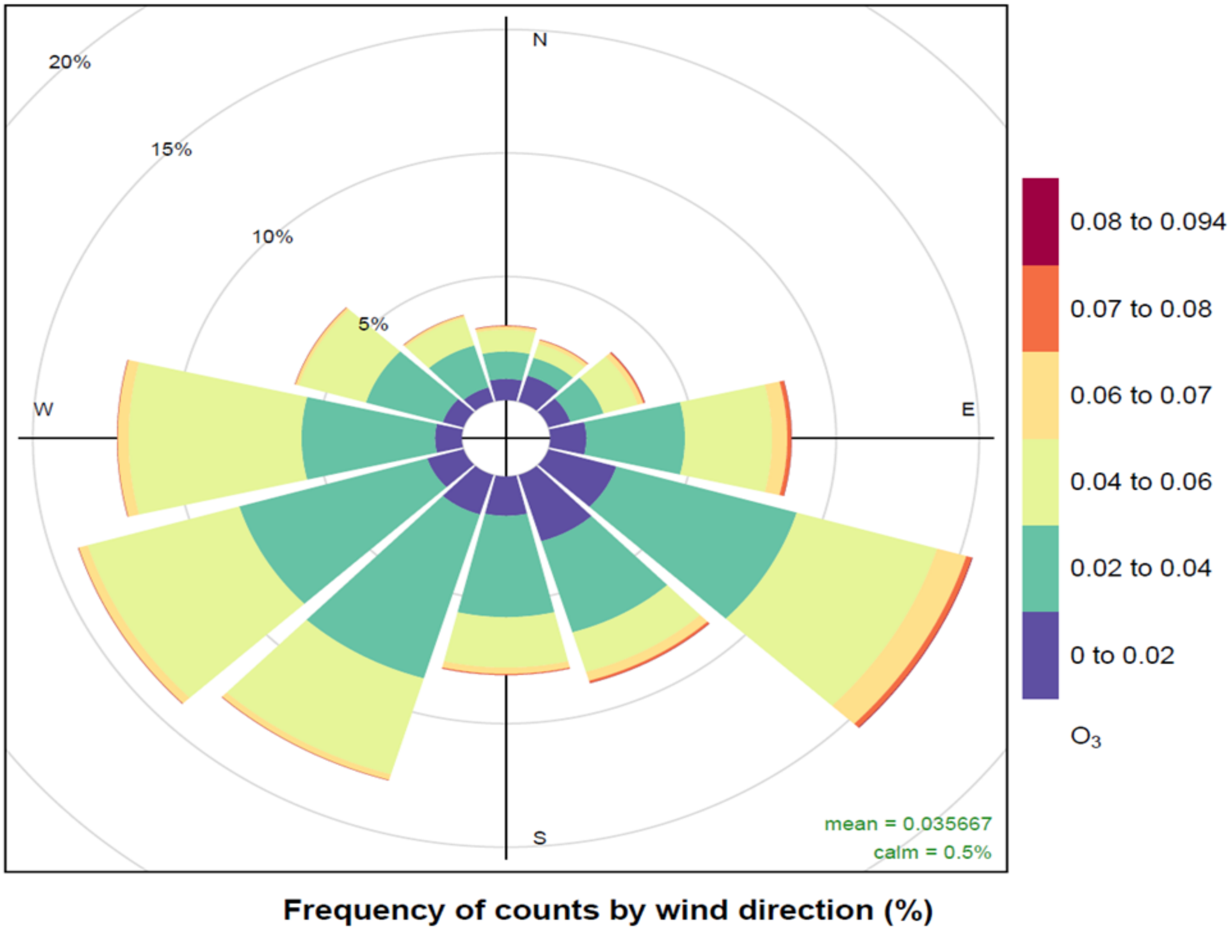

Figure 9 – Non-Exceedance Days Pollution Rose for the Desert View monitoring site from 2016 through 2020.

Monitoring Data

The NMED O_3 monitoring network in Doña Ana County consists of five monitors as part of the State Local Air Monitoring System (SLAMS): Solano (AQS ID: 35-013-0023), Chaparral (AQS ID: 35-013-0020), La Union (AQS ID: 35-013-0008), Santa Teresa (AQS ID: 35-013-0022), and Desert View (AQS ID: 35-013-0021) (Figure 10).

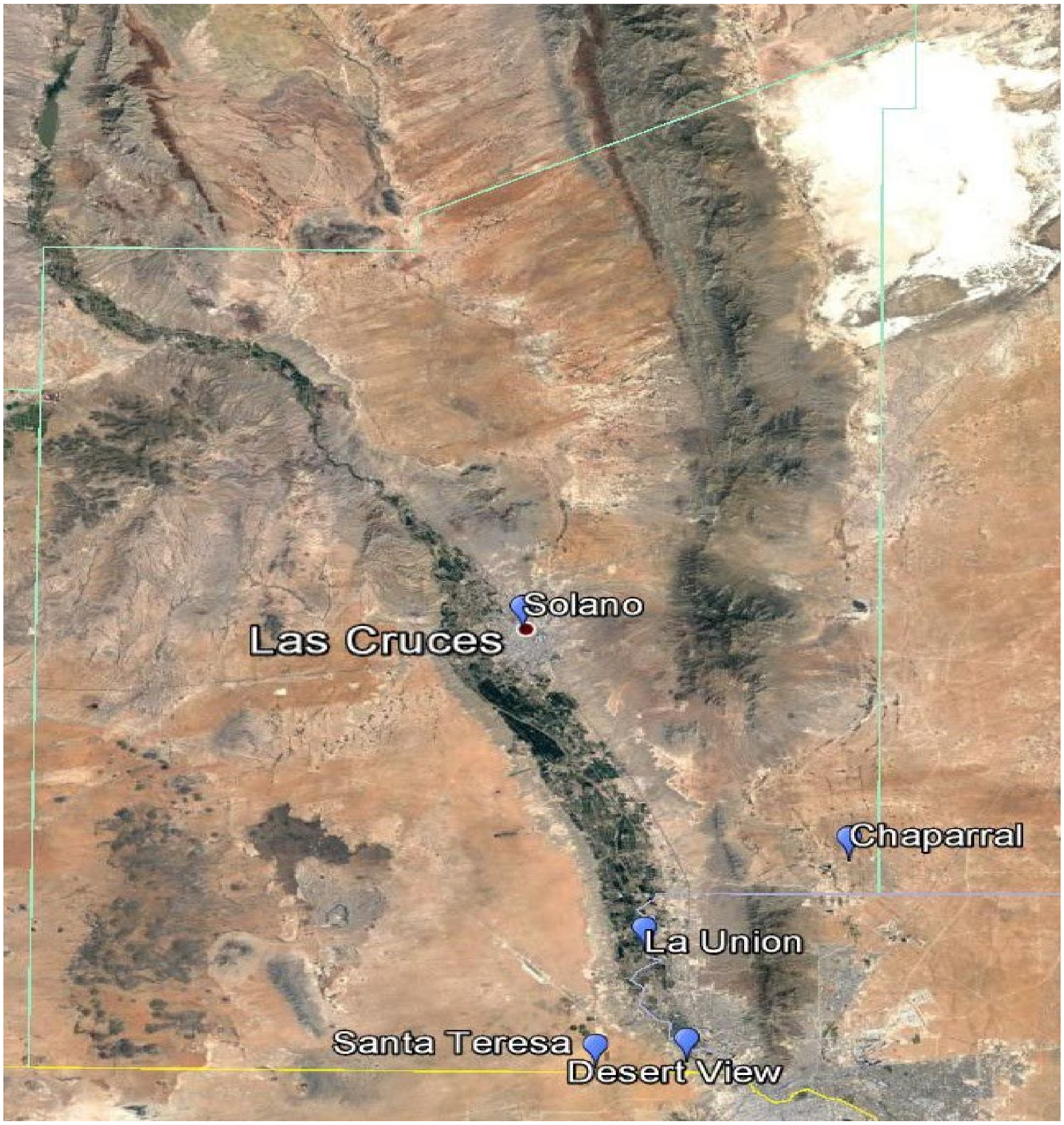

Figure 10-NMED Doña Ana County O_3 Air Quality Network.

Since 2015, the Desert View monitoring site has set the design value for Doña Ana County. From 2016-2020, the Desert View monitor's design value has violated the NAAQS, increasing from 72 to 78 ppb (Figure 11). The majority of exceedances occur in May through August (Figure 12), highlighting the peak O_3 season. The 46 exceedances within this time frame (Table 1) range from a low of 2 in 2016 to a high of 17 in 2018, with an average of 9 exceedances per year (Figure 13). The number of NAAQS exceedances and concentrations have steadily increased since 2016, with an especially bad O_3 season in 2018.

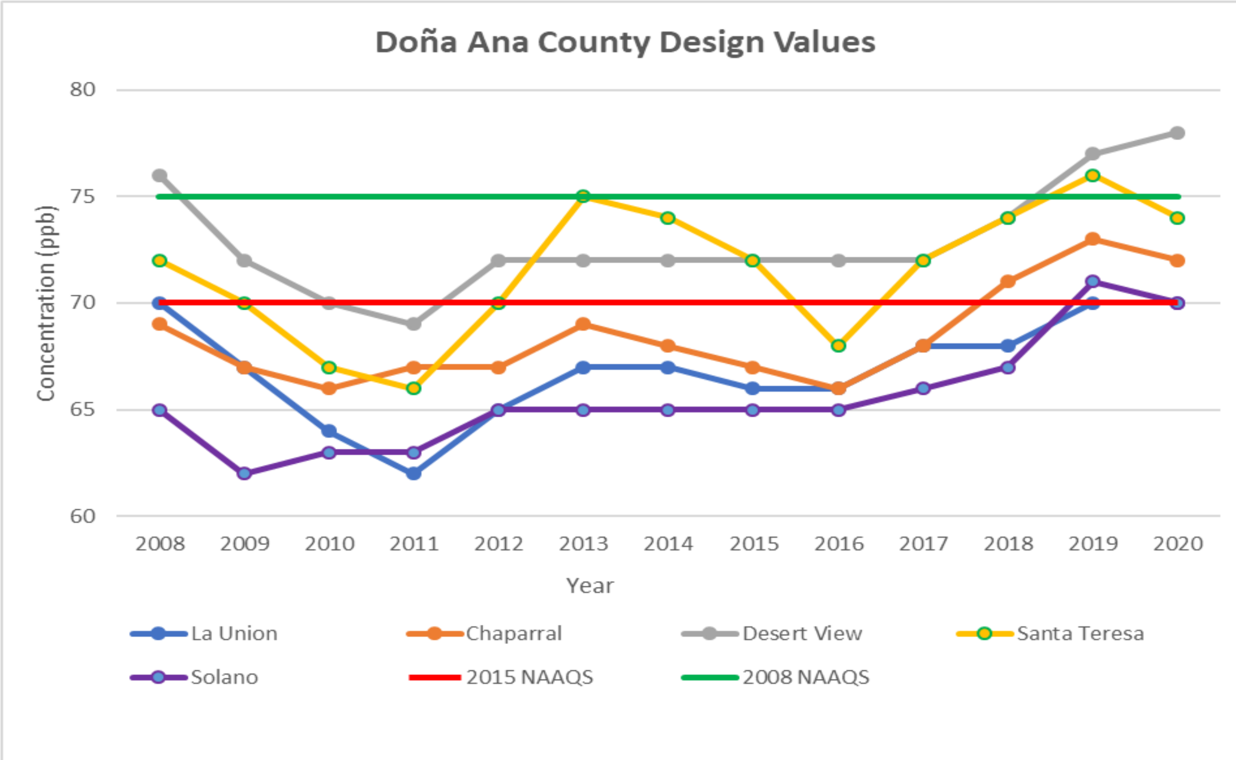

Figure 11 – NMED's Doña Ana County O_3 Monitoring Network eleven-year design value trend. Note the six ppb increase from 2016 to 2020 for the Desert View monitoring sites.

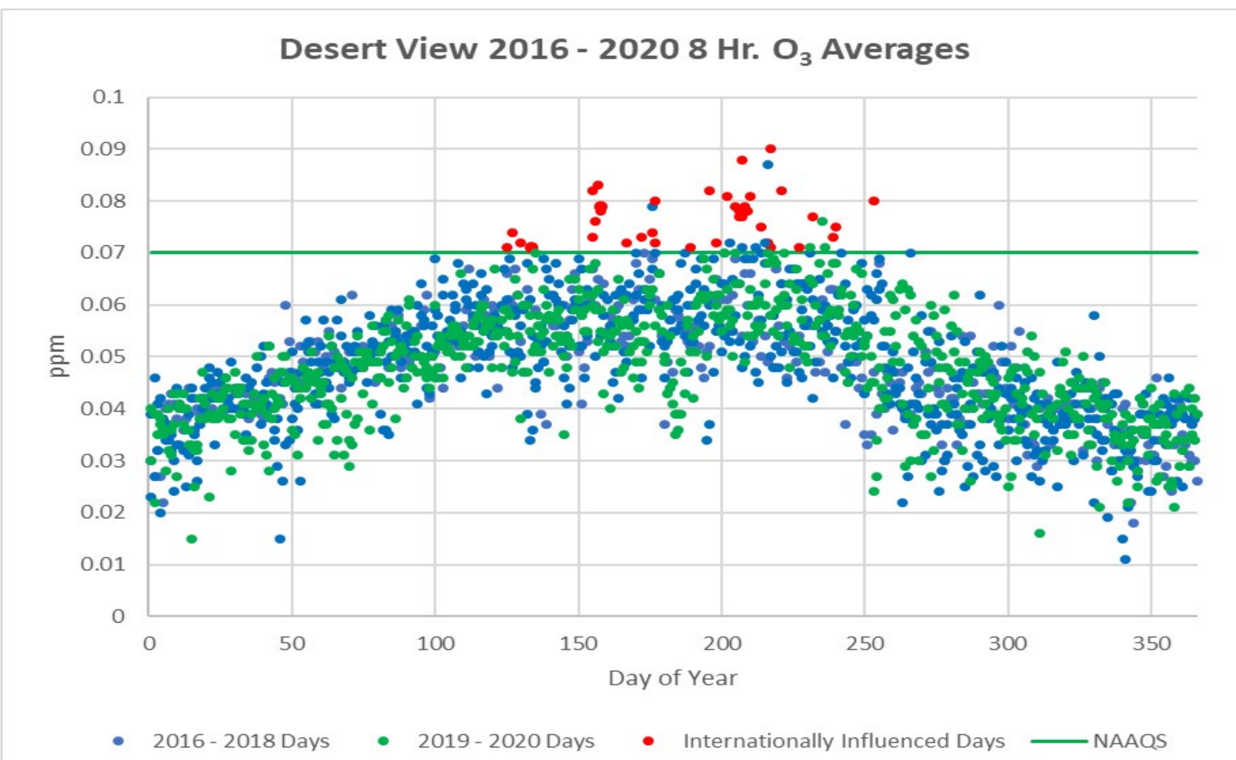

Figure 12 – Desert View monitoring site 2016-2020 8-hour O_3 averages. Peak O_3 season exceedances are through the months of May (125th day) and August (250th day). Note one exceedance day in September from 2016-2018.

2016	8-hr Ave O_3 (ppb)	2017	8-hr Ave O_3 (ppb)	2018	8-hr Ave O_3 (ppb)	2019	8-hr Ave O_3 (ppb)	2020	8-hr Ave O_3 (ppb)
Jun-6	79	Jun-6	83	Aug-4	87	Aug-5	90	Jul-25	88
May-13	71	Jun-7	78	Jun-4	82	Jul-15	82	Aug-8	82
----------	----------	Jun-5	76	Jul-21	81	Jul-27	79	Jun-25	80
----------	----------	Jun-4	73	Jul-29	81	Jul-25	77	Aug-19	77
----------	----------	Jun-26	72	Sep-10	80	Jul-26	77	Aug-22	76
----------	----------	Aug-4	72	Jun-25	79	Aug-27	73	Aug-1	75
----------	----------	----------	----------	Jul-24	79	Aug-15	71	Aug-27	75
----------	----------	----------	----------	Jul-25	78	Aug-19	71	May-6	74
----------	----------	----------	----------	Jul-28	78	----------	----------	Jun-24	74
----------	----------	----------	----------	Jun-21	73	----------	----------	May-9	72
----------	----------	----------	----------	Jul-17	72	----------	----------	Jun-15	72
----------	----------	----------	----------	Jul-22	72	----------	----------	Julu-7	71
----------	----------	----------	----------	Aug-3	72	----------	----------	Aug-23	71
----------	----------	----------	----------	May-5	71	----------	----------	----------	----------
----------	----------	----------	----------	Jul-26	71	----------	----------	----------	----------
----------	----------	----------	----------	Jul-31	71	----------	----------	----------	----------
----------	----------	----------	----------	Aug-5	71	----------	----------	----------	----------

Table 1 – Desert View monitoring site 2016-2020 8-hour average O_3 NAAQS exceedance dates and concentrations.

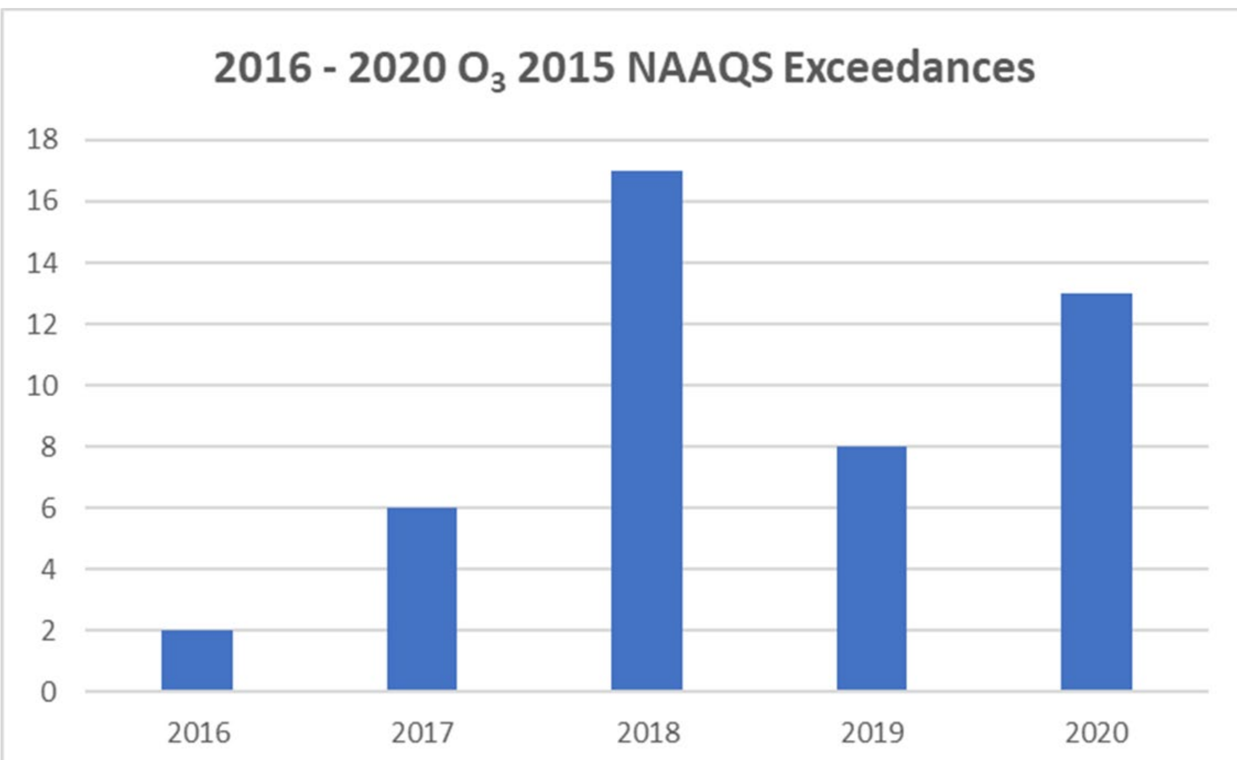

Figure 13 – Desert View monitoring site 2016-2020 O_3 2015 NAAQS Exceedances

Back-Trajectory Analysis

Ozone concentrations measured at the Desert View monitoring site may be attributed to: emissions generated from outside the U.S and transported across the international border; emissions generated locally within New Mexico and the SLP O_3 NAA; and emissions generated in the U.S. and transported across state lines. The SLP O_3 NAA is located less than 1 mile from the international border and sits directly adjacent to Ciudad Juárez. The three geological features of Sierra de Juárez, the Franklin Mountain Range, and Mount Cristo Rey facilitate the efficient production and transport of O_3 from Ciudad Juárez to the Desert View monitoring site on exceedance days with stable atmospheres over the PdN.

NMED used the National Oceanic and Atmospheric Administration's (NOAA) Hybrid Single-Particle Langrangian Integrated Trajectory (HYSPLiT) Model to determine how far and from where the air parcels originated, and subsequent pollutants, will travel. The back-trajectory HYSPLiT model was run for 72 hours using the North American Mesoscale Forecast System (NAMS) on the exceedance days and the corresponding number of non-exceedance days from 2019 through 2020 with starting heights of 100, 500, and 1000 meters above ground level. A total of eight trajectories were initiated every hour, starting at the last hour of the day which averaged the eight-hour peak concentration. Images were created showing the compilation of HYSPLiT back-trajectories for the non-exceedance days (Figure 14) and exceedance days (Figure 15). Comparing the two images indicates that during exceedance days air parcels travel through Ciudad Juárez consistently from the southeast direction during stable meteorological events.

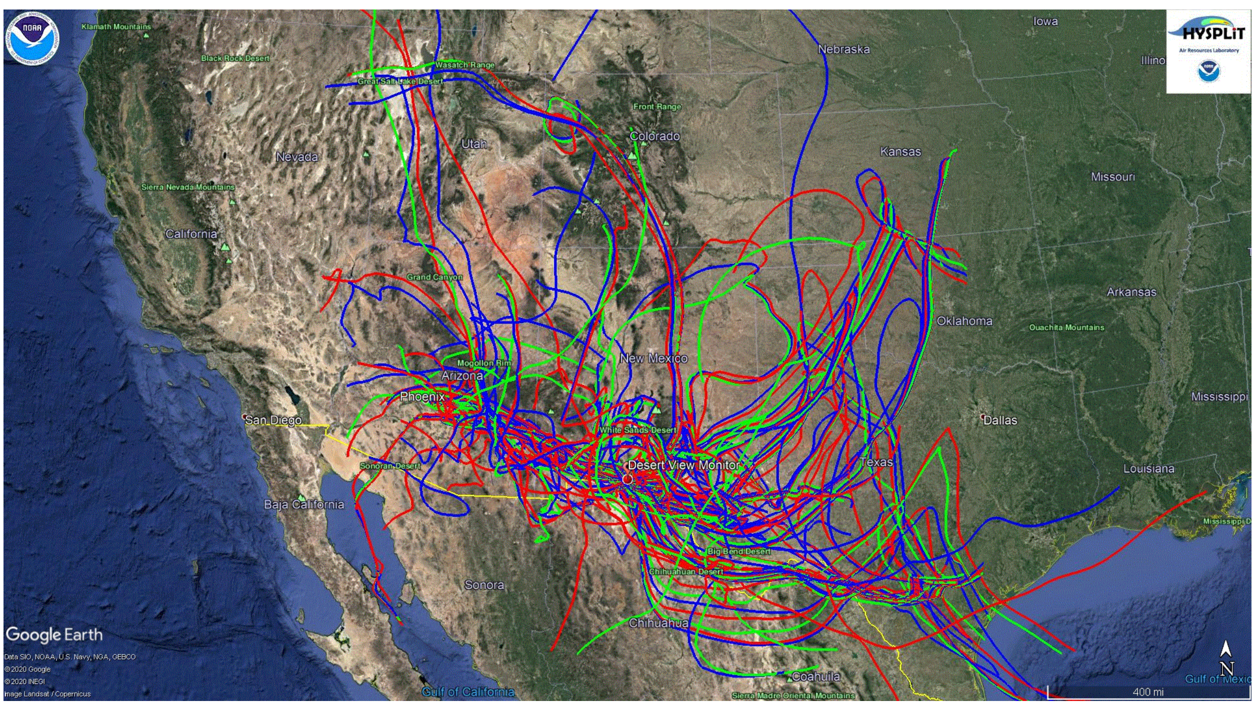

Figure 14 - The back-trajectories for the non-exceedance dates originate from many different sources within the United States with some air parcels travelling through the Ciudad Juárez metropolitan area.

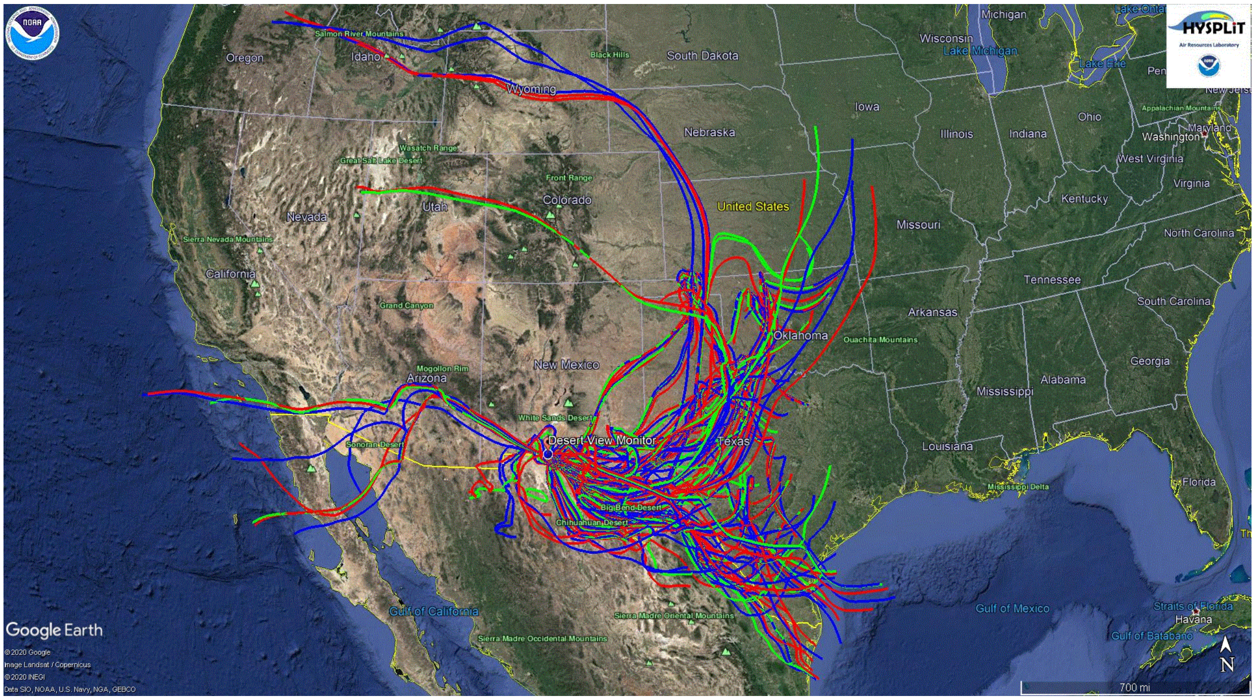

Figure 15 - Majority of the back-trajectories 2019-2020 exceedance days air parcels travel through the Ciudad Juárez metropolitan area in a consistent J pattern with many originating in the Midwestern United States or the Gulf of Mexico.

NMED conducted a HYSPLiT back-trajectory test to determine an adjusted design value that would result from excluding internationally influenced exceedance dates. Removing these dates from the data set affects the determination of the 4th annual maximum 8-hour average and the design value calculation for the Desert View monitoring site. For each exceedance date from 2016 to 2020, NMED reviewed the HYSPLiT back-trajectory to determine if 75% of the air parcels traveled through Ciudad Juárez airspace (Appendix A). When the results indicated more than 75% of the air parcels traveled through Ciudad Juárez airspace, NMED determined that O_3 maximum daily eight-hour average concentration was influenced by international emissions (Table 2).

2016	8-hr Ave O_3 (ppb)	2017	8-hr Ave O_3 (ppb)	2018	8-hr Ave O_3 (ppb)	2019	8-hr Ave O_3 (ppb)	2020	8-hr Ave O_3 (ppb)
Jun-6	79	Jun-6	83	Jun-4	82	Aug-5	90	Jul-25	88
May-13	71	Jun-7	78	Jul-21	81	Jul-15	82	Aug-8	82
------------	------------	Jun-5	76	Jul-29	81	Jul-27	79	Jun-25	80
------------	------------	Jun-4	73	Sep-10	80	Jul-25	77	Aug-19	77
------------	------------	Jun-26	72	Jul-24	79	Jul-26	77	Aug-1	75
------------	------------	Aug-4	72	Jul-25	78	Aug-27	73	Aug-27	75
------------	------------	-----------	-----------	Jul-28	78	Aug-15	71	May-6	74
------------	------------	-----------	-----------	Jun-21	73	-----------	-----------	Jun-24	74
------------	------------	-----------	-----------	Jul-17	72	-----------	-----------	May-9	72
------------	------------	-----------	-----------	May-5	71	-----------	-----------	Jun-15	72
------------	------------	-----------	-----------	Aug-5	71	-----------	-----------	Julu-7	71

Table 2 - Desert View Monitoring site 8-hour average O_3 concentrations greater than 70 ppb identified as influenced by international emissions.

The dates resulting in less than 75% of the air parcels that did not travel through Ciudad Juárez would remain on the list of exceedance dates to determine the adjusted 4th annual maximum 8-hour average to calculate the adjusted design value (Table 3). The results show that 80% of exceedances are attributable to international emissions. In the adjustment analysis only nine exceedances (46 originally) remain with six dates in 2018, one date in 2019 and two dates in 2020 included in the adjusted design value calculation.

2016	8-hr Ave O_3 (ppb)	2017	8-hr Ave O_3 (ppb)	2018	8-hr Ave O_3 (ppb)	2019	8-hr Ave O_3 (ppb)	2020	8-hr Ave O_3 (ppb)
Jun-21	70	Jun-19	70	**Aug-4**	**87**	**Aug-19**	**71**	**Aug-22**	**76**
Jul-19	70	Jul-6	70	**Jun-25**	**79**	May-15	70	**Aug-23**	**71**
Jun-24	69	May-30	69	**Jul-22**	**72**	Jul-24	70	Jul-19	70
Jul-23	69	Jul-12	69	**Aug-3**	**72**	Aug-4	70	Jun-4	68
-----------	-----------	-----------	-----------	**Jul-26**	**71**	-----------	-----------	-----------	-----------
-----------	-----------	-----------	-----------	**Jul-31**	**71**	-----------	-----------	-----------	-----------

Table 3 - Desert View Monitoring site 8-hour average O_3 concentrations after removing dates identified as influenced by international emissions. Bold values represent exceedances of the NAAQS on days that were not influenced by international emissions.

The results of this analysis show that the adjusted 4th annual maximum 8-hour average decreased each year ranging from 1 to 9 ppb from 2016 to 2020. The resultant adjusted design value dropped 8 ppb from 78 ppb to 70 ppb for the 2018 through 2020 design value (Table 4).

	2016	2017	2018	2019	2020
4th Max 8-hour Ave. (ppb)	70	73	81	77	77
Design Value (ppb)	--	--	74	77	78
Adjusted 4th Max8-hour Ave. (ppb)	69	69	72	70	68
Adjusted Design Value (ppb)	--	--	70	70	70

Table 4 – Adjusted 4th maximum 8-hour averages and design values for 2016-2020 at the Desert View monitoring site. Adjusted design values were calculated for the 2016-2018 through the 2018-2020 averaging periods only.

Comprehensive Emissions Analysis

Emission inventories were evaluated for Ciudad Juárez, El Paso County, Doña Ana County, and the SLP O_3 NAA. The Ciudad Juárez, El Paso and Doña Ana County emissions inventories were obtained from the EPA's Revised Cross-State Air Pollution Rule (CSAPR) Update (2016v1 North American Emissions Modeling Platform). The emissions were developed as part of the 2016 Platform Collaborative Project that included participation from EPA, Multi-State Jurisdictional Organizations (MJOs) and states. This process resulted in a common-use set of emissions data for a 2016 base year and 2023 and 2028 projection years that can be leveraged by EPA and states for regulatory air quality modeling. Development of the emission inventories for the modeling platform are described in detail by EPA in their Technical Support Document (EPA, 2020b). The SLP O_3 NAA emissions were estimated for 2017 as part of the baseline emissions inventory submitted in 2020 as part of the State Implementation Plan Revision. Biogenic emissions were not included to focus on the anthropogenic influence.

Ciudad Juárez NO_X was 40,049 tons per year (tpy), accounting for a 59% contribution to the PdN; VOC was 33,375 tpy, accounting for a 47% contribution to the PdN. El Paso County NO_X was 18,094 tpy, accounting for a 27% contribution to the PdN; VOC was 31,993 tpy, accounting for a 45% contribution to the PdN. Doña Ana County NO_X was 8,652 tpy, accounting for a 13% contribution to the PdN; VOC was 5,945 tpy, accounting for an 8% contribution to the PdN. The SLP O_3 NAA NO_X was 999 tpy, accounting for a 1.4% contribution to the PdN; the VOC was 280 tpy accounting for a 0.4% contribution to the PdN (Table -5). This comprehensive emissions analysis strengthens the "weight of evidence" that the Desert View monitoring site would be in attainment of the NAAQS but for emissions predominating from Ciudad Juárez.

Jurisdiction	**NOx (tpy)**	**Percent**	**VOC (tpy)**	**Percent**
Ciudad Juárez	40,049	59.1%	33,375	46.6%
El Paso County	18,094	26.7%	31,993	44.7%
Doña Ana County	*8,652	12.8%	*5,945	8.3%
Sunland Park O_3 NAA	999	1.4%	280	0.4%
Total	67,794	100%	71,593	100%

Table 5 – PdN comprehensive emissions analysis summary. *Note: SLP O_3 NAA emissions subtracted from Doña Ana County emissions to avoid double-counting.

Air Quality Modeling and Source Apportionment

NMED has focused resources on understanding O_3 formation in southern New Mexico since 2015, conducting two photochemical modeling studies that included the PdN airshed. These studies focus on determining the contribution from different source regions and categories to high O_3 levels in New Mexico. Although the studies used different platforms and emissions inputs, the results of these studies have consistently shown a significant international contribution to high O_3 levels in New Mexico.

NMED commissioned the Southern New Mexico Ozone Study (SNMOS) in 2016 to conduct photochemical modeling to help understand the causes of observed high O_3 concentrations in Doña Ana County in southern New Mexico. The SNMOS modeling used a 2011 Comprehensive Air-quality Model with extensions (CAMx) 36/12/4-km modeling platform with Weather Research and Forecasting (WRF). The SNMOS performed WRF meteorological and Sparse Matrix Operator Kernel Emissions (SMOKE) modeling to develop 2011 inputs for a 12/4 km domain centered on Doña Ana County. A CAMx 2011 base case and model performance evaluation was conducted. Emissions were projected to 2025 and CAMx 2025 future year modeling and O_3 design value projections were performed.

In addition, O_3 source apportionment (SA) modeling was conducted for the 2011 and 2025 emission scenarios to quantify the O_3 contributions due to source regions (i.e., U.S. states and Mexico) and source sectors (e.g., on-road mobile sources, electrical generating units, etc.) to O_3 concentrations in Doña Ana County and vicinity. The SA results showed design value contributions from Mexico at 7.6 in 2011 to 7.8 ppb in 2025 to the design value at the Desert View monitoring site (Figure 16). The results of the future year modeling showed the Desert

View monitoring site would attain the 70 ppb 2015 ozone NAAQS by 2025. Without the contributions from Mexico, the 2025 projected design value of 65.1 ppb would drop to 57.3 ppb. Other international emissions contributions (i.e., Asia and regions of Mexico outside of the 12/4-km grid) are included in the boundary conditions and are not included in the results for Mexico.

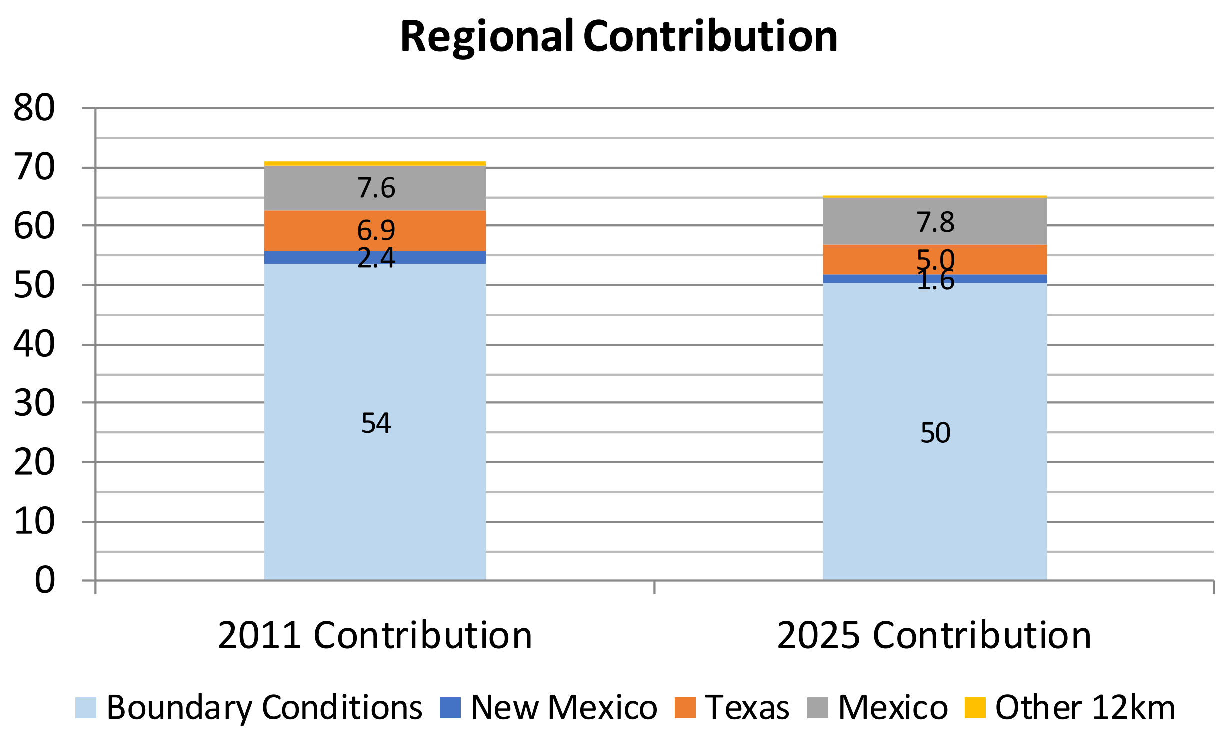

Figure 16 – Contributions in ppb by geographic regions (including Boundary Conditions) to the 2011 and 2025 O_3 Design Values at the Desert View monitoring site in Doña Ana County.

Modeled source contribution results indicated on-road mobile emissions from Texas and Mexico accounted for the highest contributions to the design value, followed by electric generating units from Mexico (Figure 17) (WRAP, 2016).

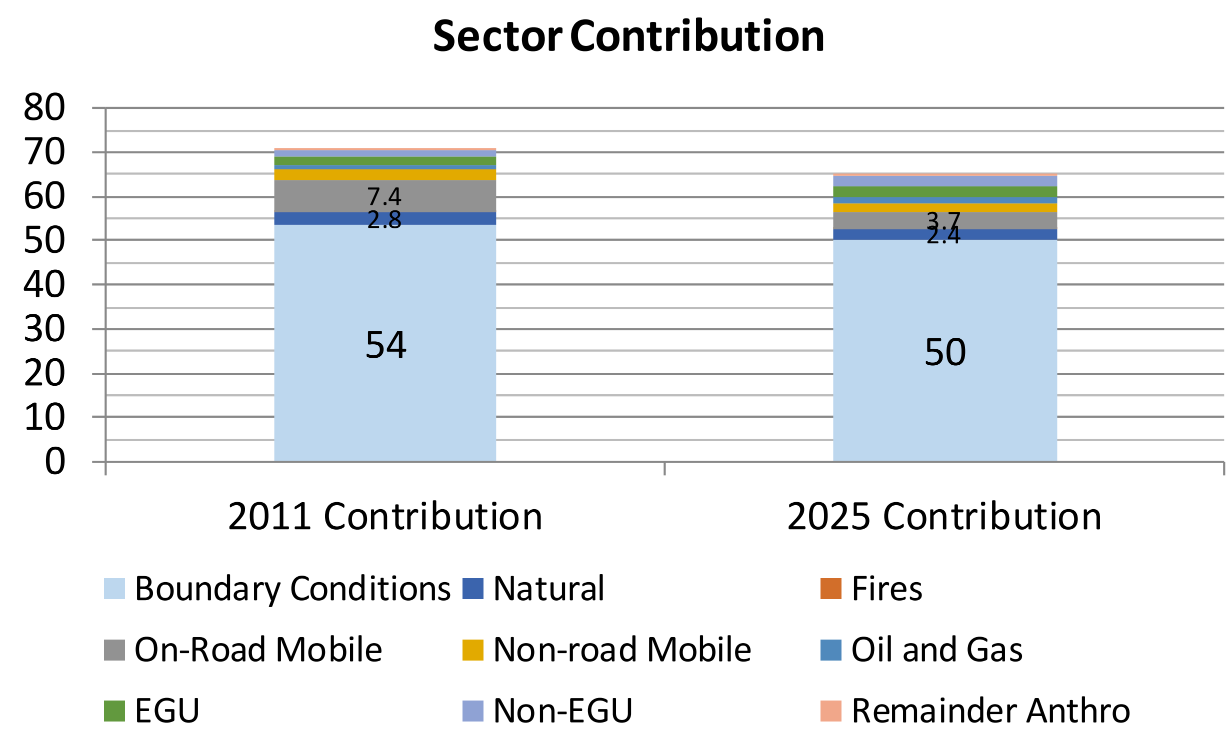

Figure 17 – SNMOS modeled O_3 source contributions by sector to the 2011 and 2025 O_3 Design Values at the Desert View Monitoring Site.

NMED contracted with the Western States Air Resources Council (WESTAR) in 2020 to develop a CAMx 2014 36/12/4-km ozone modeling platform. The study was undertaken as part of the Ozone Attainment Initiative (OAI) to support air quality rules for the Oil and Gas (O&G) sector in New Mexico and examine the cause of high ozone in Doña Ana, Sandoval and Valencia County. For this modeling the 4-km domain focused on New Mexico and adjacent states, whereas the SNMOS 4-km domain was centered on Doña Ana County. The CAMx 2014 36/12/4-km modeling platform was based on the Western Regional Air Partnership (WRAP), Western Air Quality Study (WAQS) CAMx 2014 36/12-km modeling platform. WRF meteorological modeling was conducted to generate CAMx meteorological inputs for the 36/12/4-km domains and summer of 2014. A model performance evaluation was conducted that compared CAMx 2014 estimated ozone concentrations with concurrent ozone observations that produced good ozone model performance. A revised CAMx 2014v2 base case was conducted with a newer version of the CAMx model and updated biogenic emissions that also produced very good ozone model performance. SMOKE emission and CAMx ozone modeling was conducted for a 2014v2 Base Case, a 2028 Base Case and a 2028 O&G Control Strategy that implemented O&G controls in New Mexico. The O&G sector is heavily concentrated in the San Juan (northwest) and Permian (southeast) Basins, with little to no O&G emissions in Doña Ana County.

Ozone source apportionment modeling was conducted to determine the contributions of Source Sectors within New Mexico to 2028 ozone concentrations and projected future year ozone design values (DVF) under the 2028 oil and gas (O&G) control strategy emissions scenario. The Software for Modeled Attainment Test (SMAT) tool was used to make 2028 ozone DVF projections in the NM OAI Study. The Anthropogenic Precursor Culpability Assessment (APCA) version of the CAMx ozone source apportionment tool was used and the modeling also obtained contributions from Colorado, Texas and the remainder of U.S. states as well as international anthropogenic emissions.

The 2028 ozone DVF and modeled MDA8 ozone concentrations were analyzed at the monitoring sites within the 4-km New Mexico domain. The daily CAMx 2028 Source Sector APCA ozone source apportionment modeling results were extracted at the locations of the New Mexico ozone monitoring sites in groups of 10 high ozone days, as well as averages across the 10 days. These 10 days include the 10 days used in the SMAT 2028 ozone DVF projections, as well as the modeled 2028 first and second highest group of 10 days.

The 2028 O&G Control Strategy Source Sector APCA ozone source apportionment modeling found that the highest contributing source region varied by location. International anthropogenic emissions contributed 13 to 26 ppb to the projected 2028 ozone DVFs at New Mexico sites, with larger international contributions at the southern New Mexico sites.

Ozone contributions for the 10 SMAT days at the Desert View monitor in Doña Ana County are shown in Figures 18 and 19. The BC from outside the 36-km North American domain is the largest contributor (45% on average), followed by in-domain international emissions (27%), Remainder US (14%) and Texas (8%). Emissions from New Mexico only contribute 4% of the total ozone averaged across the 10 SMAT days. As shown in Figure 18, the contributions from sources in New Mexico contributes from 1.3 to 4.4 ppb to the total MDA8 ozone on the 10 SMAT days, with an average contribution of 2.8 ppb. International anthropogenic emissions from the BC (5.8 ppb) and in-domain sources (13.0 ppb) contribute a combined 18.8 ppb (30%) of the average ozone across the 10 SMAT days at Desert View (Figure 19).

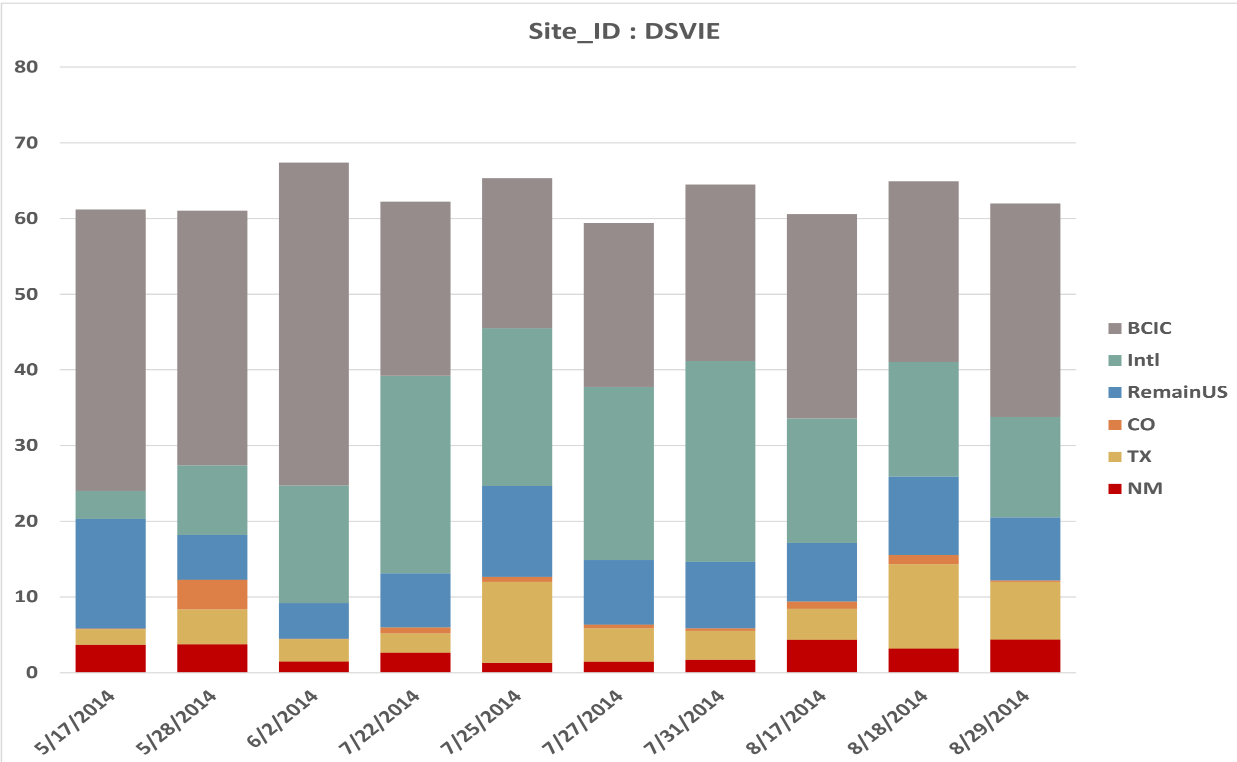

Figure 18 - Daily contributions (ppb) by geographic regions, including Boundary Conditions, on the 10 highest ozone days at the Desert View monitoring site.

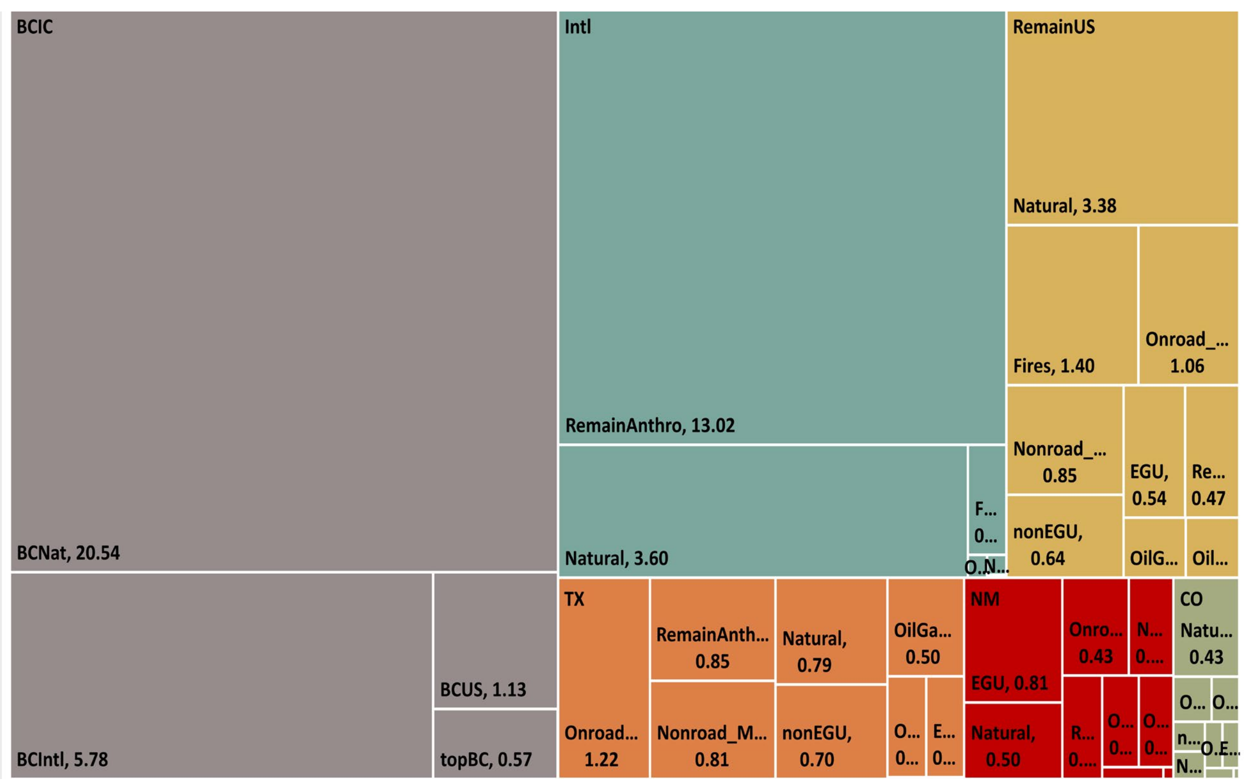

Figure 19 - Average contributions (ppb) by geographic regions and sectors, including Boundary Conditions, on the 10 highest ozone days at the Desert View monitoring site.

The SMAT ozone DVF projection tool was run on the CAMx 2028 O&G Control Strategy output with the contributions of international anthropogenic emissions removed. The ozone concentrations due to the BC_{Intl} and in-domain international emissions (i.e., Mexico, Canada and CMV_{Intl}) were removed from the CAMx 2028 O&G Control Strategy output and SMAT was run to obtain projected 2028 ozone DVFs without any contributions of international anthropogenic emissions. SMAT was run using three different current year ozone design values: $DVC_{2012-2016}$, $DVC_{2015-2019}$, and $DVC_{2017-2019}$ using the same procedures as used in the 2028 ozone DVF projection DVC sensitivity analysis. Table 6 displays the projected 2028 ozone DVFs for the 2028 O&G Control Strategy and 2028 no international anthropogenic emissions scenarios using the three sets of DVCs.

Base Years	DVC (ppb)	2028OGCS DVF (ppb)	2028INTL DVF (ppb)	2028 DVF Difference OGCS–INTL (ppb)
2012-2016	72.0	66.8	42.6	-24.2
2015-2019	74.3	68.9	43.9	-25.0
2017-2019	77.0	71.4	45.5	-25.9

Table 6 - Projected 2028 ozone DVFs for the 2028 O&G Control Strategy (2028 OGCS) and 2028 no international anthropogenic emissions (2028INTL) scenarios using the 2012-2016, 2015-2019, and 2017-2019 current year ozone DVC.

The elimination of the international anthropogenic emissions reduces the projected 2028 ozone DVFs by 24.2 to 25.9 ppb at the Desert View monitoring site. For all DVC scenarios, the projected 2028 ozone DVFs at Desert View are below the 2015 70 ppb ozone NAAQS when international anthropogenic emissions are removed. The highest projected 2028 ozone DVF under the no international anthropogenic emissions scenario is 45.5 ppb for the $DVC_{2017-2019}$ current year design value sensitivity scenario.

The two modeling studies described above did not perform a SA analysis for the 2021 attainment date for marginal nonattainment areas under the 2015 O_3 NAAQS. To account for this, NMED used the results of EPA's CSAPR Final Revised Update modeling to evaluate the projected international (i.e., Mexico) O_3 emissions contributions on the Desert View monitoring site's design value in 2021, as well as 2023 and 2028. The EPA used a 2016-based air quality modeling platform which includes emissions, meteorology and other inputs for 2016 as the base year for the modeling. The 2016 modeling platform including the projected 2023 and 2028 emissions were used to drive the 2016 base year and 2023 and 2028 base case air quality model simulations. Because projected emissions inventory data were not available for the 2021 analytic year at the time this modeling was conducted, EPA used the 2016-Centered measured O_3 design values coupled with 2023 model-predicted design values to estimate design values in 2021, based on linear interpolation between these two data points. To quantify O_3 contributions in 2021, EPA applied modeling-based contributions in 2023 to the 2021 O_3 design values. In addition, EPA modeled the 2028 base case emissions to project O_3 design values and contributions in that year. The methods for developing design values and contributions for 2021 are described in EPA's TSD for the CSAPR Update modeling (EPA, 2020c).

EPA used the observed 2016-Centered average design value of 72.7 ppb and centered maximum design value of 74 ppb to predict their projections and interpolation to 2021. Modeling results indicate that from 2021 to 2028, international contributions range from 16.65 to 15.46 ppb, with maximum design values ranging from 71.7 to 69.4 ppb (Table 7). Contributions from New Mexico are much lower, ranging from 2.22 to 2.65 ppb, in comparison. The remaining U.S. contributions range from 6.48 to 8.06 ppb, less than half of the international contribution. NMED assumes international emissions impacting the Desert View monitoring site are from Mexico based on its proximity of less than one mile to the international border. The disproportionate design value contributions modeled from New Mexico and the rest of the United States indicate that O_3 concentrations in the SLP O_3 NAA are significantly impacted by emissions from Mexico.

Year	NM Contributions (ppb)	US Contributions (ppb)	Mexico Contributions (ppb)	Average Design Value (ppb)	Maximum Design Value (ppb)
2021	2.65	8.06	16.65	70.4	71.7
2023	2.61	7.96	16.44	69.5	70.8
2028	2.22	6.48	15.46	68.2	69.4

Table -7 – US EPA CSAPR 2016 update modeled O_3 design value contributions to Desert View monitoring site.

Conclusion

Congress included section 179B in the 1990 CAA Amendments to acknowledge international transport of pollution to the U.S., especially in the areas near international borders. The Sunland Park, NM and El Paso, Texas areas serve as a premier exemplar of this with a well documented history of international emissions impacting air quality in the PdN airshed. This document provides a technical analysis to support a CAA 179B(b) demonstration showing that the SLP O_3 NAA would attain the standard "but for" the O_3 contributions from Ciudad Juárez, Mexico on the Desert View monitoring site's design value. The local meteorology, topography, and emissions sources that lead to O_3 formation provide a conceptual model for additional "weight of evidence" analyses in this demonstration to determine the influence of international O_3 production and transport within the PdN that contribute to the O_3 NAAQS exceedance days for the SLP O_3 NAA.

Additionally, analyses of monitoring data, HYSPLiT back trajectories, emissions inventories and photochemical modeling results provide support showing that international anthropogenic emissions meaningfully contributed to violations of the NAAQS in the SLP O_3 NAA. The adjusted design value determined by excluding internationally-influenced exceedances and the photochemical modeling results indicate that the SLP O_3 NAA would be in attainment of the NAAQS but for emissions from Mexico. The EPA's CSAPR Final Revised Update modeling indicates that Mexico contributions ranging from 16.65 to 15.46 ppb in 2021 and 2028, respectively. These are substantially larger contributions than the modeling shows from sources in New Mexico. Additionally, emissions from the SLP O_3 NAA account for a small fraction of the total emissions within the airshed. Taken as a whole, the evidence provided in this demonstration provides a strong and clear relationship between international emissions and violations of the NAAQS in the SLP O_3 NAA.

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