Exceptional Event Demonstration for Particulate Matter of 10 Microns or Less in Aerodynamic Diameter (PM_{10}) for January 16, 2021; June 21, 2021; and December 6, 2021

Texas Commission on Environmental Quality
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CHAPTER 1: INTRODUCTION

Exceptional events are unusual or naturally occurring events that affect air quality and are not reasonably controllable or preventable. An exceptional event may also be caused by human activity that is unlikely to recur at a particular location. Under Section 319 of the federal Clean Air Act (FCAA), states are responsible for identifying air quality monitoring data affected by an exceptional event and requesting the United States Environmental Protection Agency (EPA) exclude the data from consideration when determining whether an area is in attainment or nonattainment of a National Ambient Air Quality Standard (NAAQS). The EPA has promulgated an exceptional event rule, 40 Code of Federal Regulations (CFR) §50.14, as well as guidance to implement the requirements of the FCAA regarding exceptional events. States are required to identify air quality monitoring data potentially affected by exceptional events by flagging the data submitted into the EPA Air Quality System (AQS) database. If the EPA concurs with this demonstration, the flagged data will not be eligible for consideration when making NAAQS compliance determinations.

This document discusses the Texas Commission on Environmental Quality (TCEQ) proposed exceptional event day flags for particulate matter of 10 microns or less in aerodynamic diameter (PM_{10}), occurring on January 16, 2021; June 21, 2021; and December 6, 2021 as listed in Appendix A: *Proposed PM_{10} Exceptional Event Flags and Initial Notification*. The measured PM_{10} concentrations on these dates were not reasonably controllable or preventable, were associated with natural events due to international or domestically transported dust associated with high winds, and were in excess of normal historical fluctuations. The proposed exceptional event flags are for daily average measurements from the Federal Reference Method (FRM) PM_{10} monitors on January 16, 2021 for the Lang (C408), Houston Monroe (C406), and Dona Park (C199) monitors; on June 21, 2021 for the Socorro Hueco (C49) and Riverside/El Paso Mimosa (C9996) monitors; and on December 6, 2021 for the Ivanhoe (C414) monitor.

The data being requested for exclusion have regulatory significance and affect the regulatory determination of the counties in which the monitors are located. The Lang (C408) and Houston Monroe (C406) monitors are located within Harris County, and the Socorro Hueco (C49), Riverside/El Paso Mimosa (C9996), and Ivanhoe (C414) monitors are located within El Paso County. The Riverside/El Paso Mimosa (C9996) monitor and the Ivanhoe (C414) monitor fall within the area in El Paso County officially designated as nonattainment by the EPA for the 1987 PM_{10} NAAQS. The remaining monitors referenced are not located within areas officially designated as nonattainment by the EPA for the 1987 PM_{10} NAAQS.

The locations of Harris County PM_{10} and particulate matter of 2.5 microns or less in aerodynamic diameter ($PM_{2.5}$) monitoring sites, are shown in Figure 1-1: *Harris County PM_{10} Monitoring Sites* and Figure 1-2: *Harris County $PM_{2.5}$ Monitoring Sites*. Nueces County PM_{10} monitoring site locations are presented in Figure 1-3: *Nueces County PM_{10} Monitoring Sites,* and Nueces County $PM_{2.5}$ monitoring site locations are presented in Figure 1-4: *Nueces County $PM_{2.5}$ Monitoring Sites.* Similarly, El Paso County PM_{10} and $PM_{2.5}$ monitoring sites are respectively presented in in Figure 1-5: *El Paso County PM_{10} Monitoring Sites* and Figure 1-6: *El Paso County $PM_{2.5}$ Monitoring Sites.*

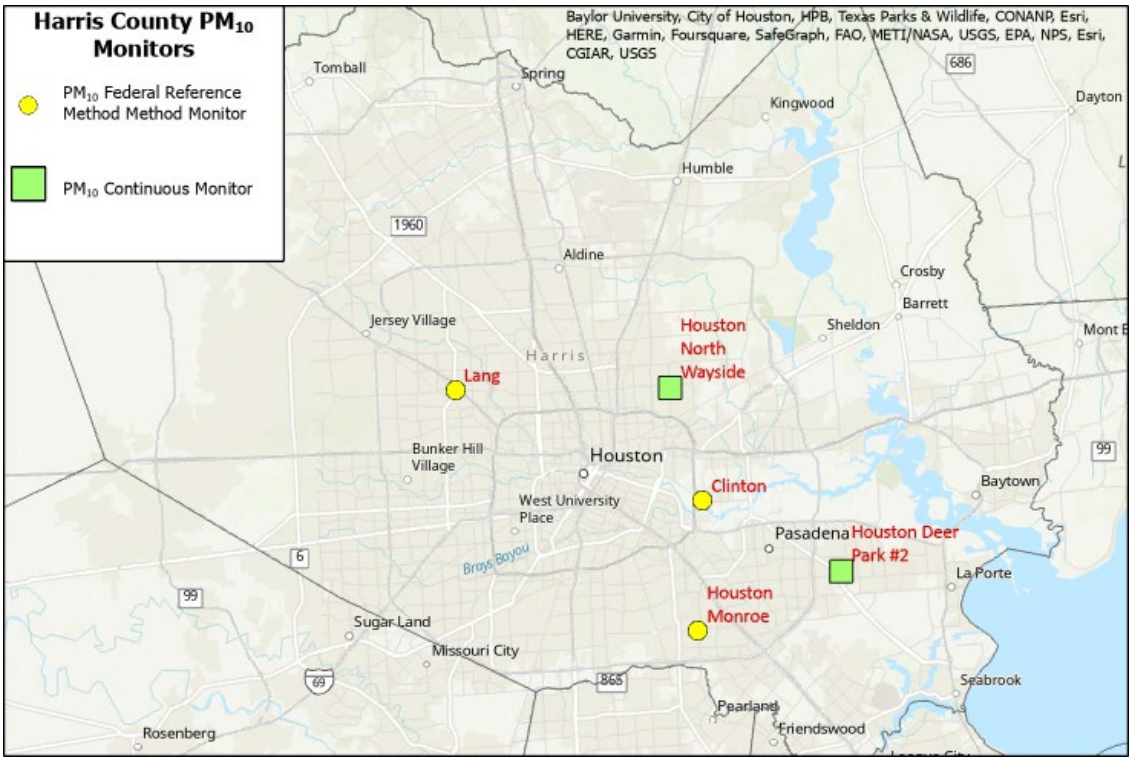

Figure 1-1: Harris County PM_{10} Monitoring Sites

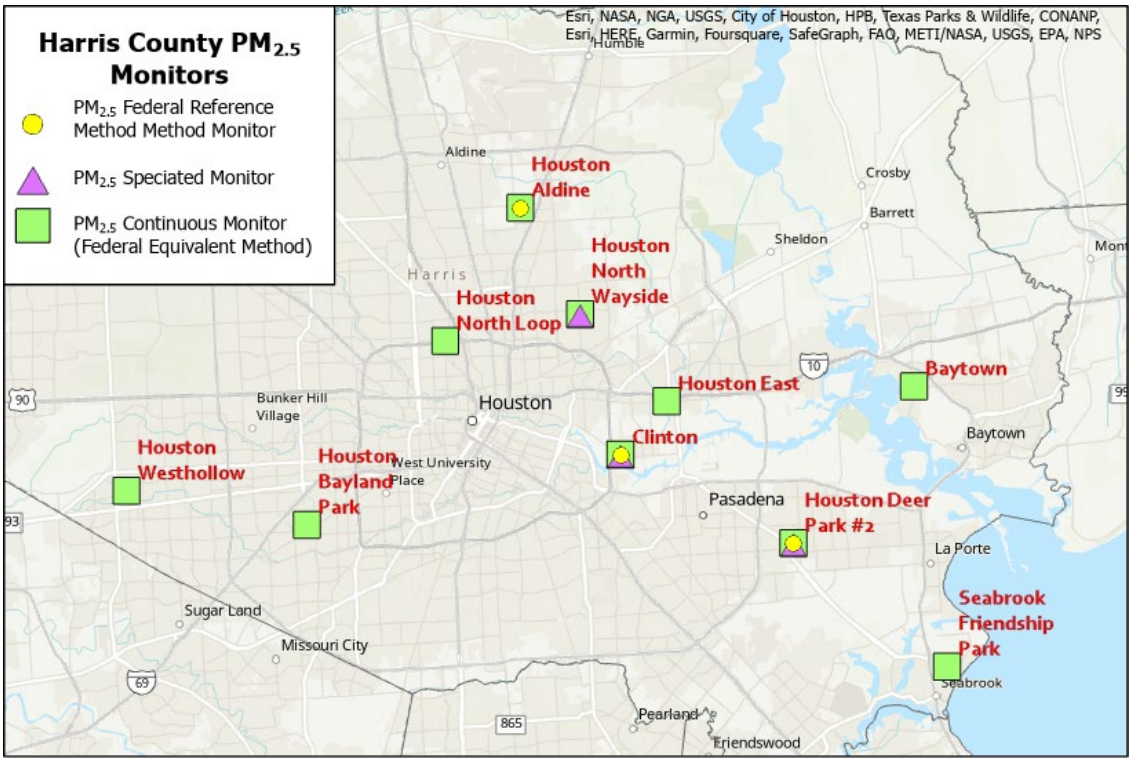

Figure 1-2: Harris County $PM_{2.5}$ Monitoring Sites

Figure 1-3: Nueces County PM_{10} Monitoring Sites

Figure 1-4: Nueces County $PM_{2.5}$ Monitoring Sites

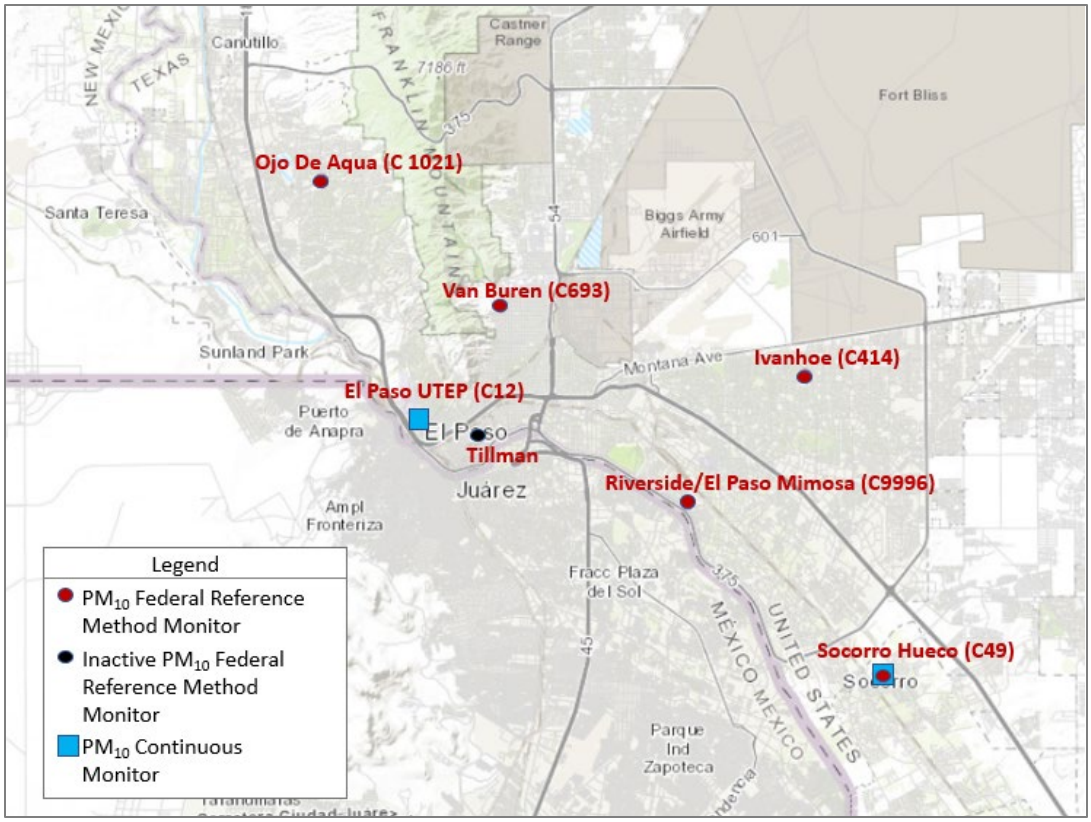

Figure 1-5: El Paso County PM_{10} Monitoring Sites

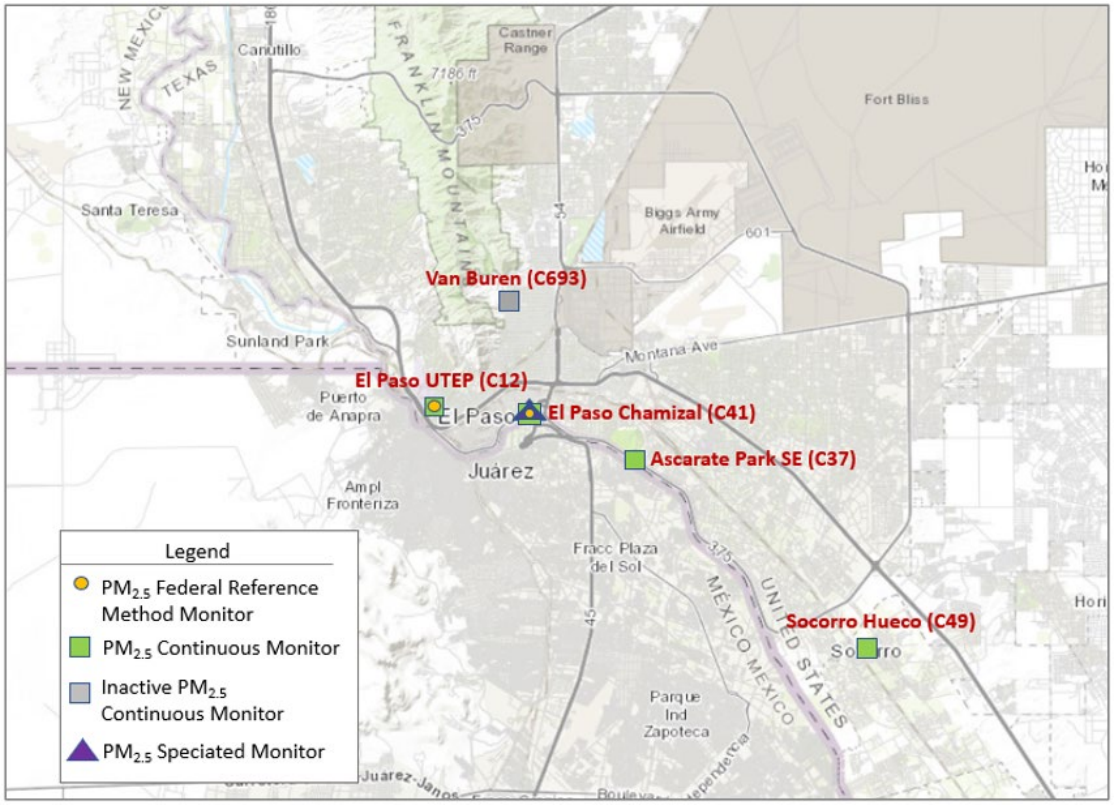

Figure 1-6: El Paso County $PM_{2.5}$ Monitoring Sites

With this demonstration, the TCEQ is providing detailed evidence to support concurrence by the EPA for the PM_{10} exceptional event flags shown in Table A-1: *Proposed 2021 PM_{10} Exceptional Event Flags* of Appendix A: *Proposed PM_{10} Exceptional Event Flags and Initial Notification*. This document will be posted on the TCEQ's Exceptional Event Demonstrations for Particulate Matter website at https://www.tceq.texas.gov/airquality/monops/pm_flags.html for a 30-day public comment period. Comments received will be addressed and submitted to the EPA for consideration.

1.1 EXCEPTIONAL EVENT DEFINITION AND CRITERIA

An exceptional event is defined in 40 CFR §50.1(j) as "an event(s) and its resulting emissions that affect air quality in such a way that there exists a clear causal relationship between the specific event(s) and the monitored exceedance(s) or violation(s), is not reasonably controllable or preventable, is an event(s) caused by human activity that is unlikely to recur at a particular location or a natural event(s), and is determined by the [EPA] Administrator in accordance with 40 CFR 50.14 to be an exceptional event.…" Furthermore, 40 CFR §50.14(c)(3)(iv) states that the demonstration to justify data exclusion shall include:

1. a narrative conceptual model that describes the event(s) causing the exceedance or violation and a discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s);
2. a demonstration that the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation;
3. analyses comparing the claimed event-influenced concentration(s) to concentrations at the same monitoring site at other times;
4. a demonstration that the event was both not reasonably controllable and not reasonably preventable; and
5. a demonstration that the event was a human activity that is unlikely to recur at a particular location or was a natural event.

Additionally, 40 CFR §50.14(c)(3)(v) requires that the state must:

6. document that the state followed the public comment process and that the comment period was open for a minimum of 30 days;
7. submit the public comments it received along with its demonstration to the Administrator; and
8. address in the submission to the Administrator those comments disputing or contradicting factual evidence provided in the demonstration.

These eight requirements must all be satisfied for data to be excluded from regulatory decisions as an exceptional event. Requirements one through five will be addressed individually in this demonstration document, and documentation for requirements six through eight will be provided as an addendum upon final submittal to the EPA.

Mitigation of exceptional events is also required by 40 CFR §51.930, which provides:

A State requesting to exclude air quality data due to exceptional events must take appropriate and reasonable actions to protect public health from exceedances or violations of the national ambient air quality standards. At a minimum, the State must:

- provide for prompt public notification whenever air quality concentrations exceed or are expected to exceed an applicable ambient air quality standard;
- provide for public education concerning actions that individuals may take to reduce exposures to unhealthy levels of air quality during and following an exceptional event; and
- provide for the implementation of appropriate measures to protect public health from exceedances or violations of ambient air quality standards caused by exceptional events.

These requirements will be addressed in Chapter 6: *Mitigation of Exceptional Events* in this demonstration.

1.2 SUMMARY OF APPROACH

The TCEQ used several methods for evaluating whether the high PM_{10} measurements in question qualify as exceptional events. Analyses performed by the TCEQ included:

- evaluating historical trends in PM_{10} and $PM_{2.5}$ data from long-term FRM monitoring sites for a period of over 10 years;
- identifying dust contributions in observed $PM_{2.5}$ concentrations using $PM_{2.5}$ speciation data from Chemical Speciation Network (CSN) monitors where available; and
- tracking blowing dust from source areas using backward-in-time air trajectories.

1.2.1 Data and Imagery Used

For the analyses presented in this document, the TCEQ used monitoring data, satellite imagery, and backward-in-time air trajectory information. The particulate data are presented in micrograms per cubic meter ($\mu g/m^3$). Regulatory PM_{10} data are in standard conditions (SC), which are adjusted to a standard temperature of 25 degrees centigrade and atmospheric pressure of 760 millimeters of mercury, and $PM_{2.5}$ data are in local conditions of temperature and pressure measured at the monitor. These parameters, for PM_{10} and $PM_{2.5}$ respectively, are required for reporting to the EPA's AQS database.

As detailed in Table 1-1: *Harris County PM_{10} and $PM_{2.5}$ Sampler Types*, Table 1-2 *Nueces County PM_{10} and $PM_{2.5}$ Sampler Types*, and Table 1-3: *El Paso County PM_{10} and $PM_{2.5}$ Sampler Types* the monitoring data include FRM non-continuous PM_{10} and $PM_{2.5}$ daily measurements, non-continuous $PM_{2.5}$ speciated daily measurements, and continuous PM_{10} and $PM_{2.5}$ measurements used for daily reporting of the EPA Air Quality Index (AQI). All the data are available in the EPA's AQS database (EPA1, 2021) except for continuous PM_{10} monitors, which are not reported as these data are not collected using a method approved for reporting to the EPA's AQS database. These results are for reference purposes only and used to provide additional data collected on an hourly

basis to supplement data from 24-hour samples used for submittal to the EPA for regulatory purposes.

Table 1-1: Harris County PM_{10} and $PM_{2.5}$ Sampler Types

Site Name	AQS Site Identifier	AQS Parameter Identifier	POC	Sampler Type
Houston East (C37)	482011034	88101	1	$PM_{2.5}$ continuous
Houston Aldine (C41)	482010024	88101	4	$PM_{2.5}$ continuous
Houston Aldine (C41)	482010024	88101	5	$PM_{2.5}$ FRM non-continuous
Houston Deer Park #2 (C12)	482011039	88101	8	$PM_{2.5}$ FRM non-continuous
Houston Deer Park #2 (C12)	482011039	Multiple	6	$PM_{2.5}$ non-continuous speciated
Houston Deer Park #2 (C12)	482011039	Multiple	7	$PM_{2.5}$ non-continuous speciated
Houston Deer Park #2 (C12)	482011039	81102	4	PM_{10} continuous
Houston Deer Park #2 (C12)	482011039	85101	4	PM_{10} (Local Conditions)
Houston Deer Park #2 (C12)	482011039	86101	4	$PM_{10 - 2.5}$ continuous)
Houston Bayland Park (C414)	482011050	88101	1	$PM_{2.5}$ continuous
Baytown (C148)	482010058	88101	2	$PM_{2.5}$ continuous
Clinton (C55)	482011035	88101	1	$PM_{2.5}$ FRM non-continuous
Clinton (C55)	482011035	88101	2	$PM_{2.5}$ FRM non-continuous
Clinton (C55)	482011035	81102	1	PM_{10} FRM non-continuous
Clinton (C55)	482011035	81102	2	PM_{10} FRM non-continuous
Clinton (C55)	482011035	Multiple	4	$PM_{2.5}$ non-continuous speciated
Clinton (C55)	482011035	88502	3	$PM_{2.5}$ continuous
Houston North Wayside (C405)	482010046	88101	1	$PM_{2.5}$ continuous
Houston North Wayside (C405)	482010046	81102	2	PM_{10} continuous
Houston North Wayside (C405)	482010046	Multiple	4	$PM_{2.5}$ non-continuous speciated
Houston Westhollow (C410)	482010066	88101	1	$PM_{2.5}$ continuous
Seabrook Friendship Park (C45)	482011050	88101	1	$PM_{2.5}$ continuous
Houston North Loop (C1052)	482011052	88101	2	$PM_{2.5}$ continuous
Houston Monroe (C406)	482010062	81102	1	PM_{10} FRM non-continuous
Lang (C408)	482010047	81102	1	PM_{10} FRM non-continuous

Abbreviations:
AQS EPA's air quality system database
POC AQS parameter occurrence code to differentiate collocated monitors.
FRM Federal Reference Method

Table 1-2: Nueces County PM_{10} and $PM_{2.5}$ Sampler Types

Site Name	AQS Site Identifier	AQS Parameter Identifier	POC	Sampler Type
Corpus Christi Huisache (C37)	483550032	88101	3	$PM_{2.5}$ continuous
Corpus Christi Huisache (C37)	483550032	88101	4	$PM_{2.5}$ continuous
National Seashore (C41)	482730314	88101	1	$PM_{2.5}$ continuous
Dona Park	483550034	88101	1	$PM_{2.5}$ continuous
Dona Park	483550034	Multiple	4	$PM_{2.5}$ non-continuous speciated
Dona Park	483550034	81102	1	PM_{10} FRM non-continuous

Abbreviations:
AQS EPA's air quality system database
POC AQS parameter occurrence code to differentiate collocated monitors.
FRM Federal Reference Method

Table 1-3: El Paso County PM_{10} and $PM_{2.5}$ Sampler Types

Site Name	AQS Site Identifier	AQS Parameter Identifier	POC	Sampler Type
Ascarate Park SE (C37)	481410055	88502	3	$PM_{2.5}$ continuous
El Paso Chamizal (C41)	481410044	88101	1	$PM_{2.5}$ FRM non-continuous
El Paso Chamizal (C41)	481410044	88502	5	$PM_{2.5}$ non-continuous speciated
El Paso Chamizal (C41)	481410044	86101		$PM_{10-2.5}$ continuous
El Paso Chamizal (C41)	481410044	81102		PM_{10} continuous
El Paso UTEP (C12)	481410037	81102	4	PM_{10} continuous
El Paso UTEP (C12)	481410037	88101	1	$PM_{2.5}$ FRM non-continuous
El Paso UTEP (C12)	481410037	88502	3	$PM_{2.5}$ continuous
Ivanhoe (C414)	481410029	81102	1	PM_{10} FRM non-continuous
Ojo De Agua	481411021	81102	1	PM_{10} FRM non-continuous
Ojo De Agua	481411021	81102	2	PM_{10} FRM non-continuous
Riverside/El Paso Mimosa (C9996)	481410038	81102	1	PM_{10} FRM non-continuous
Socorro Hueco (C49)	481410057	81102	1	PM_{10} FRM non-continuous
Socorro Hueco (C49)	481410057	81102	2	PM_{10} FRM non-continuous
Socorro Hueco (C49)	481410057	81102	4	PM_{10} continuous
Socorro Hueco (C49)	481410057	88502	3	$PM_{2.5}$ continuous
Van Buren (C693)	481410693	81102	1	PM_{10} FRM non-continuous
Van Buren (C693)*	481410693	88502	1	$PM_{2.5}$ continuous
Tillman (C413)**	481410002	81102	2	PM_{10} FRM non-continuous

Notes:
*Last recorded data in 2017
**Last recorded data in 2013
Abbreviations:
AQS EPA's air quality system database
POC AQS parameter occurrence code to differentiate collocated monitors.
FRM Federal Reference Method

Air parcel trajectories that will be presented in this demonstration were produced using the National Oceanic and Atmospheric Administration (NOAA) Applied Research Laboratory (ARL) HYSPLIT model available on the ARL HYSPLIT webpage (http://www.arl.noaa.gov/hysplit/) (NOAA ARL, 2021). HYSPLIT models simulate the dispersion and trajectory of substances transported and dispersed through the atmosphere over local to global scales. The backward trajectory analyses presented in this document were used to determine the origin of air masses and establish source-receptor relationships. These trajectories show the modeled path of the air mass, arriving at hours chosen based on relevance to the event, at a chosen point relevant to the study. Times are most frequently listed in local time, but from some sources time is listed in Coordinated Universal Time (UTC). Specifically, there are images presented in this demonstration that were obtained from sources that list the time in UTC. To preserve the images in their original form, the time was not altered.

1.2.2 Analysis

Multiple types of information were used in evaluating whether the proposed events qualify as exceptional events. Information evaluated included time series plots to show trends and events, comparison of data on the dates of the proposed exceptional events to statistical percentiles to show relevance, and review of backward-in-time air trajectories for independent confirmation of transport path of the affected air. In addition, daily averages of hourly PM_{10} and $PM_{2.5}$ continuous data were compiled. Interagency Monitoring of Protected Visual Environments (IMPROVE) calculated particulate matter components (IMPROVE, 2021) (Eldred, 2003) were calculated, when data were available, from $PM_{2.5}$ CSN speciation data to confirm the predominance of the soil component in high-wind blowing dust events. The usage of continuous and speciation data assist to confirm that the PM_{10} concentrations recorded on proposed exceptional event days were outside of normal historical fluctuations.

The TCEQ also used monitoring data from days with similar wind data as that recorded on proposed exceptional event days to compare data from proposed exceptional event days to days with similar wind conditions where elevated concentrations of PM_{10} were not recorded. Surrogate days were selected based on daily wind speed and direction comparable to proposed exceptional event days.

1.3 SUMMARY OF FINDINGS

Information provided in this demonstration supports the conclusion that the high PM_{10} daily average measurements recorded in 2021 qualify as exceptional events. The measured PM_{10} concentrations on January 16, 2021, June 21, 2021, and December 6, 2021 were not reasonably controllable or preventable, were associated with a natural event due to transported dust associated with high winds, and were in excess of normal historical fluctuations. The TCEQ requests the EPA's concurrence on these proposed exceptional events and to have the flagged days removed from consideration when making compliance determinations for the 24-hour PM_{10} NAAQS.

1.4 PRESENTATION OF FINDINGS

Information specific to each event day is respectively presented in:

- Appendix B: *Event Analysis for January 16, 2021*;
- Appendix C: *Event Analysis for June 21, 2021*; and
- Appendix D: *Event Analysis for December 6, 2021*.

CHAPTER 2: NARRATIVE CONCEPTUAL MODEL OF EVENTS

2.1 CLIMATE

The proposed exceptional events covered in this demonstration occurred in El Paso County, Harris County, and Nueces County. Climate details from each of these counties are presented in the following sections.

2.1.1 Harris County Climate

Harris County has hot summers and cool winters. The area is humid and typically partly cloudy year-round. Over the course of the year, the temperature generally varies from 47˚ Fahrenheit (F) to 95˚F and is rarely below 35˚F or above 100˚F.

Precipitation data from Houston, the largest city in Harris County, from 2000 to 2021, are shown in Figure 2-1: *Annual Precipitation Measured at William P. Hobby Airport (HOU)*

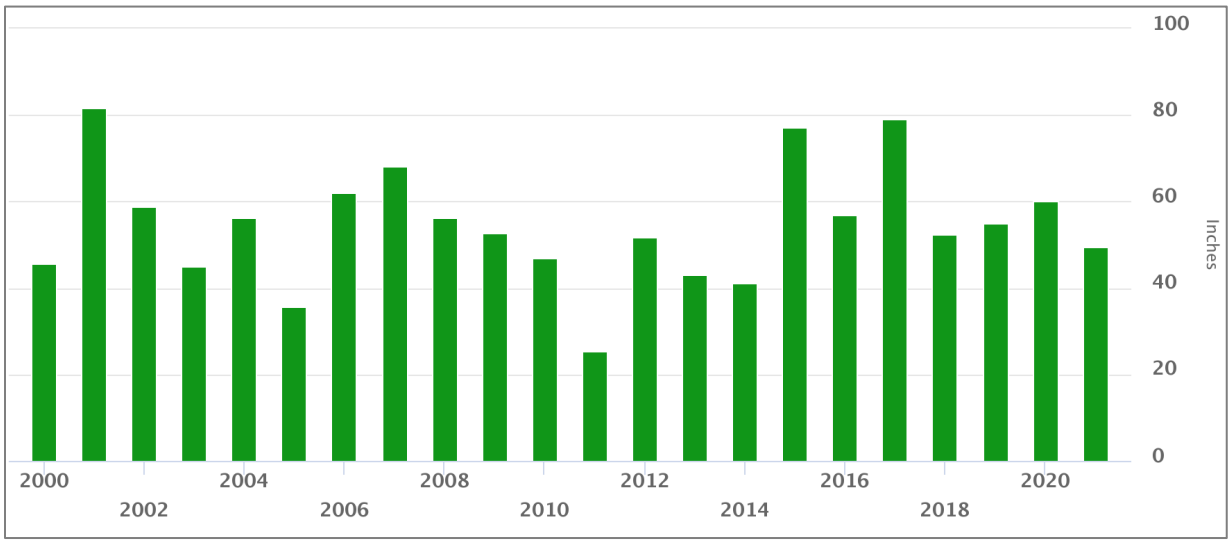

Figure 2-1: Annual Precipitation Measured at William P. Hobby Airport (HOU) from 2000 through 2021

Unlike portions of western Texas such as El Paso County, Harris County is not part of a desert environment and naturally occurring PM_{10} sources are not prevalent.

2.1.2 Nueces County Climate

Nueces County has hot summers and winters that are typically short, cool, and windy. It is partly cloudy year-round, and throughout the year, the temperature typically varies from 50˚F to 94˚F and is rarely below 37˚F or above 97˚F.

Precipitation data from Corpus Christi are presented in Figure 2-2: *Annual Precipitation Measured at Corpus Christi International Airport (CRP) from 2000 through 2021*

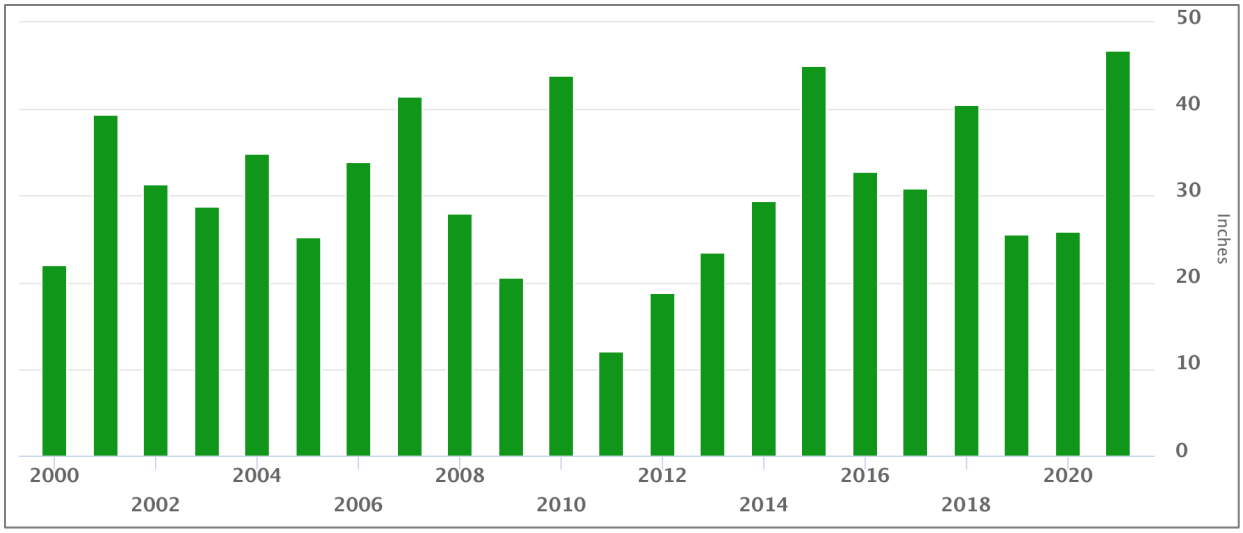

Figure 2-2: Annual Precipitation Measured at Corpus Christi International Airport (CRP) from 2000 through 2021

Similar to Harris County, Nueces County is not part of a desert environment and naturally occurring PM_{10} sources are not prevalent.

2.1.3 El Paso County Climate

El Paso County has hot summers and short, cold winters. The area is dry and mostly clear year-round. Over the course of the year, the temperature typically varies from 34 degrees Fahrenheit (˚F) to 97˚F and is rarely below 24˚F or above 104˚F.

Much of the western portion of Texas, including El Paso County, is part of the Chihuahuan Desert that extends into Arizona, New Mexico, and the Mexican state of Chihuahua. Rainfall in this area is highly variable from year to year with an average of 8.90 inches per year measured at the National Weather Service (NWS) weather station at the El Paso International Airport (KELP) from 2000 through 2021. Precipitation information is shown in Figure 2-3: *Annual Precipitation Measured at El Paso International Airport from 2000 through 2021*.

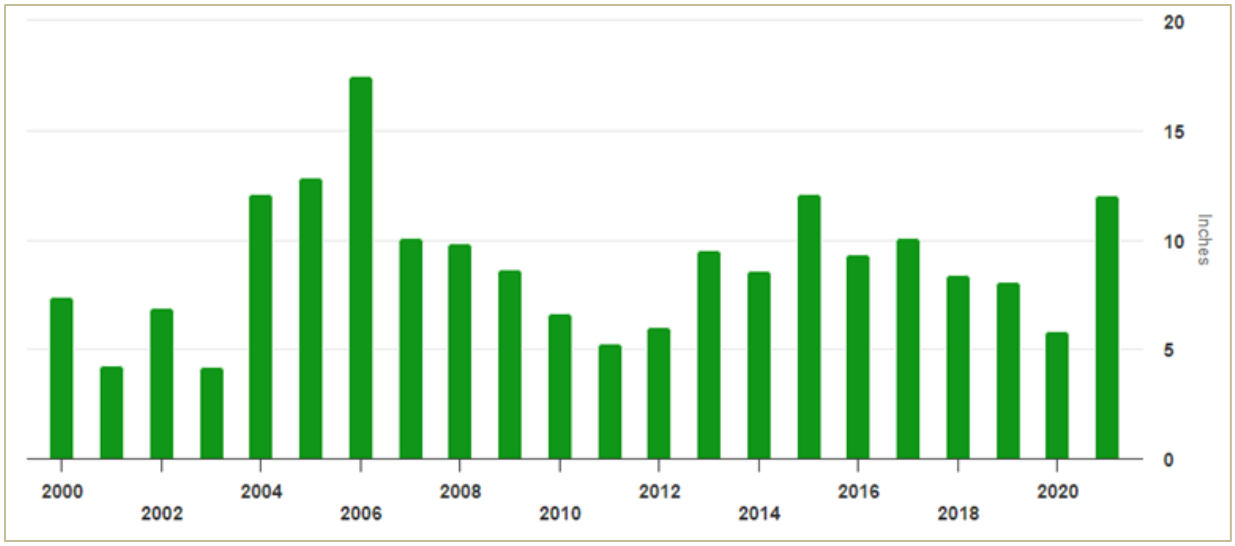

Figure 2-3: Annual Precipitation Measured at El Paso International Airport from 2000 through 2021

A large portion of this scarcely vegetated desert contains dried lakebeds and playas made of loose, fine soils. These soils can easily be picked up and remain in the air by moderate to high wind gusts of 30 miles per hour (mph) or greater (TCEQ1, 2007). The overall frequency and intensity of these dust storms is highly dependent on weather conditions and existing moisture content of the soils. Because similar meteorological trends are expected to continue, it is likely that similar dust storms will continue to occur in future years.

2.2 PARTICULATE MATTER AIR QUALITY TRENDS

Trends in particulate matter of 10 microns or less in aerodynamic diameter (PM_{10}) annual maximum 24-hour averages show variability year to year. This variability is influenced by multiple factors, including dust events coinciding with sampling days such as that which occurred on January 16, 2021, June 21, 2021, and December 6, 2021. Trends from each of the three counties represented in this demonstration are presented in the following sections.

2.2.1 Harris County Particulate Matter Trends

PM_{10} trends from FRM monitors currently in operation or previously in operation for a long period in Harris County dating from 2006 through 2021 are presented in Figure 2-4: *Harris County PM_{10} Annual Maximum 24-hour Averages for FRM Monitoring Sites, Including Exceptional Event Days*. Proposed exceptional event days at any monitor are included in Figure 2-4 to show the entire range of values from 2006 through 2021. With the exception of a few outliers at the Clinton site in 2006 and 2007, maximum 24-hour PM_{10} concentrations have been relatively consistent at monitors in Harris County. Values in 2021, due to the proposed exceptional event day of January 16, 2021, are greater than most previous years. The following data gaps are displayed in Figure 2-4:

- The Pasadena HL&P PM_{10} FRM monitor was deactivated effective December 26, 2016.
- The Houston Aldine PM_{10} FRM monitor was deactivated effective October 29, 2018.
- The Houston Deer Park #2 FRM monitor was deactivated effective October 29, 2018.

- The Houston Westhollow PM_{10} FRM monitor was deactivated effective December 29, 2020.

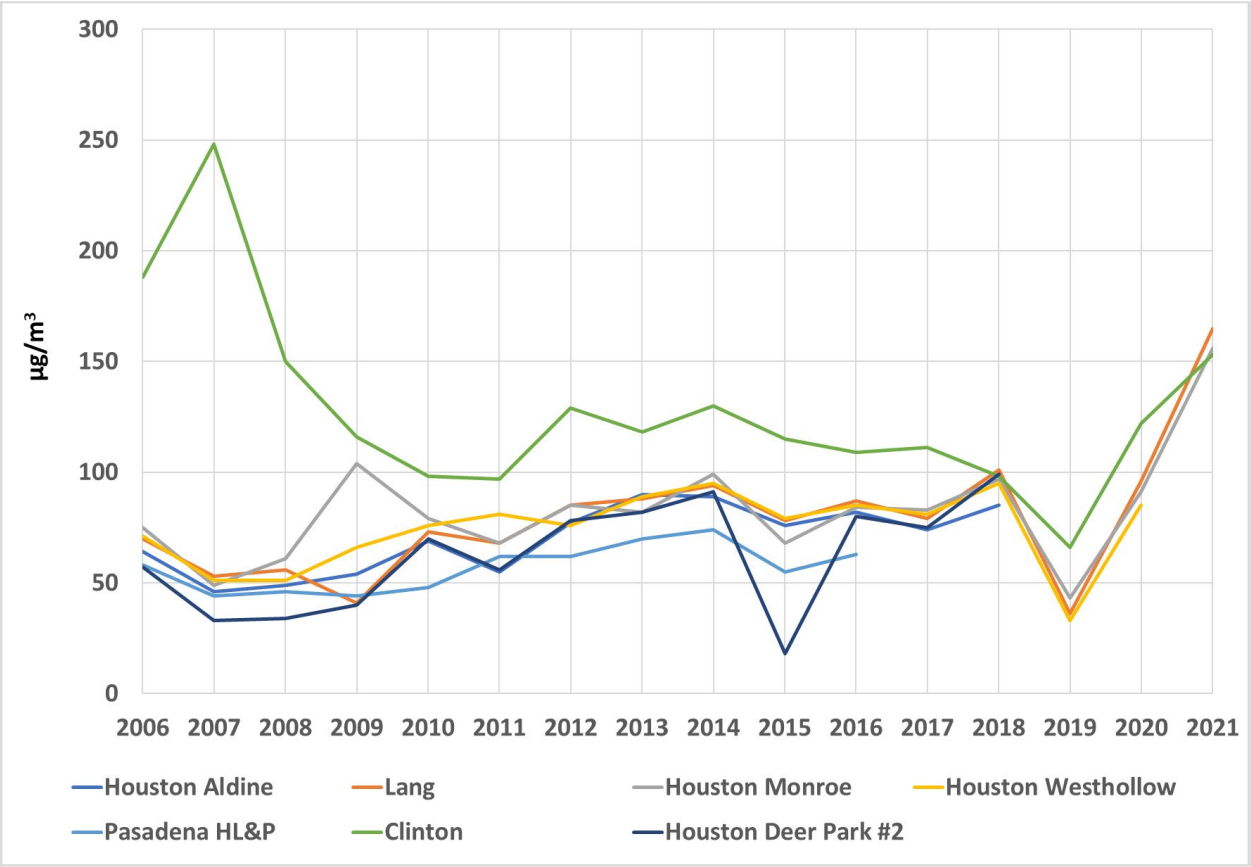

Figure 2-4: Harris County PM_{10} Annual Maximum 24-hour Averages for FRM Monitoring Sites, Including Exceptional Event Days

Annual average particulate matter of 2.5 microns or less in aerodynamic diameter ($PM_{2.5}$) levels in Harris County have been relatively stable since 2006. As would be expected, the 98th percentile value of $PM_{2.5}$ 24-hour average measurements has shown more variability from year to year. Figure 2-5: *Harris County $PM_{2.5}$ Annual 24-hour Averages for Long-Term FRM Monitoring Sites, Including Exceptional Event Days* and Figure 2-6: *Harris County Annual 98th Percentile of 24-hour Averages for Long-Term FRM Monitoring Sites, Including Exceptional Event Days* display the referenced $PM_{2.5}$ tends.

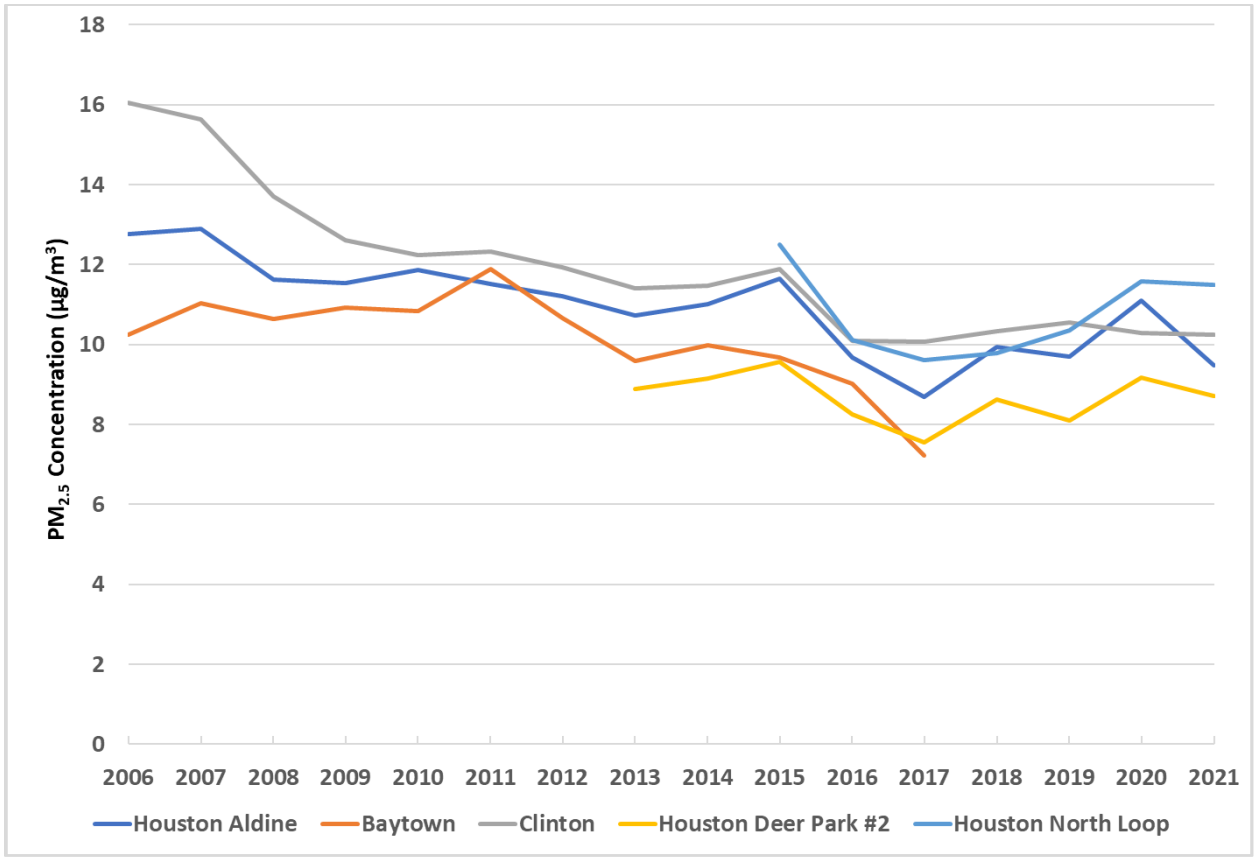

Figure 2-5: Harris County $PM_{2.5}$ Annual 24-hour Averages for Long-Term FRM Monitoring Sites, Including Exceptional Event Days

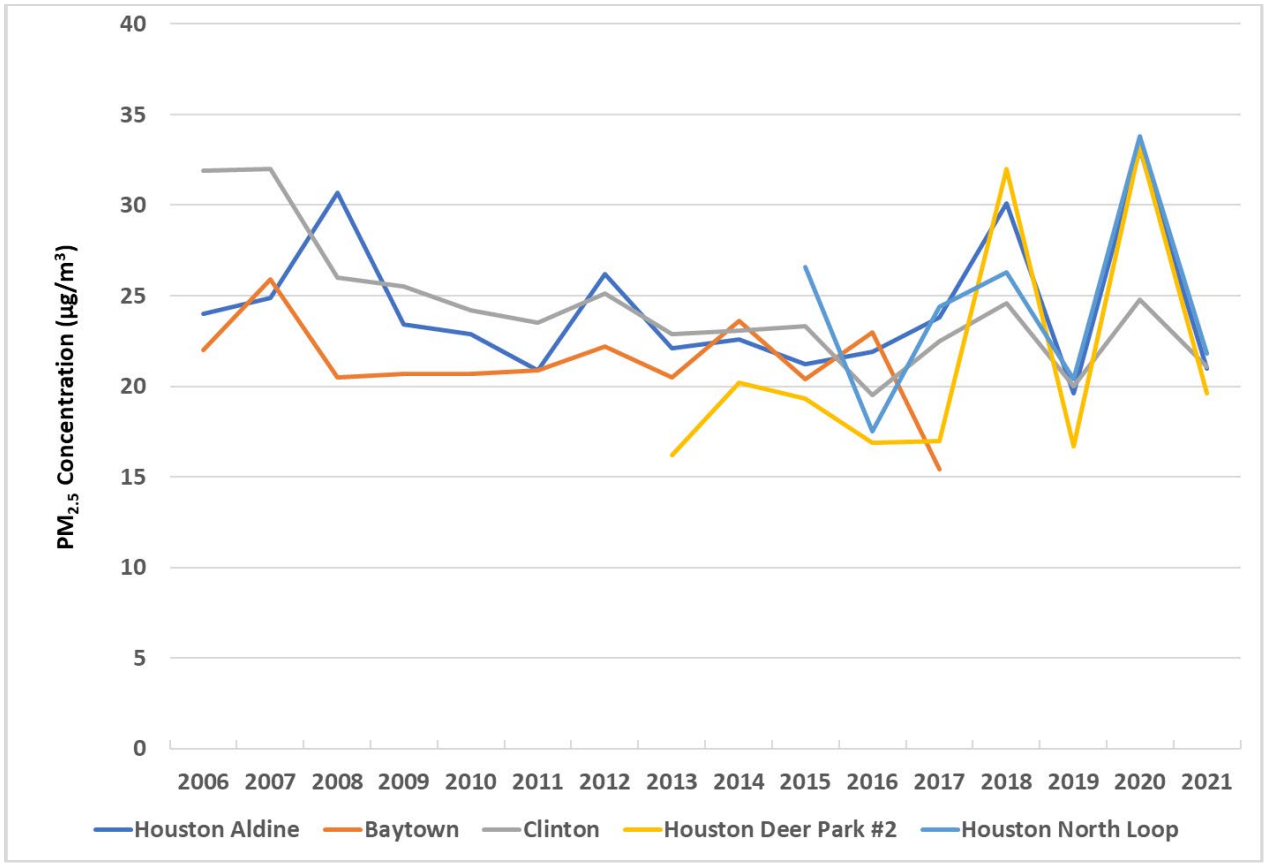

Figure 2-6: Harris County Annual 98th Percentile of 24-hour Averages for Long-Term FRM Monitoring Sites, Including Exceptional Event Days

2.2.2 Nueces County Particulate Matter Trends

PM_{10} trends from FRM monitors currently in Nueces County from 2006 through 2021 are presented in Figure 2-7: *Nueces County PM_{10} Annual Maximum 24-hour Averages for FRM Monitoring Sites, Including Exceptional Event Days*. Concentrations have been relatively consistent from 2006 through 2019. The peak value, recorded in 2021, is from the proposed exceptional event day of January 16, 2021.

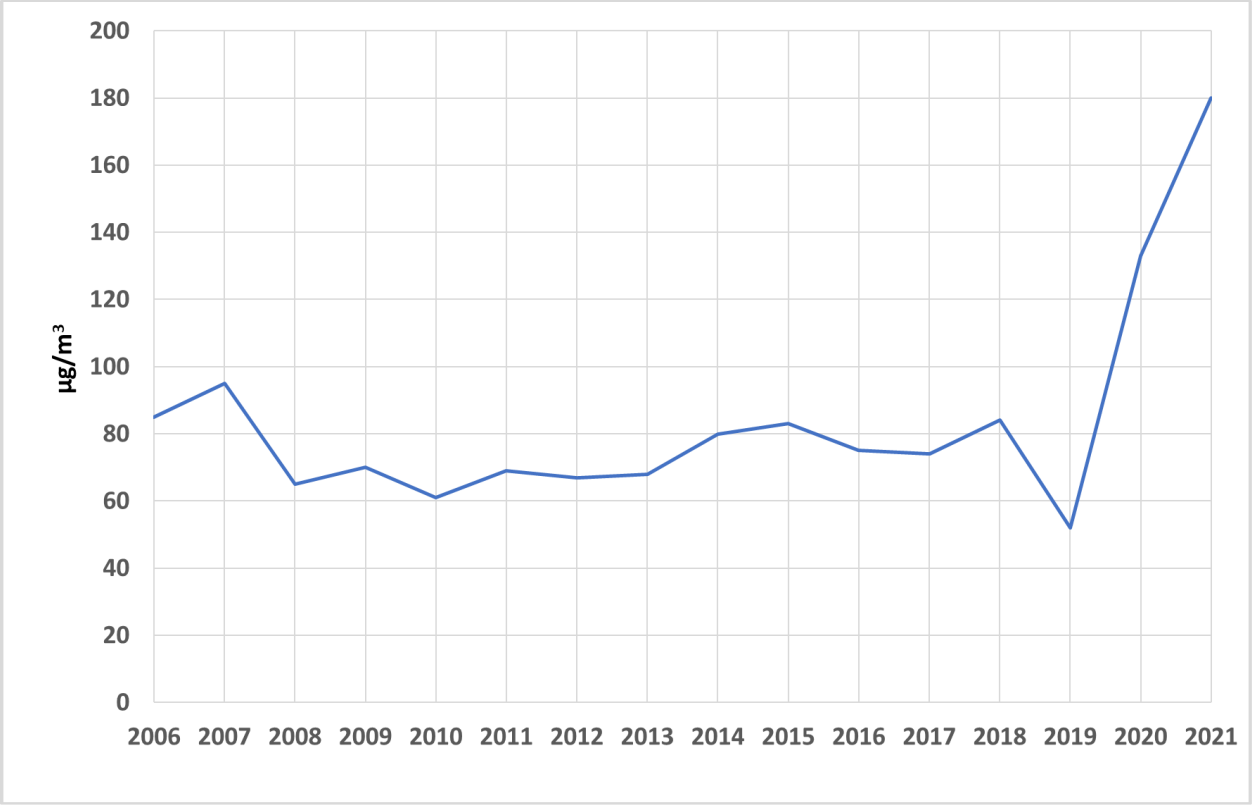

Figure 2-7: Nueces County PM_{10} Annual Maximum 24-hour Averages for FRM Monitoring Sites, Including Exceptional Event Days

Annual average $PM_{2.5}$ levels in Nueces County have been stable since 2006 with a moderate downward trend. As was the case in El Paso and Harris County, the 98th percentile value of $PM_{2.5}$ 24-hour average measurements has shown more variability from year to year. Figure 2-8: *Nueces County $PM_{2.5}$ Annual 24-hour Averages for Long-Term FRM Monitoring Sites, Including Exceptional Event Days* and Figure 2-9: *Nueces County Annual 98th Percentile of 24-hour Averages for Long-Term FRM Monitoring Sites, Including Exceptional Event Days* display the referenced $PM_{2.5}$ tends.

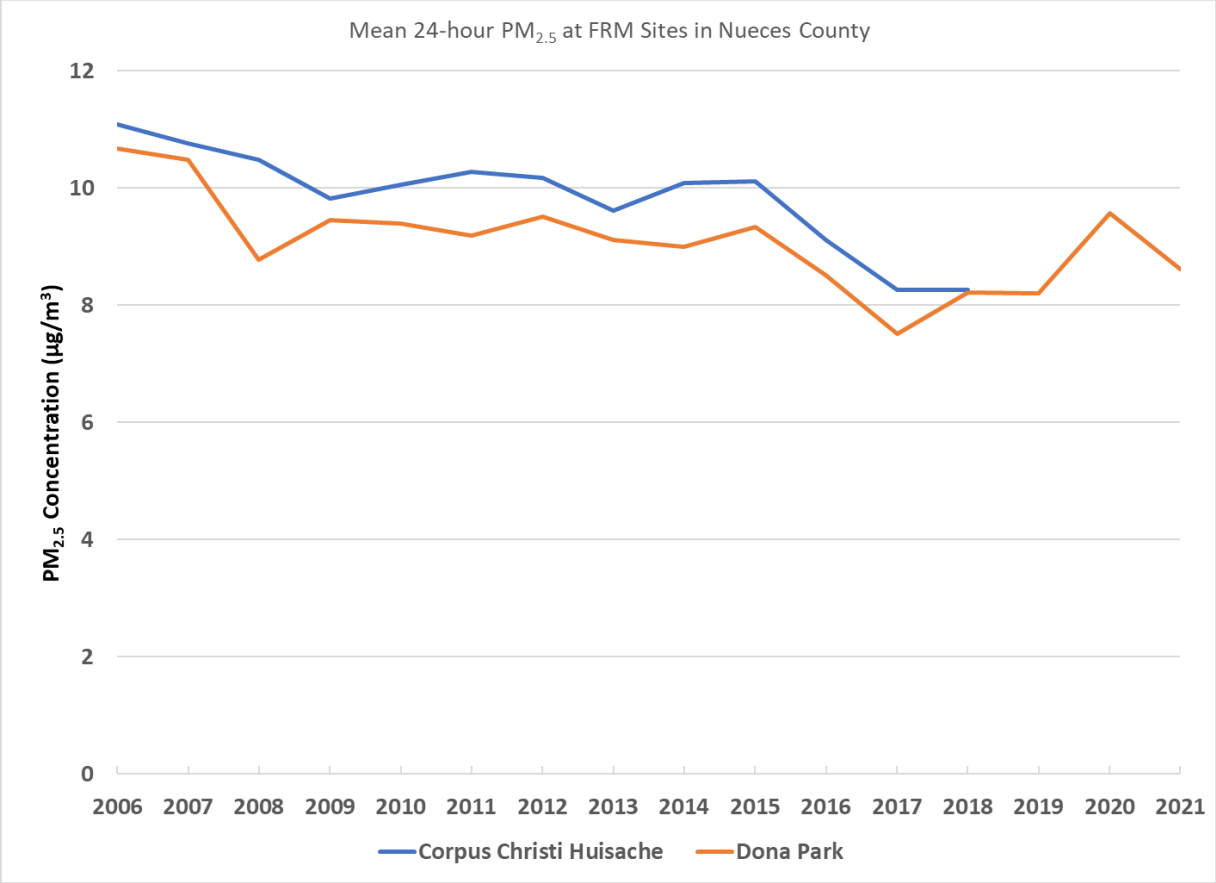

Figure 2-8: Nueces County $PM_{2.5}$ Annual 24-hour Averages for Long-Term FRM Monitoring Sites, Including Exceptional Event Days

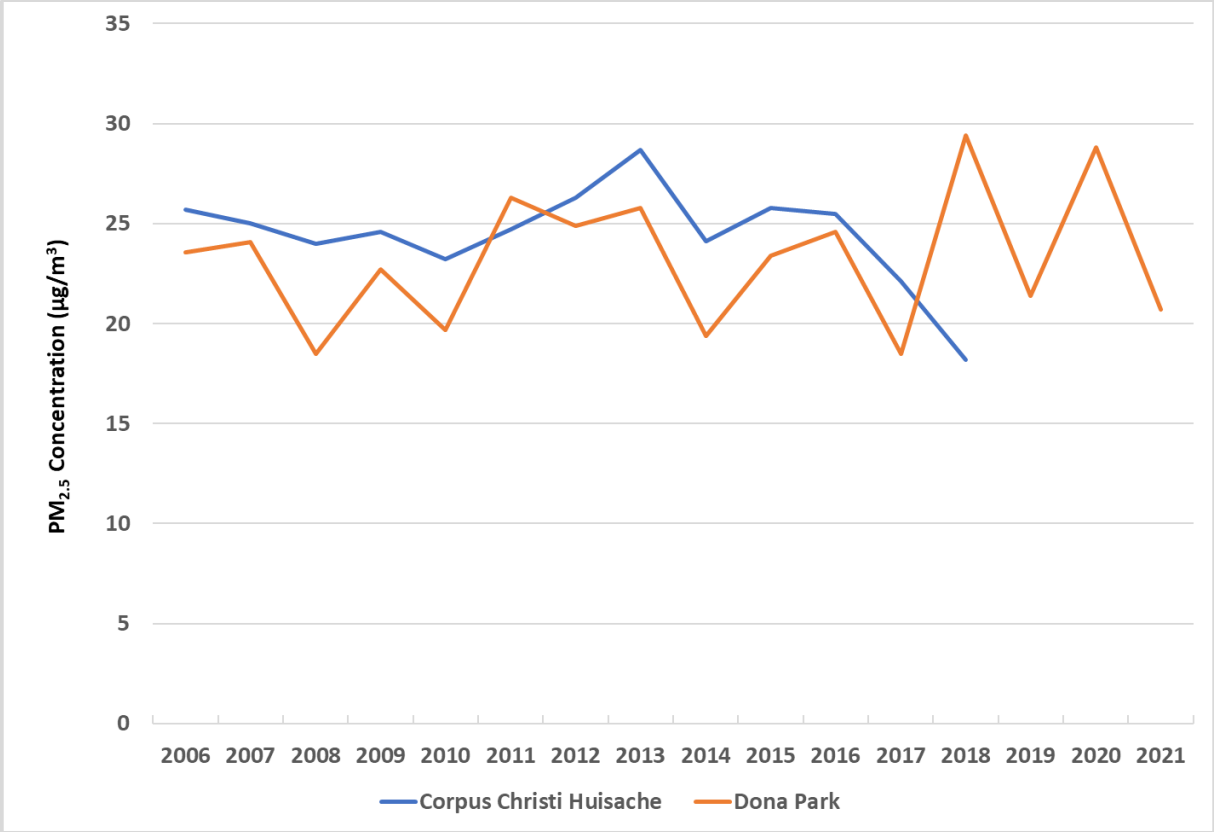

Figure 2-9: Nueces County Annual 98th Percentile of 24-hour Averages for Long-Term FRM Monitoring Sites, Including Exceptional Event Days

2.2.3 El Paso County Particulate Matter Trends

PM_{10} trends from Federal Reference Method (FRM) monitors in operation from 2006 through 2021 in El Paso County are presented in Figure 2-10: *El Paso County PM_{10} Annual Maximum 24-hour Averages for FRM Monitoring Sites, Including Exceptional Event Days*. Any proposed exceptional event day at a monitor is included in Figure 2-10 to show the entire range of values from 2006 through 2021. The following data gaps are displayed in Figure 2-10:

- The Tillman (C413) PM_{10} FRM monitor was deactivated effective April 11, 2013.
- The Ivanhoe (C414), Riverside (C9996), Van Buren (C693), and Ojo de Agua (C1021) PM_{10} FRM data were retroactively invalidated following a 2016 technical systems audit finding that the laboratory performing the gravimetric analysis on samples collected from October 25, 2013 through October 21, 2016 did not use the federally required method. This caused years 2014, 2015, and 2016 to have less than 75% valid data, which was therefore incomplete. Additionally, the Ojo de Agua (C1021) PM_{10} FRM monitors (both primary and collocated) were officially activated effective April 15, 2013, making the year 2013 incomplete for this site as well.
- The site access agreement for the original Socorro site was unexpectedly terminated by the property owner in early 2012. The site was relocated to the Hueco Elementary School and began operating in late 2012. Consequently, there are no PM_{10} FRM data available at Socorro from January 28 through December 23, 2012.

This caused the year 2012 to have less than 75% valid data, which was therefore incomplete.

- The Riverside (C9996) PM_{10} air monitoring site, deployed in 1988, was relocated approximately 0.37 miles and renamed El Paso Mimosa (C9996) in December 2019.

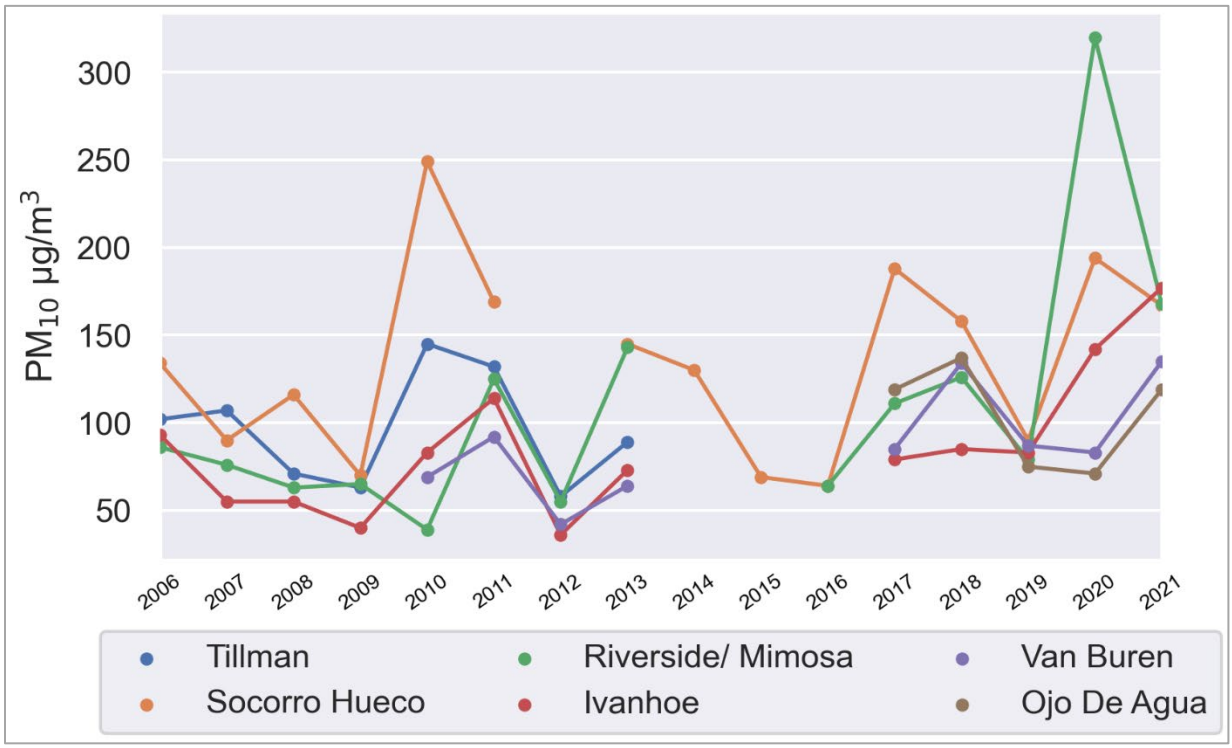

Figure 2-10: El Paso County PM_{10} Annual Maximum 24-hour Averages for FRM Monitoring Sites, Including Exceptional Event Days

Overall, annual average $PM_{2.5}$ levels in El Paso County have been relatively stable since 2006, while the 98th percentile of $PM_{2.5}$ 24-hour average measurements have shown more variability from year to year. Because the 98th percentile of the 24-hour average represents the highest 2% of all 24-hour measurements, the presence or absence of dust events on sampling days can greatly influence trend variability. Figure 2-11: *El Paso County $PM_{2.5}$ Annual Averages and Annual 98th Percentile of 24-hour Averages for Long-Term FRM Monitoring Sites, Including Exceptional Event Days* graphically depicts trends in both the annual and 98th percentile of the 24-hour average using FRM $PM_{2.5}$ data collected from the El Paso Chamizal (C41) and El Paso UTEP (C12) sites.

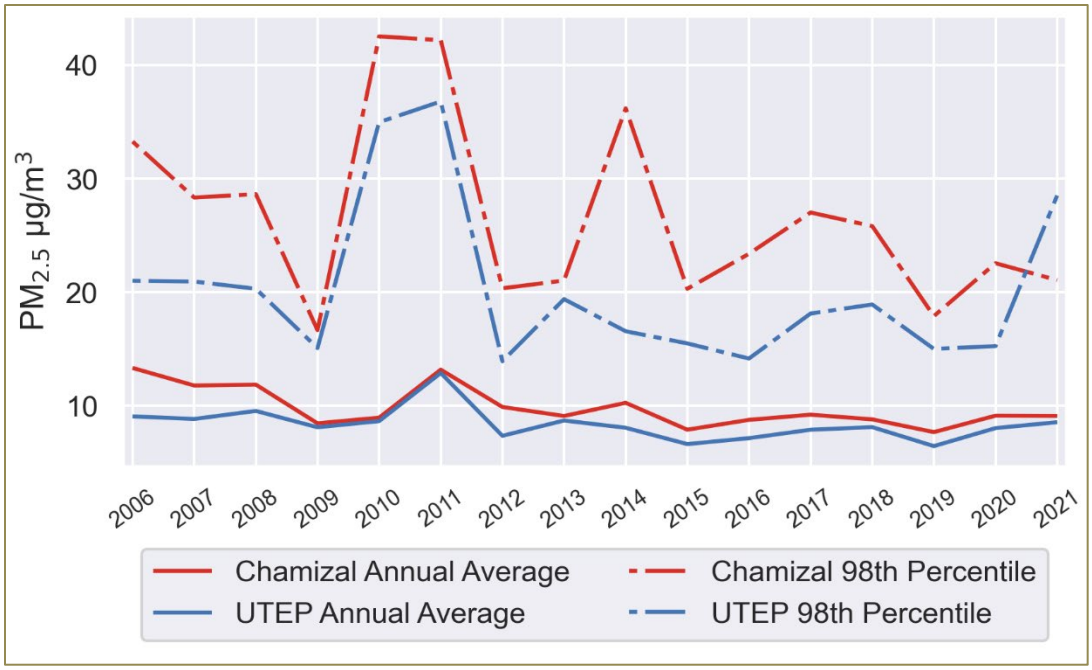

Figure 2-11: El Paso County $PM_{2.5}$ Annual Averages and Annual 98th Percentile of 24-hour Averages for Long-Term FRM Monitoring Sites, Including Exceptional Event Days

Historically, PM_{10} and $PM_{2.5}$ levels in El Paso County have been heavily impacted by natural high-wind events where large amounts of blowing dust are generated outside of, and transported into, El Paso County. These dust events are most commonly caused by regional high winds associated with large low-pressure systems. Regional blowing dust from the White Sands area in New Mexico can also be transported into El Paso County (Gill et al., 2012). Additionally, regional blowing dust generated in eastern New Mexico and the Texas Panhandle behind strong cold fronts can be transported into El Paso County. These large regional-scale dust storms occur mainly in the spring but can occur from late October into early June. On a local scale, high winds from nearby thunderstorms can generate dust that is transported into El Paso County. These local-scale thunderstorm high-wind dust events are most common in June and July. Long-range transport from other types of events also influences particulate matter concentrations in El Paso County, including smoke from fires, haze, and anthropogenic emissions in the United States (U.S.) and Mexico. These smoke and haze transport events affect $PM_{2.5}$ levels more than PM_{10} levels because $PM_{2.5}$ particles, being smaller than PM_{10} particles, can remain aloft for longer periods of time and can thus travel greater distances.

2.2.4 Blowing Dust and Wind

The U.S. Environmental Protection Agency (EPA) High Wind Dust Event Guidance (EPA, 2019) suggests using a peak sustained wind speed of 25 mph, as a threshold for determining possible influence from blowing dust.

Higher wind speeds normally result in particulate concentrations that are dominated by incoming background levels, which involve particulate transported from outside of the location in which they are monitored. At higher wind speeds,

the impact of local sources becomes substantially diluted. This dilution is proportional to wind speed for a given vertical mixing height, which is the height of vertical mixing of air and suspended particles above the ground. Additionally, high winds cause mechanical mixing. Mechanical mixing is a process that uses the kinetic energy of relative fluid motion at night and weakens the formation of nocturnal inversions (an increase in temperature with increasing height above the earth's surface), thus supporting deeper vertical mixing and lower pollutant concentrations.

The EPA High Wind Dust Event Guidance also advises that a large-scale, high-energy high wind dust (LS/HE/HWD) event is not reasonably controllable if the following criteria are met:

- the event is associated with a dust storm and is the focus of a Dust Storm Warning;
- the event has sustained winds that are greater than or equal to 40 mph; and
- the event has reduced visibility equal to or less than 0.5 miles.

In addition, as stated in the Exceptional Events Rule preamble, an LS/HE/HWD event would be associated with measured exceedances occurring at multiple monitoring sites over a large geographic area unless the area has only a single particulate matter monitor or if the area has monitors operating on a sampling frequency that does not coincide with the timing of the event.

2.2.5 Harris County Blowing Dust and Wind Trends

Figure 2-12: *Harris County Daily Peak PM_{10} Average for FRM Measurements versus Harris County Daily Peak Sustained Hourly Wind Speed for 2006 through 2021* shows that there is not a definitive relationship in Harris County between local wind speeds and PM_{10} concentrations. The orange dots in the plot, representing the Clinton (C55) monitor, were highest in 2006 and 2007 when unpaved roads in the vicinity of the monitor were causing elevated PM_{10} concentrations at the monitor prior to the resolution of this issue. Other than the select PM_{10} concentrations at the Clinton (C55) monitor, with the exception of concentrations recorded on the proposed exceptional event day of January 16, 2021, PM_{10} concentrations in Harris County have not approached the 150 µg/m^3 National Ambient Air Quality Standard (NAAQS) during the entirety of 2006 through 2021. This fact reinforces that PM_{10} concentrations from local sources have been well controlled in Harris County at the Lang (C408) and Houston Monroe (C406) monitors, and the outlying high PM_{10} concentrations on January 16, 2021 were the result of long-range transport that was neither controllable nor preventable.

The two FRM PM_{10} concentrations exceeding the NAAQS on January 16, 2021 are labeled in Figure 2-12. The only other FRM monitor operating on January 16, 2021, the Clinton (C55) monitor, recorded a PM_{10} concentration of 153 µg/m^3. Although this value is above the 150 µg/m^3 line and appears to exceed the NAAQS, when considering that rounding conventions require a sample to be greater than or equal to 155 µg/m^3 to exceed the NAAQS, this value was not an exceedance. The fact that all three concentrations recorded on January 16, 2021 either exceeded or narrowly missed

exceeding the NAAQS, reinforces the fact that PM_{10} concentrations on January 16, 2021 were the result of a large-scale event that impacted the entirety of Harris County.

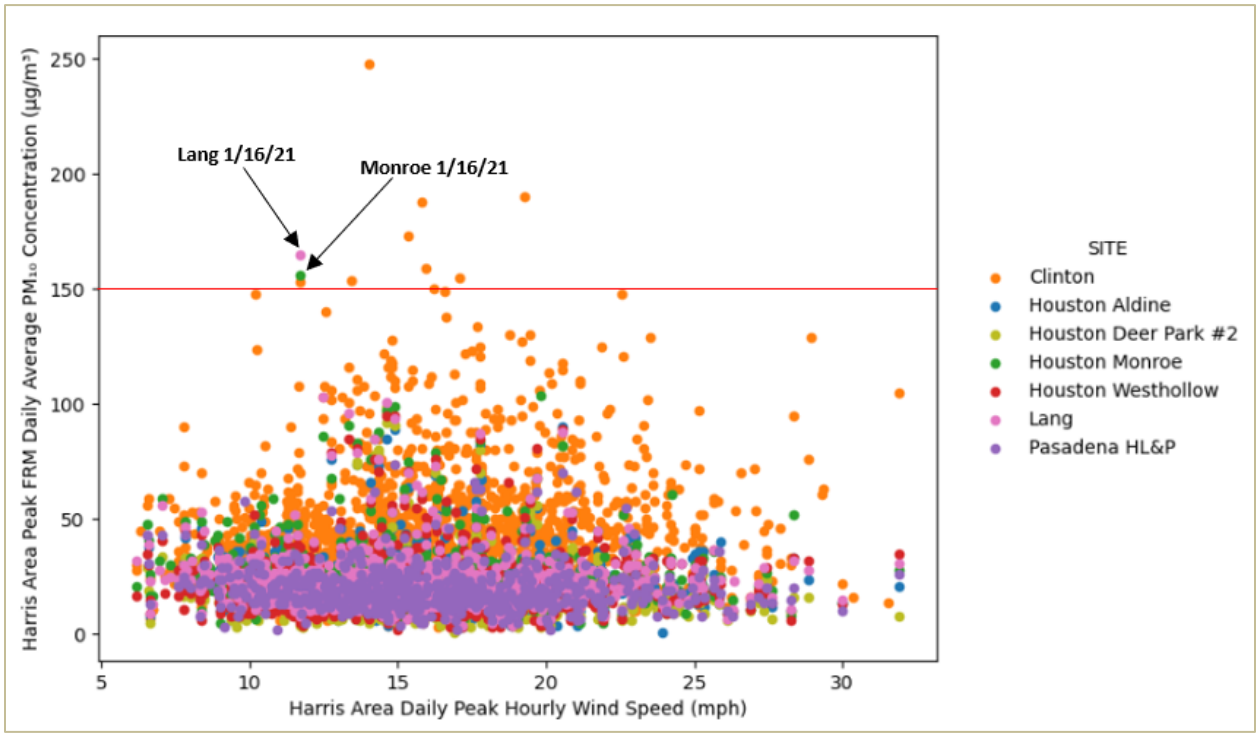

Figure 2-12: Harris County Daily Peak PM_{10} Average for FRM Measurements versus El Paso County Daily Peak Sustained Hourly Wind Speed for 2006 through 2021

Figure 2-13: *Harris County Daily Peak $PM_{2.5}$ Average for FRM Measurements versus Harris County Daily Peak Sustained Hourly Wind Speed for 2006 through 2021* shows that, similar to PM_{10}, $PM_{2.5}$ concentrations in Harris County do not show a definitive relationship between wind speed and $PM_{2.5}$ concentration.

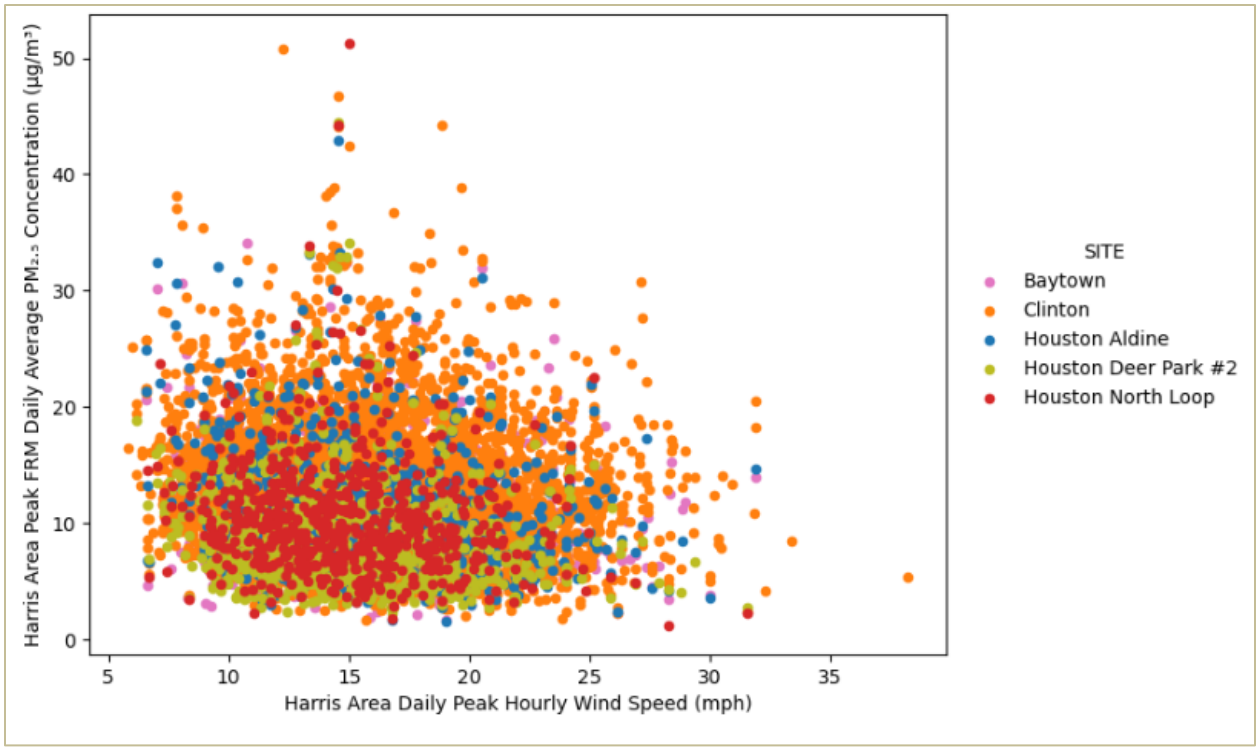

Figure 2-13: Harris County Daily Peak $PM_{2.5}$ Average for FRM Measurements versus Harris County Daily Peak Sustained Hourly Wind Speed for 2006 through 2021

Figure 2-14: *Deer Park #2 (C35) Hourly Average Continuous PM_{10} Concentration versus Hourly Wind Speed for 2020 and 2021* shows the lack of a definitive pattern between wind speed and PM_{10} at a Harris County monitor. The orange dots are hourly values from the proposed exceptional event day of January 16, 2021. The green dots are from the day following the proposed exceptional event day and demonstrate that PM_{10} values were still higher than average because of the dust event. The Deer Park #2 monitor was used because neither the Lang (C408) or Houston Monroe (C406) monitors record hourly PM_{10} concentrations. These hourly values are not used to determine compliance at the monitor like the FRM samples at Lang (C408) and Houston Monroe (C406), but they are useful to supplement 24-hour data from FRM samples especially in an instance such as that on January 16, 2021 when a dust event impacted the entire county.

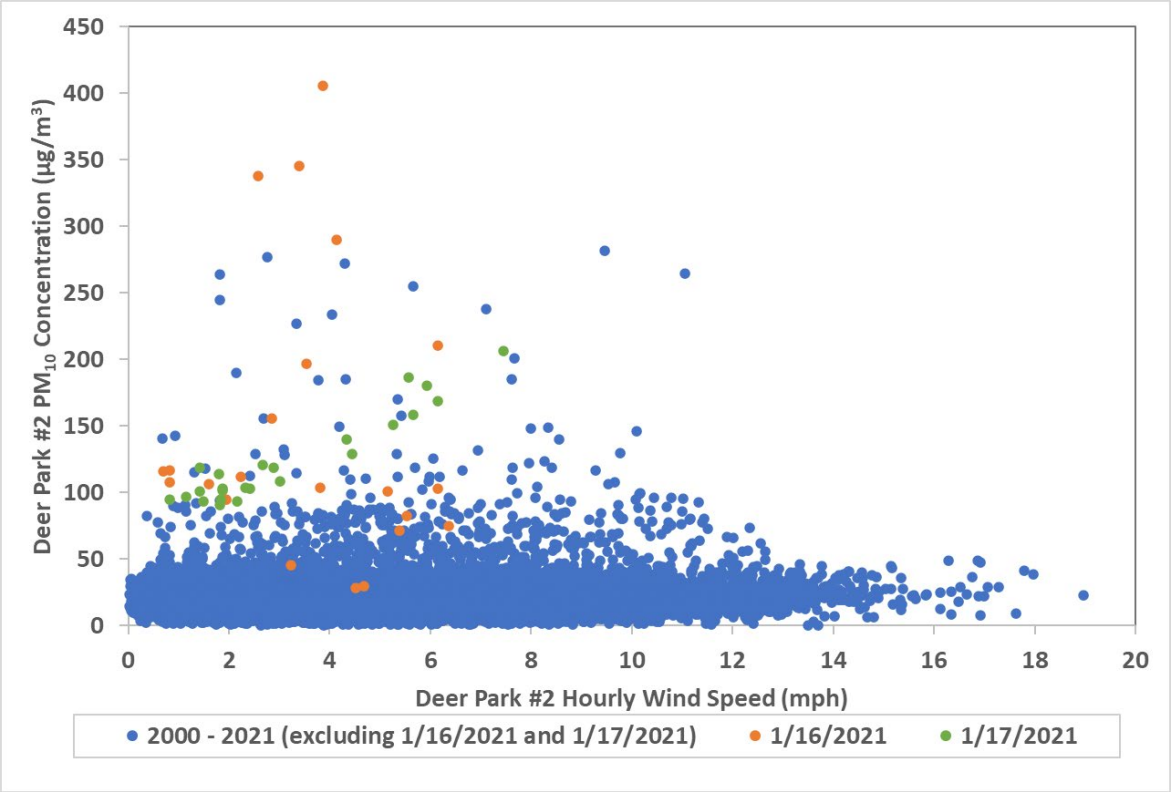

Figure 2-14: Deer Park #2 (C35) Hourly Average Continuous PM_{10} Concentration versus Hourly Wind Speed for 2020 and 2021

Figure 2-15: *Houston North Loop (C1052) Hourly Average Carbon Monoxide Concentrations versus Houston North Loop (C1052) Hourly Wind Speeds for 2020 and 2021* shows the impact to concentrations of more localized pollutants at higher wind speeds. In a large urban area like Harris County, and specifically the city of Houston where the Houston North Loop (C1052) monitor is located, carbon monoxide is generated locally through anthropogenic activity. Figure 2-15 is provided for comparison with Figure 2-14. The difference in the relationship with hourly wind speeds between PM_{10} and carbon monoxide is pronounced at higher wind speeds. Instead of tailing off to incoming background levels from the effects of dilution as with carbon monoxide, PM_{10} concentrations remain relatively consistent in Harris County where elevated PM_{10} concentrations are primarily influenced by long-range transport making local wind speeds less relevant.

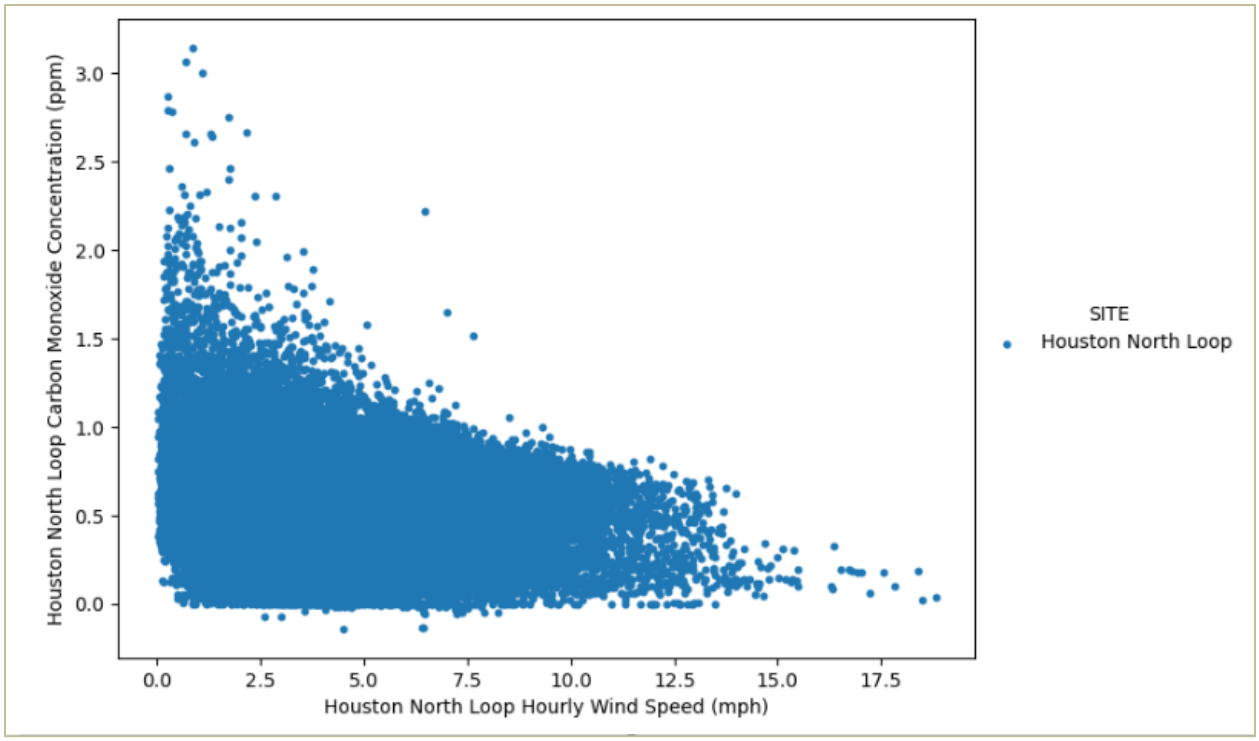

Figure 2-15: Houston North Loop (C1052) Hourly Average Carbon Monoxide Concentrations versus Houston North Loop (C1052) Hourly Wind Speeds for 2020 and 2021

2.2.6 Nueces County Blowing Dust and Wind Trends

Figure 2-16: *Nueces County Daily Peak PM_{10} Average for FRM Measurements versus Nueces County Daily Peak Sustained Hourly Wind Speed for 2006 through 2021* shows that there is not a definitive relationship in Nueces County between local wind speeds and PM_{10} concentrations. Apart from the concentration recorded on the proposed exceptional event day of January 16, 2021, PM_{10} concentrations in Nueces County have not approached the 150 µg/m^3 NAAQS during the entirety of 2006 through 2021. Local PM_{10} sources have been well controlled in Nueces County, and the outlying high PM_{10} concentration on January 16, 2021 was the result of long-range transport that was not controllable or preventable.

The FRM PM_{10} concentration exceeding the NAAQS on January 16, 2021 is labeled in Figure 2-16. Dona Park (C199) was the only FRM PM_{10} monitor operating on January 16, 2021 in Nueces County. Although only one FRM PM_{10} monitor was operating on January 16, 2021, The fact that all three FRM PM_{10} concentrations recorded on January 16, 2021 in Harris County, located approximately 175 miles northeast of Nueces County, either exceeded or narrowly missed exceeding the NAAQS, reinforces the fact that PM_{10} concentrations on January 16, 2021 were the result of a large-scale event that impacted areas of Texas large distances apart.

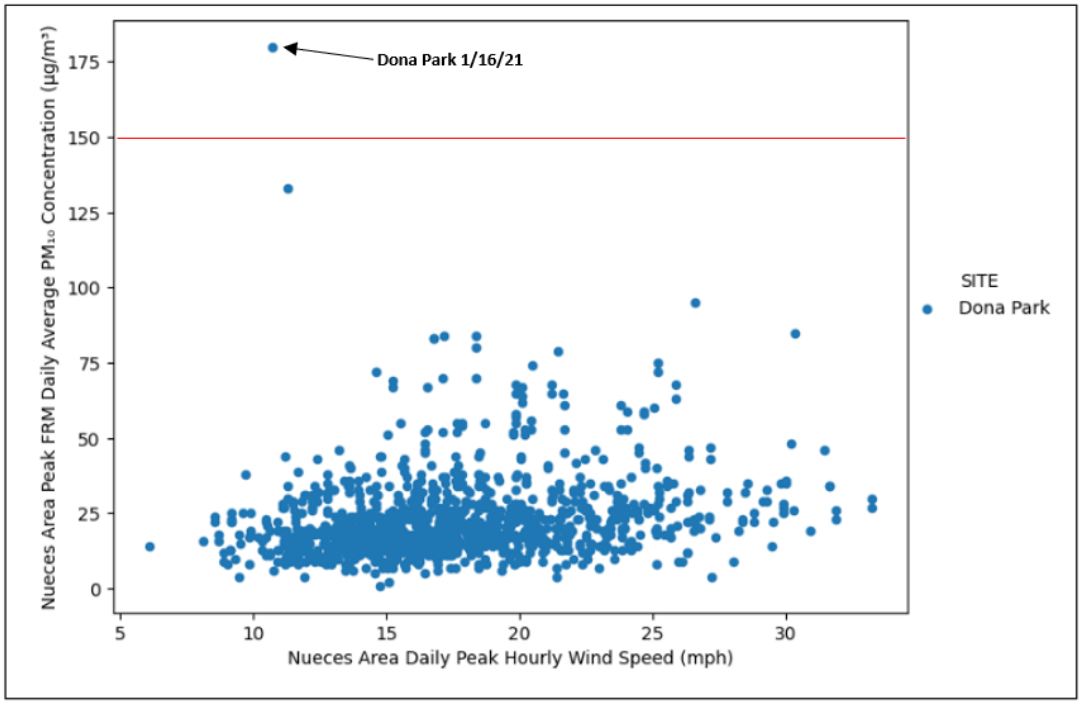

Figure 2-16: Nueces County Daily Peak PM_{10} Average for FRM Measurements versus Nueces County Daily Peak Sustained Hourly Wind Speed for 2006 through 2021

Figure 2-17: *Nueces County Daily Peak $PM_{2.5}$ Average for FRM Measurements versus Nueces County Daily Peak Sustained Hourly Wind Speed for 2006 through 2021* shows that, similar to PM_{10}, $PM_{2.5}$ concentrations in Nueces County do not show a definitive relationship between wind speed and $PM_{2.5}$ concentration.

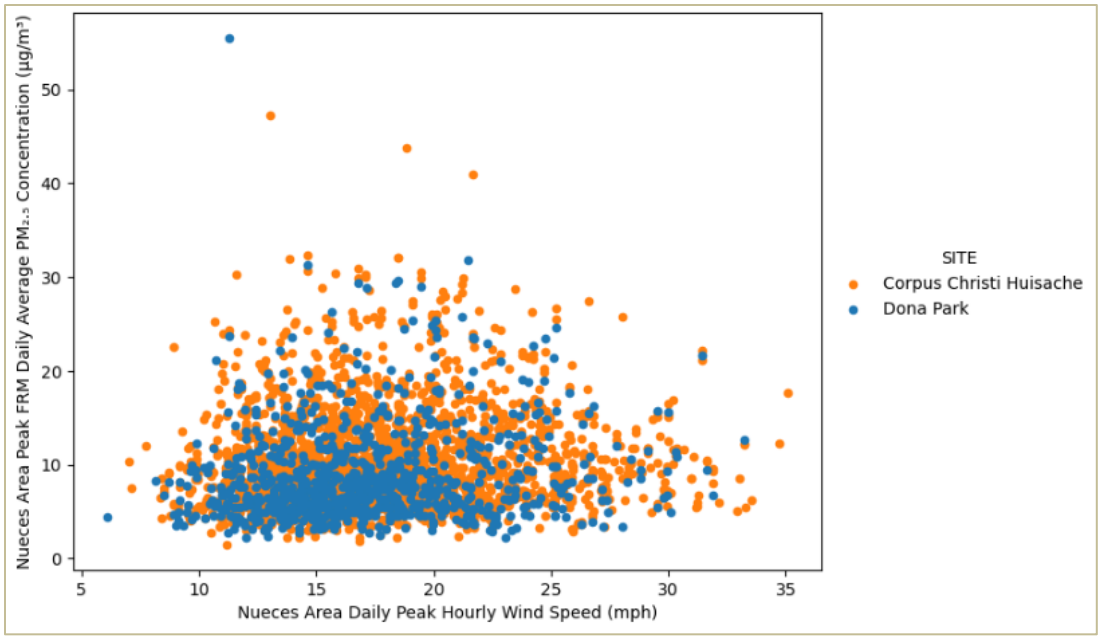

Figure 2-17: Nueces County Daily Peak $PM_{2.5}$ Average for FRM Measurements versus Nueces County Daily Peak Sustained Hourly Wind Speed for 2006 through 2021

2.2.7 El Paso County Blowing Dust and Wind Trends

Figure 2-18: *El Paso County Daily Peak PM_{10} Average for FRM Measurements versus El Paso County Daily Peak Sustained Hourly Wind Speed for 2006 through 2021* shows that the highest PM_{10} concentrations were recorded when peak El Paso County wind speeds exceeded 20 mph, indicating an influence from wind-blown dust. Of particular interest in Figure 2-18 are the daily PM_{10} FRM measurements, that exceeded the 24-hour PM_{10} National Ambient Air Quality Standard (NAAQS). Five of these measurements are exceptional events the EPA has previously concurred; two of them, from December 23, 2020, are currently under review by the EPA; the two green dots that are not labeled are less than 155 µg/m³, which although above the 150 µg/m³ line and appear to exceed the standard, do not exceed the standard when considering that rounding conventions require a sample to be greater than or equal to 155 µg/m³ to exceed the standard; and the two circled in blue are the proposed exceptional events for El Paso County from June 21, 2021. Within the blue circle in Figure 2-18, the green dot representing the Socorro Hueco concentration of 167 µg/m³ is almost entirely covering the orange dot representing the El Paso Mimosa concentration of 168 µg/m³. It is for this reason that there appears to be only one value on the event date of June 21, 2021 within the blue circle in Figure 2-18.

The Ivanhoe measurement from December 6, 2021, circled in orange, is the third El Paso County proposed exceptional event covered in this demonstration. Although the concentration at the Ivanhoe (C414) monitor on December 6, 2021 falls behind the 25-mph demarcation in the graphic, it must be noted that this graphic is only showing monitors recording wind speed in El Paso County. On December 6, 2021, two-minute sustained winds as high as 46.1 mph were recorded at the Guadalupe Mountains National Park (KGDP) weather station which is approximately 100 miles east of El Paso. On December 6, 2021, wind was blowing into El Paso County from the direction of the

KGDP station. Although wind monitors within El Paso County did not record hourly sustained winds greater than 25 mph, sustained winds at averaging times lower than one hour exceeded 25 mph.

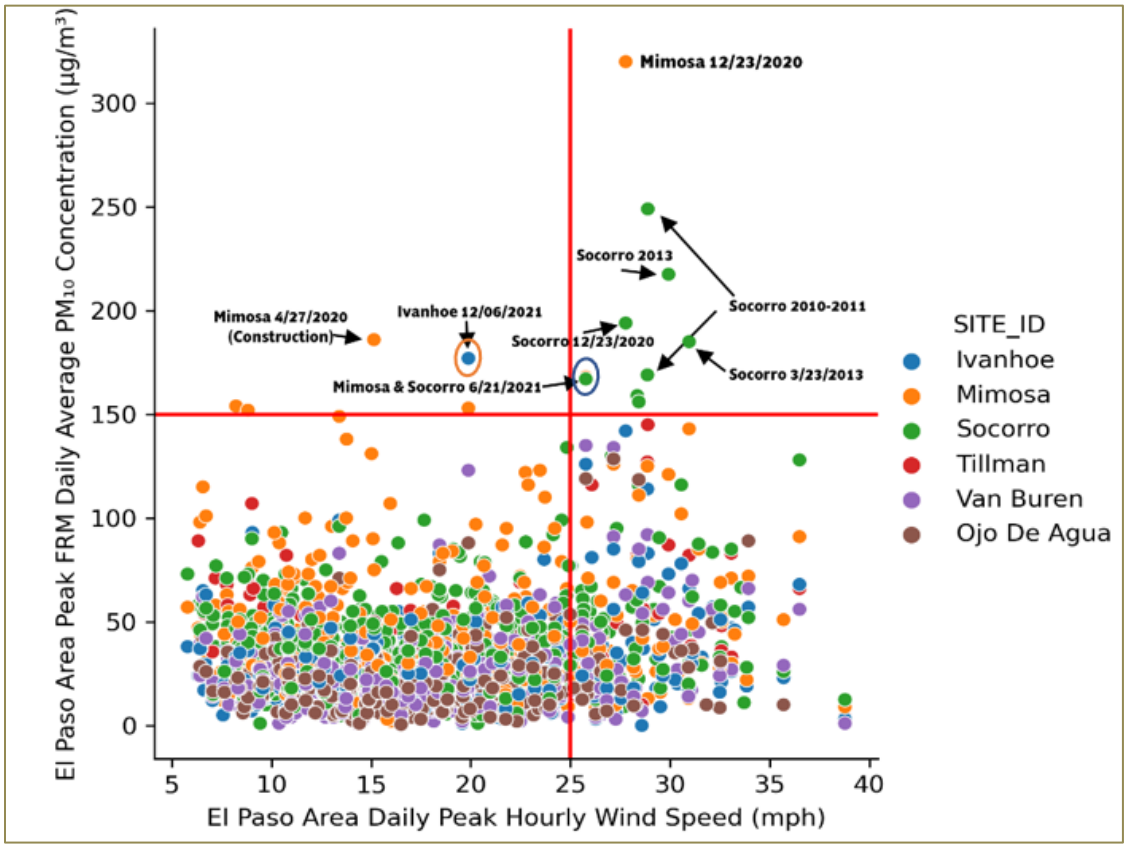

Figure 2-18: El Paso County Daily Peak PM_{10} Average for FRM Measurements versus El Paso County Daily Peak Sustained Hourly Wind Speed for 2006 through 2021

Figure 2-19: *El Paso County Daily Peak $PM_{2.5}$ Average for FRM Measurements versus El Paso County Daily Peak Sustained Hourly Wind Speed for 2006 through 2021* shows that, similar to PM_{10}, $PM_{2.5}$ concentrations are greatest when peak hourly sustained wind speeds exceed 25 mph.

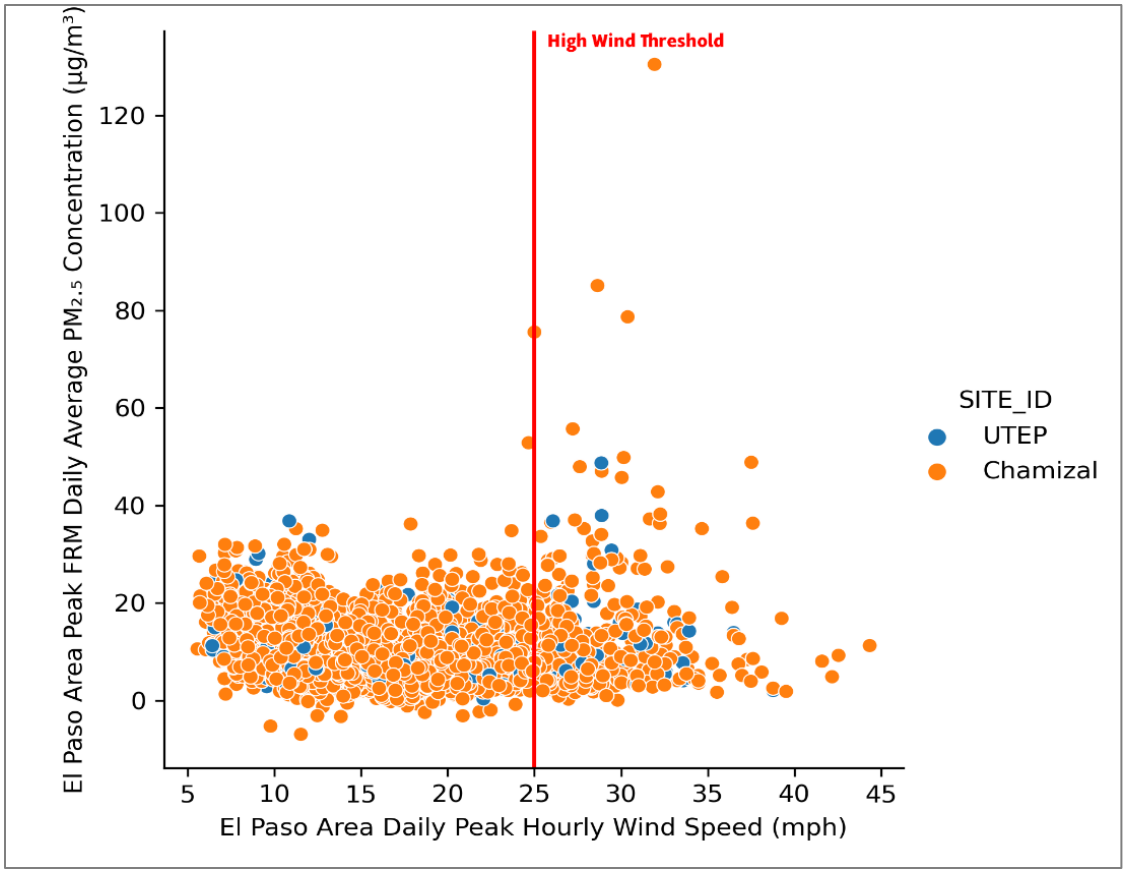

Figure 2-19: El Paso County Daily Peak $PM_{2.5}$ Average for FRM Measurements versus El Paso County Daily Peak Sustained Hourly Wind Speed for 2006 through 2021

Specific to the Socorro Hueco (C49) air monitoring site, Figure 2-20: *Socorro Hueco (C49) Hourly Average Continuous PM_{10} Concentration versus Hourly Wind Speed for 2020 and 2021* shows the decrease in the frequency of hourly PM_{10} measurements in the zero through 200 micrograms per cubic meter (µg/m³) range once hourly winds reach 20 mph (noticeable even as low as 18 mph). Of the three monitors in El Paso County with proposed 2021 exceptional events, only the Socorro Hueco (C49) monitor measures hourly PM_{10} concentrations. These hourly values are not used to determine compliance at the monitor like the FRM samples, but they are useful to supplement 24-hour data from FRM samples.

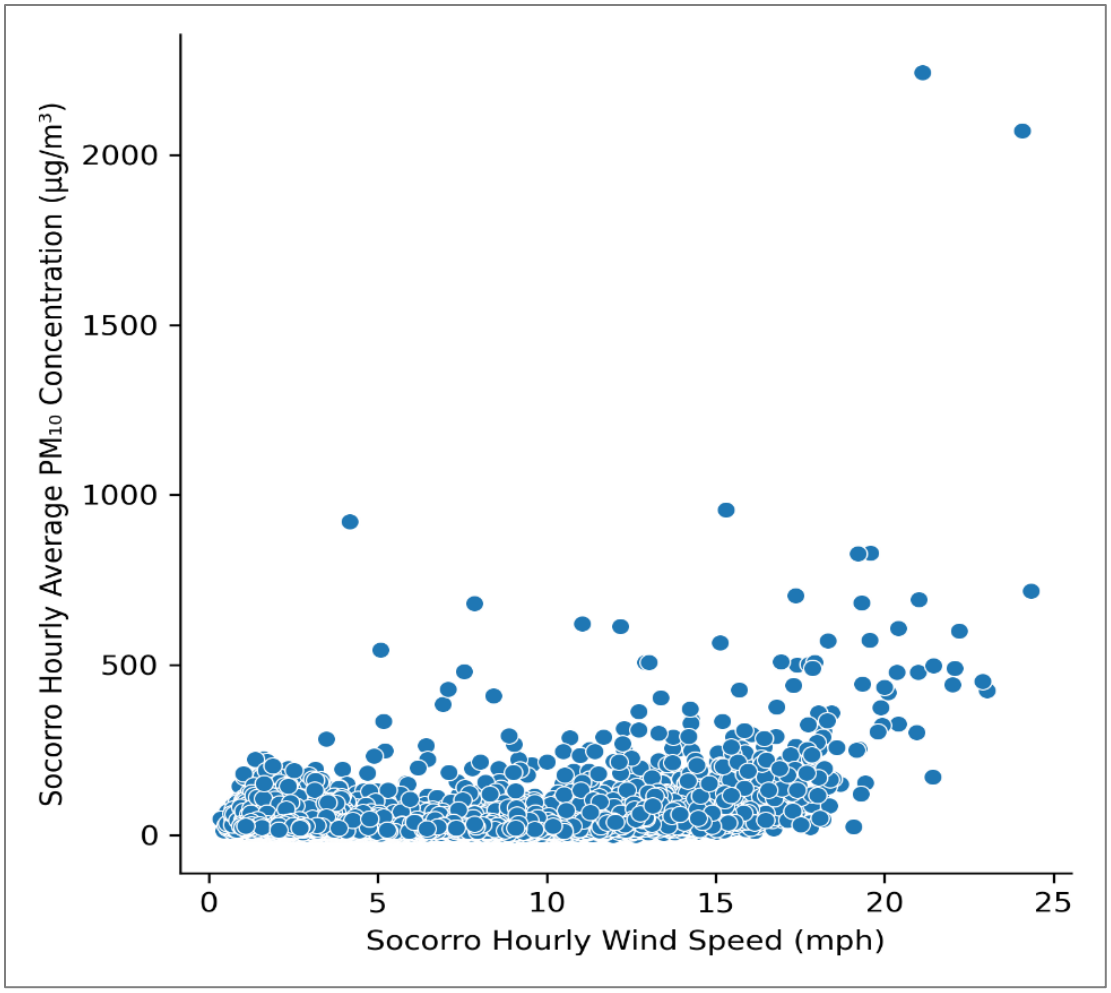

Figure 2-20: Socorro Hueco (C49) Hourly Average Continuous PM_{10} Concentration versus Hourly Wind Speed for 2020 and 2021

Figure 2-21: *El Paso UTEP (C12) Hourly Average Carbon Monoxide Concentrations versus El Paso UTEP (C12) Hourly Wind Speeds for 2020 and 2021* shows the impact to concentrations of more localized pollutants that begin to occur at higher wind speeds. In an urban area like the portion of El Paso County, surrounding the El Paso UTEP (C12) monitor, carbon monoxide is generated locally through anthropogenic activity. Figure 2-21 is provided for comparison with Figure 2-19. The difference in the relationship with hourly wind speeds between PM_{10} and carbon monoxide is pronounced at higher wind speeds. Instead of tailing off to incoming background levels from the effects of dilution as with carbon monoxide, PM_{10} concentrations increase with higher wind speeds, indicating an impact from windblown dust at wind speeds above approximately 18 mph, with the clearest influence at speeds above 20 mph.

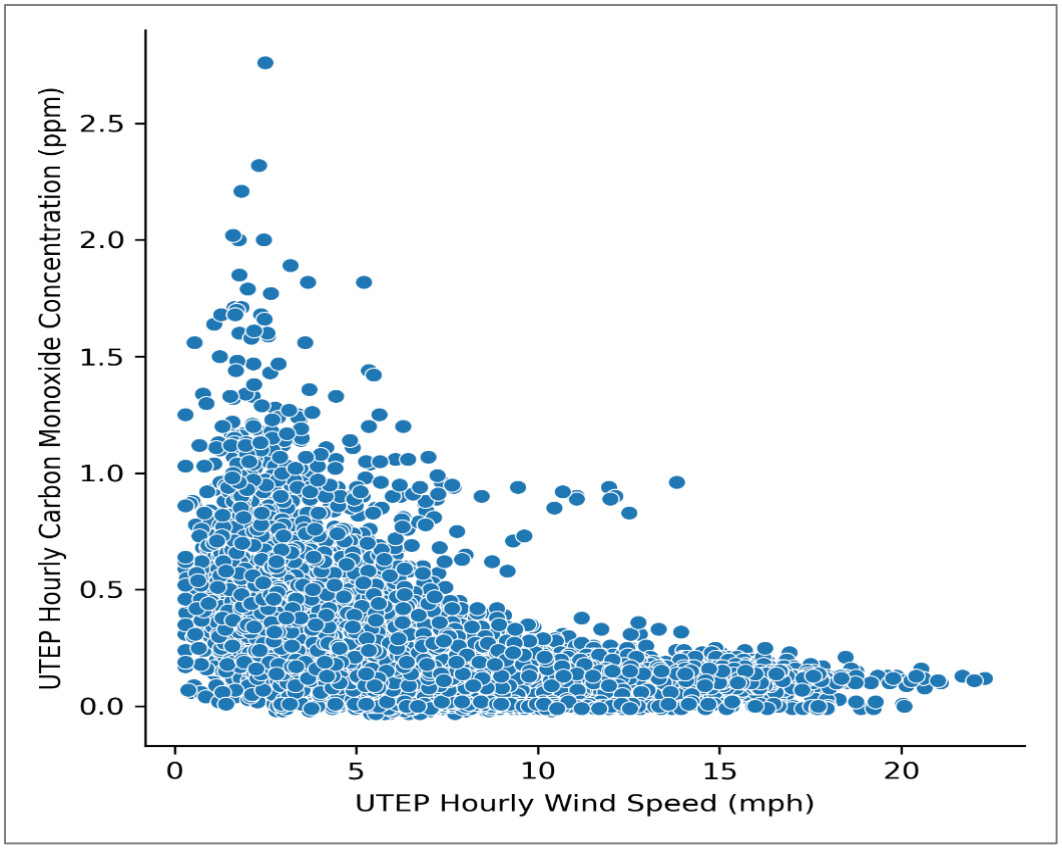

Figure 2-21: El Paso UTEP (C12) Hourly Average Carbon Monoxide Concentrations versus El Paso UTEP (C12) Hourly Wind Speeds for 2020 and 2021

2.3 EVENT DAY SUMMARY INFORMATION

Descriptions of the meteorological conditions on each of the proposed exceptional event dates is provided in this section.

The event day of January 16, 2021 was characterized by a tight pressure gradient that formed over southeastern Colorado on January 15, 2021. The northwesterly winds associated with the tight pressure gradient reached 60 mph based on reports in dust storm warnings issued by the National Weather Service. These winds carried high levels of particulate matter associated with blowing dust into Texas. On January 16, 2021, a shallow mixing layer brought elevated levels of particulate matter to the surface level where monitors locating in both Harris County and Nueces County measured the elevated concentrations. An event day analysis is provided in Appendix B: *Event Analysis for January 16, 2021*.

The event day of June 21, 2021 was characterized by a strong outflow boundary that passed from north to south through El Paso County. An outflow boundary is a storm-scale or mesoscale boundary separating thunderstorm-cooled air (outflow) from the surrounding air. The outflow boundary was triggered by thunderstorms at the higher elevations north of El Paso County. Sustained winds up to 30 mph and gusts up to 49 mph were recorded on June 21, 2021, as measured at the NWS weather station at KELP. An event day analysis is provided in Appendix C: *Event Analysis for June 21, 2021*.

The event day of December 6, 2021 was characterized by a backdoor cold front moving southwest over El Paso County. Behind the front northeasterly winds were about 10 to 15 mph and temperatures where about 5 to 10 degrees cooler than previous days. Approximately 100 miles east of El Paso County, the same front generated sustained hourly winds of up to 44 mph. It was these winds in the source area of the Chihuahuan Desert that are believed to have entrained the particulate matter that was transported into El Paso County. An event day analysis is provided in Appendix D: *Event Analysis for December 6, 2021*.

2.3.1 Wind and Particulate Measurements

PM_{10} concentrations at monitors that exceeded the standard and wind measurements on the proposed exceptional event days are provided in the appendices of this document.

The EPA's High Wind Dust Event Guidance (EPA, 2019) suggests a minimum sustained wind speed of 25 mph for western states including Texas, or development of an alternate area-specific high wind threshold at which a dust event could occur. The June 21, 2021 and December 6, 2021 events meet the strictest definition of this threshold with peak area hourly wind speeds greater than 25 mph. High winds were recorded in the local as well as surrounding areas on June 21, 2021 and December 6, 2021. High winds in areas outside of the immediate sampling area indicate that PM_{10} concentrations recorded were influenced by regional transport from surrounding areas.

Wind speeds exceeding 25 mph were not recorded in Harris County or Nueces County on January 16, 2021, but wind speeds exceeding 40 mph were recorded in areas where the dust originated. Satellite images provided in Appendix B: *Event Analysis for January 16, 2021* provide clear evidence that despite the local winds not exceeding 25 mph, particulate matter from long-range transport as a result of distant high winds influenced particulate matter concentrations on January 16, 2021.

The TCEQ used National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory (ARL) meteorological model results to display wind speeds and direction in the source areas of natural undisturbed land in Colorado for the January 16, 2021 proposed exceptional event, Mexico west-southwest of El Paso County for June 21, 2021, and east of El Paso County for December 6, 2021. Specifically, the TCEQ used the 12-kilometer (km) North American Model (NAM) hourly wind speeds and wind vectors at a 10-meter height. These maps are presented in the appendices of this document.

All available continuous and non-continuous area daily average particulate measurements from proposed exceptional event days are provided in the appendices of this document.

Comprehensive $PM_{2.5}$ Chemical Speciation Network (CSN) data were available in the areas of the proposed exceptional events on January 16, 2021 and June 21, 2021. Only select CSN data were available for the event day on December 6, 2021. These data are presented in the appendices of this document.

The speciation data show a predominance of the Interagency Monitoring of Protected Visual Environments (IMPROVE) soil component on the proposed exceptional event days of January 16, 2021 and June 21, 2021, indicating transported dust from high winds. As referenced, these data were not available in their entirety for December 6, 2021; therefore, the reconstructed $PM_{2.5}$ calculation could not be performed. The IMPROVE soil component is derived using a calculation consisting of speciated $PM_{2.5}$ parameters understood to be the primary constituents in soil that would be representative of transported dust from natural undisturbed land.

2.3.2 Synoptic Weather Maps

Weather maps are helpful for displaying large-scale observation-based weather features. On the proposed exceptional event days, regional weather maps depict weather systems favorable for producing winds, and by extension, airborne particulate matter. These maps are presented in the appendices of this document.

2.3.3 Backward-in-Time Air Trajectories

Backward-in-time air parcel trajectories were produced using the NOAA HYSPLIT model. For each event date these trajectories provide a clear indication of the path an air parcel took enroute to the area where elevated PM_{10} concentrations were recorded. This analysis is accomplished by tracking the air arriving at the time detailed on the event day (and day prior if relevant) and following the air backward in time to demonstrate both the origin and path of the air parcels. These trajectories are presented in the appendices of this document.

2.3.4 Maps of Daily Average Particulate Matter

Maps of the daily average PM_{10} and $PM_{2.5}$ concentrations show the spatial distribution of measurements on an event day. For all three proposed exceptional event days, the maps demonstrate that while the highest concentrations were recorded at a monitor that exceeded the standard, relatively high concentrations were recorded throughout the area. This wide spatial distribution of high readings provides evidence that the elevated PM_{10} concentrations were the result of a non-local source as a local source would result in a greater inconsistency amongst the monitors. These maps are presented in the appendices of this document.

2.3.5 Continuous Data Time Series Graphs

Time series graphs with continuous particulate measurements plotted against wind speed measurements illustrate the nature of dust events by showing that particulate concentrations increase following sustained high wind speeds. Specifically, these plots show the correlation between an increase in wind speed and the associated PM_{10} concentrations. A complete set of graphs for each event is presented in the appendices of this document.

CHAPTER 3: NOT REASONABLY CONTROLLABLE OR PREVENTABLE

The 2016 Exceptional Event Rule, 40 Code of Federal Regulations (CFR) §50.14(c)(3)(iv)(D), requires states to demonstrate that the event was both not reasonably controllable and not reasonably preventable. However, under 40 CFR §50.14(b)(5)(iv), states are not required to provide a case-specific justification for a high wind dust event to address the not reasonably preventable criterion. Therefore, only evidence to meet the not reasonably controllable criterion is presented here.

3.1 NATURAL AND ANTHROPOGENIC SOURCE CONTRIBUTIONS

Vast expanses of undeveloped land exist in the central United States. In a large-scale blowing dust event, uncharacteristically high northerly winds in the central portion of the country have the potential to generate blowing dust that can be transported through Texas and continue into the Gulf of Mexico as occurred on January 16, 2021. Without the assistance of satellite imagery, it can be difficult to pinpoint the origin of dust that has been transported large distances, but in the instance of January 16, 2021, satellite imagery demonstrated the origin of the dust to be Colorado's Great Plains. This semiarid region, situated in the eastern portion of the state, is characterized by silty and sandy loam soils and is considered the agricultural core of the state. Satellite images are presented in Appendix B: *Event Analysis for January 16, 2021*.

With respect to the proposed exceptional events for El Paso County, a study of blowing dust plume origins in the Chihuahuan Desert area surrounding El Paso County, based on satellite imagery for 26 episodes from 2001 through 2009, indicated that origin locations were primarily in northern Mexico and southwestern New Mexico (Baddock et al., 2011). Although not identified as a primary origin location, the Chihuahuan Desert extends east of El Paso County providing a potential dust source when winds are entering El Paso County from the east. Dust sources for multiple dust storm events from 2002 through 2006 were studied by Gill et al. (2007). Their work found that a large playa complex within the Lake Palomas region of northern Chihuahua, Mexico frequently contributed to concentrated plumes of particulate matter that spread into the El Paso/Ciudad Juarez area. Particle size analyses of surface sediment samples from these playas revealed very fine clays and silts with grain sizes in the particulate matter of 2.5 microns or less in aerodynamic diameter ($PM_{2.5}$) and particulate matter of 10 microns or less in aerodynamic diameter (PM_{10}) ranges, including particles as small as 0.2 micron.

The El Paso/Ciudad Juarez area is located in a bowl-shaped valley where particulate matter gets trapped by strong temperature inversions (a layer in the atmosphere in which air temperature increases with height) and down-sloping winds from surrounding mountains during air stagnation events (periods of low wind speeds). Anthropogenic sources that contribute to elevated particulate matter concentrations during these episodes often include local industrial facilities, automobiles, and fires. Ciudad Juarez has minimal controls on burning of wood, tires, scrap plastics, and construction debris. Automobiles in Ciudad Juarez are on average older than those in El Paso and can have greater particulate matter emissions. El Paso and nearby Sunland Park, New Mexico have comparatively strict controls on pollution sources from various combustion types that are considered reasonably available control technology (RACT) or reasonably available control measures (RACM) (TCEQ1, 2007).

Particulate matter emissions inventories (EI) were reviewed for each county for which an exceptional event for 2021 is proposed. These inventories were reviewed to identify the sources of the largest anthropogenic particulate matter emitters to gain an understanding of if these sources could have influenced PM_{10} concentrations on the proposed exceptional event days.

When considering the January 16, 2021 event, evaluation of the Harris County particulate matter EI indicate that the most significant contributions of anthropogenic PM_{10} emissions are from industrial/commercial/institutional construction, unpaved roads, paved roads, and point sources. In Nueces County, the most significant contributions are from unpaved roads, agricultural tilling, point sources, and industrial/commercial/institutional construction. In both counties, the listed sources do not typically have potential for an emission event or large increases in emissions on a single day.

Table 3-1: *Harris County Particulate Matter Emissions Inventory in Tons per Year* shows the 2020 area, point, and mobile source particulate matter EI for Harris County, and Table 3-2: *Nueces County Particulate Matter Emissions Inventory in Tons per Year* shows the 2020 area, point, and mobile source particulate matter EI for Nueces County. These emissions inventories are representative of an entire county and not specific to just those areas upwind of area monitors on January 16, 2021. Given the widespread recording of above-average PM_{10} concentrations on January 16, 2021, as opposed to stand-alone high values at a single monitor relative to local particulate matter sources, impacts from factors listed in the EI are unlikely to have been a major contributor to measured PM_{10} values. Sources listed in the EI would typically lead to increased PM_{10} concentrations over a longer period as opposed to a single sampling day as was the case on January 16, 2021.

Table 3-1: Harris County Particulate Matter Emissions Inventory in Tons per Year

Year	Source Type	Source Category	PM_{10}	$PM_{2.5}$
2020	Area	Road Construction	2,871	287
2020	Area	Unpaved Roads	9,085	904
2020	Area	Industrial/Commercial/Institutional Construction	30,402	3,040
2020	Area	Paved Roads	5,643	1,411
2020	Area	Agricultural Tilling	343	69
2020	Area	Residential Construction	990	99
2020	Area	Mining and Quarrying	830	104
2020	Area	Remaining Area Sources	3,119	1,918
2020	Mobile	On-road	2,139	598
2020	Mobile	Non-road	1,209	1,143
2020	Point	Point Sources	4,613	3,845

Table 3-2: Nueces County Particulate Matter Emissions Inventory in Tons per Year

Year	Source Type	Source Category	PM_{10}	$PM_{2.5}$
2020	Area	Road Construction	124	12
2020	Area	Unpaved Roads	4,591	457
2020	Area	Industrial/Commercial/Institutional Construction	968	97
2020	Area	Paved Roads	534	133
2020	Area	Agricultural Tilling	3,499	700
2020	Area	Residential Construction	158	16
2020	Area	Mining and Quarrying	23	3
2020	Area	Remaining Area Sources	440	202
2020	Mobile	On-road	158	51
2020	Mobile	Non-road	172	162
2020	Point	Point Sources	1,491	1,181

Figure 3-1: *Harris County PM_{10} Point Source Locations in Tons per Year (TPY)* and Figure 3-2: *Nueces County PM_{10} Point Source Locations in Tons per Year (TPY)* display point sources reporting 2020 particulate matter emissions. Please note that the scale fluctuates between Figure 3-1 and Figure 3-2. On January 16, 2021, wind was consistently from the northwest which is not upwind of large PM_{10} emitting point sources relative to the positions of the monitors that recorded PM_{10} exceedances in Harris County and Nueces County on January 16, 2021.

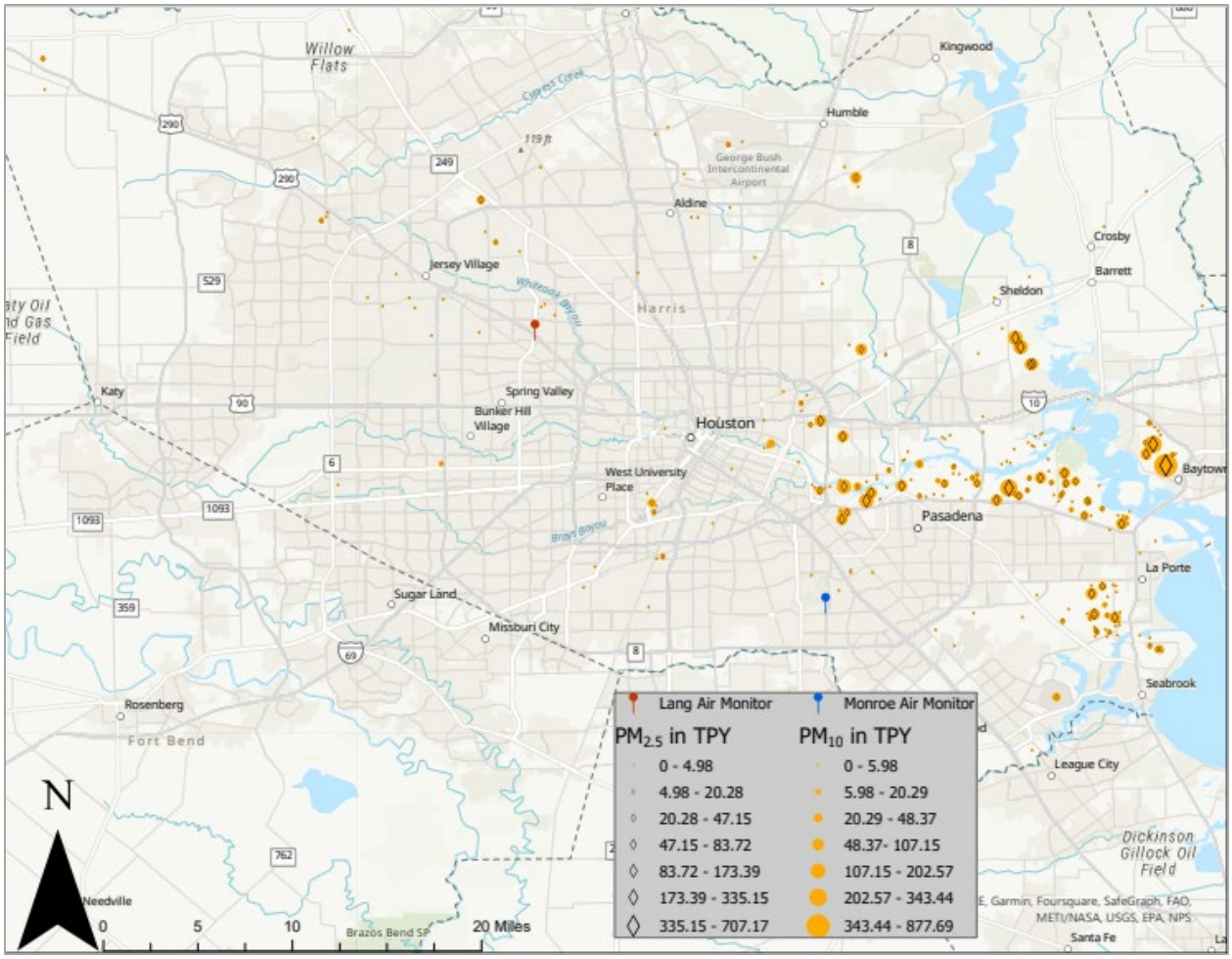

Figure 3-1: Harris County PM_{10} Point Source Locations in Tons per Year (TPY)

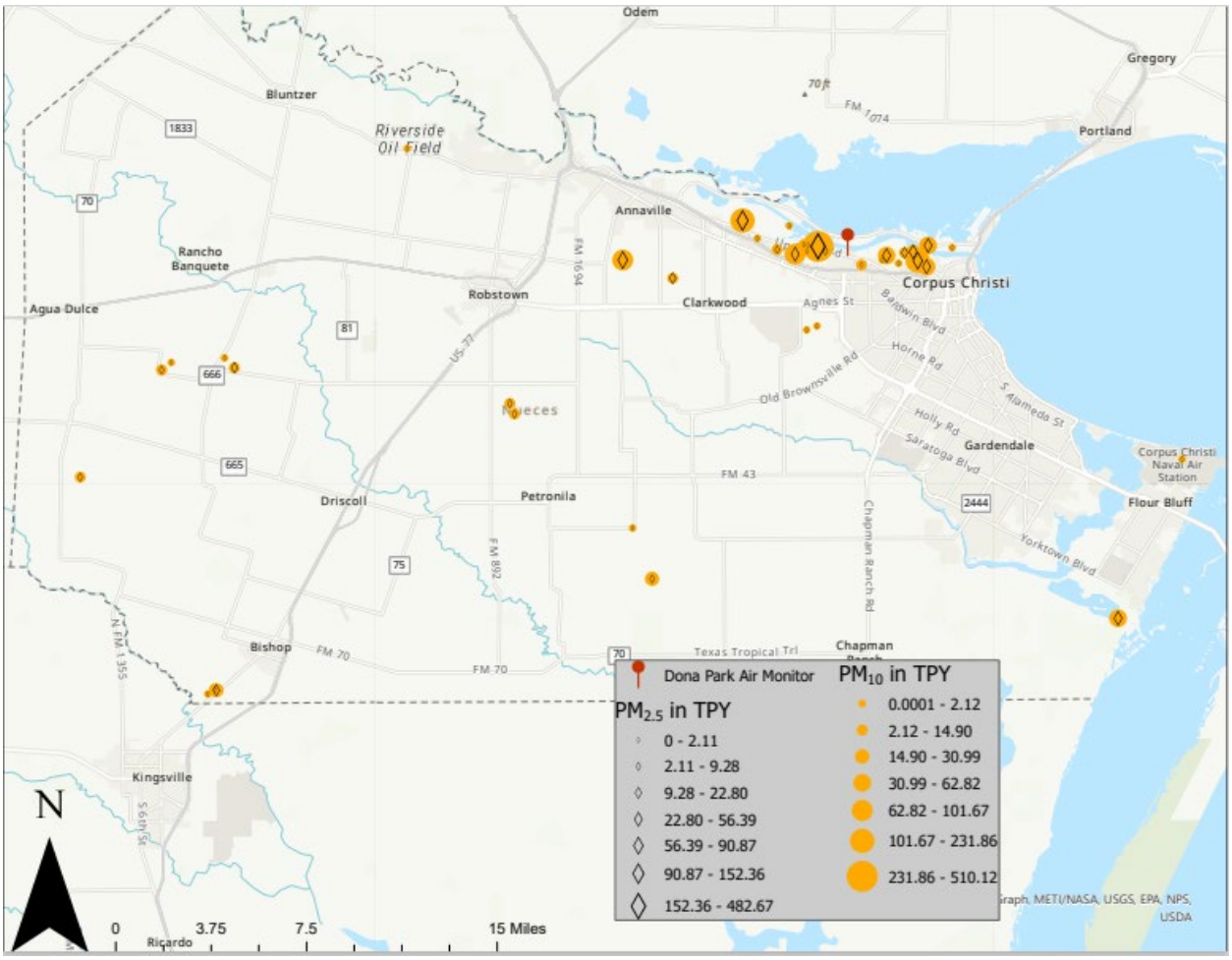

Figure 3-2: Nueces County PM_{10} Point Source Locations in Tons per Year (TPY)

When considering the June 21, 2021 and December 6, 2021 proposed exceptional events, evaluation of the El Paso County particulate matter EI reveals the most significant contributions of anthropogenic particulate emissions are from unpaved roads, commercial construction, and paved roads. These sources do not typically have potential for an emission event or large increases in emissions on a single day. Table 3-3: *El Paso County Particulate Matter Emissions Inventory in Tons per Year* shows the 2020 area source and mobile source particulate matter EI for El Paso County as reported for the 2020 National Emissions Inventory, as well as the 2016 through 2021 point-source EI. These emissions inventories are representative of the entire county and not specific to just those areas upwind of area monitors on the event days. Given the locations of the Socorro Hueco (C49), Riverside/El Paso Mimosa (C9996), and Ivanhoe (C414) monitors, road construction or commercial construction projects are unlikely to have been a major contributor to measured concentration values on flagged exceptional event days.

Table 3-3: El Paso County Particulate Matter Emissions Inventory in Tons per Year

Year	Source Type	Source Category	PM_{10}	$PM_{2.5}$
2020	Area	Road Construction	340	34
2020	Area	Unpaved Roads	9,460	942
2020	Area	Commercial Construction	4,193	419
2020	Area	Paved Roads	1,298	325
2020	Area	Agricultural Tilling	615	123
2020	Area	Residential Construction	294	29
2020	Area	Mining and Quarrying	476	60
2020	Area	Remaining Area Sources	593	371
2020	Mobile	On-road	475	166
2020	Mobile	Non-road	113	107
2016	Point	Point Sources	346	285
2017	Point	Point Sources	305	196
2018	Point	Point Sources	306	218
2019	Point	Point Sources	289	200
2020	Point	Point Sources	286	200
2021	Point	Point Sources	277	194

Figure 3-3: *El Paso County PM_{10} Point Source Locations in Tons per Year (TPY)* displays locations of point sources in El Paso County reporting 2020 particulate matter emissions of five tons per year or greater. On the event day of June 21, 2021, primarily westerly wind was infrequently from the direction of these sources relative to the Riverside/El Paso Mimosa (C9996) and Socorro Hueco (C49) monitors. Similarly, on the event day of December 6, 2021, primarily easterly wind was infrequently from the direction of these sources relative to the Ivanhoe (C414) monitor. The number plotted inside each point source circle in Figure 3-3 is the PM_{10} annual emission rate in tons per year from the 2020 Texas Commission on Environmental Quality (TCEQ) emissions inventory. Blue shading in each point source circle indicates the fraction of the total PM_{10} emitted as $PM_{2.5}$ based on the 2020 $PM_{2.5}$ annual emission rate.

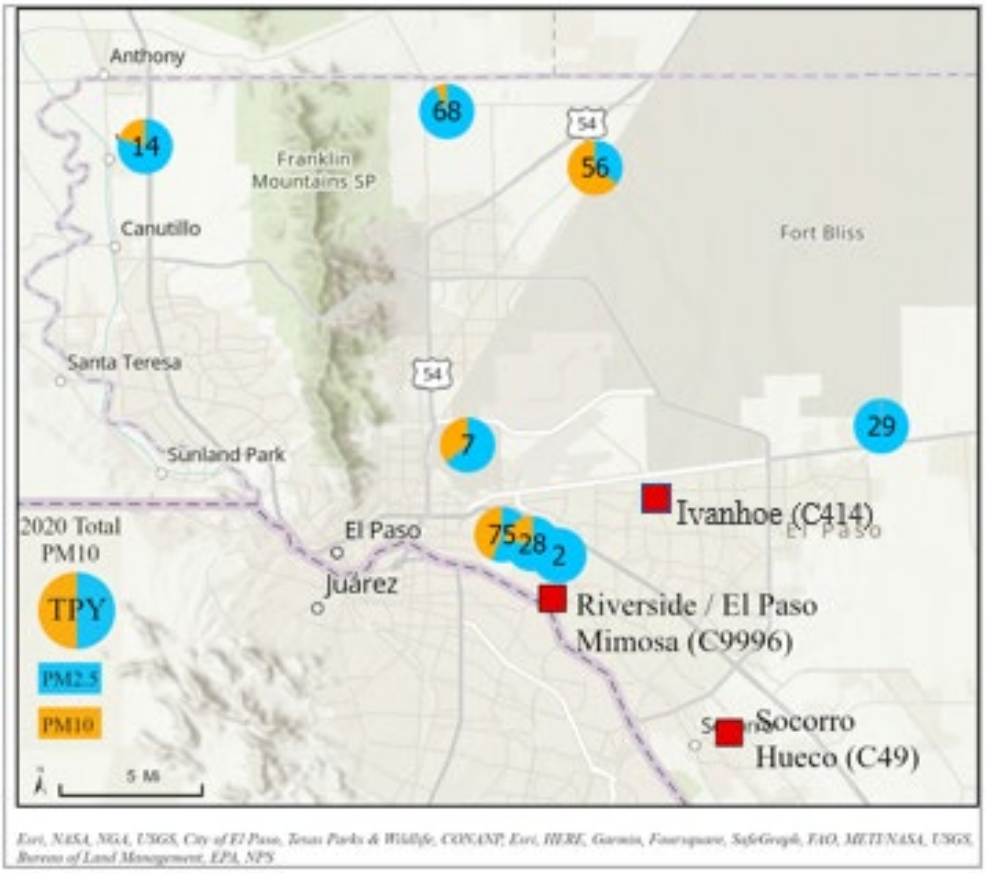

Figure 3-3: El Paso County PM_{10} Point Source Locations in Tons per Year (TPY)

$PM_{2.5}$ speciation data were used to provide further indication that particulate matter constituents on the exceptional event days were not representative of particulate matter species on days not influenced by wind-blown dust. Through a series of calculations, this analysis was performed on dates speciation data were available in their entirety from the affected counties. The referenced dates covered two of the three proposed exceptional event dates and included January 16, 2021 and June 21, 2021. Results from this study are presented in the appendices of this document.

Wind roses are an effective way to present long term trends in wind speed and direction. Wind roses were generated from select monitors within all three counties for which exceptional events are proposed for 2021. Lengths of the wind rose bars indicate the frequency of hourly winds blowing from the direction of the bar toward a site. The width and color of the bars indicate the hourly wind speeds for the ranges shown in the key. With stronger winds, the direction of the wind will more directly indicate the source of any air pollution present. When reviewing wind roses from a region with mountainous topography such as El Paso County, the channeling effect of such topography must be considered relative to a monitor's location. Assistance with reading a wind rose can be found at the EPA's How to Read a Wind Rose webpage (https://www.epa.gov/sites/default/files/2019-01/documents/how_to_read_a_wind_rose.pdf).

Figure 3-4: *Wind Rose Plots for Harris County and Nueces County Monitors for 2019 through 2021* illustrates typical, overall wind patterns at select monitors within both counties. In the instance of the long-range transport event on January 16, 2021, local wind speeds are less relevant than wind speeds at the origin point of the dust source. As such, the wind roses in Figure 3-4 are less informative than if the source of the wind-blown dust was in closer proximity.

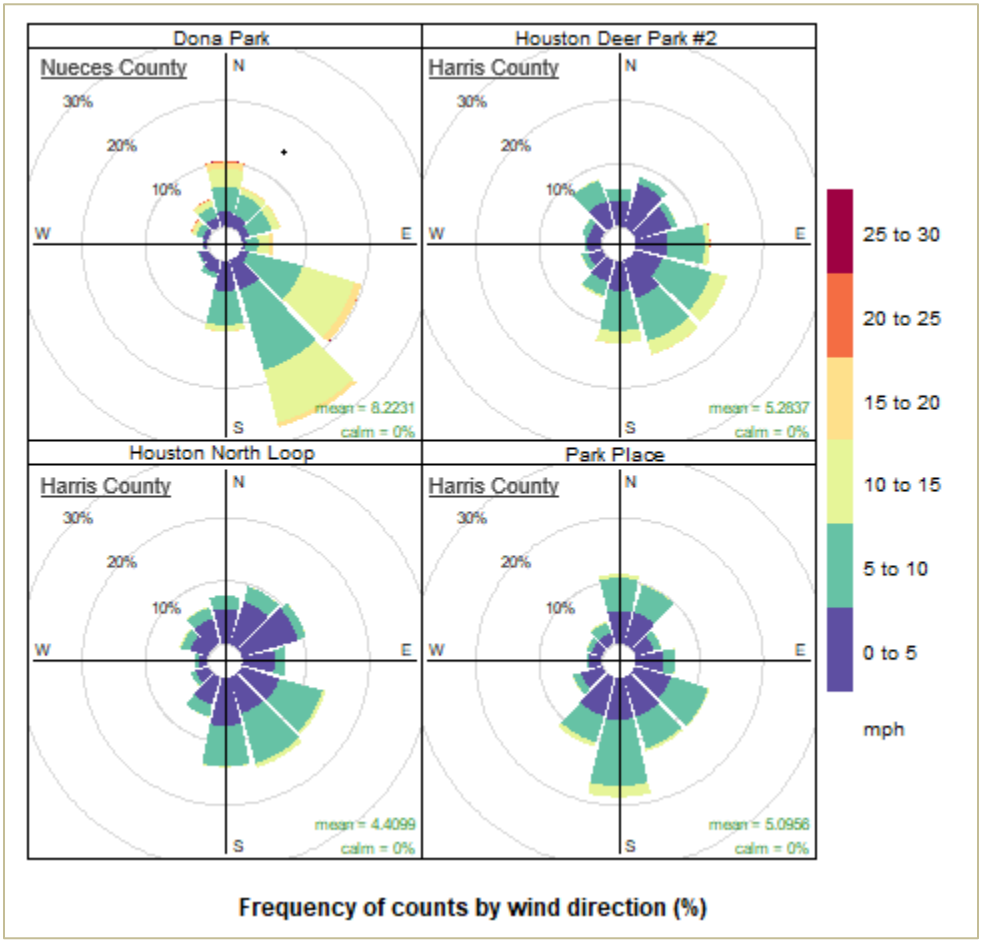

Figure 3-4: Wind Rose Plots for Harris County and Nueces County Monitors for 2019 through 2021

Figure 3-5: *Wind Rose Plots for the El Paso UTEP (C12), Ascarate Park SE (C37), El Paso Chamizal (C41), and Socorro Hueco (C49) Monitors for 2019 through 2021* illustrates typical, overall wind patterns in El Paso County. The inconsistencies in wind data observed from monitors within the same geographic area is due to the channeling effect of the mountainous terrain in the area.

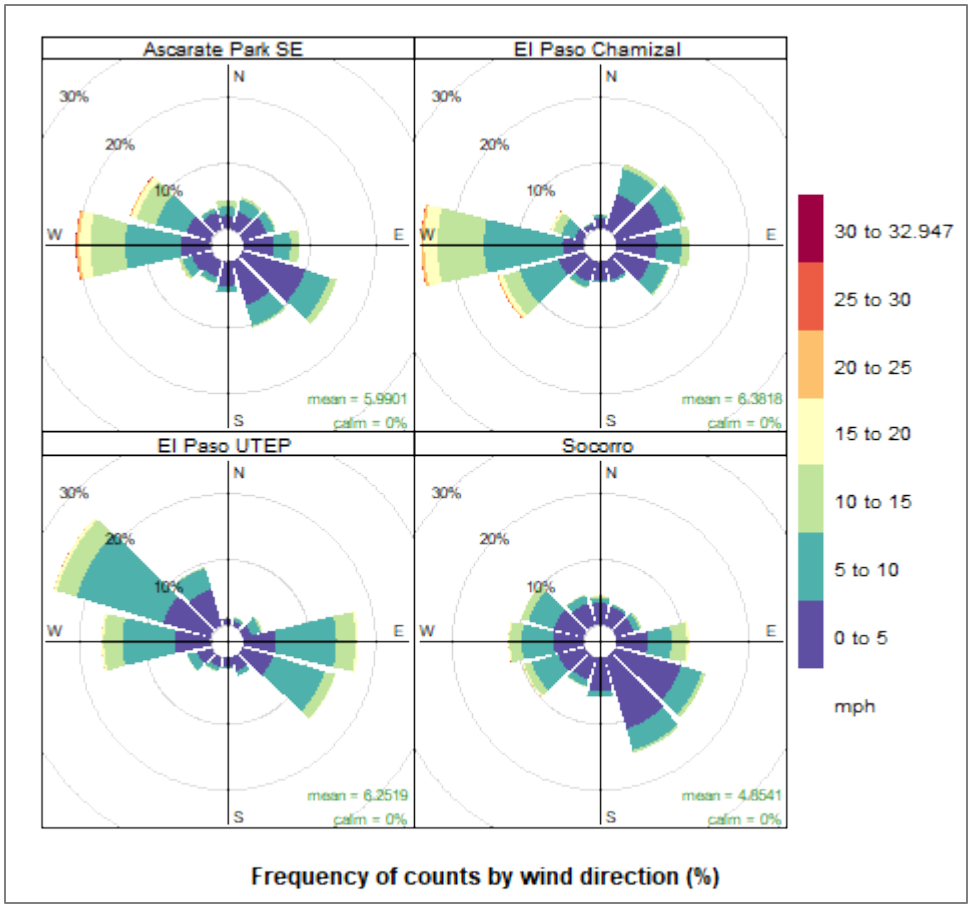

Figure 3-5: Wind Rose Plots for the El Paso UTEP (C12), Ascarate Park SE (C37), El Paso Chamizal (C41), and Socorro Hueco (C49) Monitors for 2019 through 2021

3.2 ATTAINMENT STATUS AND CONTROL MEASURES

Both Houston and Corpus Christi have been designated as attainment for the 24-hour PM_{10} National Ambient Air Quality Standard (NAAQS) since November 15, 1990, and they have also been designated as attainment for both the annual and 24-hour $PM_{2.5}$ NAAQS ever since $PM_{2.5}$ designations were first made on December 17, 2004.

The city of El Paso has been designated as nonattainment for the 24-hour PM_{10} NAAQS since November 15, 1990 but has been designated as attainment for both the annual and 24-hour $PM_{2.5}$ NAAQS ever since $PM_{2.5}$ designations were first made on April 5, 2005. The State of Texas adopted state implementation plan (SIP) provisions in November 1991 that include regulations on PM_{10} sources in the El Paso area. The United States (U.S.) Environmental Protection Agency (EPA) published its approval of the El Paso PM_{10} SIP revision on January 18, 1994, effective on February 17, 1994 (59 *Federal Register* 02532). The approved SIP revision incorporated all nonattainment requirements including RACT and RACM. Additionally, a Memorandum of Understanding (MOU) between the City of El Paso and the Texas Air Control Board (TACB), a predecessor agency of the TCEQ, was incorporated to define the division of responsibility and commitments to carry out provisions of the rules developed in the 1991 El Paso PM_{10} SIP revision.

On January 25, 2012, the TCEQ adopted a SIP revision to incorporate updates to the PM_{10} control measures and to incorporate a Memorandum of Agreement (MOA) between the TCEQ and the City of El Paso to reflect the updated control measures. The EPA published its approval of this SIP revision on December 14, 2015, effective January 13, 2016 (80 *Federal Register* 77253). The regulations included in this SIP revision are summarized below:

- Title 30 Texas Administrative Code (TAC) §111.111(c) established conditions for the use of solid fuel heating devices during periods of atmospheric stagnation in the City of El Paso, including the Fort Bliss Military Reservation.
- Title 30 TAC §111.141 establishes that §111.143 (relating to Materials Handling), §111.145 (relating to Construction and Demolition), §111.147 (relating to Roads, Streets, and Alleys), and §111.149 (relating to Parking Lots), and associated dates of compliance, shall apply to the City of El Paso and portions of the Fort Bliss Military Reservation.
- Title 30 TAC §111.145 establishes measures to control dust emissions related to land clearing and construction, repair, alteration and demolition of structures, roads, streets, alleys, or parking areas of any size in the City of El Paso.
- Title 30 TAC §111.147 establishes measures to control dust emissions on public, industrial, commercial, or private roads, streets, or alleys including application of asphalt, water, or suitable oil or chemicals and mechanical street sweeping. Specific requirements are established for alleys and levee roads within the City of El Paso, including paving new alleys and disallowing use of unpaved existing alleys for residential garbage and recycling collection.

The following summarizes other existing regulations applicable to particulate matter control in the El Paso area:

- Title 30 TAC §111.143 establishes measures to control dust emissions related to the handling, transport, or storage of materials which can create airborne particulate matter including the application of water, chemicals, or coverings on materials stockpiles; use of hoods, fans, and filters to enclose, collect, and clean the emissions of dusty materials; and the covering of all open-bodied trucks, trailers, and railroad cars transporting materials in the City of El Paso.
- Title 30 TAC §111.149 establishes measures to control dust emissions, including appropriate application of asphalt, water, or suitable oil or chemicals for temporary parking lots, parking lots having more than five spaces, and paved parking lots having more than one-hundred spaces.
- City of El Paso Municipal Code Chapter 9.38, concerning wood burning, prohibits the operation of a solid fuel heating device within the City of El Paso during a no-burn period, unless an exemption has been obtained.
- City of El Paso Municipal Code Chapter 19.15.020, concerning subdivider responsibility, establishes standards for proposed roads serving new developments, including alleys.
- City of El Paso Municipal Code Chapter 19.15.160 establishes standards for the construction and improvement of alleys.
- City of El Paso Municipal Code Chapter 20.14 establishes standards for the provision of off-street parking, loading and storage, including standards for dust-free surfacing.

Existing regulations applicable to particulate matter control also apply to portions of Harris County and Nueces County. The area in Harris County includes that which is inside the loop formed by Beltway 8. The area of Nueces County includes the Port Terminal area of the City of Corpus Christi and is more precisely delimited as Nueces Bay on the north, Ocean Drive on the east, Highway 44 on the south, and due north from Highway 44 at the intersection of Highway 358 to Nueces Bay on the west. The following summarizes the aforementioned regulations:

- Title 30 TAC §111.143 establishes measures to control dust emissions related to the handling, transport, or storage of materials which can create airborne particulate matter including the application of water, chemicals, or coverings on materials stockpiles; use of hoods, fans, and filters to enclose, collect, and clean the emissions of dusty materials; and the covering of all open-bodied trucks, trailers, and railroad cars transporting materials.
- Title 30 TAC §111.145 establishes measures to control dust emissions related to land clearing and construction, repair, alteration and demolition of structures, roads, streets, alleys, or parking areas of any size.
- Title 30 TAC §111.147 establishes measures to control dust emissions on public, industrial, commercial, or private roads, streets, or alleys including application of asphalt, water, or suitable oil or chemicals and mechanical street sweeping.
- Title 30 TAC §111.149 establishes measures to control dust emissions, including appropriate application of asphalt, water, or suitable oil or chemicals for temporary parking lots, parking lots having more than five spaces, and paved parking lots having more than one-hundred spaces.

Title 30 TAC §111, Subchapter B is a statewide regulation that addresses outdoor burning and is applicable to particulate matter control.

3.3 NOT REASONABLY CONTROLLABLE

As discussed throughout this document, the proposed event days were characterized by international or domestic transport of blowing dust not indicative of local sources. Backward trajectories presented in the appendices of this document suggested the transport of large amounts of dust from uncontrollable sources within Texas and outside of the U.S. and Texas. The transport of this dust was associated with regional high winds as described throughout this document.

3.4 NOT REASONABLY CONTROLLABLE OR PREVENTABLE DETERMINATION

The documentation and analysis presented in this chapter and within this document's appendices demonstrate that all identified sources that caused or contributed to the exceedances were reasonably controlled, effectively implemented, and enforced at the time of the events; therefore, emissions associated with the high wind dust events were not reasonably controllable or preventable.

CHAPTER 4: NATURAL EVENT

The proposed exceptional event flags for January 16, 2021, June 21, 2021, and December 6, 2021 are for high wind blowing dust events generated entirely from natural undisturbed lands, which are natural events. High wind blowing dust events, typically associated with large low-pressure systems, can impact El Paso County every year. International dust source locations are consistent with a study of blowing dust origin locations in the Chihuahua Desert surrounding El Paso during the period 2001 through 2009 (Baddock et al., 2011). High wind blowing dust events are less common in Harris County and Nueces County as dust must typically travel a greater distance to impact these counties in comparison to El Paso County.

On the event days of January 16, 2021 and June 21, 2021, the Interagency Monitoring of Protected Visual Environments (IMPROVE) soil component also provided evidence that elevated particulate concentrations were from natural sources. The Harris County and Nueces County area IMPROVE soil component shown in Appendix B: *Event Analysis for January 16, 2021*, and the El Paso County IMPROVE soil component shown in Appendix C: *Event Analysis for June 21, 2021* both exceeded the 2019 through 2021 average values as would be expected with natural events caused by blowing dust associated with high winds. The data necessary to conduct this study were not available on December 6, 2021. As such, the IMPROVE soil component could not be calculated for the proposed exceptional event on this date for the Ivanhoe (C414) monitor in El Paso County.

Based on the documentation provided in this demonstration, the events qualify as natural events. The exceedances associated with the events meet the regulatory definition of natural events under 40 Code of Federal Regulations §50.14(b)(5)(ii). The events transported windblown dust from natural, undisturbed lands as documented throughout this demonstration, and accordingly, the Texas Commission on Environmental Quality (TCEQ) has demonstrated that the events were natural events and may be considered for treatment as exceptional events.

CHAPTER 5: CLEAR CAUSAL RELATIONSHIP

Abundant evidence, including wind information, particulate matter of 2.5 microns or less in aerodynamic diameter ($PM_{2.5}$) speciation data, and backward-in-time air parcel trajectories, provides proof that the elevated particulate concentrations on the event days were caused by blowing dust from natural sources generated by high winds.

A comparison of $PM_{2.5}$ chemical speciation data provided evidence that particulate matter concentrations on the proposed exceptional event days were influenced by particulate matter transported into the counties with flagged PM_{10} values. As presented in Appendix B: *Event Analysis for January 16, 2021* and Appendix C: *Event Analysis for June 21, 2021,* speciation data confirmed that on the referenced dates the IMPROVE soil component was higher than the average IMPROVE soil component for 2019 through 2021 at both monitoring sites. Due to a lack of availability of $PM_{2.5}$ speciated data in El Paso County on December 6, 2021, this study could not be conducted for this date.

Backward-in-time air trajectories (NOAA ARL, 2021) confirmed that air arriving during the proposed exceptional event days traveled through natural, undisturbed land prior to arrival in counties that monitored elevated PM_{10} concentrations. Specifically, trajectories for the January 16, 2021 event traveled through southeastern Colorado, a location confirmed by satellite imagery to be the origin of the dust that traveled through Texas and ultimately into the Gulf of Mexico. Trajectories for June 21, 2021 traveled through natural, undisturbed land in northern Mexico prior to arrival in El Paso County, and trajectories for December 6, 2021 traveled through natural, undisturbed land from the Chihuahuan Desert east of El Paso County. Backward-in-time air trajectories are presented in graphic form in the appendices of this document.

5.1 OCCURRENCE AND GEOGRAPHIC EXTENT OF THE EVENT

To contribute additional supporting documentation establishing the occurrence and geographical extent of the proposed exceptional events, descriptions of weather conditions and maps of particulate matter concentrations are presented in the appendices of this document. Additionally, special weather statements and media coverage information, on dates available, are presented in the appendices of this document.

5.1.1 Transport of Event Emissions to the Relevant Particulate Matter Monitor

Evidence to demonstrate that high wind blowing dust events transported particulate matter to the impacted monitors on the proposed exceptional event days, including analysis of continuous particulate matter and meteorological data, HYSPLIT backward trajectories, and maps of particulate matter concentrations, are provided in the appendices of this document.

5.1.2 Spatial Relationship Between the Event, Particulate Matter Sources, Transport of Emissions, and Recorded Concentrations

Information to help establish relevant spatial relationships during the events, including area maps, wind direction, anthropogenic/natural particulate matter source locations, monitor locations, and measured particulate matter concentrations are discussed

throughout the demonstration document with supplemental information presented in the appendices of this document.

5.1.3 Temporal Relationship Between the High Wind and Elevated Particulate Matter Concentrations

Continuous data time series plots in the narrative conceptual model generally establish the concurrent relationship between high winds and elevated particulate matter concentrations for an event. This is clearly the case for the June 21, 2021 event where sustained hourly winds of greater than 25 mph were recorded at El Paso County monitors. Because particulate matter on the January 16, 2021 and December 6, 2021 events was transported from a greater distance, the local winds recorded within the county are less relevant than the high winds in the region from which the particulate matter was initially entrained in the air. In both of these instances, sustained hourly winds well over 25 mph were recorded in dust source areas outside of the counties into which the dust was ultimately transported.

5.1.4 Speciation Data: Chemical Composition and/or Size Distribution

Speciation data profiles, available for the January 16, 2021 and June 21, 2021 events, provide supporting evidence that the particulate compositions were different than normal compositions on these event days. Specifically, a greater-than-average portion of particulate matter on these days was composed of crustal material that included components consistent with natural soils. Speciation data were not available for analysis for the December 6, 2021 event.

5.1.5 Comparison of Event-Affected Days to Other High Wind Days without Elevated Concentrations

To illustrate the impact a windblown dust event has as compared to the impact of local anthropogenic dust, an analysis comparing the event days to other high wind days without elevated 24-hour PM_{10} concentrations in 2021 was conducted. Specifically, this comparative analysis focused on identifying days with wind speed and wind direction measurements comparable to the event days but without elevated 24-hour PM_{10} values. PM_{10} data used for select dates in this study were also collected via a tapered element oscillating microbalance (TEOM) sampler. Due to the once-every-six-days sampling schedule for Federal Reference Method (FRM) PM_{10} results, these data can be unavailable on the days that met the wind criteria.

On each of the identified days, daily average PM_{10} measurements were significantly less than the flagged event days. These data are provided in the appendices of this document and supply additional supporting evidence that measured concentrations on the flagged event days were not the result of local anthropogenic sources but were instead caused by transport of widespread dust.

5.1.6 Assessment of Possible Alternative Causes for the Relevant Particulate Matter Exceedances or Violations

A review of the location of PM_{10} point source locations in counties with proposed exceptional events provided further evidence that the PM_{10} concentrations on the proposed exceptional event dates were the result of particulate matter transported into the areas as opposed to local sources. Figure 3-1: *Harris County PM_{10} Point Source Locations* and Figure 3-2: *Nueces County PM_{10} Point Source Locations* in Section 3.1:

Natural and Anthropogenic Source Contributions, Chapter 3: *Not Reasonably Controllable or Preventable* shows that because winds were from the north-northwest, significant non-event particulate matter sources were not upwind of the monitors that recorded PM_{10} exceedances in Harris County and Nueces County on January 16, 2021. This is evident when reviewing backward trajectories in Appendix B: *Event Analysis for January 16, 2021*

Figure 3-3: *El Paso County Significant PM_{10} Point Source Locations* in Section 3.1: *Natural and Anthropogenic Source Contributions*, Chapter 3: *Not Reasonably Controllable or Preventable* also indicates that the significant non-event PM sources were not upwind of the Riverside/El Paso Mimosa (C9996) and Socorro Hueco (C49) monitors during the highest winds on June 21, 2021 which were from the west southwest. This is evident when reviewing backward trajectories in Appendix C: *Event Analysis for June 21, 2021*. Similarly, non-event PM sources were not upwind of the Ivanhoe (C414) monitor during the highest winds on December 6, 2021, primarily from the east. This is evident when reviewing backward trajectories in Appendix D: *Event Analysis for December 6, 2021*. Additionally, the not reasonably preventable analysis describes implementation and enforcement of high wind dust control measures that were in place at the time of the event. Collectively, this evidence establishes the unlikelihood of potential anthropogenic causes of the relevant PM_{10} exceedances at Socorro Hueco (C49) and Riverside/El Paso Mimosa (C9996) on June 21, 2021 and Ivanhoe (C414) on December 6, 2021.

The evidence provided by PM_{10} point source locations relative to wind directions on proposed exceptional event days establishes the unlikelihood of potential anthropogenic causes of the PM_{10} exceedances.

5.2 COMPARISON OF EVENT-RELATED CONCENTRATIONS TO HISTORICAL CONCENTRATIONS

The 2016 Exceptional Event Rule requires that states compare event-related concentrations to historical concentrations. This section was prepared in accordance with the United States Environmental Protection Agency (EPA) High Wind Dust Event Guidance document (EPA, 2019). The information also serves as an important basis for the clear causal relationship criteria.

5.2.1 Comparison of Concentrations on the Claimed Event Days with Past Historical Data

Figure 5-1: *Houston Monroe (C406) and Lang (C408) FRM PM_{10} Daily Measurements from 2017 through 2021* and Figure 5-2: *Dona Park (C199) FRM PM_{10} Daily Measurements from 2017 through 2021* show the valid daily measurements of PM_{10} over the five years referenced at the stated monitors. PM_{10} concentrations on the proposed exceptional event day of January 16, 2021, are circled, and the level of the 24-hour PM_{10} National Ambient Air Quality Standard (NAAQS) is represented by the red line. These figures demonstrate that flagged measurements on January 16, 2021 were well outside of normal historical fluctuations in measured particulate concentrations for Harris County and Nueces County.

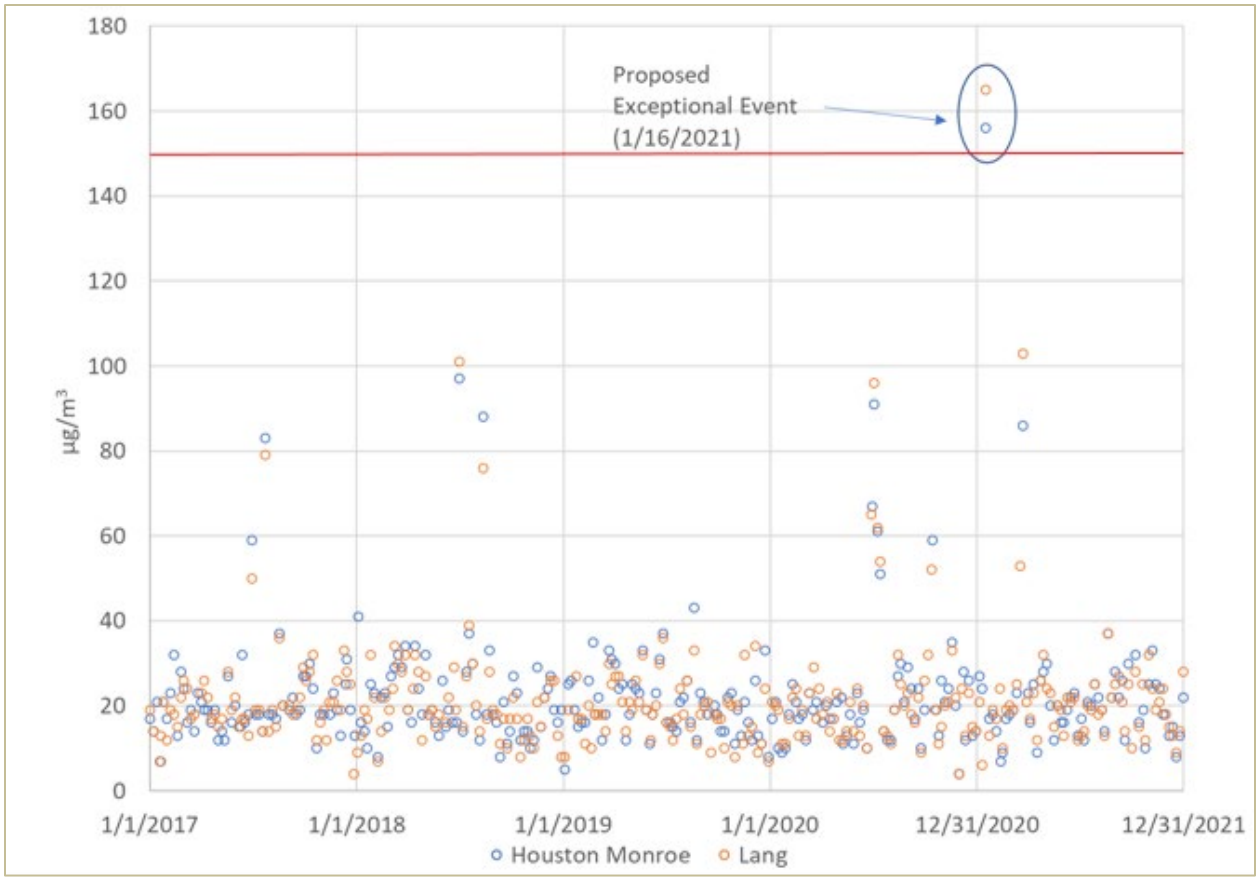

Figure 5-1: Houston Monroe (C406) and Lang (C408) FRM PM_{10} Daily Measurements from 2017 through 2021

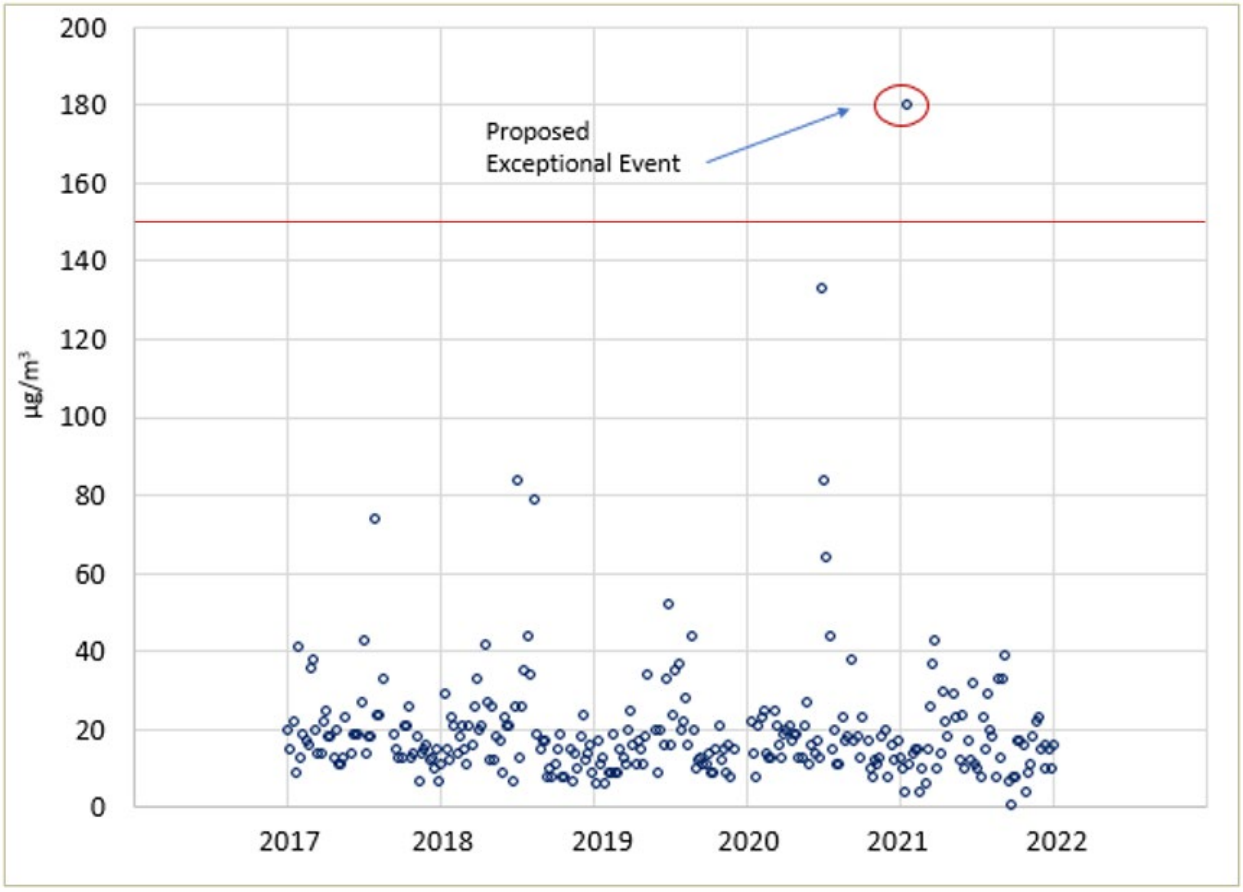

Figure 5-2: Dona Park (C199) FRM PM_{10} Daily Measurements from 2017 through 2021

Figure 5-3: *Socorro Hueco (C49) FRM PM_{10} Daily Measurements from 2017 through 2021* shows the valid daily measurements of PM_{10} at Socorro Hueco (C49) along with the level of the 24-hour PM_{10} NAAQS. EPA-confirmed 2017 and 2018 exceptional event days, a proposed exceptional event day for December 23, 2020, and the date of June 21, 2021 covered in this demonstration are labeled accordingly. This figure demonstrates that flagged measurements on each event day were outside of normal historical fluctuations in measured particulate concentrations at the Socorro Hueco (C49) monitor.

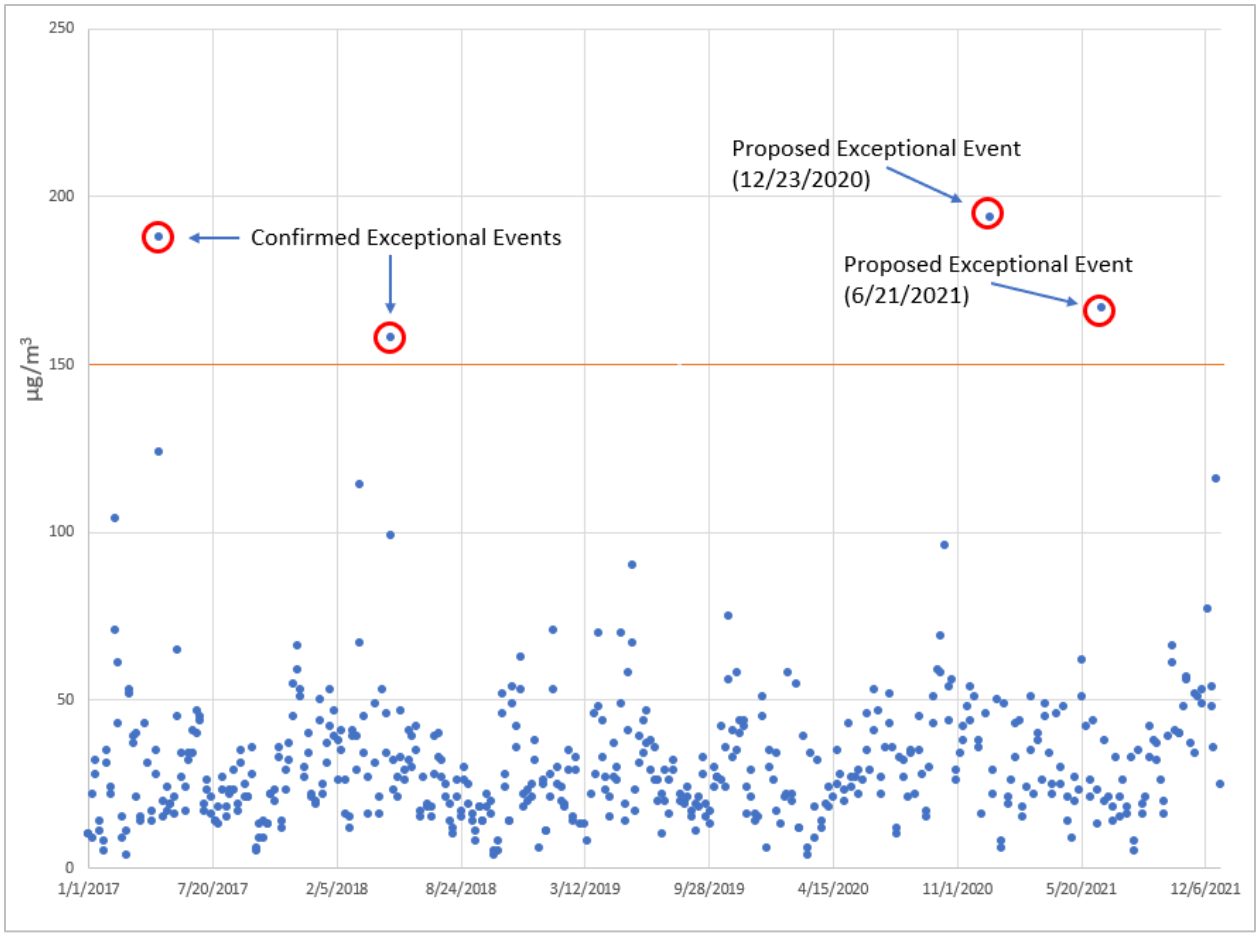

Figure 5-3: Socorro Hueco (C49) FRM PM_{10} Daily Measurements from 2017 through 2021

Figure 5-4: *Riverside/El Paso Mimosa (C9996) FRM PM_{10} Daily Measurements from 2017 through 2021* shows the valid daily measurements of PM_{10} at Riverside/El Paso Mimosa (C9996) along with the level of the 24-hour PM_{10} NAAQS. Proposed exceptional event days are circled in red and labeled accordingly. The increase in daily averages beginning in the early portion of 2020 is due to a construction project that began in March 2020 and continued through the remainder of the year. The figure demonstrates that the flagged measurement on June 21, 2021 was outside of normal historical fluctuations in measured particulate concentrations at the Riverside/El Paso Mimosa (C9996) monitor.

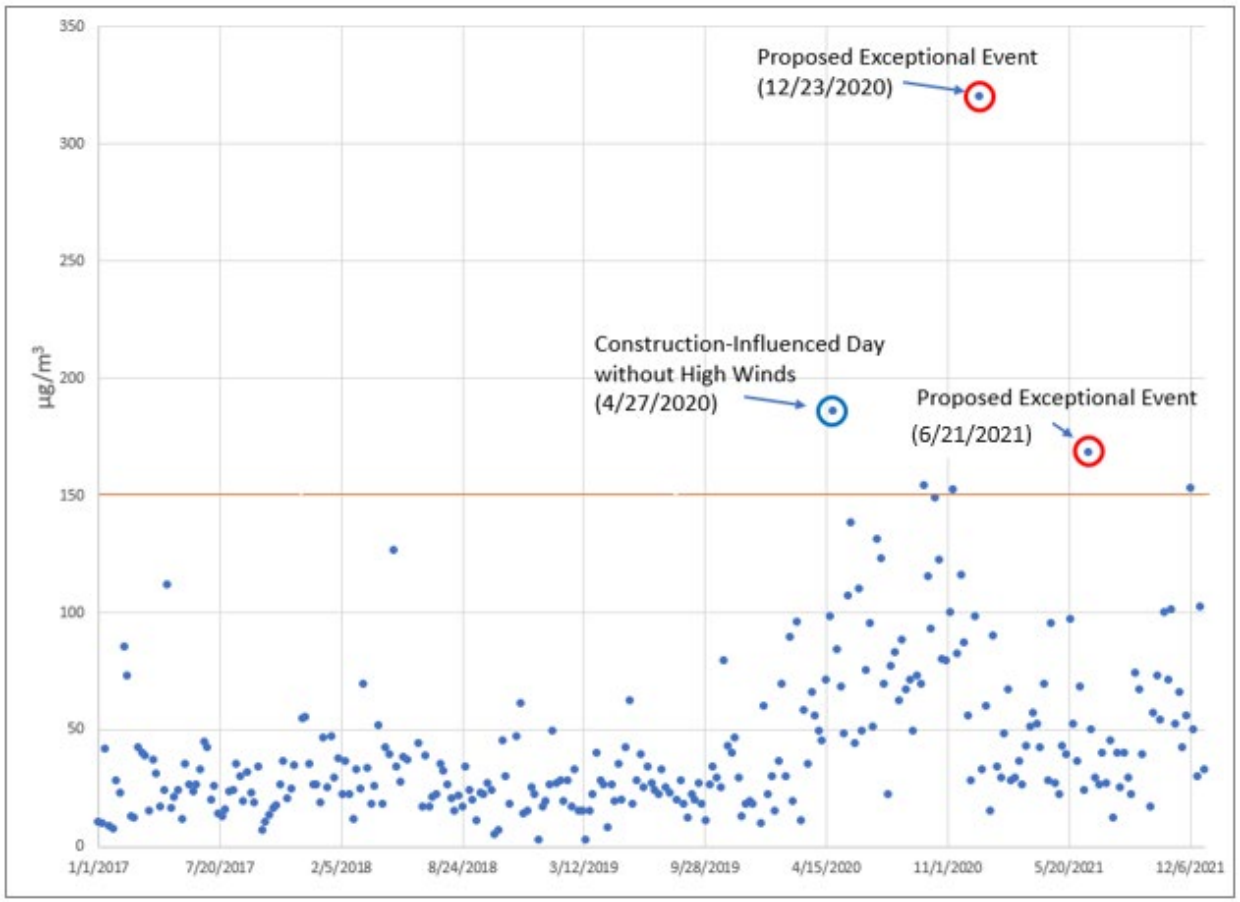

Figure 5-4: Riverside/El Paso Mimosa (C9996) FRM PM_{10} Daily Measurements from 2017 through 2021

Figure 5-5: *Ivanhoe (C414) FRM PM_{10} Daily Measurements from 2017 through 2021* shows the valid daily measurements of PM_{10} at the Ivanhoe (C414) site along with the level of the 24-hour PM_{10} NAAQS. The proposed exceptional event day is circled in red and labeled accordingly. The figure demonstrates that the flagged measurement on December 6, 2021 was outside of normal historical fluctuations in measured particulate concentrations at the Ivanhoe (C414) monitor.

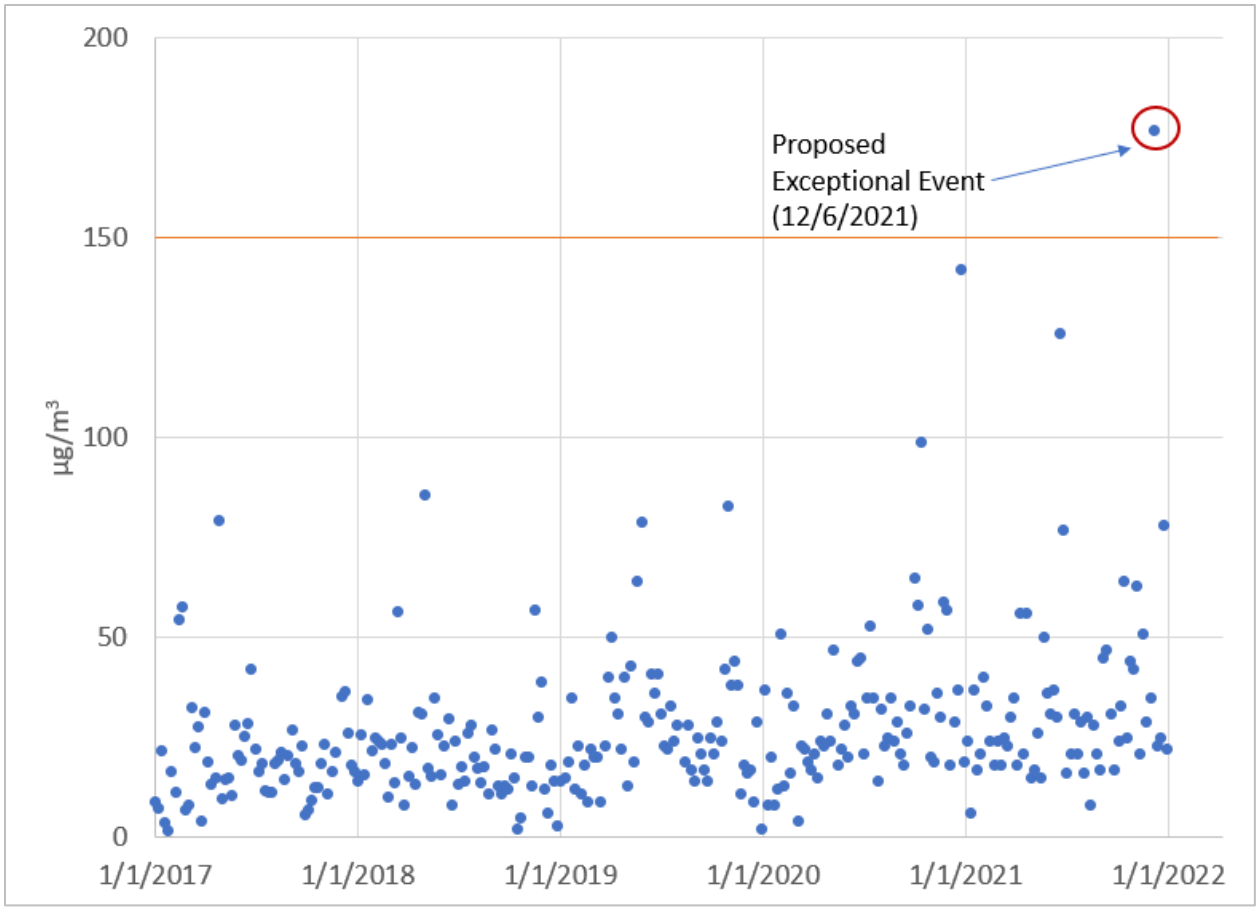

Figure 5-5: Ivanhoe (C414) FRM PM_{10} Daily Measurements from 2017 through 2021

5.2.2 Spatial and Temporal Variability of PM_{10}

PM_{10} data across a county in days preceding and following a proposed exceptional event highlight the impact of a windblown dust event on a flagged event day and demonstrate spatial and temporal variability of PM_{10} in the impacted county. These data, for all three proposed exceptional event dates for 2021, are presented in the appendices of this document. In each instance, the respective proposed exceptional event date was an outlier relative to its surrounding dates.

5.2.3 Percentile Ranking

The flagged PM_{10} concentrations on all three proposed exceptional event dates were above the 99th percentile at their respective monitors and demonstrate that the measurements were well above normal historical fluctuations.

5.3 CLEAR CAUSAL RELATIONSHIP DETERMINATION

On January 16, 2021 a long-range transport dust event initiated by high winds occurred that resulted in elevated PM_{10} concentrations at the Lang (C408) and Houston Monroe (C406) monitors in Harris County and the Dona Park (C199) monitor in Nueces County. The monitored PM_{10} concentration of 165 micrograms per cubic meter (µg/m³) at Lang (C408), 156 µg/m³ at Houston Monroe (C406), and 180 µg/m³ at Dona Park (C199) were the-highest measurement at each monitor during the five-year period from

2017 through 2021. The elevated concentrations were the result of widespread blowing dust originating in southeastern Colorado from northwest winds of up to 60 mph.

On June 21, 2021, a high wind dust event occurred and resulted in elevated PM_{10} concentrations at the Socorro Hueco (C49) and Riverside/El Paso Mimosa (C9996) monitoring sites in El Paso County. The monitored PM_{10} concentration of 167 µg/m^3 at Socorro Hueco (C49) and that of 168 µg/m^3 at the Riverside/El Paso Mimosa (C9996) monitor were the third-highest measurements, respectively, at each monitor during the five-year period from 2017 through 2021. The elevated concentrations on June 21, 2021 were the result of widespread blowing dust transported from northern Mexico associated with high winds generated by a cold front.

On December 6, 2021 a high wind dust event occurred and resulted in elevated PM_{10} concentrations at the Ivanhoe (C414) monitoring site in El Paso County. The monitored PM_{10} concentration of 177 µg/m^3 was the-highest measurement at this monitor during the five-year period from 2017 through 2021. The elevated concentration on June 21, 2021 was the result of widespread blowing dust transported from natural, undisturbed land east of El Paso County that is part of the Chihuahuan Desert.

The comparisons and analyses provided in both the narrative conceptual model, clear causal relationship sections, and associated appendices of this demonstration, support the TCEQ's position that the events affected air quality in such a way that there exists a clear causal relationship between the specific events and the monitored PM_{10} exceedances at the Lang (C408), Houston Monroe (C406), and Dona Park (C199) monitors on January 16, 2021; the Socorro Hueco (C49) and Riverside/El Paso Mimosa (C9996) monitors on June 21, 2021; and the Ivanhoe (C414) monitor on December 6, 2021 and thus satisfy the clear causal relationship criterion.

CHAPTER 6: MITIGATION OF EXCEPTIONAL EVENTS

Title 40 Code of Federal Regulations (CFR) § 51.930(a) requires that "A State requesting to exclude air quality data due to exceptional events must take appropriate and reasonable actions to protect public health from exceedances or violations of the national ambient air quality standards." Three specific requirements are described in this regulation and are addressed individually below. Examples of each of the webpages identified below can be found in the appendices of this document.

6.1 PROMPT PUBLIC NOTIFICATION

The first requirement, 40 CFR §51.930(a)(1), is to "provide for prompt public notification whenever air quality concentrations exceed or are expected to exceed an applicable ambient air quality standard." The Texas Commission on Environmental Quality (TCEQ) provides the United States Environmental Protection Agency (EPA) Air Quality Index (AQI) forecasts for the current day and the next three to four days for 17 areas in Texas for ozone, particulate matter of 2.5 microns or less in aerodynamic diameter ($PM_{2.5}$), and particulate matter of 10 microns or less in aerodynamic diameter (PM_{10}). These forecasts are available to the public on the Today's Texas Air Quality Forecast webpage (http://www.tceq.texas.gov/airquality/monops/forecast_today.html) (TCEQ2, 2021) and on the EPA AIRNOW website (http://airnow.gov/) (EPA3, 2021). The Today's Texas Air Quality webpage forecast discussion for each event day is presented in the appendices of these documents.

The TCEQ also provides near real-time hourly PM_{10} and $PM_{2.5}$ measurements from monitors across the state that are available to the public on the Airborne Particulates webpage (https://www.tceq.texas.gov/cgi-bin/compliance/monops/particulates.pl) (TCEQ3, 2021) of the TCEQ website. Finally, the TCEQ publishes an AQI Report on the Air Quality Index Report webpage (https://www.tceq.texas.gov/cgi-bin/compliance/monops/aqi_rpt.pl) (TCEQ4, 2021) that displays the latest and historical daily AQI measurements. These items allow the public to access forecast, current, and past PM_{10} and $PM_{2.5}$ air quality levels.

6.2 PUBLIC EDUCATION

The second requirement, 40 CFR §51.930(a)(2), is to "provide for public education concerning actions that individuals may take to reduce exposures to unhealthy levels of air quality during and following an exceptional event." Links to TCEQ and EPA webpages describing recommended actions for individuals to reduce exposure to particulate matter whenever it is high (EPA2, 2021) are included on TCEQ web displays of forecast and measured AQI levels, including the TCEQ's Air Pollution from Particulate Matter webpage (http://www.tceq.texas.gov/airquality/sip/criteria-pollutants/sip-pm) and the EPA's Air Quality Index (AQI) Basics webpage (https://www.airnow.gov/aqi/aqi-basics/). The EPA also provides similar links on the AIRNOW webpages where TCEQ forecasts and current data are displayed.

The TCEQ also pursues outreach and educational opportunities in the El Paso area through work with the Paso Del Norte Joint Advisory Committee (https://www.cccjac.org/) and through public informational meetings. The Joint Advisory Committee holds meetings that are open to the public and are attended by TCEQ staff.

The TCEQ pursues outreach and educational opportunities in the Houston area and Harris County through work with the Houston-Galveston Area Council's (HGAC) Regional Air Quality Advisory Committee (RAQPAC) (https://www.h-gac.com/board-of-directors/advisory-committees/regional-air-quality-planning-advisory-committee/meeting-materials). RAQPAC membership is made up of individuals from industry, county and city government, and local environmental organizations. The TCEQ participates in monthly meetings with RAQPAC to discuss air quality issues including, but not limited to, particulate matter.

6.3 IMPLEMENT MEASURES TO PROTECT PUBLIC HEALTH

The third requirement, 40 CFR §51.930(a)(3), is to "provide for the implementation of appropriate measures to protect public health from exceedances or violations of ambient air quality standards caused by exceptional events." Since 1991, the TCEQ and the city of El Paso have implemented dust control measures as part of the state implementation plan (SIP) and its revisions for the El Paso PM_{10} nonattainment area. Additional regulations are in place in Title 30 Texas Administrative Code Chapter 111 that are applicable to particulate matter control either statewide or in portions of El Paso County, Harris County, and Nueces County. These regulations and elements of the SIP and its revisions for the El Paso PM_{10} nonattainment area are previously described in greater detail under Section 3.2: *Attainment Status and Control Measures*, Chapter 3: *Not Reasonably Controllable or Preventable*.

6.4 TCEQ MITIGATION PLAN

On December 28, 2018, the EPA determined that the TCEQ had met the requirement to develop a Mitigation Plan (https://www.tceq.texas.gov/downloads/air-quality/modeling/exceptional/texas-ee-mitigation-plan-final.pdf) for El Paso County for $PM_{2.5}$ due to historic recurrences of exceptional events due to high winds. See Treatment of Data Influenced by Exceptional Events, 81 Fed. Reg. 68216, 68272-73 (Oct. 3, 2016) for a list of areas required to develop Mitigation Plans. While development of this Mitigation Plan was required specifically due to recurrent $PM_{2.5}$ exceptional events, the items included also pertain to PM_{10}. The Mitigation Plan outlines the following components that apply to El Paso County:

- 40 CFR §51.930(a)(1-3) and §51.930(b)(2)(i): Public notification and education programs for affected or potentially affected communities;
- 40 CFR §51.930(b)(2)(ii): Steps to identify, study and implement mitigating measures; and
- 40 CFR §51.930(b)(2)(iii): Provisions for review and evaluation of the mitigation plan and its implementation and effectiveness by the air agency and all interested stakeholders (e.g., public and private landowners/managers, air quality, agriculture and forestry agencies, the public).

CHAPTER 7: CONCLUSION

The information provided in this document demonstrates that the proposed exceptional event flags for particulate matter of 10 microns or less in aerodynamic diameter (PM_{10}) data at the Lang (C408), Houston Monroe (C406), and Dona Park (C199) monitors on January 16, 2021; the Socorro Hueco (C49) and Riverside/El Paso Mimosa (C9996) monitors on June 21, 2021; and the Ivanhoe (C414) monitor on December 6, 2021 meet the requirements for exceptional events. As indicated by backward trajectories and measurement statistics, high winds blowing transported dust clearly caused exceedances of the 24-hour PM_{10} National Ambient Air Quality Standard (NAAQS) on the aforementioned dates. Elevated levels of PM_{10} were caused by regional high winds, were not reasonably controllable or preventable, and were due to natural events. Measured PM_{10} concentrations on the referenced dates were above the 99th percentile of historical measurements and thus affected air quality in excess of normal historical fluctuations. The Texas Commission on Environmental Quality therefore requests the United States Environmental Protection Agency's concurrence on the exceptional event flags and to have the associated measurements removed from consideration when making compliance determinations for the 24-hour PM_{10} NAAQS.

CHAPTER 8: REFERENCES

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APPENDIX A

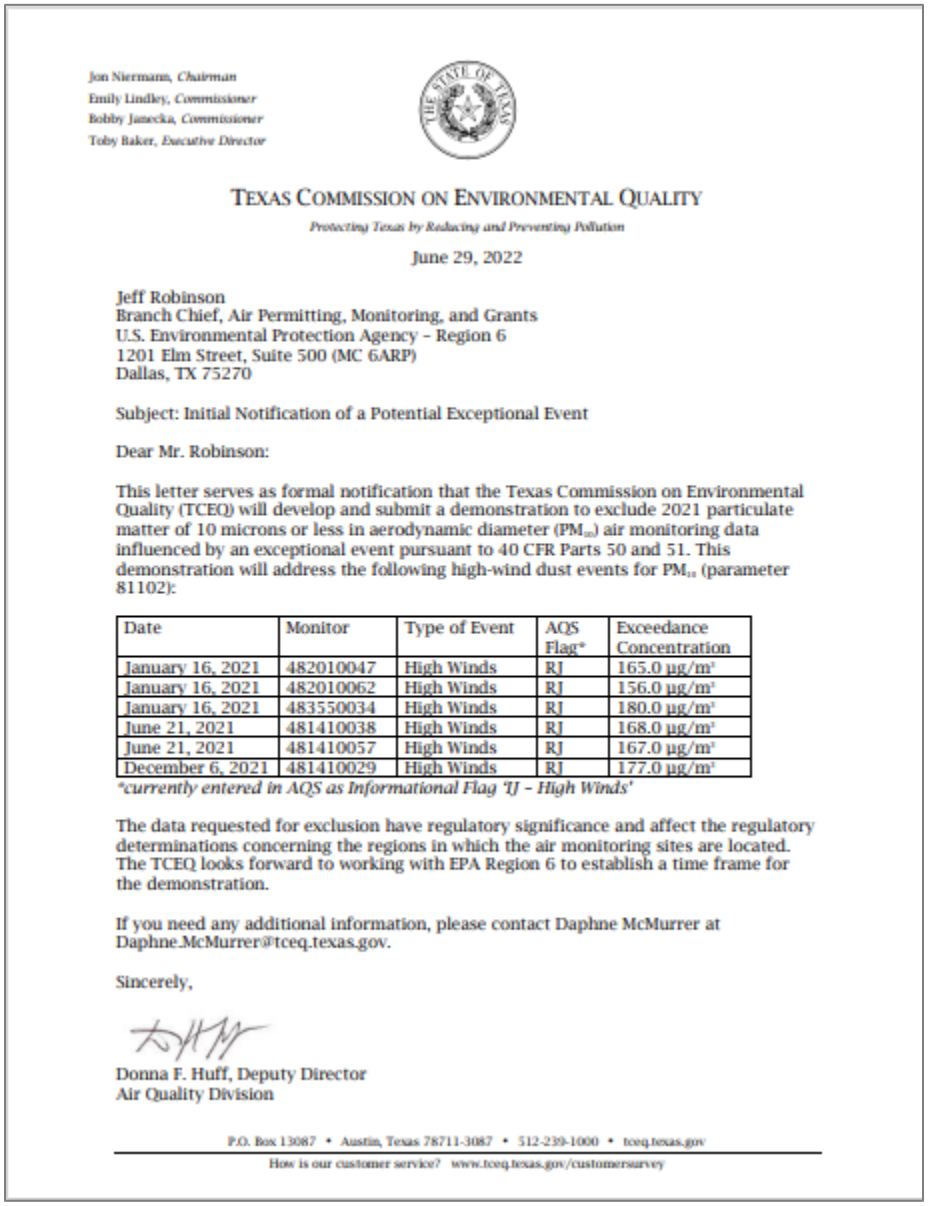
PROPOSED PM_{10} EXCEPTIONAL EVENT FLAGS AND INITIAL NOTIFICATION

EXCEPTIONAL EVENT DEMONSTRATION FOR PARTICULATE MATTER OF 10 MICRONS OR LESS IN AERODYNAMIC DIAMETER (PM_{10}) FOR JANUARY 16, 2021; JUNE 21, 2021; AND DECEMBER 6, 2021

1987 PM_{10} STANDARD

A.1 INITIAL NOTIFICATION PROCESS

The Texas Commission on Environmental Quality submitted an initial notification to the United States Environmental Protection Agency (EPA) Region 6 and engaged in discussions with its EPA Regional office regarding the demonstration prior to formal submittal. A copy of the initial notification letter is provided below in Figure A-1: *Initial Notification Letter to the EPA Region 6.*



Jon Niermann, *Chairman*
Emily Lindley, *Commissioner*
Bobby Janecka, *Commissioner*
Toby Baker, *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

June 29, 2022

Jeff Robinson
Branch Chief, Air Permitting, Monitoring, and Grants
U.S. Environmental Protection Agency – Region 6
1201 Elm Street, Suite 500 (MC 6ARP)
Dallas, TX 75270

Subject: Initial Notification of a Potential Exceptional Event

Dear Mr. Robinson:

This letter serves as formal notification that the Texas Commission on Environmental Quality (TCEQ) will develop and submit a demonstration to exclude 2021 particulate matter of 10 microns or less in aerodynamic diameter (PM_{10}) air monitoring data influenced by an exceptional event pursuant to 40 CFR Parts 50 and 51. This demonstration will address the following high-wind dust events for PM_{10} (parameter 81102):

Date	Monitor	Type of Event	AQS Flag*	Exceedance Concentration
January 16, 2021	482010047	High Winds	RJ	165.0 µg/m³
January 16, 2021	482010062	High Winds	RJ	156.0 µg/m³
January 16, 2021	483550034	High Winds	RJ	180.0 µg/m³
June 21, 2021	481410038	High Winds	RJ	168.0 µg/m³
June 21, 2021	481410057	High Winds	RJ	167.0 µg/m³
December 6, 2021	481410029	High Winds	RJ	177.0 µg/m³

**currently entered in AQS as Informational Flag 'IJ – High Winds'*

The data requested for exclusion have regulatory significance and affect the regulatory determinations concerning the regions in which the air monitoring sites are located. The TCEQ looks forward to working with EPA Region 6 to establish a time frame for the demonstration.

If you need any additional information, please contact Daphne McMurrer at Daphne.McMurrer@tceq.texas.gov.

Sincerely,

Donna F. Huff, Deputy Director
Air Quality Division

P.O. Box 13087 • Austin, Texas 78711-3087 • 512-239-1000 • tceq.texas.gov
How is our customer service? www.tceq.texas.gov/customersurvey

Figure A-1: Initial Notification Letter to the EPA Region 6

A.2 PROPOSED PM_{10} EXCEPTIONAL EVENT FLAGS

Table A-1: Proposed 2021 El Paso Area PM_{10} Exceptional Event Flags

Date	Site ID	Site Name	POC	PM_{10}	Flag	Flag Description
1/16/2021	482010047	Lang (C408)	1	165	RJ	High winds – regional blowing dust
1/16/2021	482010062	Houston Monroe (C406)	1	156	RJ	High winds – regional blowing dust
1/16/2021	483550034	Dona Park (C199)	1	180	RJ	High winds – regional blowing dust
6/21/2021	481410057	Socorro Hueco (C49)	1	167	RJ	High winds – regional blowing dust
6/21/2021	481410038	Riverside/El Paso Mimosa (C9996)	1	168	RJ	High winds – regional blowing dust
12/6/2021	481410029	Ivanhoe (C414)	1	177	RJ	High winds – regional blowing dust

Abbreviations:
Site ID EPA site identification number
POC EPA Parameter Occurrence Code
PM_{10} daily average concentration in micrograms per cubic meter standard conditions ($\mu g/m^3$ standard conditions)
RJ high winds, request exclusion

APPENDIX B

EVENT ANALYSIS FOR JANUARY 16, 2021

HARRIS COUNTY AND NUECES COUNTY EXCEPTIONAL EVENT DEMONSTRATION FOR PARTICULATE MATTER OF 10 MICRONS OR LESS IN AERODYNAMIC DIAMETER (PM_{10}) ON JANUARY 16, 2021

1987 PM_{10} STANDARD

B.1 EVENT SUMMARY

On January 15, 2021 a relatively tight pressure gradient over eastern Colorado and western Kansas caused wind speeds in these areas to increase. Figure B-1: *Regional Weather Map for January 15, 2021* displays this gradient at 1200 Central Standard Time (CST) and displays northwest winds in southeast Colorado at around 30 knots or 35 miles per hour (mph). These strong winds initiated the long-range dust transport that resulted in the PM_{10} exceedances in Harris County and Nueces County on January 16, 2021.

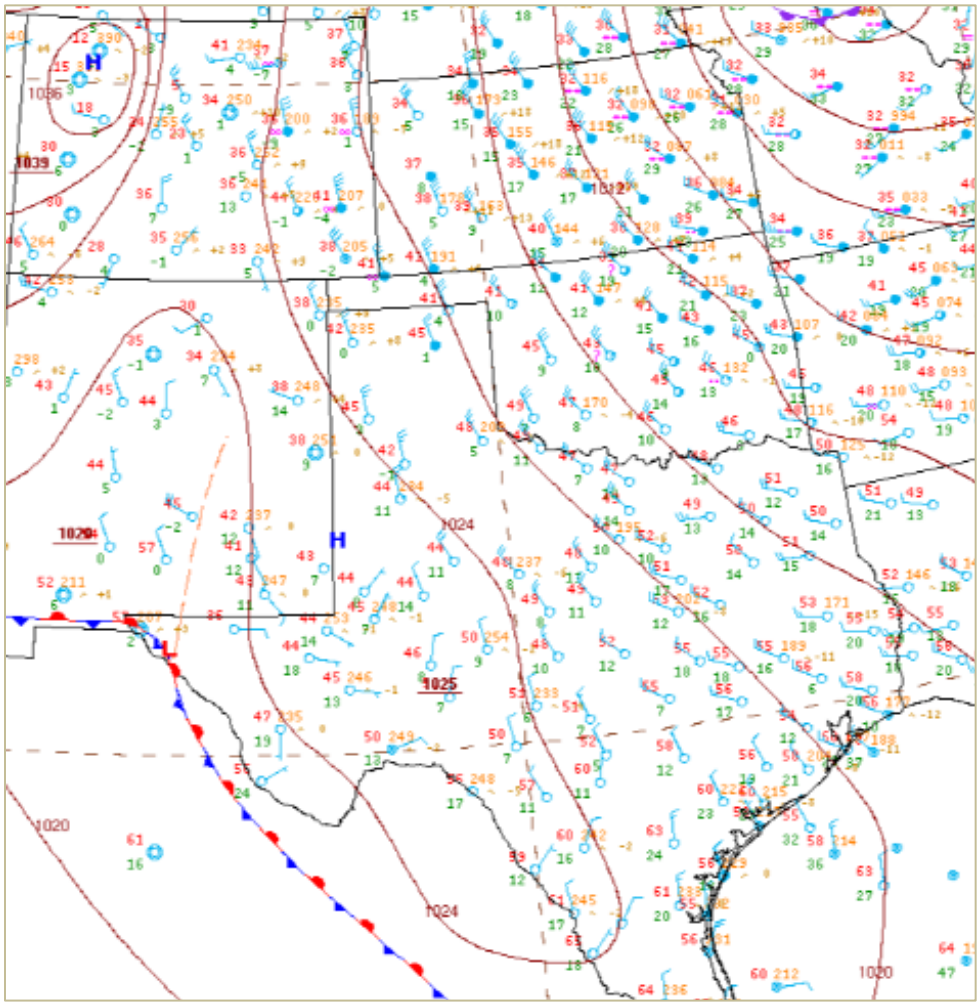


Figure B-1: Regional Weather Map for January 15, 2021

Figure B-2: *Regional Weather Map for January 16, 2021* shows much slower northwest winds, five to 10 knots, or six to 12 mph, over east Texas. These slow winds delivered elevated PM_{10} concentrations to Harris County and Nueces County. This map also indicates that an area of high pressure had taken control over much of east Texas on January 16, 2021. This high pressure likely resulted in wide range subsidence causing dust higher in the atmosphere to mix down toward the surface resulting in the PM_{10} being deposited in Harris County and Nueces County in the absence of high wind speeds locally in those counties.

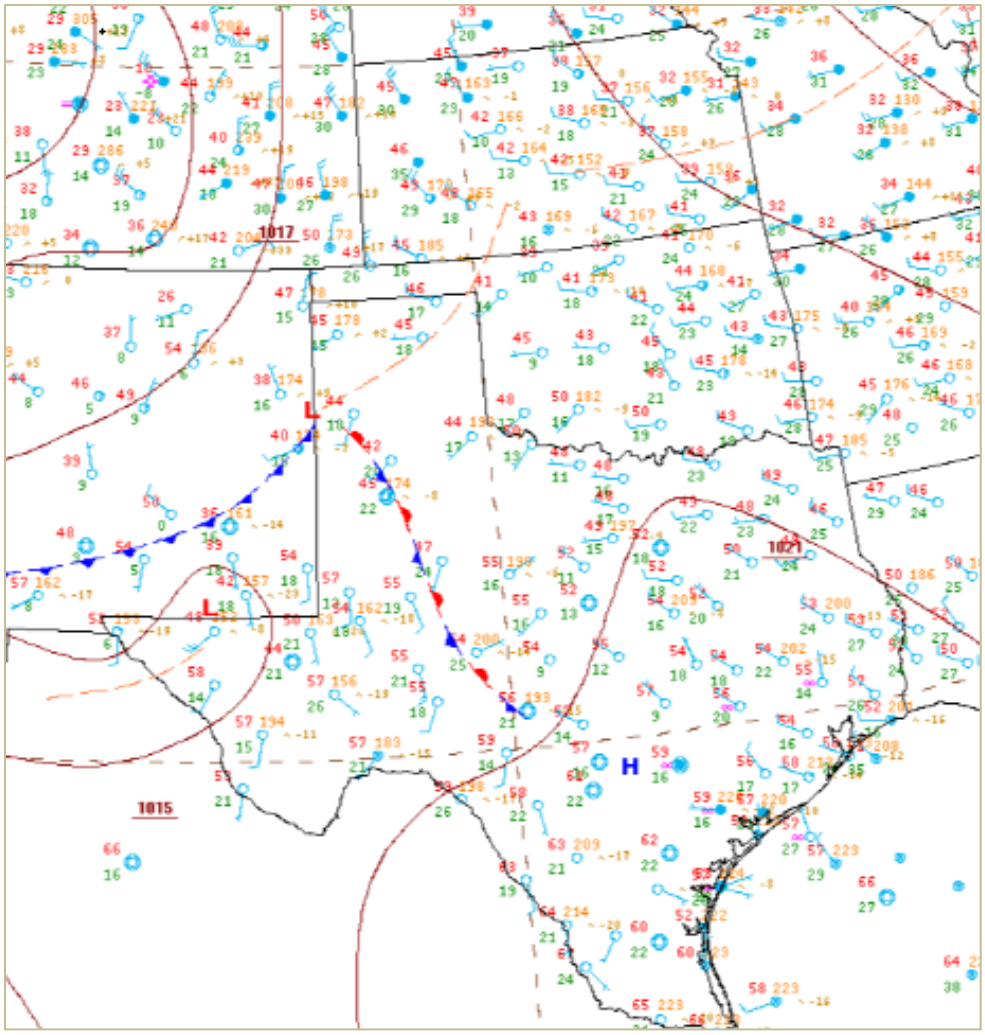


Figure B-2: Regional Weather Map for January 16, 2021

PM_{10} exceptional event flags are proposed for Federal Reference Method (FRM) PM_{10} measurements on January 16, 2021 at the Lang (C408), Monroe (C406), and Dona Park (C199) monitors due to transported particulate matter. These monitors, respectively, recorded PM_{10} measurements of 165 micrograms per cubic meter (µg/m^3), 156 µg/m^3, and 180 µg/m^3 on January 16, 2021.

B.2 BACKWARD-IN-TIME AIR TRAJECTORIES

Backward-in-time air parcel trajectories were produced using the National Oceanic and Atmospheric Administration (NOAA) HYSPLIT model for January 16, 2021. The images in Figure B-3: *HYSPLIT 36-Hour Backward Trajectories (1200 LST) at 10, 100, and 1,000 m AGL* display trajectories that track the air arriving at 12:00 CST and follow the air backward-in-time for 36 hours. The left image in Figure B-3 shows air arriving at the Lang (C408) monitor, and the right image shows results at the Dona Park (C199) monitor. The time of 1200 CST was selected arbitrarily, but since this was a long-range transport event that impacted these areas over a long period of time with wind direction remaining consistent throughout the course of the day, the time of day selected is less relevant than if wind direction was shifting throughout the day with a more localized source. Both images show winds coming from the direction of areas north of Texas where satellite imagery and hazardous weather warnings confirmed the presence of large areas of wind-blown dust. In both images, the three colors assigned to each trajectory represent air arriving at the designated monitor at 10 meters (m) (red), 100 m (blue), and 1,000 m (green) above ground level (AGL).

Figure B-4: *HYSPLIT Backward Trajectories (Every 2 Hours on Jan. 16, 2021) at 10, 100, and 1000 m AGL at Houston Lang* and Figure 2-15 *HYSPLIT Backward Trajectories (Every 2 Hours on Jan. 16, 2021) at 10, 100, and 1000 m AGL at Dona Park* show backward trajectories for January 16, 2021.These hours were chosen to provide the wind direction throughout the day and illustrate that the wind was consistently from the north-northwest which was the direction of the source-areas of blowing dust. In what is the inverse of the presentation in Figure B-3, three colors assigned to each trajectory in Figure B-4 and Figure B-5 represent air arriving at the monitor at 10 m (green), 100 m (blue), and 1,000 m (red) AGL. The trajectories in Figure B-4 and Figure B-5 are 36-hour trajectories, but to show a higher level of detail in the figures, the maps are zoomed in which omits some trajectory points from the earliest hours when they were the farthest north from the receptor monitors.

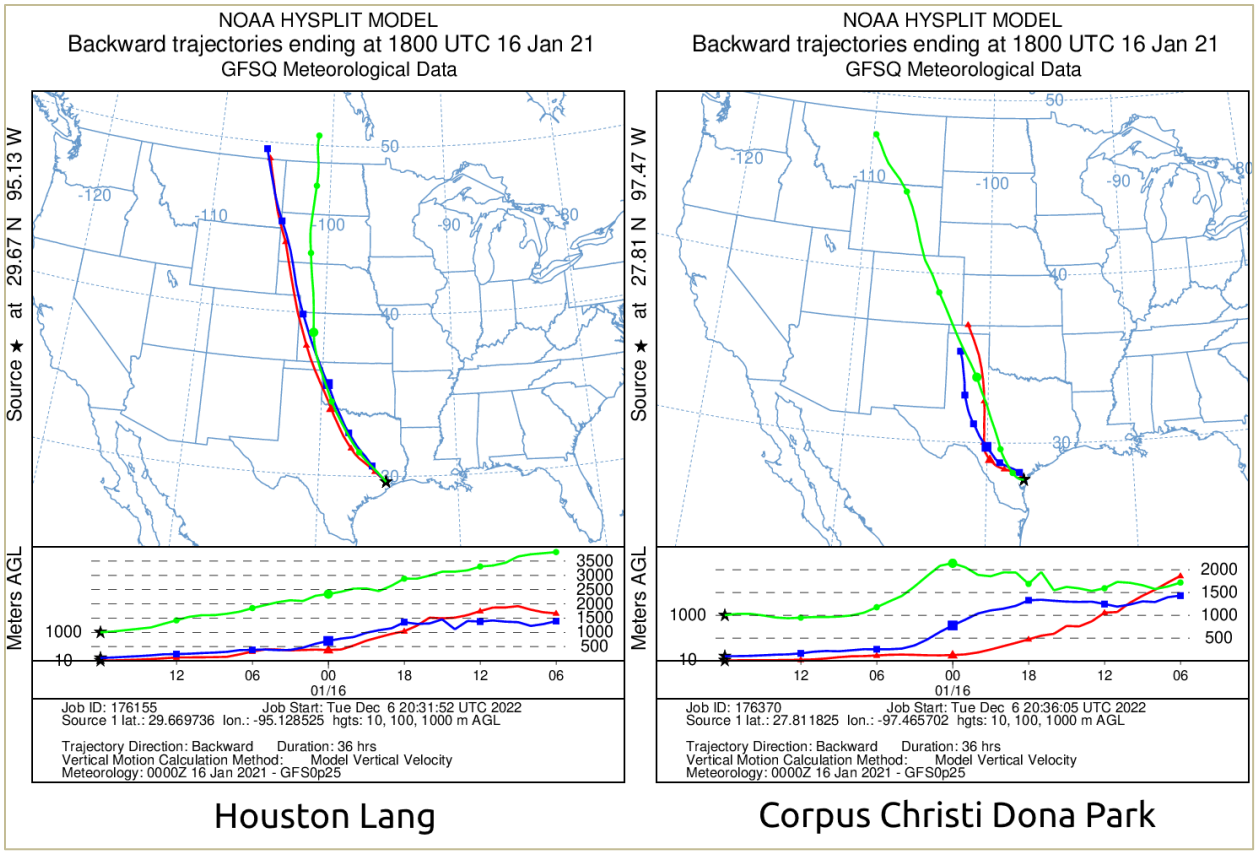


Figure B-1: HYSPLIT 36-Hour Backward Trajectories (1200 LST) at 10, 100, and 1,000 m AGL

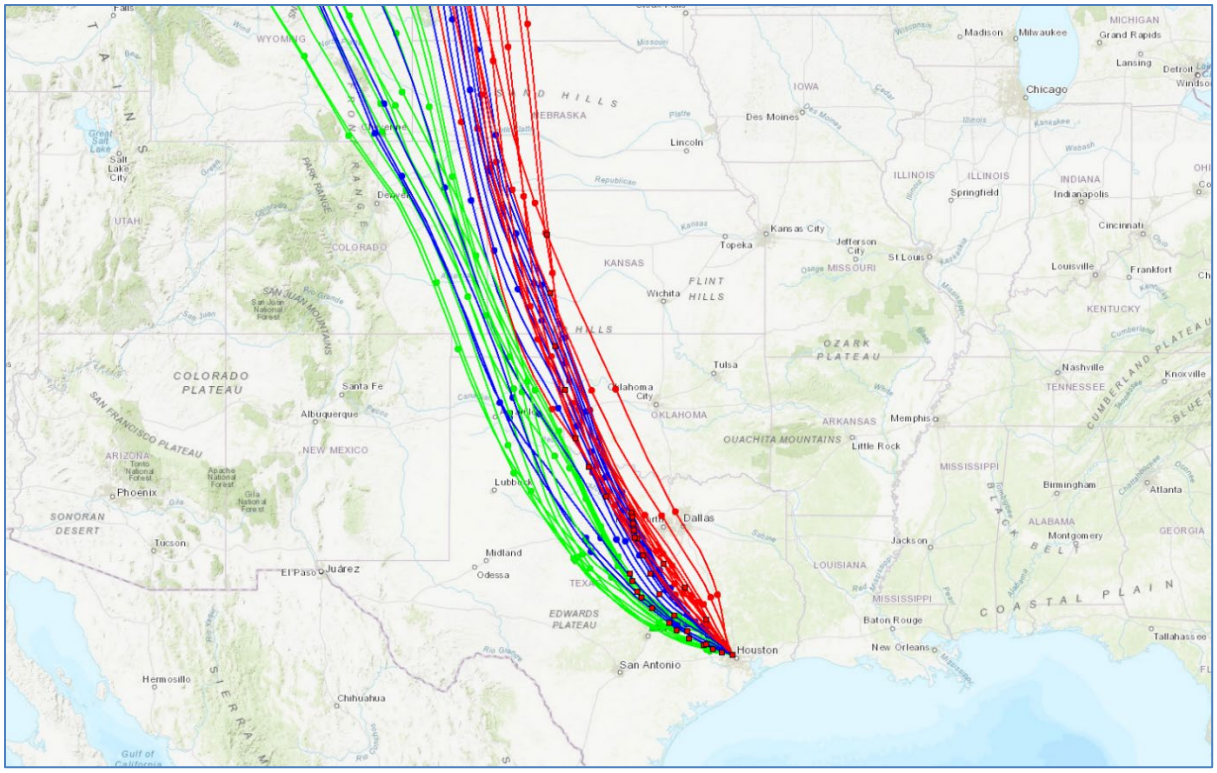


Figure B-4: HYSPLIT Backward Trajectories (Every 2 Hours on Jan. 16, 2021) at 10, 100, and 1000 m AGL at Houston Lang

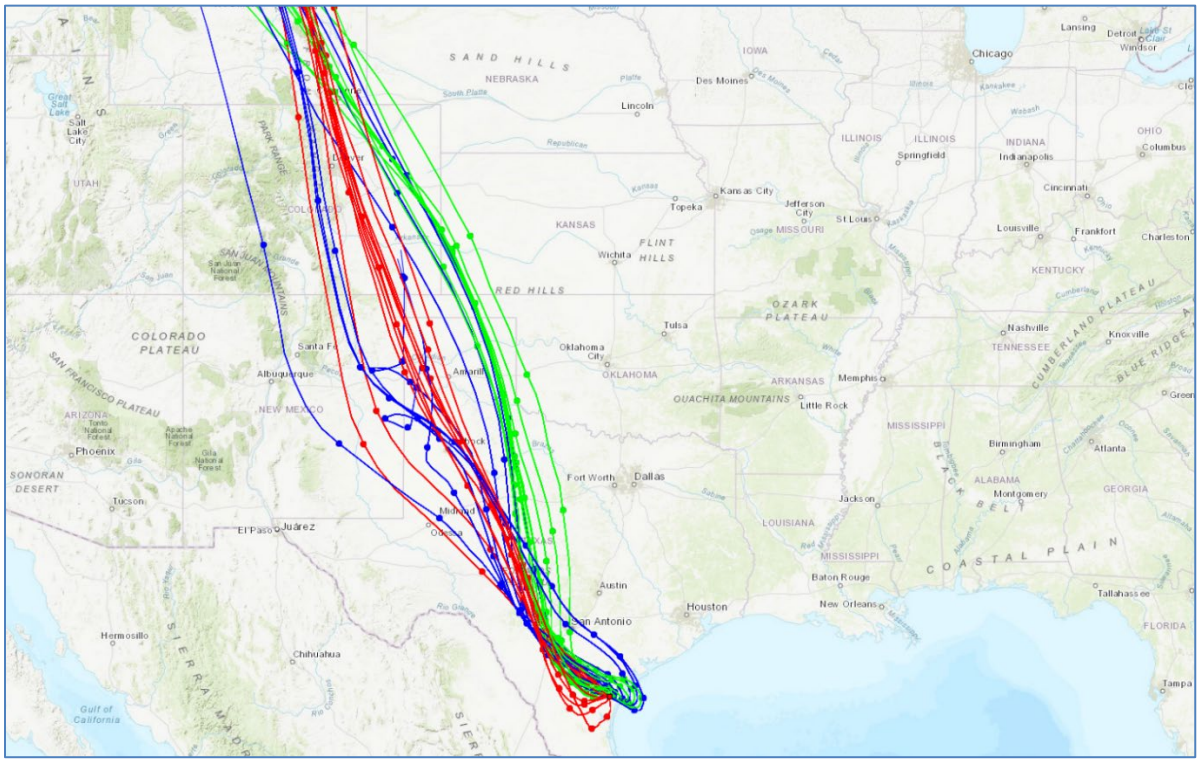


Figure B-5: HYSPLIT Backward Trajectories (Every 2 Hours on Jan. 16, 2021) at 10, 100, and 1000 m AGL at Dona Park

B.3 MAP PLOTS OF DAILY PARTICULATE MATTER DATA

Maps of the daily average PM_{10} and $PM_{2.5}$ concentrations show the spatial distribution of measurements on the event day, with the flagged measurements identified by monitoring site name. PM_{10} concentrations are shown in Figure B-6: *Daily Average PM_{10} Measurements (µg/m³) in Harris County on January 16, 2021 and* Figure B-7: *Daily Average PM_{10} Measurements (µg/m³) in Nueces County on January 16, 2021*. $PM_{2.5}$ concentrations are shown in Figure B-8: *Daily Average $PM_{2.5}$ Measurements (µg/m³) in Harris County on January 16, 2021 and* Figure B-9: *Daily Average $PM_{2.5}$ Measurements (µg/m³) in Nueces County on January 16, 2021*. As shown in Figure B-6, all PM_{10} values measured in Harris County were right at or above the standard. This distribution of measurements is indicative of a widespread event. In a localized event, the distribution of PM_{10} concentrations would be less uniform from one monitor to another. This comparative analysis could not be done for Nueces County for PM_{10} as this county only has one monitor, but satellite imagery of the dust plume transported through Texas provided evidence that a similar uniform distribution of PM_{10} concentrations across the county would be expected.

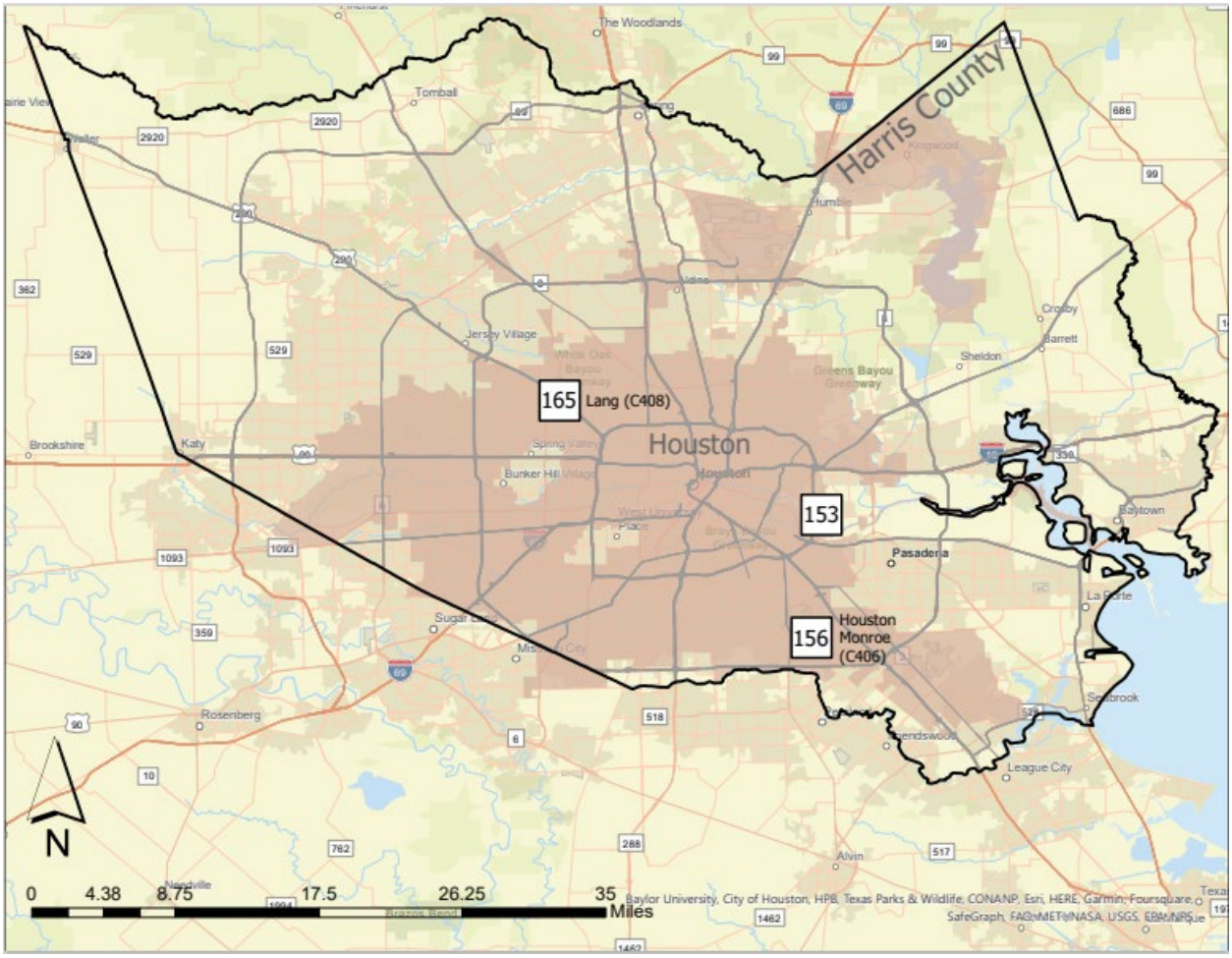


Figure B-6: Daily Average PM_{10} Measurements (µg/m³) in Harris County on January 21, 2021

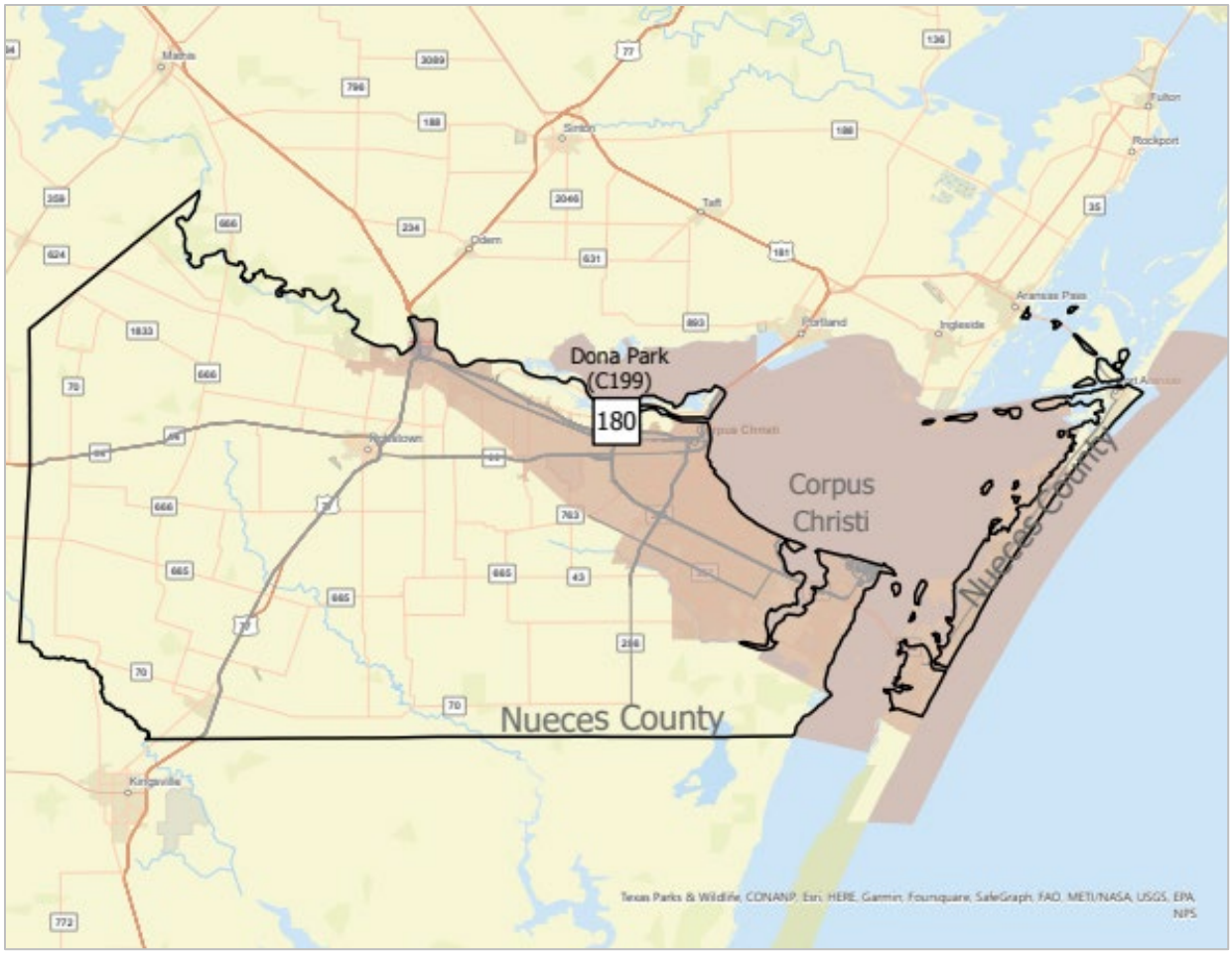


Figure B-7: Daily Average PM_{10} Measurements ($\mu g/m^3$) in Nueces County on January 21, 2021

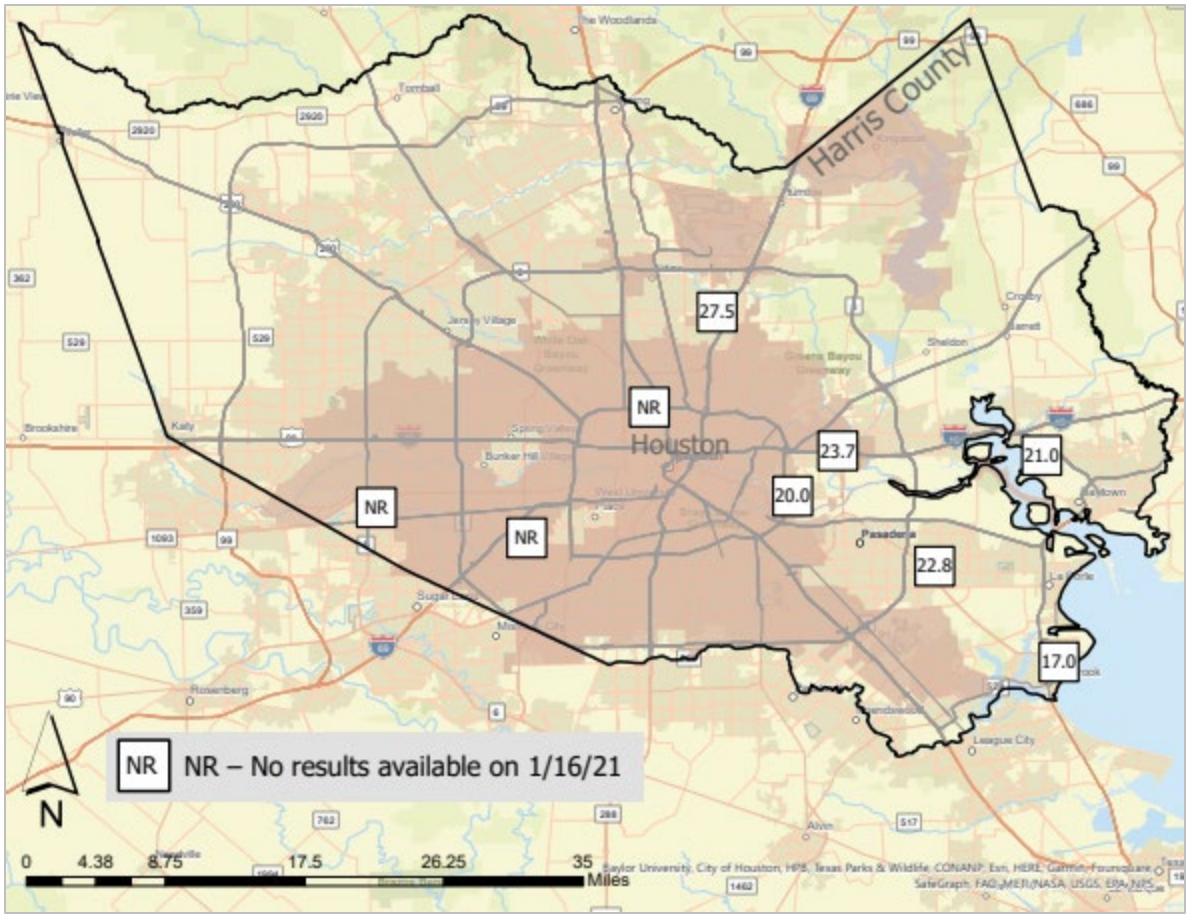


Figure B-8: Daily Average $PM_{2.5}$ Measurements (µg/m³) in Harris County on January 21, 2021

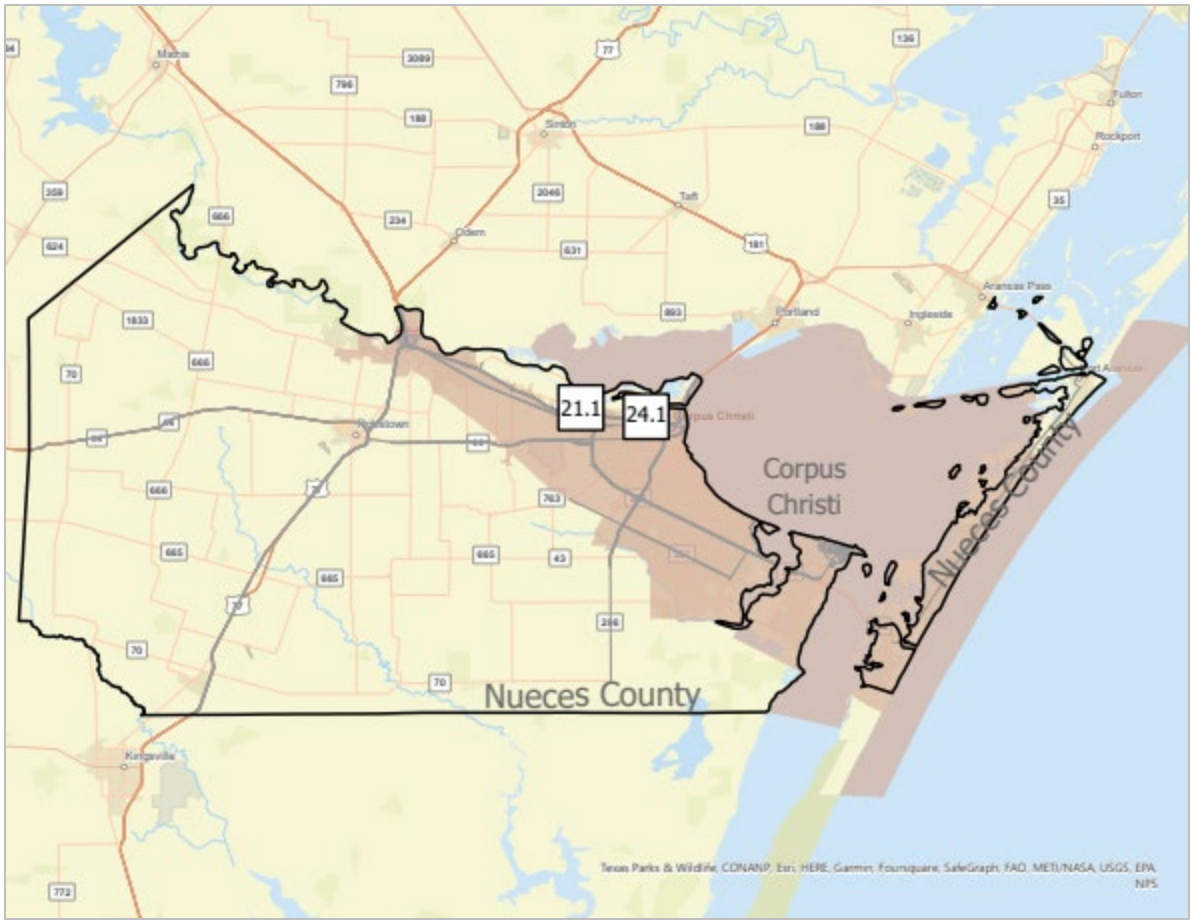


Figure B-9: Daily Average $PM_{2.5}$ Measurements (µg/m³) in Nueces County on January 21, 2021

B.4 CONTINUOUS PARTICULATE MATTER AND WIND GRAPHS

Time series graphs with continuous particulate measurements plotted against wind speed measurements, illustrate the nature of dust events by typically showing that particulate concentrations increase following sustained, high wind speeds. In a long-distance transport event such as that which generated elevated PM_{10} in Harris County and Nueces County on January 16, 2021, the influence of wind speeds in the immediate area in which elevated PM_{10} concentrations were recorded is less relevant than the high wind speeds in the area from which the dust was initially entrained in the air and subsequently transported over large distances. Figure B-10: *Harris County Continuous Five-Minute PM_{10} and Peak Area Five-Minute Sustained Wind Speed Measurements on January 21, 2021* demonstrates that hourly PM_{10} values collected at the Deer Park #2 (C35) monitor in Harris County rose and fell from approximately 02:00 through 11:00 CST on January 16, 2021 while wind speeds remained relatively consistent during this interval. The Deer Park #2 (C35) monitor was used for this study because neither the Lang (C408) nor Houston Monroe (C406) sites have a monitor that measures PM_{10} on an hourly basis. Because this was a large-scale particulate matter event throughout the county, the Deer Park #2 (C35) monitor, located approximately nine miles east-northeast of the Monroe monitor and approximately 24 miles southeast of the Lang monitor, was considered to be a reasonable representation of conditions throughout the county.

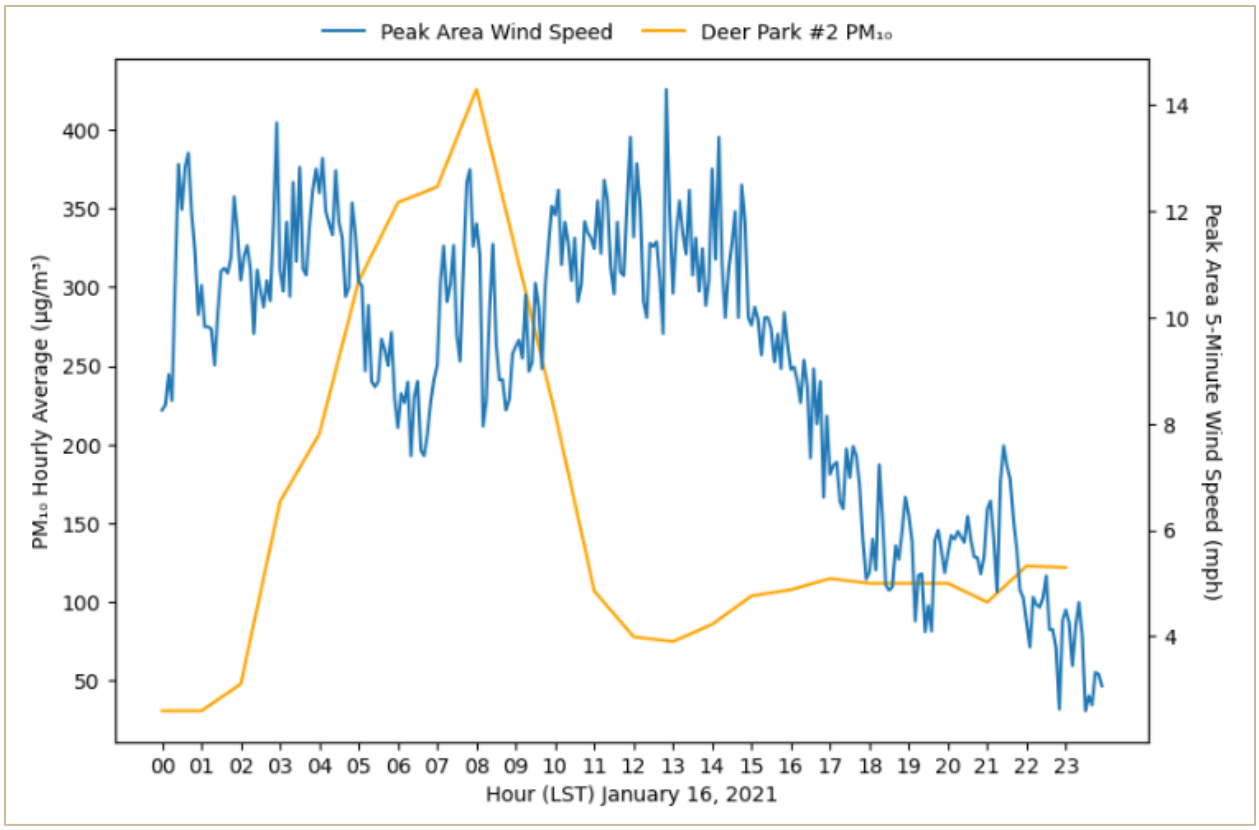


Figure B-10: Harris County Continuous Five-Minute PM_{10} and Peak Area Five-Minute Sustained Wind Speed Measurements on January 16, 2021

Because a PM_{10} monitor that records hourly measurements was not available in Nueces County, hourly PM_{10} values could not be plotted against wind speed. As such, Figure B-11: *Nueces County Peak Area Five-Minute Sustained Wind Speed Measurements on January 21, 2021* only displays the wind component. It can be assumed that the PM_{10} concentrations would peak later in the day than what was observed in Harris County as the dust plume traveled through Harris County prior to arrival in Nueces County.

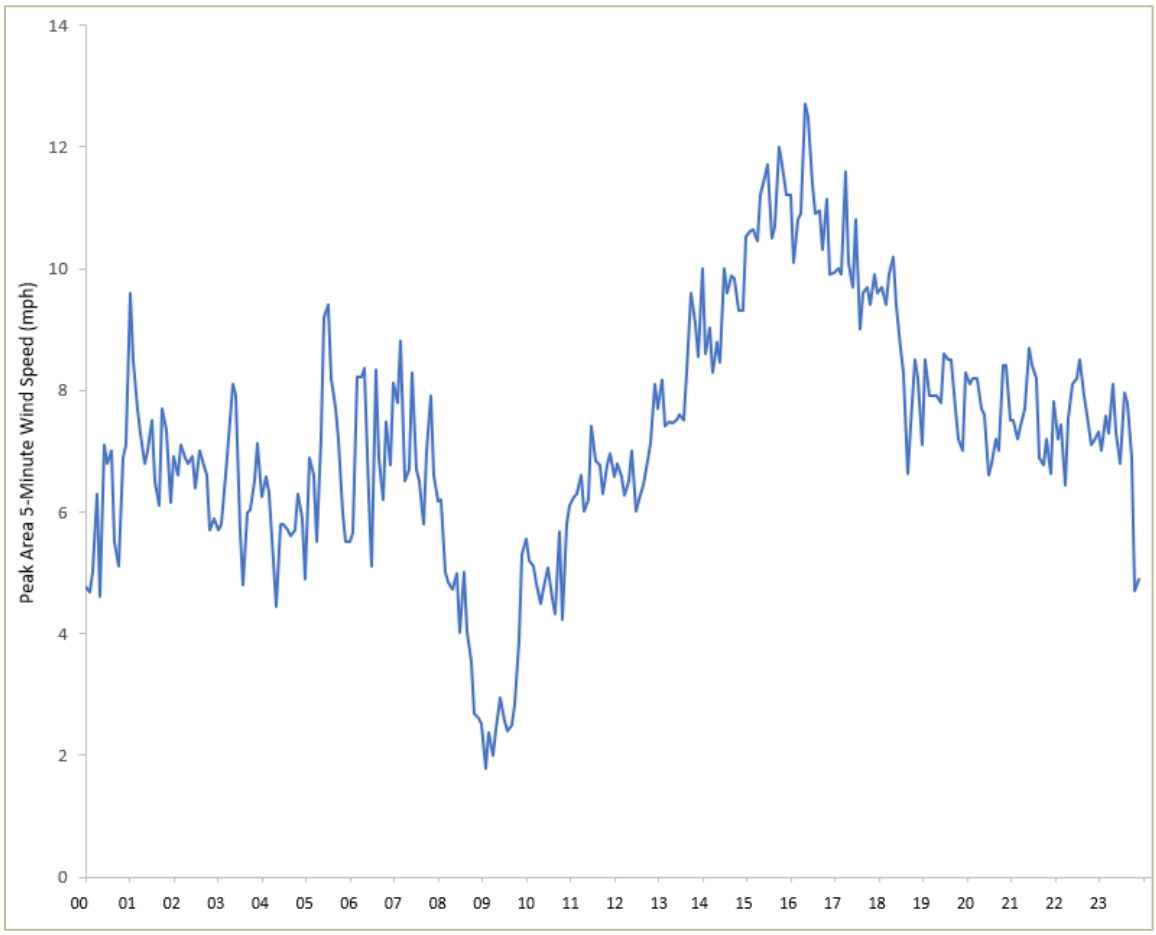


Figure B-11: Nueces County Peak Area Five-Minute Sustained Wind Speed Measurements on January 16, 2021

B.5 SPECIAL WEATHER STATEMENTS

A special weather statement and two instances of media coverage information are provided in Figure B-12: *Hazardous Weather Outlook Message Issued by the National Weather Service Pueblo, Colorado*, Figure B-13: *Media Report on Dust Transported into Houston* and Figure B-14: *Media Report on Dust Transported into Corpus Christi*. Figure 5-1 specifically references counties positioned in the southeast corner of Colorado. Satellite imagery showed this area to be the origin of the dust transported into Texas. Figure 5-2 references the dust storm that was north of Texas and the prevalence of a thin layer of dust on vehicles in the area as a result. Figure 5-3, two screen captures from a National Weather Service Corpus Christi Facebook post, references the visible band of dust over the area as a result of a strong wind event. These items contribute additional supporting documentation establishing the occurrence and geographical extent of this event.

```
Dust Storm Warning
National Weather Service Pueblo CO
117 PM MST Fri Jan 15 2021

COC009-011-061-099-152200-
/O.CON.KPUB.DS.W.0003.000000T0000Z-210115T2200Z/
Prowers CO-Baca CO-Kiowa CO-Bent CO-
117 PM MST Fri Jan 15 2021

...A DUST STORM WARNING REMAINS IN EFFECT UNTIL 300 PM MST FOR
PROWERS...BACA...KIOWA AND BENT COUNTIES...

At 117 PM MST, Satellite data continues to indicate widespread areas
of blowing dust across the eastern one half of the southeast plains
of Colorado. The most intense dust storm activity was occurring
generally east of a line from La Junta to Pritchett, Colorado. This
dust was being caused by winds blowing from the north to northwest
at 30 to 50 mph. Law enforcement is indicating visibility is very
poor across southeast Colorado. Highway 287 was closed from Kit
Carson to Springfield. Web cam imagery in the Eads area was showing
visibility below 1/4 of a mile.

  HAZARD...Less than a quarter mile visibility.

  SOURCE...Satellite data, web cams and reports of emergency
           officials.

  IMPACT...Dangerous life-threatening travel.

Locations impacted include...
Lamar, Springfield, Las Animas, Holly, Eads, Walsh, Granada, Wiley,
Pritchett, Vilas, Campo, Sheridan Lake, Hartman, Haswell, Two Buttes,
Neeoshe Reservoir, Chivington, Blue Lake, Bristol and Sweetwater
Reservoir.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Dust storms lead to dangerous driving conditions with visibility
reduced to near zero. If driving, avoid dust storms if possible. If
caught in one, then pull off the road, turn off your lights and keep
your foot off the brake.
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Figure B-12: Hazardous Weather Outlook Message Issued by the National Weather Service El Paso Office on December 23, 2020

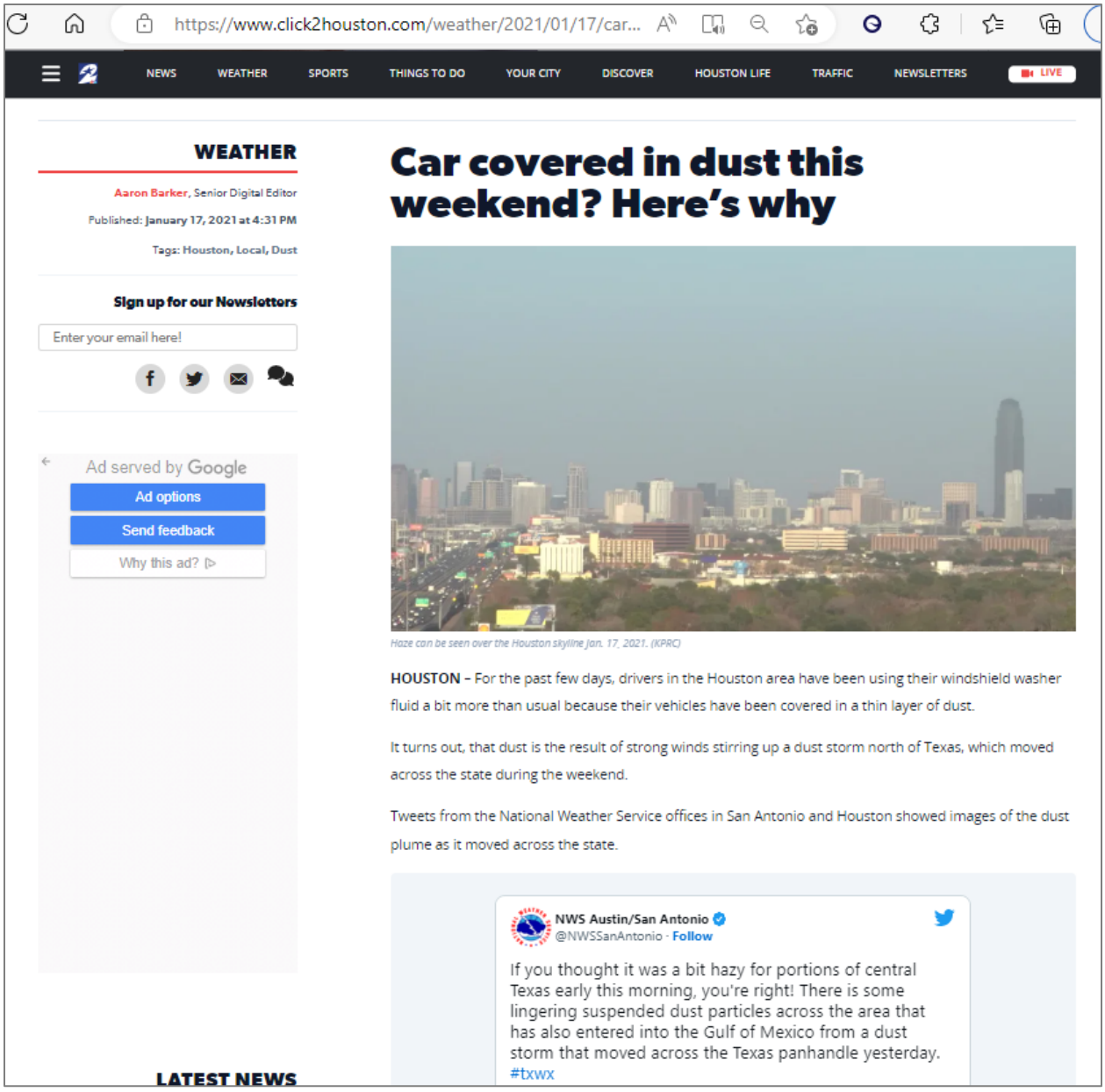

Figure B-13: Media Report on Dust Transported into Houston

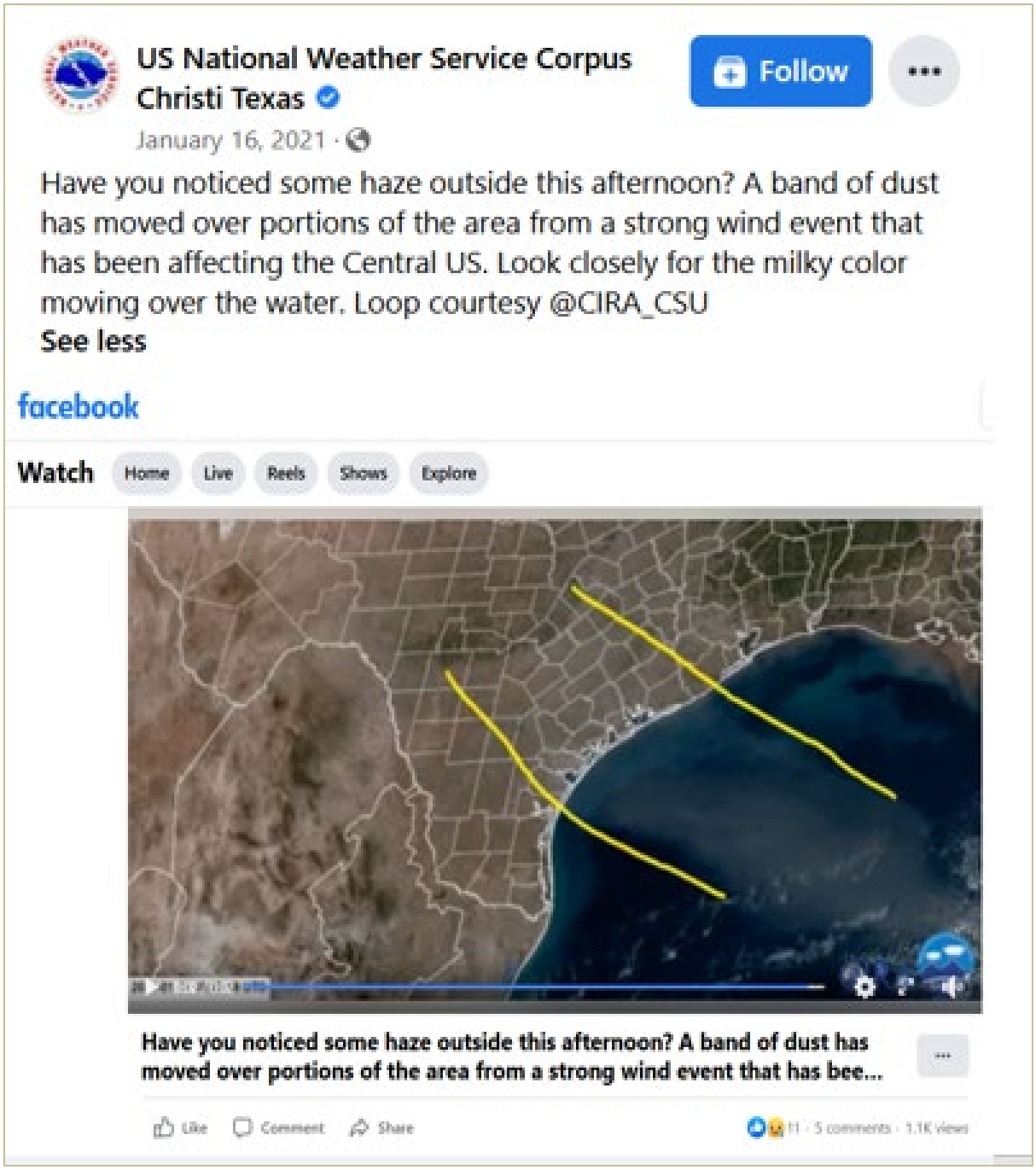

Figure B-14: Media Report on Dust Transported into Corpus Christi

B.6 DAILY AVERAGE PARTICULATE MATTER MEASUREMENTS

All available continuous and non-continuous Harris County and Nueces County daily average particulate measurements from January 16, 2021 are provided in Table B-1: *Harris County Particulate Matter Measurements on the Exceptional Event Day* and Table B-2: *Nueces County Particulate Matter Measurements on the Exceptional Event Day*

Table B-1: Harris County Particulate Matter Measurements on the Exceptional Event Day

Site Name	Type	Method	Concentration (µg/m^3)
Houston East (C1)	$PM_{2.5}$	C	23.7
Houston Aldine (C8)	$PM_{2.5}$	C	27.5
Houston Deer Park #2 (C35)	$PM_{2.5}$	FRM	21.8
Houston Deer Park #2 (C35)	$PM_{2.5}$	C	22.8
Houston Deer Park #2 (C35)	$PM_{2.5}$	CSN	19.4
Houston Deer Park #2 (C35)	PM_{10}	C	147.1*
Houston Deer Park #2 (C35)	PM_{10}	C	153.8**
Houston Deer Park #2 (C35)	$PM_{10-2.5}$	C	134.3
Houston Bayland Park (C53)	$PM_{2.5}$	C	No results on 1/16/2021
Baytown (C148)	$PM_{2.5}$	C	21.0
Clinton (C55)	$PM_{2.5}$	FRM	21.1
Clinton (C55)	PM_{10}	FRM	153
Clinton (C55)	$PM_{2.5}$	C	20.0
Houston Westhollow (C410)	$PM_{2.5}$	C	No results on 1/16/2021
Seabrook Friendship Park (C45)	$PM_{2.5}$	C	17.0
Houston North Loop (C1052)	$PM_{2.5}$	FRM	No results on 1/16/2021
Houston Monroe (C406)	PM_{10}	FRM	156***
Lang (C408)	PM_{10}	FRM	165***

Notes:
*This value is in standard conditions (25 degrees Celsius).
**This value is in local conditions.
***This measurement is proposed as an exceptional event.
Abbreviations:
FRM Federal Reference Method non-continuous monitor
C Continuous monitor
CSN Reconstructed $PM_{2.5}$ mass from speciated non-continuous monitor

Table B-2: Nueces County Particulate Matter Measurements on the Exceptional Event Day

Site Name	Type	Method	Concentration (µg/m³)
Corpus Christi Huisache POC 3 (C98)	$PM_{2.5}$	C	22.2
Corpus Christi Huisache POC 4 (C98)	$PM_{2.5}$	C	24.1
National Seashore (C314)	$PM_{2.5}$	C	15.3
Dona Park (C199)	$PM_{2.5}$	C	No results on 1/16/2021
Dona Park (C199)	$PM_{2.5}$	CSN	20.8
Dona Park (C199)	$PM_{2.5}$	FRM	21.1
Dona Park (C199)	PM_{10}	FRM	180*

Notes:
*This measurement is proposed as an exceptional event.
Abbreviations:
FRM Federal Reference Method non-continuous monitor
C Continuous monitor
CSN Reconstructed $PM_{2.5}$ mass from speciated non-continuous monitor

B.7 CHEMICAL SPECIATION STUDY

$PM_{2.5}$ Chemical Speciation Network (CSN) speciation data were available from the Houston Deer Park #2 (C35, 139, 235, 1001, and 3000) monitor in Harris County and the Dona Park (C199 and 635) monitor in Corpus Christi for the event day. A summary of the Houston Deer Park #2 speciation data on January 16, 2021, is provided in Table B-3: *Houston Deer Park #2 Speciation Summary for the Exceptional Event Day*, and a summary of the Dona Park speciation data on January 16, 2021 is provided in Table B-4: *Dona Park Speciation Summary for the Exceptional Event Day*. Both tables include averages for the period from 2019 through 2021 for comparison to results on January 16, 2021. The speciation data show a predominance of the Interagency Monitoring of Protected Visual Environments (IMPROVE) soil component on the exceptional event day indicating transported dust from high winds. The IMPROVE soil component is derived using a calculation consisting of speciated $PM_{2.5}$ parameters understood to be the primary constituents in soil that would be representative of transported dust from vacant land.

Table B-1 Deer Park #2 (C12) $PM_{2.5}$ Speciation Summary for the Exceptional Event Day

Species	2019 through 2021*	January 16, 2021	Difference	Percent Change	Percent Difference
C	20.4	147.1	126.7	621%	151%
RM	8.068	19.396	11.328	140%	82%
Soil	1.179	8.391	7.212	612%	151%
AS	2.360	0.355	-2.005	-85%	-148%
AN	N/A	N/A	N/A	N/A	N/A
OC	3.861	9.266	5.405	140%	82%
EC	0.397	1.342	0.945	238%	109%
Si	0.234	2.005	1.771	757%	158%
Al	0.117	0.711	0.594	508%	143%
Fe	0.089	0.391	0.302	339%	126%
Ca	0.066	0.502	0.436	661%	154%
S	0.572	0.086	-0.486	-85%	-148%
Sr	0.001	0.000	-0.001	-100%	-200%

Notes:
All units are in $\mu g/m^3$.
*Average for 2019 through 2021 including June 21, 2021
Abbreviations:
C Continuous monitor concentration
RM IMPROVE reconstructed $PM_{2.5}$ mass concentration calculated from speciation data
Soil IMPROVE soil concentration calculated from speciation data
AS IMPROVE ammonium sulfate concentration calculated from speciation data
AN IMPROVE ammonium nitrate concentration calculated from speciation data
OC IMPROVE organic carbon concentration calculated from speciation data
EC elemental carbon concentration
Si silicon speciation concentration
Al aluminum speciation concentration
Fe iron speciation concentration
Ca calcium speciation concentration
S sulfur speciation concentration
Sr strontium speciation concentrations

Table B-4 Dona Park #2 (C199) $PM_{2.5}$ Speciation Summary for the Exceptional Event Day

Species	2019 through 2021*	January 16, 2021	Difference	Percent Change	Percent Difference
FRM	19	180	161	847%	162%
RM	8.633	20.756	12.123	140%	83%
Soil	1.448	16.427	14.978	1034%	168%
AS	3.395	0.268	-3.127	-92%	-171%
AN	0.360	0.393	0.034	9%	9%
OC	2.563	3.148	0.585	23%	20%
EC	0.251	0.412	0.161	64%	49%
Si	0.277	3.699	3.422	1235%	172%
Al	0.128	1.748	1.62	1266%	173%
Fe	0.111	0.770	0.659	594%	150%
Ca	0.116	0.846	0.730	629%	152%
S	0.823	0.065	-0.758	-92%	-171%
Sr	0.002	0.003	0.001	50%	40%

Notes:
All units are in µg/m³.
*Average for 2019 through 2021 including June 21, 2021
Abbreviations:
FRM Federal Reference Method $PM_{2.5}$ concentration
RM IMPROVE reconstructed $PM_{2.5}$ mass concentration calculated from speciation data
Soil IMPROVE soil concentration calculated from speciation data
AS IMPROVE ammonium sulfate concentration calculated from speciation data
AN IMPROVE ammonium nitrate concentration calculated from speciation data
OC IMPROVE organic carbon concentration calculated from speciation data
EC elemental carbon concentration
Si silicon speciation concentration
Al aluminum speciation concentration
Fe iron speciation concentration
Ca calcium speciation concentration
S sulfur speciation concentration
Sr strontium speciation concentration

Figure B-15: *Houston Deer Park #2 (C12) $PM_{2.5}$ IMPROVE Organic Carbon Concentration versus Houston Deer Park #2 (C12) Daily Peak Hourly Wind Speed for 2019 through 2021* indicates, in general, that the highest local carbon related emission impacts on $PM_{2.5}$ occur with lower wind speeds. Figure B-16: *Dona Park (C199) $PM_{2.5}$ IMPROVE Organic Carbon Concentration versus Dona Park (C199) Daily Peak Hourly Wind Speed for 2019 through 2021* does not show a definitive trend, and this fact is believed to be due to the monitor's close proximity to open water from a large system of bays. Organic carbon is generally highest with light winds as it can frequently be attributed to anthropogenic sources such as combustion.

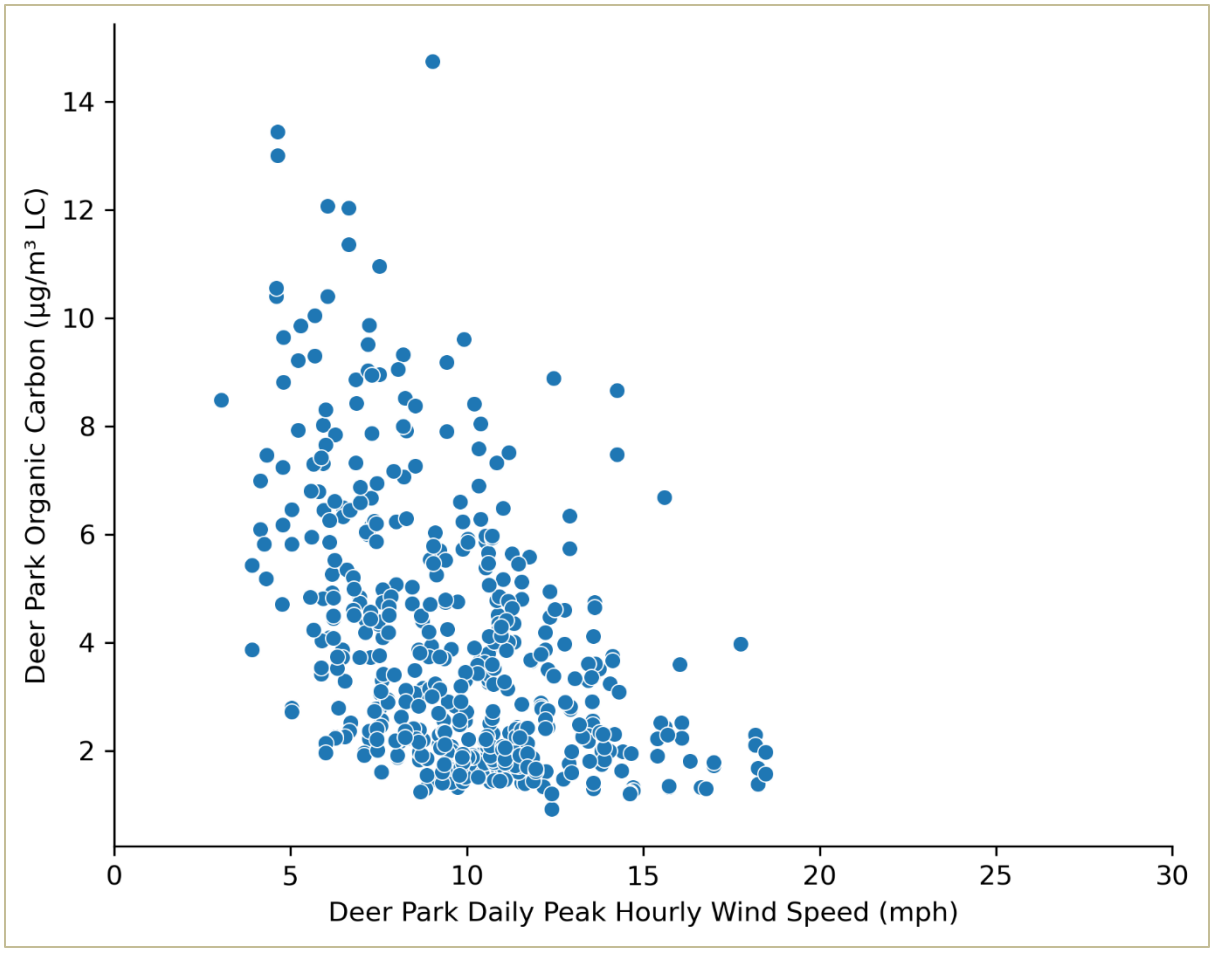

Figure B-15: Houston Deer Park #2 (C12) $PM_{2.5}$ IMPROVE Organic Carbon Concentration versus Houston Deer Park #2 (C12) Daily Peak Hourly Wind Speed for 2019 through 2021

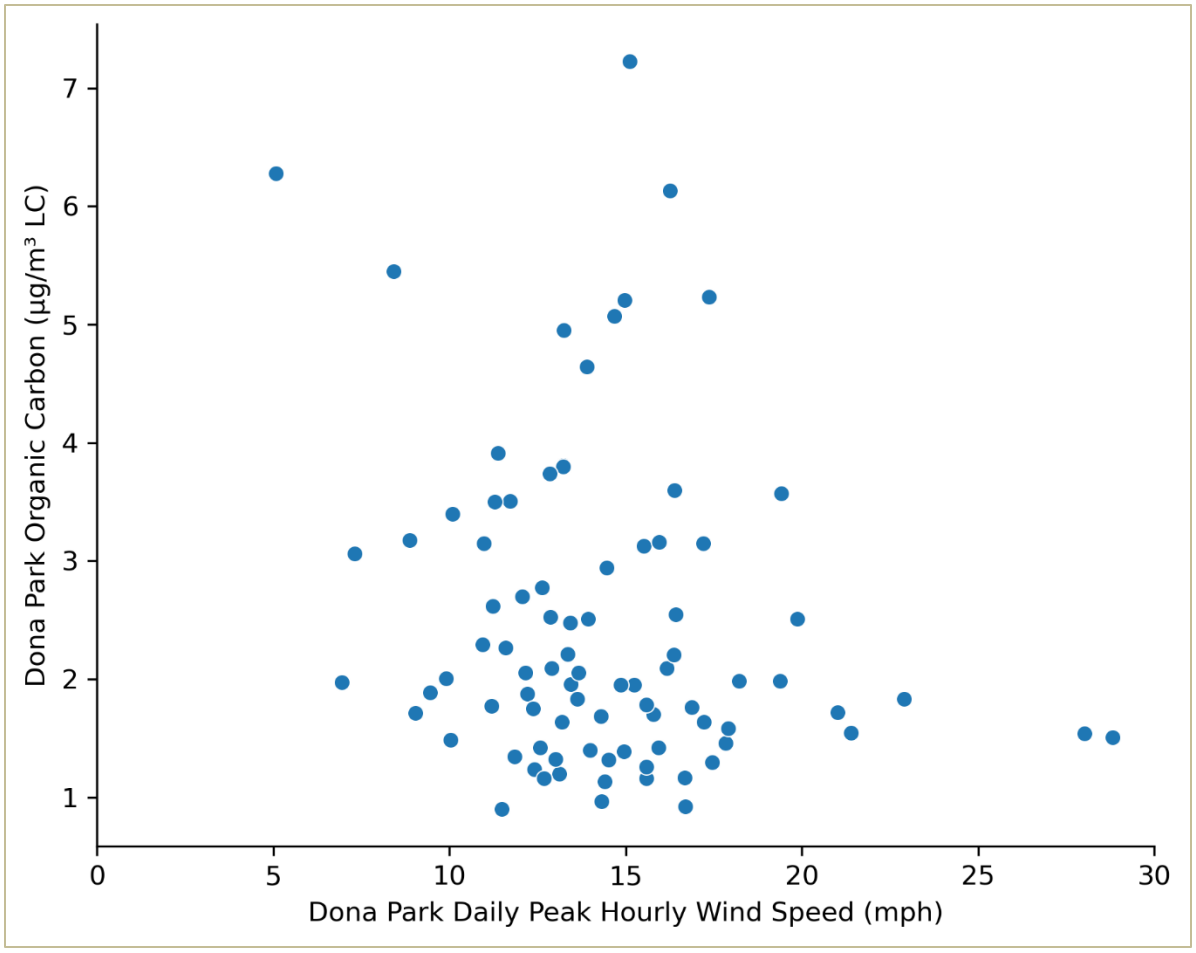

Figure B-16: Dona Park (C199) $PM_{2.5}$ IMPROVE Organic Carbon Concentration versus Dona Park (C199) Daily Peak Hourly Wind Speed for 2019 through 2021

Figure B-17: *Houston Deer Park #2 (C12) $PM_{2.5}$ IMPROVE Soil Concentration versus Houston Deer Park #2 (C12) Daily Peak Hourly Wind Speed for 2019 through 2021* demonstrates that the IMPROVE soil component is highest when winds are at or around 10 mph. In an area in close proximity to sources of potential wind-blown dust, this value would be expected to show a trend where increased wind speed would lead to increased IMPROVE soil concentrations. The urban nature of the Houston area and general lack of nearby, large naturally occurring dust sources makes this area more conducive to long-range transport of PM_{10} where high winds in a distant location transport PM_{10} into the region. It was the long-range transport scenario that brought elevated levels of PM_{10} into Harris County on January 16, 2021. Figure B-18: *Dona Park (C199) $PM_{2.5}$ IMPROVE Soil Concentration versus Dona Park (C199) Daily Peak Hourly Wind Speed for 2019 through 2021* shows that the IMPROVE soil component is typically highest when wind speeds exceed 10 mph. As with results in Figure 3-3, the correlation between wind speed and $PM_{2.5}$, in this case IMPROVE soil concentrations, is less definitive when considering the proximity of large bodies of open water to the Dona Park (C199) receptor monitor.

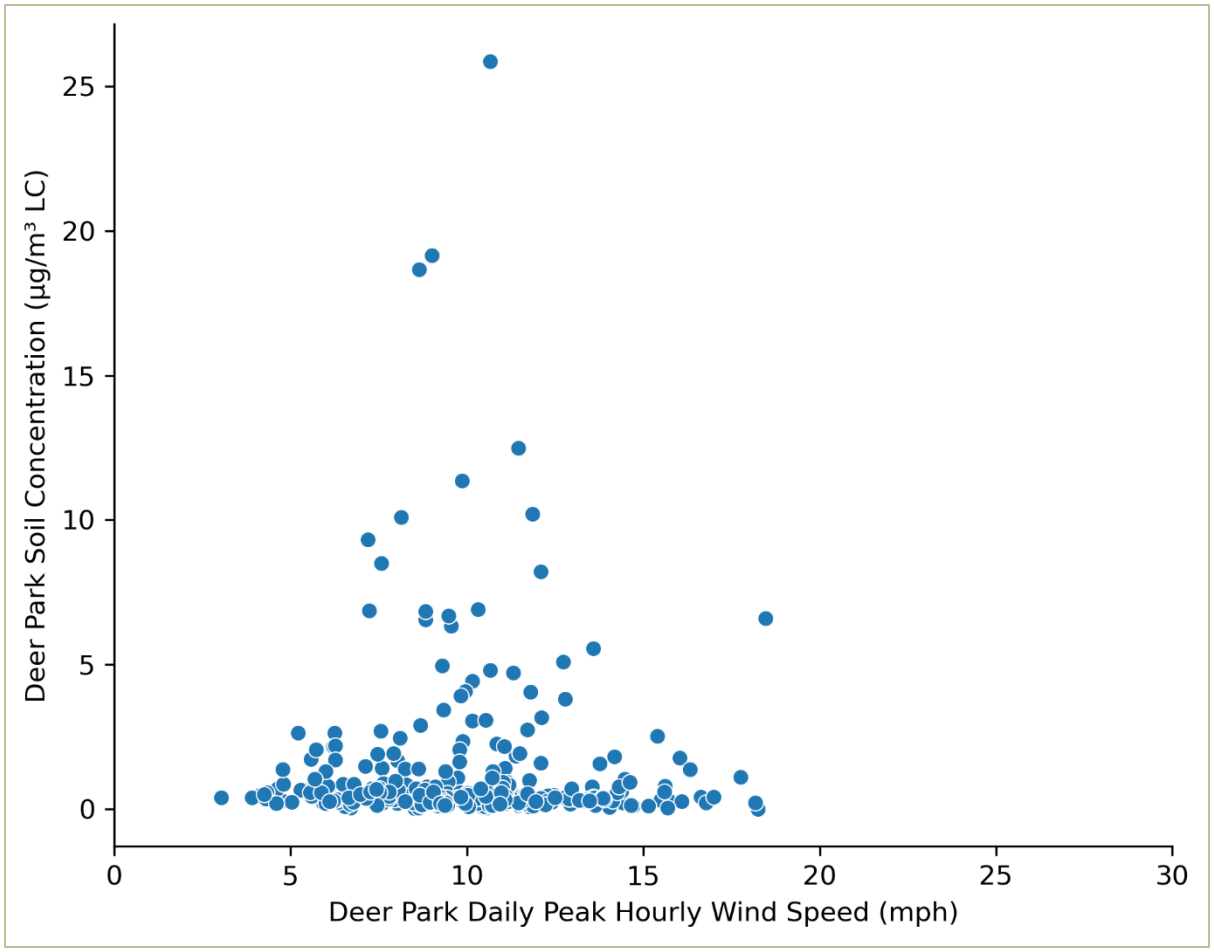

Figure B-17: Houston Deer Park #2 (C12) $PM_{2.5}$ IMPROVE Soil Concentration versus Houston Deer Park #2 (C12) Daily Peak Hourly Wind Speed for 2019 through 2021

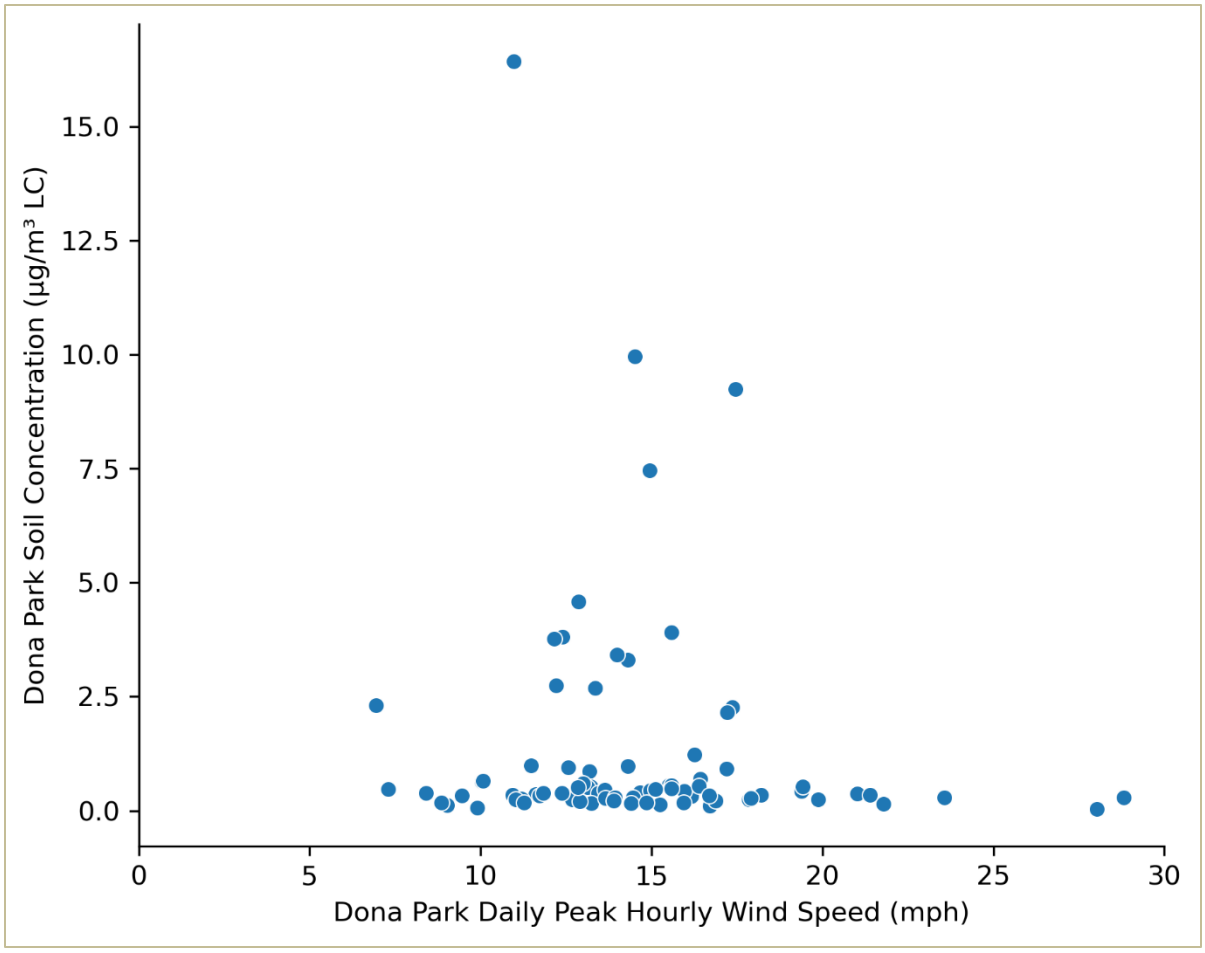

Figure B-18: Dona Park (C199) $PM_{2.5}$ IMPROVE Soil Concentration versus Dona Park (C199) Daily Peak Hourly Wind Speed for 2019 through 2021

B.8 COMPARISON OF EVENT-AFFECTED DAYS TO SIMILAR DAYS WITHOUT ELEVATED PM_{10} CONCENTRATIONS

To illustrate the impact a windblown dust event has versus local anthropogenic dust, the Texas Commission on Environmental Quality (TCEQ) conducted an analysis comparing the event day of January 16, 2021 to other high wind days without elevated PM_{10} concentrations in 2020. Specifically, this comparative analysis focused on identifying days with wind speed and, to a lesser extent, wind direction measurements comparable to the event day, but without elevated PM_{10} values. PM_{10}

Table B-5: *Lang and Monroe PM_{10} and Houston Area Wind Measurements on the Event Day and Days with Comparable Winds but Low Particulate Matter Concentrations* and Table B-6: *Dona Park PM_{10} and Corpus Christi Area Wind Measurements on the Event Day and Days with Comparable Winds but Low Particulate Matter Concentrations* provide five representative days in Harris County and Nueces County where wind speed and wind direction are comparable to the event day. On each of the identified days, daily average PM_{10} measurements were significantly less than the event day of January 16, 2021 when windblown dust was transported through Texas after originating in southeast Colorado. This analysis provides additional supporting evidence that measured concentrations on the event day of January 16, 2021 were not the result of local anthropogenic sources but were instead caused by long-range transport of widespread dust from southeast Colorado.

Table B-5: Lang and Monroe PM_{10} and Houston Area Wind Measurements on the Event Day and Days with Comparable Winds but Low Particulate Matter Concentrations

Day	PkWnd	WDR	StDev	Time	PM_{10} FRM Lang	PM_{10} FRM Monroe
1/16/21	7	323	24	11:00	165	156
2/15/21	12	319	25	10:00	10	9
3/17/21	12	315	27	15:00	53	N/A
5/4/2021	8	4	17	16:00	24	30
8/2/2021	8	275	23	09:00	18	22
11/12/21	6	351	28	15:00	19	25

Abbreviations:

PkWnd	peak one-hour average wind speed in mph at the Clinton monitor (Lang and Monroe don't measure wind.)
WDR	daily wind direction resultant in degrees from north at Clinton
StDev	wind direction standard deviation at Clinton
Time	Time in Central Standard Time (CST) of peak continuous hourly PM_{10} measurement
PM_{10} FRM	non-continuous FRM daily average in $\mu g/m^3$

Table B-6: Dona Park PM_{10} and Corpus Christi Area Wind Measurements on the Event Day and Days with Comparable Winds but Low Particulate Matter Concentrations

Day	PkWnd	WDR	StDev	Time	PM_{10} FRM
1/16/21	11	112	12	15:00	180
2/3/21	13	143	16	17:00	15
6/9/21	12	120	15	16:00	17
6/21/21	13	113	12	16:00	15
9/1/21	12	138	16	17:00	33
11/30/21	11	116	14	14:00	15

Abbreviations:

PkWnd	peak one-hour average wind speed in mph at the Dona Park monitor
WDR	daily wind direction resultant in degrees from north at the Dona Park monitor
StDev	wind direction standard deviation at the Dona Park monitor
Time	Time in Central Standard Time (CST) of peak continuous hourly PM_{10} measurement
PM_{10} FRM	non-continuous FRM daily average in $\mu g/m^3$

B.9 SPATIAL AND TEMPORAL VARIABILITY OF PM_{10}

PM_{10} data across Harris County are presented in Table B-7: *Harris County PM_{10} Daily Measurements (µg/m³) before and after January 16, 2021*. This information highlights the impact of the windblown dust event on the flagged event day and demonstrates spatial and temporal variability of PM_{10} in Harris County. The Federal Reference Method (FRM) samples, used to determine compliance, are only collected one a once-every-six-day basis. The continuous (C) samples, used for reference purposes only, are collected on a daily basis. When reviewing both sample types for the dates listed in Table B-7 prior to the event day of January 16, 2021, it is apparent that something out of the ordinary occurred on January 16, 2021 to make the PM_{10} concentrations increase to the extent that was observed.

Table B-7: Harris County PM_{10} Daily Measurements (µg/m³) before and after January 16, 2021

Date	Lang C408 (FRM)	Houston Monroe C406 (FRM)	Clinton C403 (FRM)	Deer Park #2 C35 (C)
1/10/2021	6	24	6	12
1/11/2021	--	--	--	14
1/12/2021	--	--	--	24
1/13/2021	--	--	--	17
1/14/2021	--	--	--	21
1/15/2021	--	--	--	28
1/16/2021*	165*	156*	153*	147*
1/17/2021	--	--	--	124
1/18/2021	--	--	--	62
1/19/2021	--	--	--	27
1/20/2021	--	--	--	31
1/21/2021	--	--	--	16
1/22/2021	13	17	11	12

Notes:
* indicates proposed exceptional event day measurements.
-- sample collection was not scheduled for listed day.
Abbreviations:
FRM Federal Reference Method monitor PM_{10} concentration (µg/m³)
C continuous monitor PM_{10} concentration (µg/m³)

Only one PM_{10} monitor is positioned in Nueces County, and PM_{10} measurements from this monitor are presented in Table 5-3: *Nueces County PM_{10} Daily Measurements (µg/m³) before and after January 16, 2021*. The data in Table B-8, although limited by the once-every-six-day sampling schedule, show the extreme difference in PM_{10} concentrations from the samples taken prior to and after the proposed exceptional event day of January 16, 2021.

Table B-8: Nueces County PM_{10} Daily Measurements ($\mu g/m^3$) before and after January 16, 2021

Date	Dona Park C408 (FRM)
1/10/2021	4
1/11/2021	--
1/12/2021	--
1/13/2021	--
1/14/2021	--
1/15/2021	--
1/16/2021*	180*
1/17/2021	--
1/18/2021	--
1/19/2021	--
1/20/2021	--
1/21/2021	--
1/22/2021	11

Notes:
* indicates proposed exceptional event day measurements.
-- sample collection was not scheduled for listed day.
Abbreviations:
FRM Federal Reference Method monitor PM_{10} concentration ($\mu g/m^3$)

B.10 AIR QUALITY FORECAST ON THE EVENT DAY

The Texas Commission on Environmental Quality (TCEQ) provides the United States Environmental Protection Agency (EPA) Air Quality Index (AQI) forecasts for the current day and the next three to four days for 15 areas in Texas, for ozone, particulate matter of 2.5 microns or less in aerodynamic diameter ($PM_{2.5}$), and PM_{10}. These forecasts are available to the public on the Today's Texas Air Quality Forecast webpage (http://www.tceq.texas.gov/airquality/monops/forecast_today.html) (TCEQ2, 2021) and on the EPA AIRNOW website (http://airnow.gov/) (EPA3, 2021). These notifications are forecasts that focus primarily on local conditions. The fact that local conditions were not deemed favorable for elevated PM_{10} concentrations in Harris County or Nueces County provides further evidence that the long-range transport of wind-blown dust through Texas was the cause of elevated PM_{10} concentration on January 16, 2021. The Today's Texas Air Quality webpage forecast discussion for the event day is quoted below:

> "Saturday 01/16/2021
>
> Light winds, mild temperatures, and limited vertical mixing could enhance urban fine particulate levels across portions of Far West Texas enough for the daily $PM_{2.5}$ and PM_{10} AQIs to reach the lower to middle end of the "Moderate" range in parts of the El Paso area, with highest concentrations in the morning and evening.
>
> Elsewhere in the state, cool temperatures and/or lower incoming background levels should help keep air quality in the "Good" range in most spots."

B.11 MAP OF WIND SPEED AND DIRECTION

The TCEQ used NOAA Air Resources Laboratory (ARL) model results to illustrate wind speeds in the source areas. Specifically, the TCEQ used the 12-kilometer (km) North American Model (NAM) hourly wind speeds and wind vectors at a 10-meter height. Figure B-19: *NOAA ARL Model Wind Field in the Southeast United States at 13:00 CST on January 15, 2021* illustrates the predicted wind speeds in the dust source areas for the flagged event day. This model supports the occurrence of windblown dust from the source area of southeast Colorado by displaying wind speeds of up to 36 knots or 41 mph. The date of January 15, 2021, one day prior the event day of January 16, 2021, was chosen because this was when dust was initially entrained in the air from the source area of southeast Colorado.

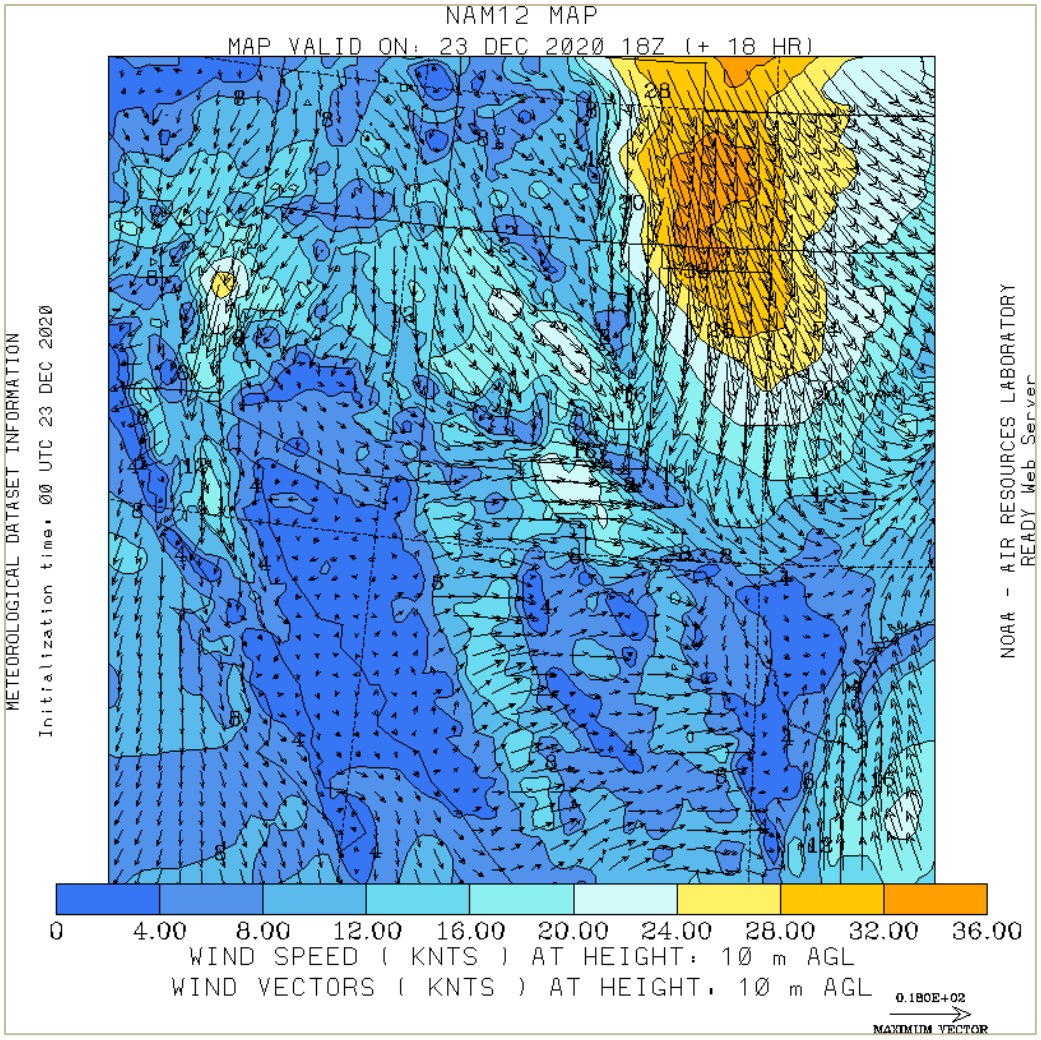

Figure B-19: NOAA ARL Model Wind Field in the Southeast United States at 13:00 CST on January 15, 2021

Figure B-20: *NOAA ARL Model Wind Field in the Southeast United States at 13:00 CST on January 16, 2021* displays the same parameters as those in Figure 2-8, but it represents conditions 24 hours later on January 16, 2021 at 13:00 CST. Figure B-20

shows that some high wind is still present in the source area, but more relevantly, it shows northwesterly wind directions through the Harris County and Nueces County areas.

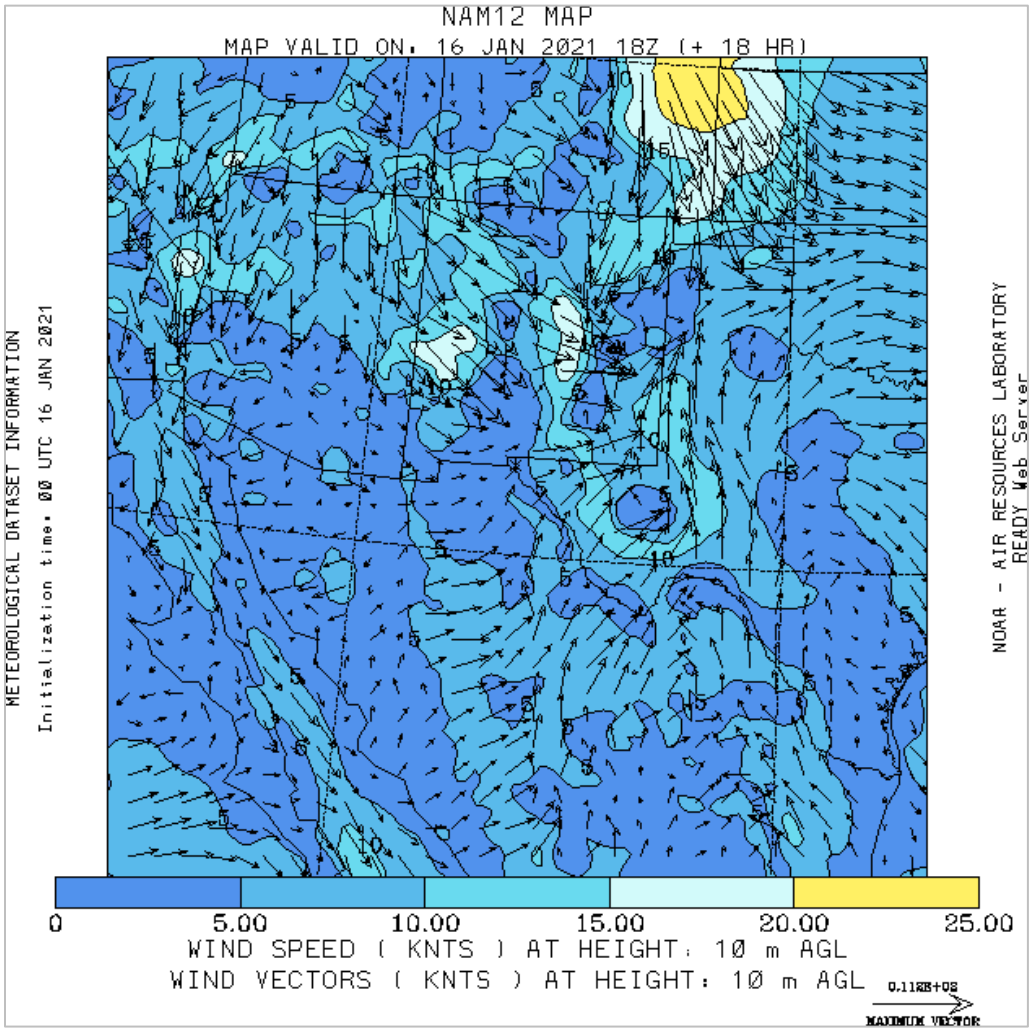

Figure B-20: NOAA ARL Model Wind Field in the Southeast United States at 13:00 CST on January 16, 2021

The combination of elevated winds from the north-northwest on January 15, 2021 to entrain the dust originating in southeast Colorado, with the northwest winds on January 16, 2021 that transported the entrained dust through Texas and into the Gulf of Mexico, comprised the wind conditions over these two days that led to elevated PM_{10} in Harris County and Nueces County on January 16, 2021.

B.12 WIND AND PARTICULATE MATTER MEASUREMENTS

PM_{10} concentrations at monitors that exceeded the standard and wind measurements on the proposed exceptional event day of January 16, 2021 are provided In Table B-9: *Harris County Event-Relevant Wind Measurements* and Table B-10: *Nueces County Event-Relevant Wind Measurements*. Neither the Lang (C408) nor Houston Monroe (C406) monitors record wind speed, so specific wind speeds at these monitors are not presented in Table B-9. Additionally, data from January 15, 2021, the day prior to the proposed exceptional event day, are presented in both Table B-9 and Table B-10. It was on January 15, 2021 that high winds in southeast Colorado initiated the transport of dust through Texas and ultimately into the Gulf of Mexico.

Table B-9: Harris County Area Wind Measurements

Date	Lang (C408) FRM PM_{10} ($\mu g/m^3$)	Houston Monroe (C402) FRM PM_{10} ($\mu g/m^3$)	Peak IAH 2-min Wind Speed	Peak IAH 5-sec Wind Speed	Peak Area Hourly Wind Speed (mph)	Wind Direction at Peak 2-min Speed (degrees)	Peak Area 5-min Wind Speed (mph)
January 15, 2021	NA	NA	25.9	36.0	20.4	290	24.5
January, 16, 2021	165	156	16.1	19.0	11.7	340	14.3

Table B-10: Corpus Christi Area Wind Measurements

Date	Dona Park (C199) FRM PM_{10} ($\mu g/m^3$)	Peak CRP 2-min Wind Speed	Peak CRP 5-sec Wind Speed	Peak Area Hourly Wind Speed (mph)	Peak Dona Park (C199) Hourly Wind Speed (mph)	Wind Direction at Peak 2-min Speed (degrees)	Peak Area 5-min Wind Speed (mph)
January 15, 2021	NA	18.1	25.1	13.4	10.4	310	17.8
January, 16, 2021	180	14.1	17.0	10.7	10.7	80	12.7

B.13 SATELLITE IMAGERY

Figure B-21: *Satellite Imagery of the Initiation of Particulate Matter Transport into Texas* shows screen captures of a 10-minute interval animation from the Geostationary Operational Environmental Satellite Network (GOES)-16 Dust Red-Green-Blue (RGB). The imagery displays that starting at approximately 15:30 UTC on January 15, 2021, strong northerly winds picked up dust (pink in color in Figure B-21) over eastern Colorado that was carried southward. Figure B-22: *Satellite Imagery of Particulate Matter Transported into Texas* shows the dust cloud (beige in color in Figure B-22) on January 16, 2021 at 15:00 UTC from the GOES-17 Geocolor RGB product.

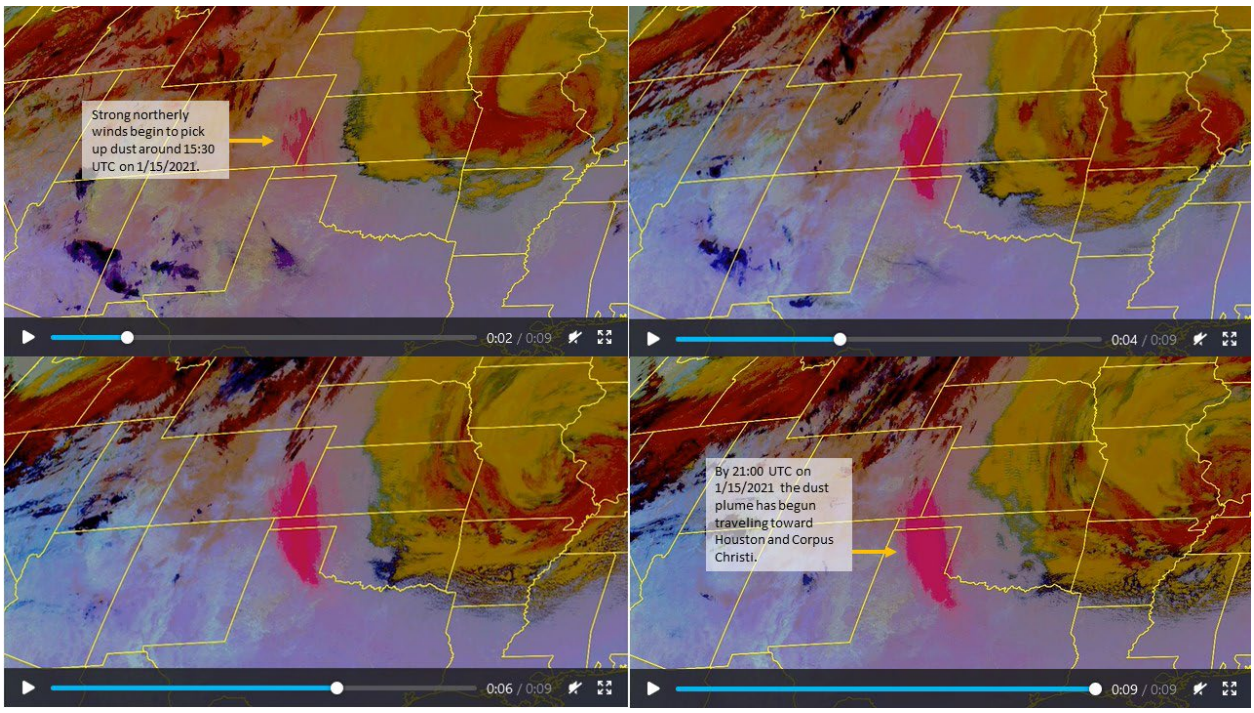

Figure B-21: Satellite Imagery of the Initiation of Particulate Matter Transport into Texas

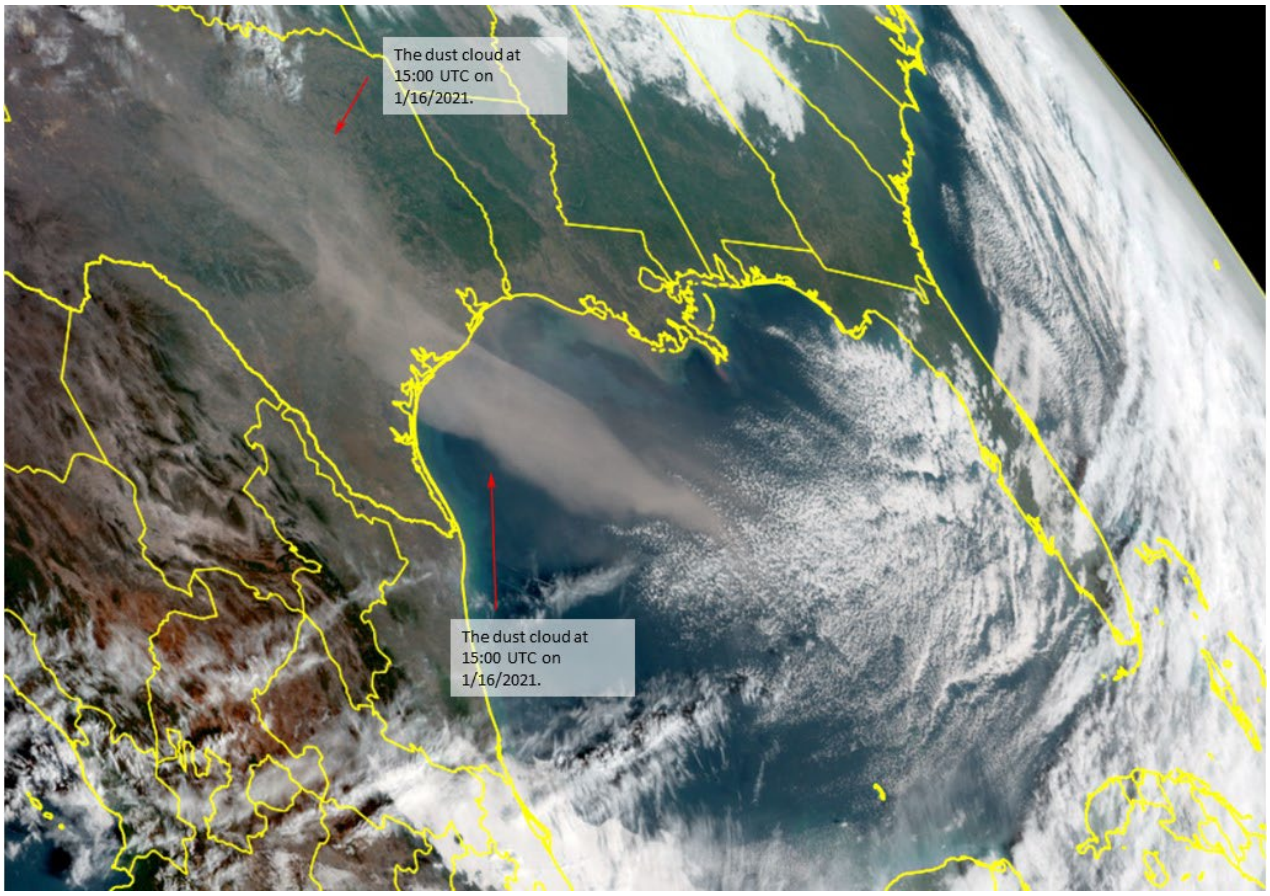

Figure B-22: Satellite Imagery of Particulate Matter Transported into Texas

APPENDIX C

EVENT ANALYSIS FOR JUNE 21, 2021

EL PASO EXCEPTIONAL EVENT DEMONSTRATION FOR
PARTICULATE MATTER OF 10 MICRONS OR LESS IN
AERODYNAMIC DIAMETER (PM_{10}) FOR JUNE 21, 2021

1987 PM_{10} STANDARD

C.1 EVENT SUMMARY

A cold front advanced southwest toward El Paso County. The green dashed shading in Figure C-1: *Regional Weather Map for June 21, 2021* indicated areas ahead of the front where rain/thunderstorm development was possible. Strong outflow boundaries from developing storms in and around El Paso County produced strong wind gusts.

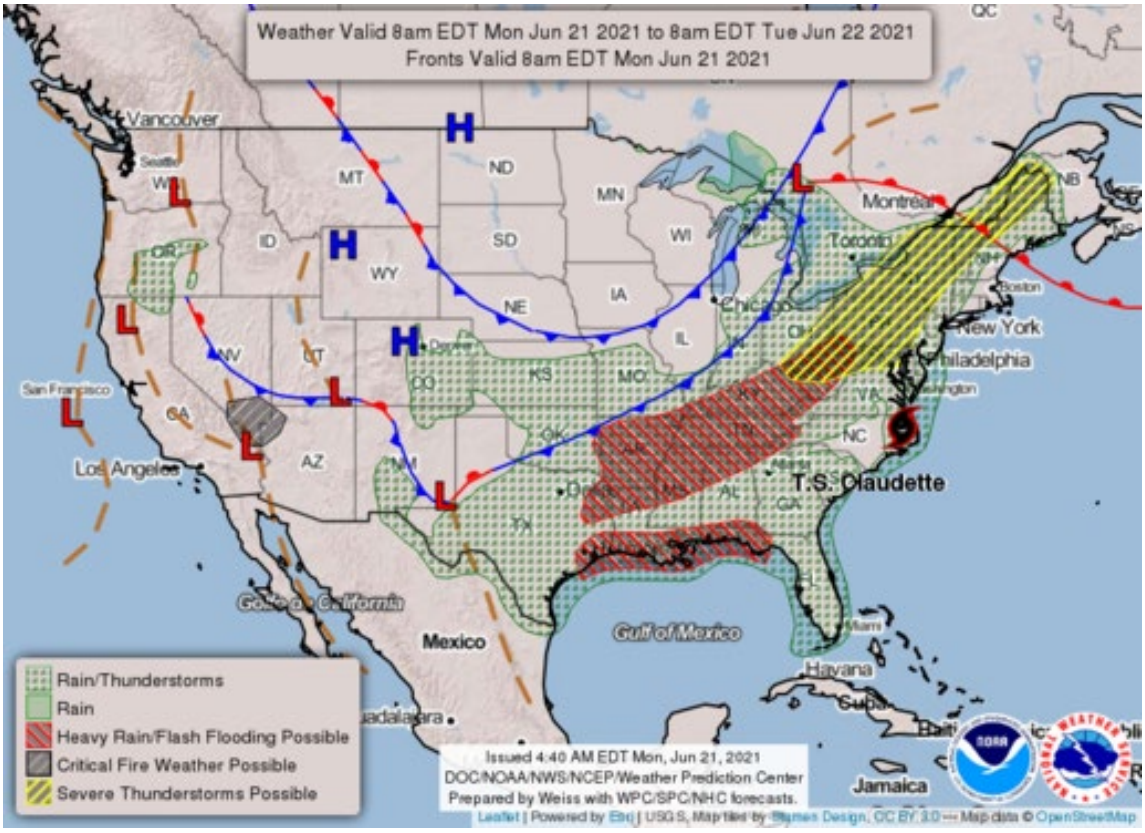

Figure C-1: Regional Weather Map for June 21, 2021

High winds associated with the cold front generated an area of blowing dust in northern Mexico that began impacting El Paso County in the early morning hours. Area peak wind gusts reached 49 miles per hour (mph), and peak five-minute sustained winds reached 29.6 mph. Peak area hourly sustained winds reached 25.3 mph.

An exceptional event flag is proposed for the Socorro Hueco (C49) Federal Reference Method (FRM) PM_{10} measurement of 167 micrograms per cubic meter ($\mu g/m^3$) on June 21, 2021. The collocated continuous PM_{10} monitor measured a daily average of 149.8 $\mu g/m^3$ and a peak one-hour average of 681.2 $\mu g/m^3$ for the hour beginning at 01:00 Mountain Daylight Time (MDT). The hourly average PM_{10} concentration was above the 24-hour National Ambient Air Quality Standard of 150 $\mu g/m^3$ for four consecutive hours beginning with the 01:00 MDT hour. The peak measured wind gust at Socorro Hueco (C49) was 29.7 mph and the highest hourly wind speed was 13.4 mph.

Additionally, an exceptional event flag is proposed for the Riverside/El Paso Mimosa (C9996) FRM PM_{10} measurement of 168 $\mu g/m^3$ on June 21,2021. A collocated continuous PM_{10} sampler is not present at this site.

C.2 BACKWARD-IN-TIME AIR TRAJECTORIES

Backward-in-time air parcel trajectories were produced using the National Oceanic and Atmospheric Administration (NOAA) HYSPLIT model for June 20, 2021 and June 21, 2021. The images in Figure C-2: *HYSPLIT Backward Trajectories (June 20, 2021 at 18:00 MDT and June 21 at 0100 MDT) at 10, 100, and 1,000 m above ground level (AGL)* display trajectories that track the air arriving at the time detailed on the event day and day prior and follow the air backward in time for 12 hours to demonstrate both the origin and path of the air parcels. The left image in Figure B-2 shows winds from the west in the evening of the day prior to June 21, 2021. The time of 18:00 MDT was selected as it corresponds with the highest hourly PM_{10} concentration recorded on June 20, 2021 when winds were from the west-northwest. The PM_{10} value at the Socorro Hueco (C49) monitor at 18:00 MDT was 613 µg/m^3. The right image in Figure B-2 shows trajectories primarily from the west-southwest that track the air arriving at the time of the highest one-hour average PM_{10} concentration observed at the site on the event day at 01:00 MDT. The value at the monitor at 01:00 MDT was 681 µg/m^3. Data from June 20, 2021 were included to provide evidence that conditions were favorable for elevated PM_{10} on the day prior to the sampling date of June 21, 2021. In both images, the three colors assigned to each trajectory represent air arriving at the Socorro Hueco (C49) monitor at 10 meters (m) (red), 100 m (blue), and 1,000 m (green) AGL. Wind from the trajectories at the lower altitudes due to their proximity to the surface are likely to disturb the surface and cause dust to be entrained in the air.

Similarly, Figure C-3: *HYSPLIT Backward Trajectories (June 21, 2021 from 01:00 through 04:00 MDT) at 10, 100, and 1,000 m AGL* shows backward trajectories for each hour from 01:00 through 04:00 MDT on June 21, 2021. These hours were chosen because they correspond with the hours when PM_{10} concentrations were most elevated on the event date. Trajectories pictured in Figure C-3 are 12-hour backward trajectories. In what is the inverse of the presentation in Figure C-2, three colors assigned to each trajectory in Figure C-3 represent air arriving at the Socorro Hueco (C49) monitor at 10 m (green), 100 m (blue), and 1,000 m (red) AGL. The lower-altitude trajectories, most relevant when considering dust transport from nearby Mexico, can be seen to pass directly over Mexico prior to arriving in El Paso County.

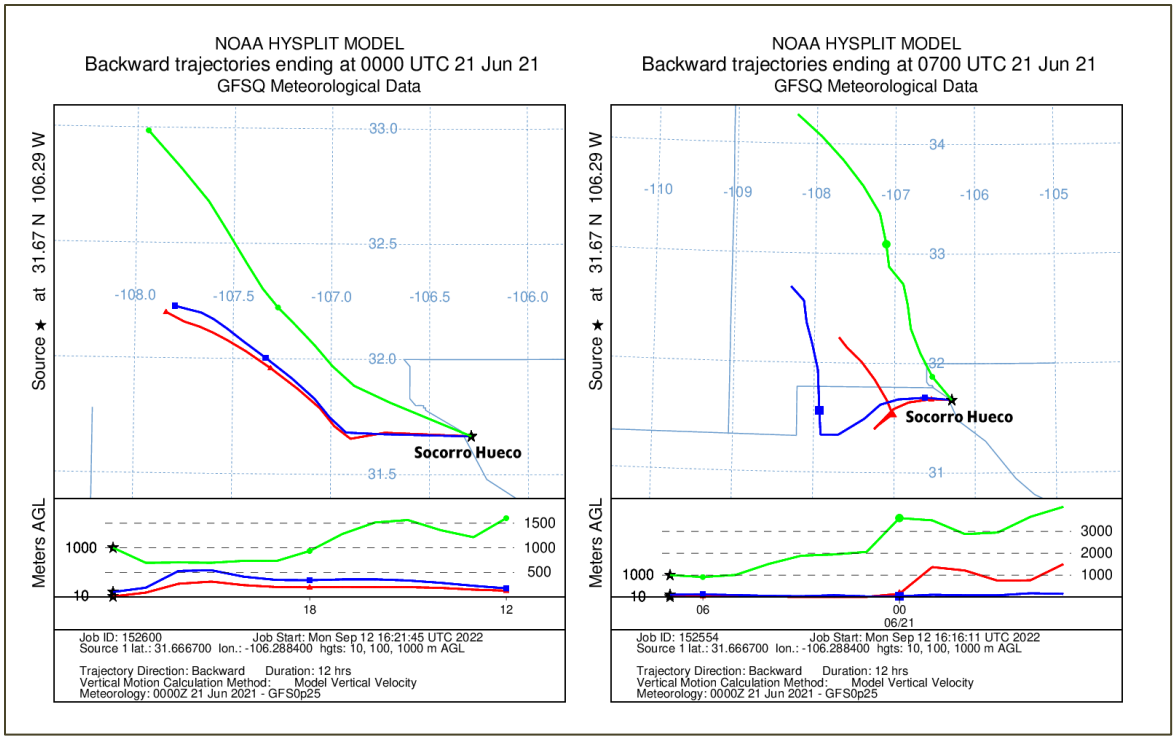

Figure C-2: HYSPLIT Backward Trajectories (June 20, 2021 at 18:00 MDT and June 21 at 0100 MDT) at 10, 100, and 1,000 m AGL

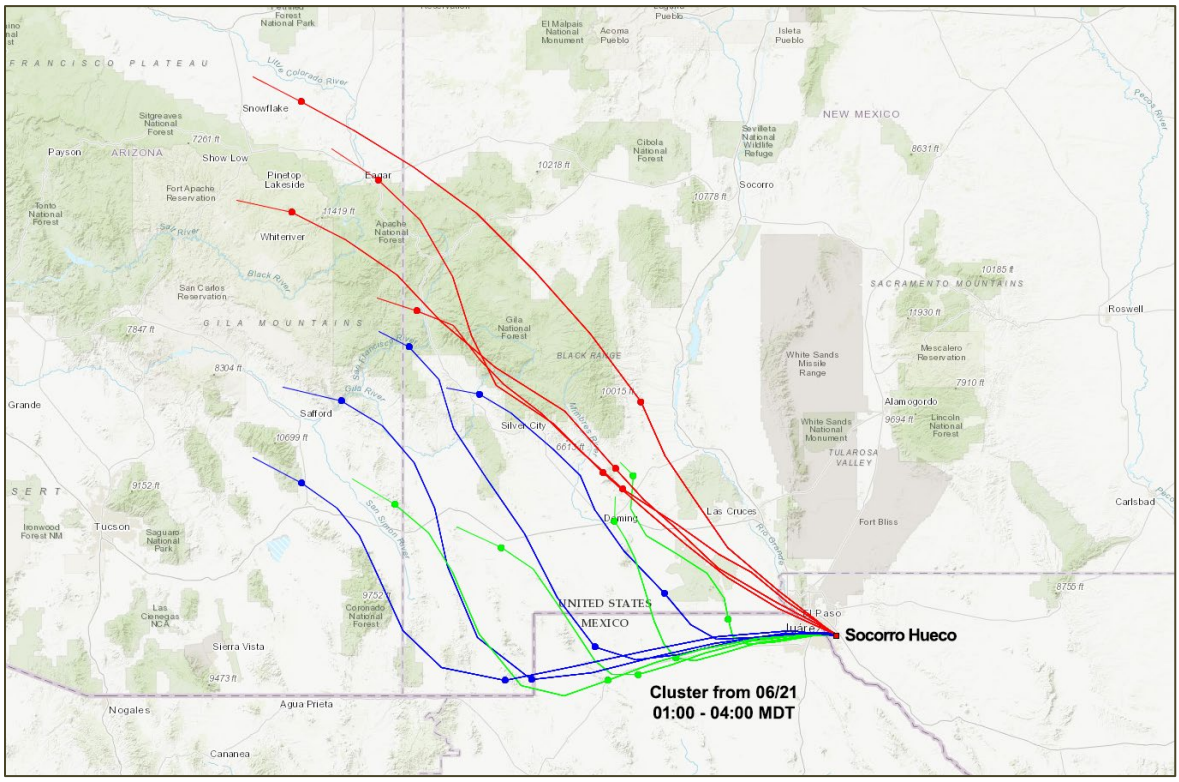

Figure C-3: HYSPLIT Backward Trajectories (June 21, 2021 from 01:00 through 04:00 MDT) at 10, 100, and 1,000 m AGL

The Riverside/El Paso Mimosa (C9996) monitor is located approximately seven miles northwest of the Socorro Hueco (C49) monitor. As such, the trajectories presented in Figures C-2 and C-3 are also applicable to the Riverside/El Paso Mimosa (C9996) monitor.

C.3 MAP PLOTS OF DAILY PARTICULATE MATTER DATA

The following maps display daily average PM_{10} and $PM_{2.5}$ measurements from the June 21, 2021 event. Maps of the daily average PM_{10} and $PM_{2.5}$ concentrations show the spatial distribution of measurements on the event day, with the flagged measurement identified by site name. PM_{10} concentrations are shown in Figure C-4: *Daily Average PM_{10} Measurements (µg/m³) on June 21, 2021*, and $PM_{2.5}$ concentrations are shown in Figure C-5: *Daily Average $PM_{2.5}$ Measurements (µg/m³) on June 21, 2021*. As shown in Figure C-4, the highest measured PM_{10} values occurred in the eastern portion of the county.

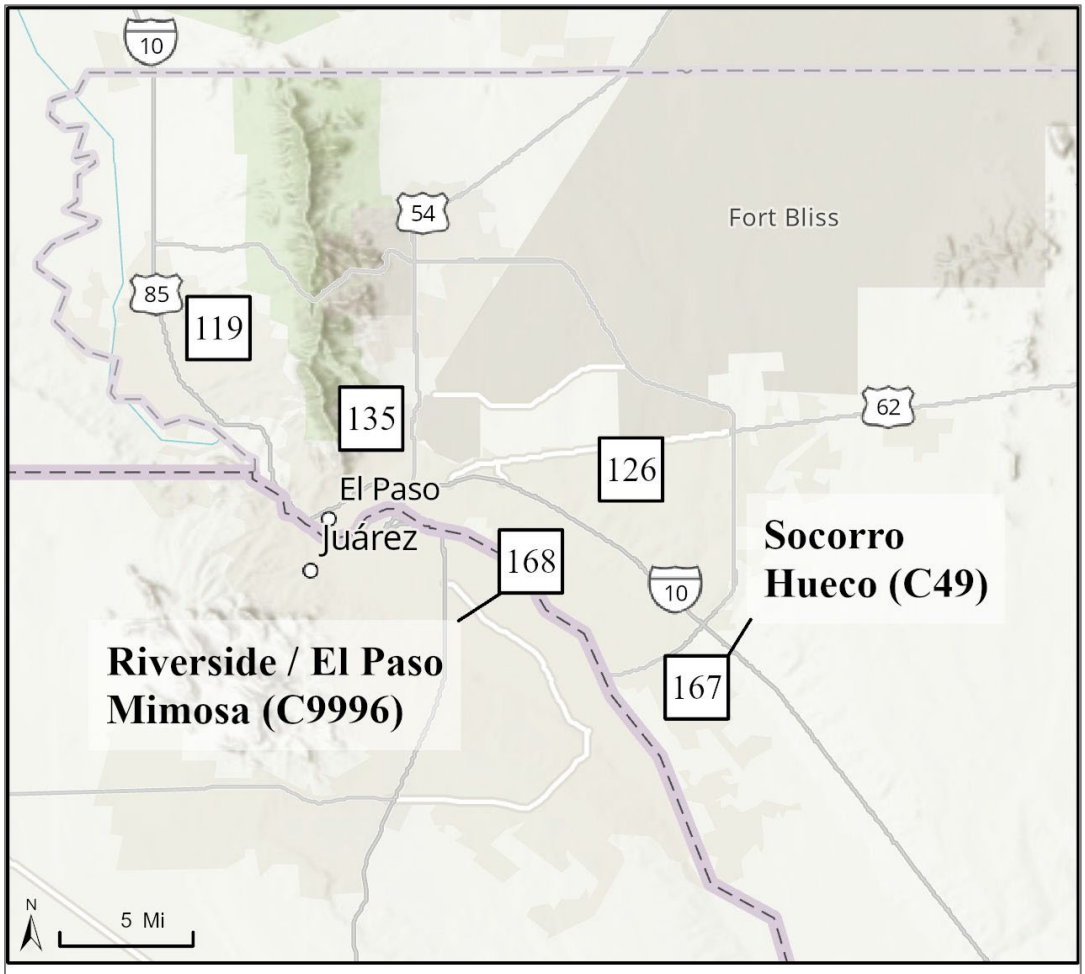

Figure C-4: Daily Average PM_{10} Measurements (µg/m³) on June 21, 2021

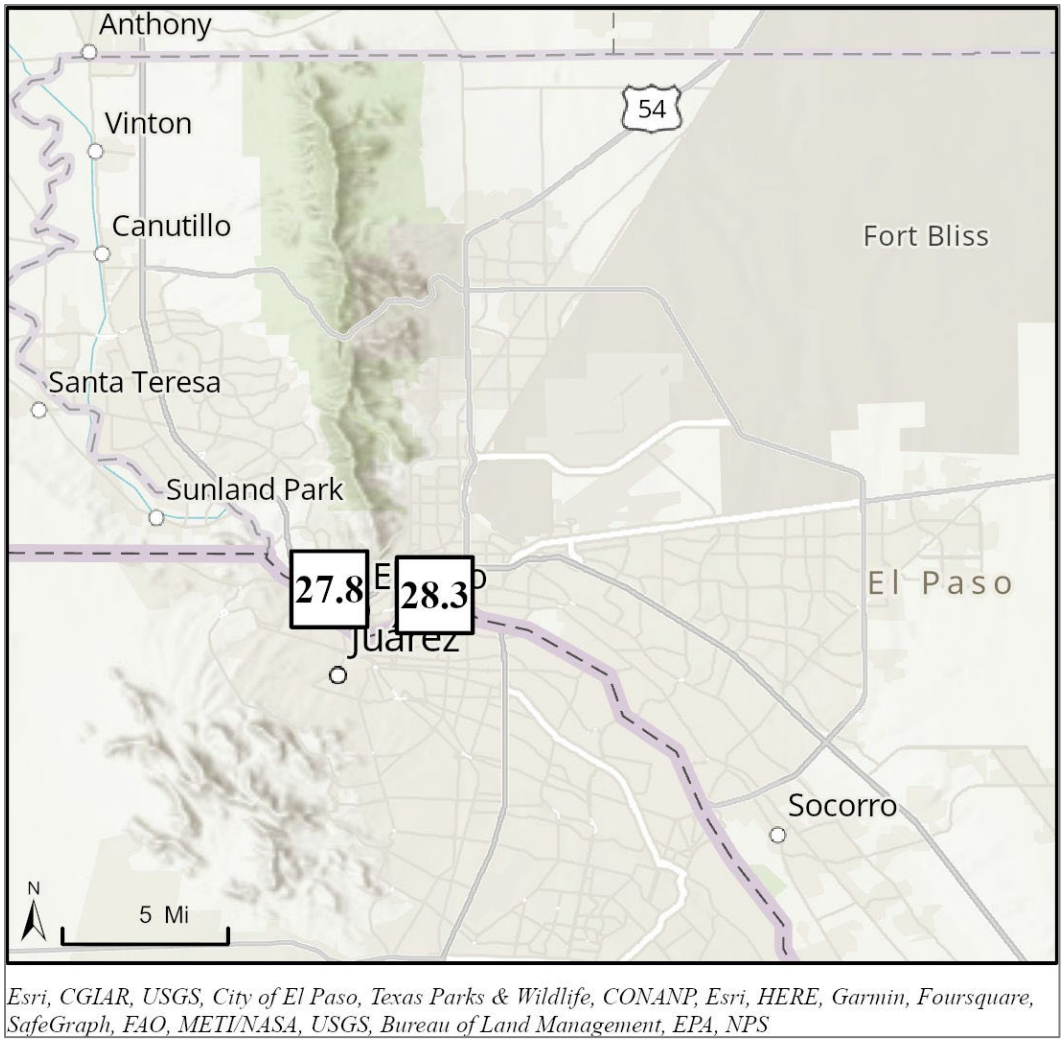

Figure C-5: Daily Average $PM_{2.5}$ Measurements (µg/m³) on June 21, 2021

C.4 CONTINUOUS PARTICULATE MATTER AND WIND GRAPHS

Time series graphs, plotting continuous particulate measurements against wind speed measurements, illustrate the nature of dust events with particulate concentrations rising following sustained, high wind speeds. Figure C-6: *Continuous Five-Minute PM_{10} and Peak Area Five-Minute Sustained Wind Speed Measurements on June 21, 2021* demonstrates that peak sustained wind speed measurements on June 21, 2021 in El Paso County reached 20 to 25 mph in the early part of the day. Shortly thereafter peak PM_{10} concentrations were recorded. This pattern indicates that the source of dust was likely the nearby natural undisturbed land in the Chihuahuan Desert in Mexico. Although wind speeds in El Paso County remained elevated through much of the morning, PM_{10} concentrations remained relatively consistent. This pattern further supports that the high winds outside of El Paso County prior to peak PM_{10} concentrations recorded in El Paso were the cause of transport of elevated PM_{10} concentrations into El Paso County.

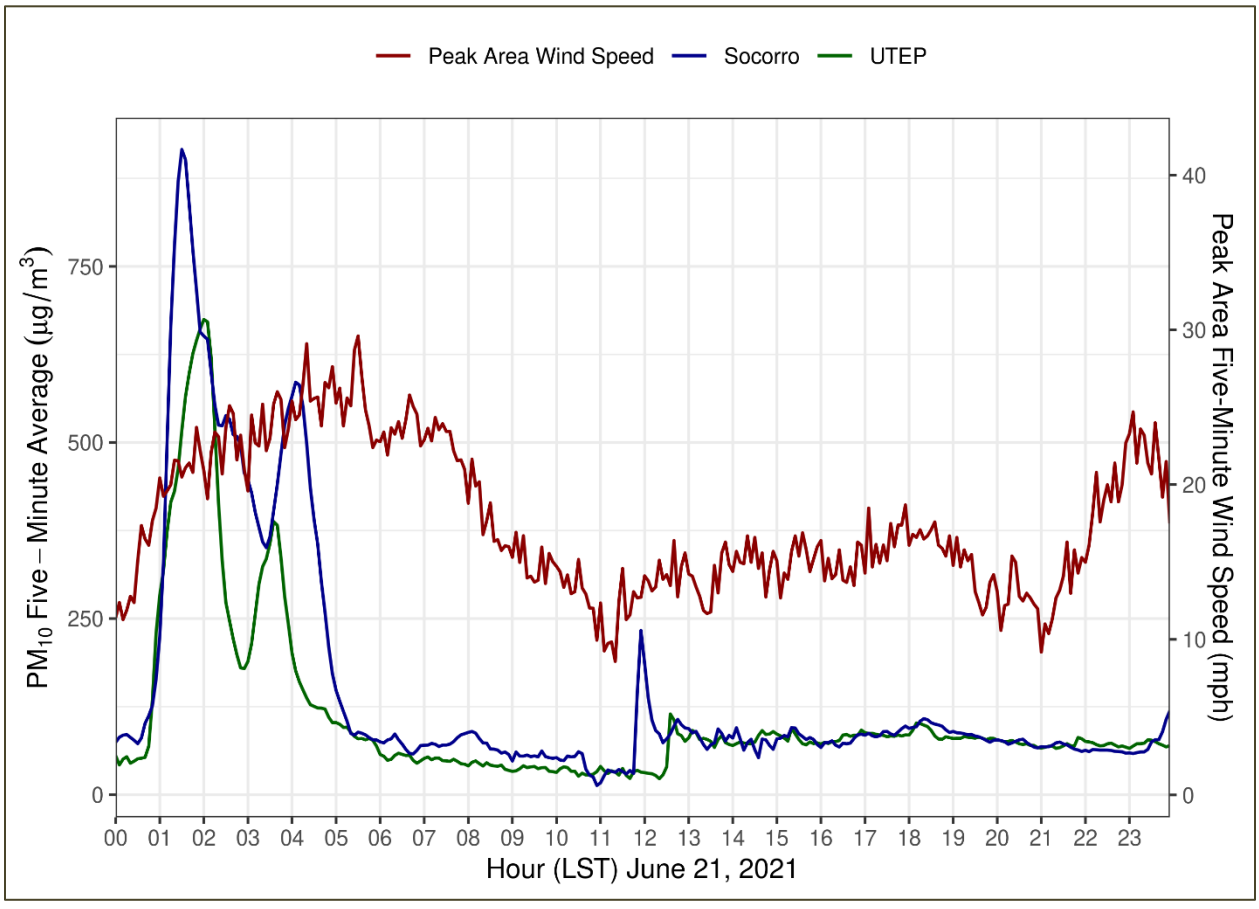

Figure C-6: Continuous Five-Minute PM_{10} and Peak Area Five-Minute Sustained Wind Speed Measurements on June 21, 2021

C.5 SPECIAL WEATHER STATEMENTS

A special weather statement is provided in Figure C-7: *Hazardous Weather Outlook Message Issued by the National Weather Service El Paso Office on June 20, 2021*, and a storm warning in Figure C-8: *Satellite Image of Storm Warnings on June 20, 2021*. High winds began on the evening of June 20, 2021, and these warnings were issued on this date. Outflow boundaries may persist for 24 hours or more after the thunderstorms that generated them dissipate, and may travel hundreds of miles from their area of origin. These items serve to contribute additional supporting documentation establishing the occurrence and geographical extent of this event.

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153
WWUS54 KEPZ 210006
DSWEPZ

Dust Advisory
National Weather Service El Paso TX
606 PM MDT Sun Jun 20 2021

NMC013-TXC141-210200-
/O.NEW.KEPZ.DS.Y.0005.210621T0006Z-210621T0200Z/
Dona Ana NM-El Paso TX-
606 PM MDT Sun Jun 20 2021

The National Weather Service in El Paso has issued a

* Dust Advisory for...
  South central Dona Ana County in south central New Mexico...
  Northwestern El Paso County in western Texas...

* Until 800 PM MDT.

* At 606 PM MDT, a wall of blowing dust was along a line extending
  from near Organ to near Sunland Park, moving east at 20 mph.

  HAZARD...Less than two miles visibility with strong winds up to 45
           mph.

  SOURCE...Doppler radar and surface observations.

  IMPACT...Hazardous travel.

* This includes Interstate 10 in Texas between mile markers 4 and 46.

Locations impacted include...
West El Paso, Central El Paso, East El Paso, Northeast El Paso, Far
East El Paso, Mission Valley, Clint, Horizon City, Santa Teresa,
Sunland Park, Canutillo, San Elizario, Fort Bliss, Socorro, La Union,
Vinton, Sparks, Homestead Meadows, Biggs Field and Fort Bliss
Northeast.
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Figure C-7: Hazardous Weather Outlook Message Issued by the National Weather Service El Paso Office on June 20, 2021

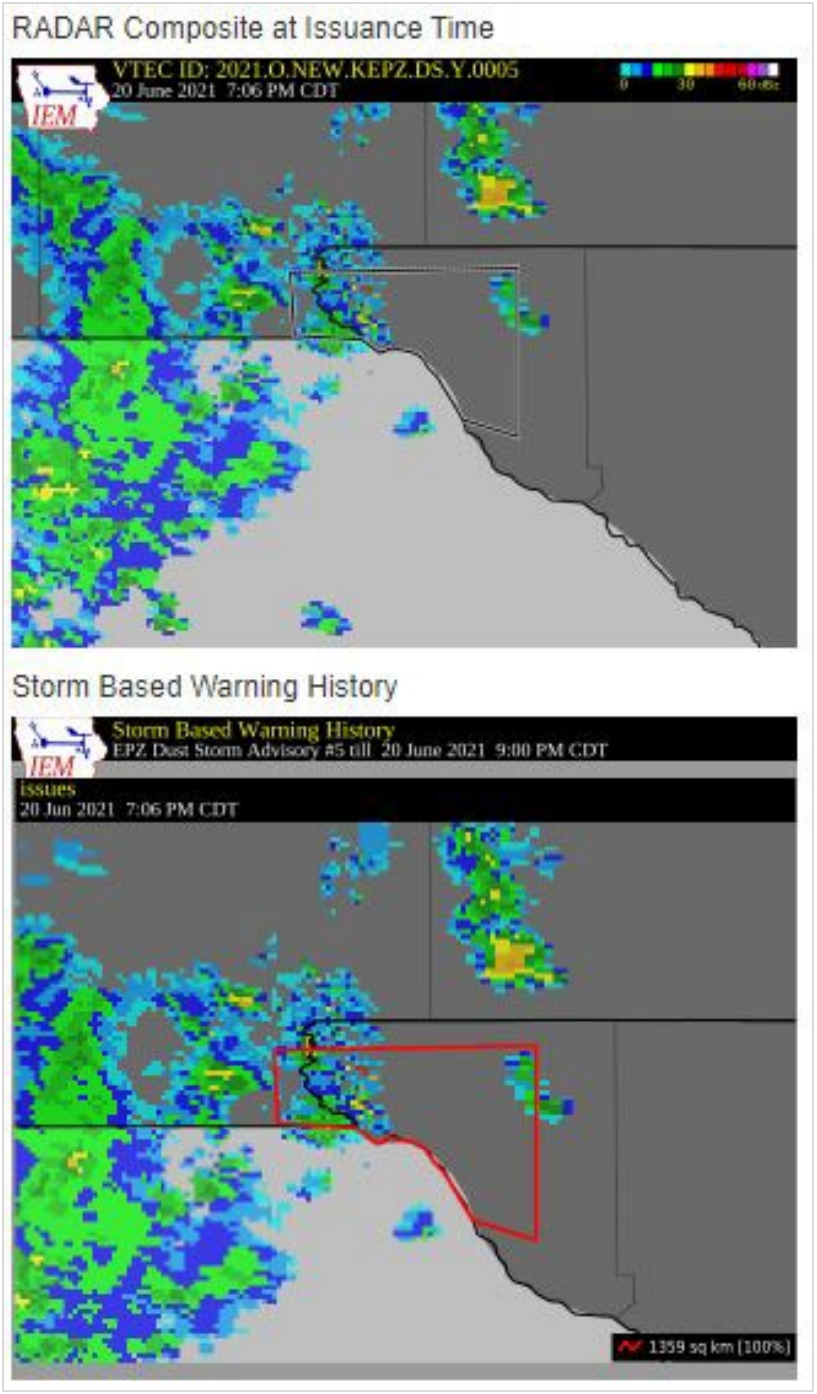

Figure C-8: Satellite Image of Storm Warnings on June 20, 2021

C.6 DAILY AVERAGE PARTICULATE MATTER MEASUREMENTS

All available continuous and non-continuous El Paso area daily average particulate measurements from June 21, 2021 are provided in Table C-1: *El Paso County Particulate Matter Measurements on the Exceptional Event Day of June 21, 2021*.

Table C-1: El Paso County Particulate Matter Measurements on the Exceptional Event Day of June 21, 2021

Site	Type	Method	Concentration (µg/m^3)
Ivanhoe (C414)	PM_{10}	FRM	126
El Paso UTEP (C12)	PM_{10}	C	109.4
Riverside/El Paso Mimosa (C9996)	PM_{10}	FRM	168*
Socorro Hueco (C49)	PM_{10}	FRM	167*
Socorro Hueco (C49)	PM_{10}	FRQ	No data
Socorro Hueco (C49)	PM_{10}	C	149.8
Van Buren (C693)	PM_{10}	FRM	135
Ojo de Agua (C1021)	PM_{10}	FRM	119
Ojo de Agua (C1021)	PM_{10}	FRQ	No data
El Paso UTEP (C12)	$PM_{2.5}$	FRM	27.8
El Paso UTEP (C12)	$PM_{2.5}$	C	29.1
El Paso Chamizal (C41)	$PM_{2.5}$	FRM	28.3
El Paso Chamizal (C41)	$PM_{2.5}$	FRQ	27.7
El Paso Chamizal (C41)	$PM_{2.5}$	CSN	22.0
Socorro Hueco (C49)	$PM_{2.5}$	C	33.6
Ascarate Park SE (C37)	$PM_{2.5}$	C	49.5

Notes:
*Indicates the measurement is proposed as an exceptional event.
Abbreviations:
FRM Federal Reference Method non-continuous monitor
FRQ Federal Reference Method non-continuous quality control (collocated) monitor
C Continuous monitor
CSN Reconstructed $PM_{2.5}$ mass from speciated non-continuous monitor

C.7 CHEMICAL SPECIATION STUDY

$PM_{2.5}$ Chemical Speciation Network (CSN) speciation data were available from the El Paso Chamizal (C41) site for the event day. A summary of the El Paso Chamizal (C41) speciation data on June 21, 2021 is provided in Table C-2: *El Paso Chamizal (C41) $PM_{2.5}$ Speciation Summary for June 21, 2021*, including averages for the period from 2019 through 2021 for comparison. The speciation data show a predominance of the Interagency Monitoring of Protected Visual Environments (IMPROVE) soil component on the proposed exceptional event day indicating transported dust from high winds. The IMPROVE soil component is derived using a calculation consisting of speciated $PM_{2.5}$ parameters understood to be the primary constituents in soil that would be representative of transported dust from natural undisturbed land.

Table C-2: El Paso Chamizal (C41) $PM_{2.5}$ Speciation Summary for the Exceptional Event Day

Species	2019 through 2021*	June 21, 2021	Difference	Percent Change	Percent Difference
FRM	8.777	28.3	19.52	222%	105%
RM	8.004	22.02	14.02	175%	93%
Soil	2.421	11.67	9.249	382%	131%
AS	0.992	1.716	0.724	73%	53%
AN	0.573	0.403	-0.170	-30%	35%
OC	3.251	7.732	4.481	138%	82%
SS	0.045	0.042	-0.003	-7%	7%
EC	0.722	0.457	-0.265	-37%	45%
Si	0.385	2.646	2.261	587%	149%
Al	0.136	1.056	0.920	676%	154%
Fe	0.124	0.553	0.429	346%	127%
Ca	0.315	0.804	0.489	155%	87%
S	0.232	0.416	0.184	79%	57%
Sr	0.002	0.007	0.005	250%	111%
Ti	0.009	0.056	0.047	509%	144%

Notes:
All units are in $\mu g/m^3$.
*Average for 2019 through 2021 including June 21, 2021.
Abbreviations:
FRM Federal Reference Method $PM_{2.5}$ concentration
RM IMPROVE reconstructed $PM_{2.5}$ mass concentration calculated from speciation data
Soil IMPROVE soil concentration calculated from speciation data
AS IMPROVE ammonium sulfate concentration calculated from speciation data
AN IMPROVE ammonium nitrate concentration calculated from speciation data
OC IMPROVE organic carbon concentration calculated from speciation data using parameter 88355.
SS IMPROVE sea salt concentration calculated from speciation data.
EC Elemental carbon concentration from speciation data.
Si silicon speciation concentration
Al aluminum speciation concentration
Fe iron speciation concentration
Ca calcium speciation concentration
S sulfur speciation concentration
Sr strontium speciation concentration
Ti titanium speciation concentration

The speciation data from the Chamizal (C41) monitor in El Paso County show that the IMPROVE organic carbon component is highest with light winds, as would be expected with local contribution during air stagnation. Alternatively, the IMPROVE soil component is highest with high winds. Figure C-9: *El Paso Chamizal (C41) $PM_{2.5}$ IMPROVE Organic Carbon Concentration versus El Paso Chamizal (C41) Daily Peak Hourly Wind Speed for 2019 through 2021* indicates, in general, that the highest local carbon related emission impacts on $PM_{2.5}$ occur with lower wind speeds. Organic carbon is generally highest with light winds as it can frequently be attributed to anthropogenic sources such as combustion.

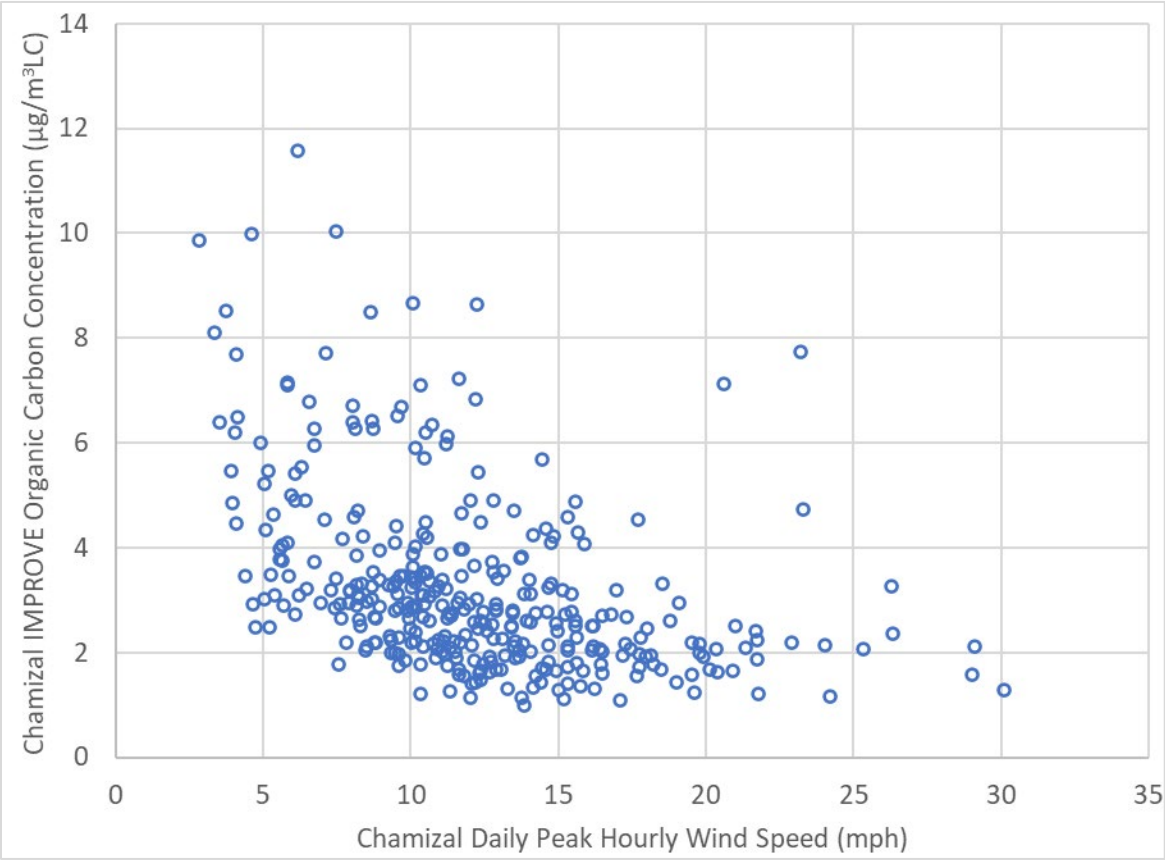

Figure C-9: El Paso Chamizal (C41) $PM_{2.5}$ IMPROVE Organic Carbon Concentration versus El Paso Chamizal (C41) Daily Peak Hourly Wind Speed for 2019 through 2021

Figure C-10: *El Paso Chamizal (C41) $PM_{2.5}$ IMPROVE Soil Concentration versus El Paso Chamizal (C41) Daily Peak Hourly Wind Speed for 2019 through 2021* indicates that the IMPROVE soil component is generally highest with high winds, as is the case for the $PM_{2.5}$ and PM_{10} concentrations previously shown in Figure 2-18: *El Paso County Daily Peak PM_{10} Average for FRM Measurements versus El Paso County Daily Peak Sustained Hourly Wind Speed for 2006 through 2021*. The IMPROVE soil component does not increase significantly at lower wind speeds, indicating that local dust is not a major contributor to particulate concentrations without high winds.

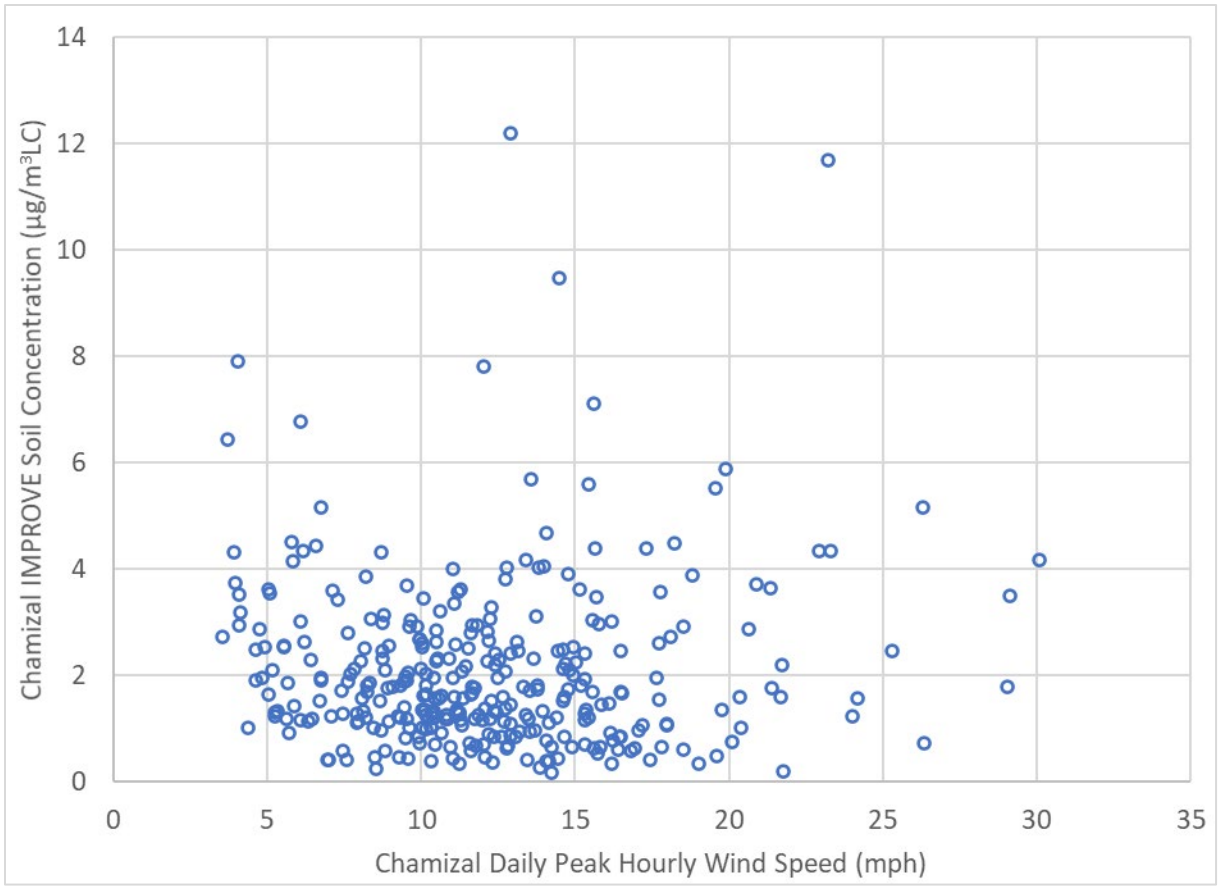

Figure C-10: El Paso Chamizal (C41) $PM_{2.5}$ IMPROVE Soil Concentration versus El Paso Chamizal (C41) Daily Peak Hourly Wind Speed for 2019 through 2021

C.8 COMPARISON OF EVENT-AFFECTED DAYS TO SIMILAR DAYS WITHOUT ELEVATED PM_{10} CONCENTRATIONS

To illustrate the impact a windblown dust event has on El Paso County versus local anthropogenic dust, the Texas Commission on Environmental Quality (TCEQ) conducted an analysis comparing the event days to other high wind days without elevated 24-hour PM_{10} concentrations in 2021. Specifically, this comparative analysis focused on identifying days with wind speed and, to a lesser extent, wind direction measurements comparable to the event days but without elevated 24-hour PM_{10} values. PM_{10} data used in this study were also collected via a tapered element oscillating microbalance (TEOM) sampler. Due to the once-every-six-days sampling schedule for FRM PM_{10} results, these data can be unavailable on the days that met the wind criteria.

Table C-3: *Socorro Hueco (C49) Particulate Matter and El Paso Area Wind Measurements on June 21, 2021 and Days with High Winds but Low Particulate Matter Concentrations* and Table 5-2: Ivanhoe (C414) *Particulate Matter and El Paso Area Wind Measurements on December 6, 2021 and Days with High Winds but Low Particulate Matter Concentrations* provide, respectively, four representative days in 2021 where wind speed and wind direction are comparable to the event days. On each of the identified days, daily average PM_{10} measurements were significantly less than the flagged event days when windblown dust plumes were advecting out of northern Mexico on June 21, 2021 and west Texas on December 6, 2021. This analysis provides additional supporting evidence that measured concentrations on the flagged event days were not the result of local anthropogenic sources but were instead caused by transport of widespread dust.

Table C-3: Socorro Hueco (C49) Particulate Matter and El Paso Area Wind Measurements on June 21, 2021 and Days with High Winds but Low Particulate Matter Concentrations

Day	PM_{10}C	PkWnd	WDR	StDev	Pk1HrPM_{10}C	Time	PM_{10} FRM
6/21/2021	150	30	179	101	681	100	167
1/25/2021	33	32	252	59	508	1500	NA
5/13/2021	66	42	119	28	621	1600	NA
7/11/2021	63	49	321	71	600	1900	NA
12/9/2021	63	29	216	61	215	2100	77

Abbreviations:

PM_{10} C	continuous daily average in µg/m^3 at Socorro Hueco
PkWnd	peak area one-hour average wind speed in mph
WDR	daily wind direction resultant in degrees from north at Socorro Hueco
StDev	wind direction standard deviation at Socorro Hueco
Pk1HrPM_{10}C	peak continuous hourly PM_{10} measurement at Socorro Hueco in µg/m^3
Time	Time in Mountain Standard Time (MST) of peak continuous hourly PM_{10} measurement
PM_{10} FRM	non-continuous FRM daily average in µg/m^3 at Socorro Hueco

C.9 SPATIAL AND TEMPORAL VARIABILITY OF PM_{10}

PM_{10} data across El Paso County are presented in Table C-4: *El Paso County PM_{10} Daily Measurements (µg/m³) before and after June 21, 2021*. This information highlights the impact of the windblown dust event on the flagged event day and demonstrates spatial and temporal variability of PM_{10} in El Paso County.

Table C-4: El Paso County PM_{10} Daily Measurements (µg/m³) before and after June 21, 2021

Date	Socorro Hueco (C49) FRM	Socorro Hueco (C49) C	Ivanhoe (C414) FRM	El Paso UTEP (C12) C	Riverside/El Paso Mimosa (C9996) FRM	Van Buren (C693) FRM	Ojo de Agua (C1021) FRM
6/15/2021	23	20	30	22	24	18	21
6/16/2021	--	22	--	23	--	--	--
6/17/2021	--	21	--	25	--	--	--
6/18/2021	--	26	--	32	--	--	--
6/19/2021	--	28	--	34	--	--	--
6/20/2021	--	96	--	74	--	--	--
6/21/2021*	167*	150*	126*	109*	168*	135*	119*
6/22/2021	--	70	--	69	--	--	--
6/23/2021	--	64	--	54	--	--	--
6/24/2021	--	75	--	35	--	--	--
6/25/2021	--	26	--	18	--	--	--
6/26/2021	--	44	--	28	--	--	--
6/27/2021	38	37	77	39	50	39	50

Notes:
* indicates proposed exceptional event day measurements.
-- sample collection was not scheduled for listed day.
Abbreviations:
FRM Federal Reference Method monitor PM_{10} concentration (µg/m³)
C continuous monitor PM_{10} concentration (µg/m³)
NA valid data were not recorded on these scheduled sample days

C.10 AIR QUALITY FORECAST ON THE EVENT DAY

The TCEQ provides the United States Environmental Protection Agency (EPA) Air Quality Index (AQI) forecasts for the current day and the next three to four days for 17 areas in Texas, including the El Paso area, for ozone, particulate matter of 2.5 microns or less in aerodynamic diameter ($PM_{2.5}$), and PM_{10}. These forecasts are available to the public on the Today's Texas Air Quality Forecast webpage (http://www.tceq.texas.gov/airquality/monops/forecast_today.html) (TCEQ2, 2021) and on the EPA AIRNOW website (http://airnow.gov/) (EPA3, 2021). These notifications are forecasts, and although the forecast did predict blowing dust, the PM_{10} levels were not predicted to be as high as what occurred. The Today's Texas Air Quality webpage forecast discussion for the event day is quoted below this paragraph. Text related to particulate matter begins in the second paragraph of the forecast.

> **Monday 06/21/2021**
>
> Warm to hot temperatures, sufficient afternoon sunshine, and/or elevated incoming background levels could be enough for ozone to reach the lower to middle end of the "Moderate" range in parts of the El Paso area; the lower end of the "Moderate" range in parts of the Midland-Odessa and San Antonio areas; and the upper end of the "Good" range (perhaps with an isolated low "Moderate" or two) in parts of the Big Bend area, with highest concentrations in the afternoon and early evening.
>
> Light amounts of African dust are expected to continue across portions of South through Southeast Texas extending toward East Texas, while light amounts of residual smoke from ongoing wildfire activity in the Southwest U.S. persists across portions of West Texas while extending into South Central, Central, and North Central Texas. Overall, depending on the coverage and intensity of the dust and smoke, the daily $PM_{2.5}$ AQI is forecast to reach the lower to middle end of the "Moderate" range in parts of the Austin, Corpus Christi, Dallas-Fort Worth, San Antonio, Victoria, and Waco-Killeen areas; the lower end of the "Moderate" range in parts of the Brownsville-McAllen, Bryan-College Station, Laredo, and Tyler-Longview areas; and the upper end of the "Good" range (perhaps with an isolated low "Moderate" or two) in parts of the Beaumont-Port Arthur and Houston areas.
>
> Strong afternoon winds, associated with a cold frontal boundary, may generate and transport patchy blowing dust into and through portions of the Texas Panhandle, South Plains, Permian Basin, and Far West Texas. Depending on the intensity and duration of the blowing dust, the daily $PM_{2.5}$ AQI could reach the lower to middle end of the "Moderate" range in parts of the Amarillo, Big Bend, El Paso, Lubbock, and Midland-Odessa areas. The associated blowing dust could raise the daily PM_{10} AQI to the lower end of the "Moderate" range in parts of the Big Bend and El Paso areas as well.
>
> Otherwise, and elsewhere in the Southeast portion of the state, moderate winds, increased cloud cover, and/or lower incoming background levels should help keep air quality in the "Good" range in most spots.

C.11 MAP OF WIND SPEED AND DIRECTION

The EPA's High Wind Dust Event Guidance (EPA, 2019) suggests a minimum sustained wind speed of 25 mph for western states including Texas, or development of an alternate area-specific high wind threshold at which a dust event could occur. The event meets the strictest definition of this threshold with peak area hourly wind speeds greater than 25 mph. High, area winds in surrounding areas indicate that PM_{10} concentrations recorded were influenced by regional transport from surrounding areas.

The TCEQ used NOAA Air Resources Laboratory (ARL) meteorological model results to display wind speeds and direction in the source areas of natural undisturbed land in Mexico west-southwest of El Paso County for June 21, 2021. The same method was used to show wind speeds and direction for December 6, 2021 where high winds over natural, undisturbed land east of El Paso transported particulate matter into El Paso County. Specifically, the TCEQ used the 12-kilometer (km) North American Model (NAM) hourly wind speeds and wind vectors at a 10-meter height. Figure C-11: *NOAA ARL Model Wind Field in El Paso County at 03:00 MDT on June 21, 2021* illustrates the predicted wind speeds in dust source areas for the event day. This model supports the occurrence of windblown dust from source areas at wind speed averages in the 15 through 25 nautical mph, or 17 through 29 mph, range.

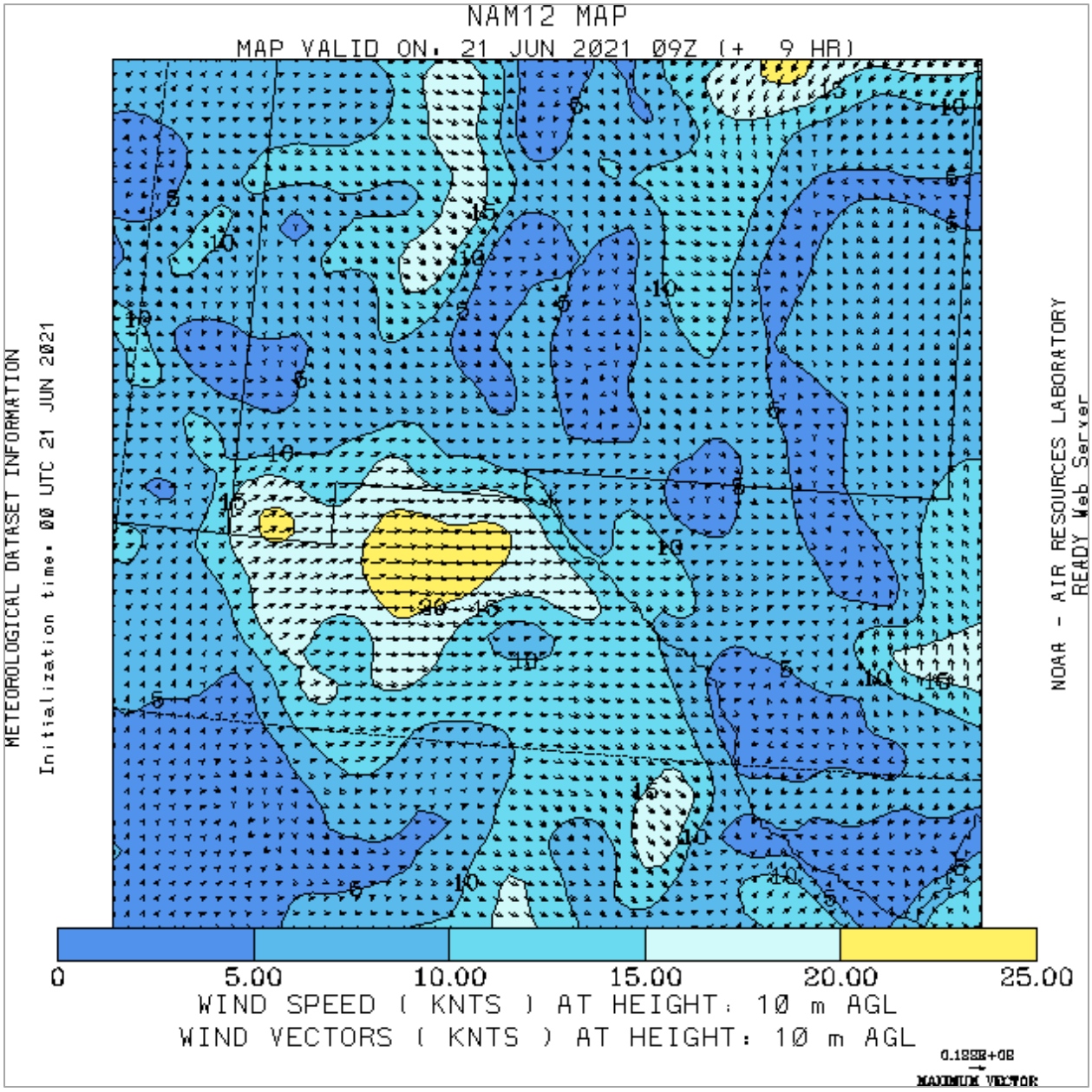

Figure C-11: NOAA ARL Model Wind Field in El Paso County at 03:00 MDT on June 21, 2021

As depicted in Figure C-11, the event on June 21, 2021 was characterized by high winds that extended beyond the immediate El Paso area. Figure 2-8 shows the time of 03:00 MDT to illustrate the high winds early in the day in dust source areas in Mexico. As documented by Prospero et al. (2002), Gill et al. (2007), Rivera Rivera (2006), and Novlan et al. (2007), natural sources just south of the U.S.-Mexico border have been found to contribute to dust storm events in the El Paso area.

Measurements from El Paso area monitoring sites help confirm the large-scale nature of the high winds and characterize the event impacts on a localized scale immediately surrounding the monitoring sites.

The contribution of Chihuahuan Desert sources, in the primarily unpopulated areas of northern Chihuahua, Mexico, to dust events that impact El Paso has been well established in peer-reviewed literature.

C.12 WIND AND PARTICULATE MATTER MEASUREMENTS

A list of the PM_{10} concentration and wind measurements on the event day of June 21, 2021 at monitors that exceeded the standard is provided in Table C-5: *El Paso County Wind Measurements and PM_{10} Concentrations*. The event day had peak sustained winds measured in excess of the suggested 25 mph threshold for blowing dust cited in the EPA's High Wind Dust Event Guidance (EPA, 2019).

Table C-5: El Paso County Wind Measurements and PM_{10} Concentrations at the Socorro Hueco (C49) and Riverside/El Paso Mimosa (C9996) Monitors

Date	Socorro Hueco (C49) FRM PM_{10} ($\mu g/m^3$)	Riverside/ El Paso Mimosa (C9996) FRM PM_{10} ($\mu g/m^3$)	Peak KELP Wind Gust (mph)	Peak Area 5-min Wind Speed (mph)	Peak Area Hourly Wind Speed (mph)	Peak Socorro Hueco (C49) Hourly Wind Speed (mph)	Wind Direction at Peak 5-min Speed (degrees)	Wind Direction at Peak Hourly Speed (degrees)
June 21, 2021	167	168	49	29.6	25.3	13.4	302	302

Note: Only the flagged particulate matter concentrations at the Socorro Hueco (C49) and Riverside/El Paso Mimosa monitor (C9996) on June 21, 2021 are listed in this table. See Table C-1: *El Paso County Particulate Matter Measurements on the Exceptional Event Day of June 21, 2021* for all available particulate matter measurements on this day. Wind measurements are from the NWS El Paso International Airport weather station (KELP) and from El Paso area air quality monitoring stations, including the Socorro Hueco (C49) site. The Riverside/El Paso Mimosa monitor (C9996) does not record wind information. The peak wind speeds depicted include sustained five-minute averages (5-min Wind Speed), and hourly averages (Hourly Wind Speed). The associated peak wind directions are in degrees clockwise from true north and indicate the direction from which the wind was blowing at the time of peak sustained five-minute and hourly wind speeds.

APPENDIX D

EVENT ANALYSIS FOR DECEMBER 6, 2021

EL PASO COUNTY EXCEPTIONAL EVENT DEMONSTRATION
FOR PARTICULATE MATTER OF 10 MICRONS OR LESS IN
AERODYNAMIC DIAMETER (PM_{10}) FOR THE IVANHOE MONITOR
ON DECEMBER 6, 2021

1987 PM_{10} STANDARD

D.1 EVENT SUMMARY

The event day of December 6, 2021 is characterized by a backdoor cold front moving southwest over the El Paso area. Behind the front temperatures were about 5-10 degrees cooler than previous days. Figure D-1: *Regional Weather Map for December 6, 2021* shows high pressure is present over the central United States as the cold front moves into the southeast United States. In the El Paso area, the backdoor cold front is moving through the area from the east to the west. On December 6, 2021, two-minute sustained winds as high as 46.1 miles per hour (mph) were recorded at the GDP weather station which is approximately 100 miles east of El Paso. This region, associated with the Chihuahuan Desert, is believed to be the origin of the dust that was transported into El Paso County.

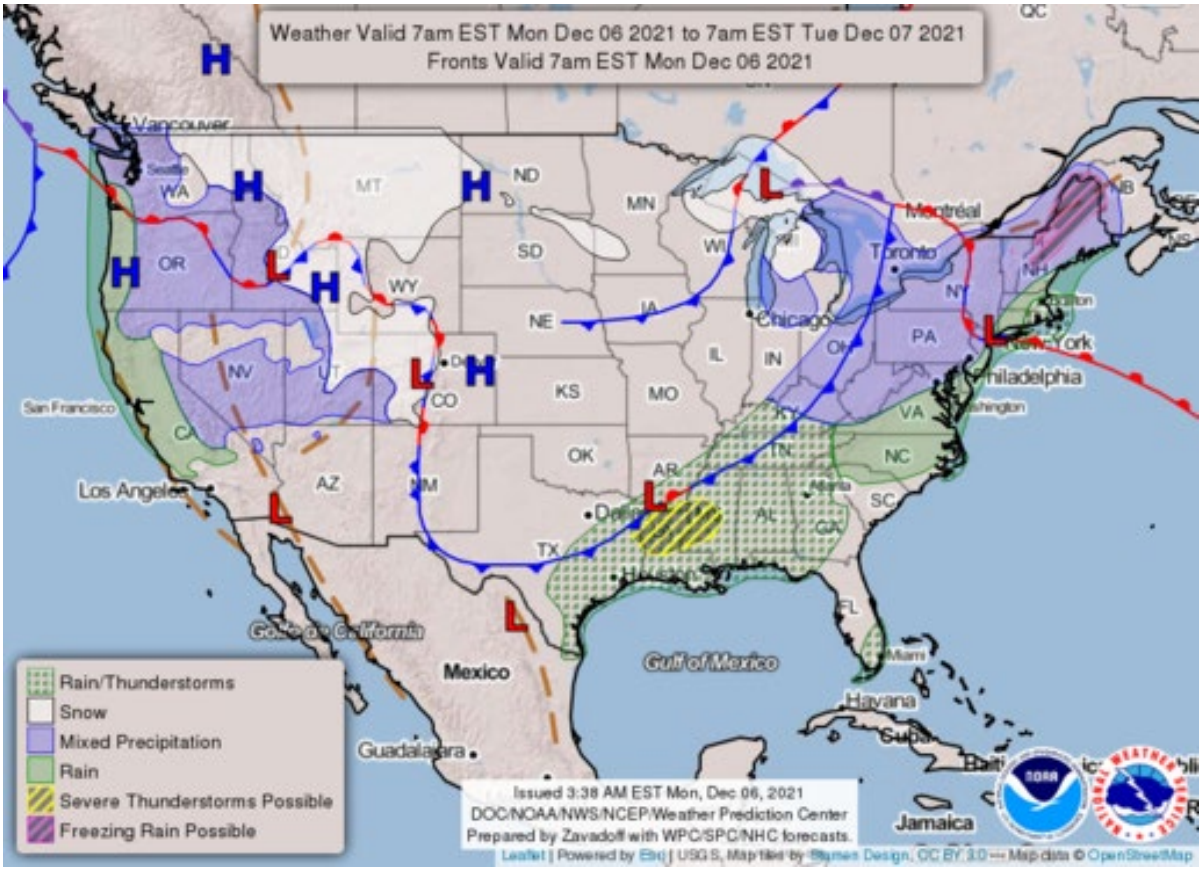

Figure D-1: Regional Weather Map for December 6, 2021

An exceptional event flag is proposed for the Ivanhoe (C414) Federal Reference Method (FRM) PM_{10} measurement of 177 micrograms per cubic meter ($\mu g/m^3$) on December 6, 2021.

D.2 BACKWARD-IN-TIME AIR TRAJECTORIES

Backward-in-time air parcel trajectories were produced using the National Oceanic and Atmospheric Administration (NOAA) HYSPLIT model for December 6, 2021. The images in Figure D-2: *HYSPLIT Backward Trajectories (December 6, 2021) Every Two Hours at 10, 100, and 1,000 m AGL* display trajectories that track the air arriving every two hours on the event day and follow the air backward in time for 36 hours to demonstrate both the origin and path of the air parcels. Figure D-2 shows that at the lower altitudes the air parcels were traveling east to west prior to reaching El Paso County. With the dust source believed to be natural, undisturbed land east of El Paso County, the lower altitude trajectories are the most relevant when considering a source in relatively close proximity to the monitor.

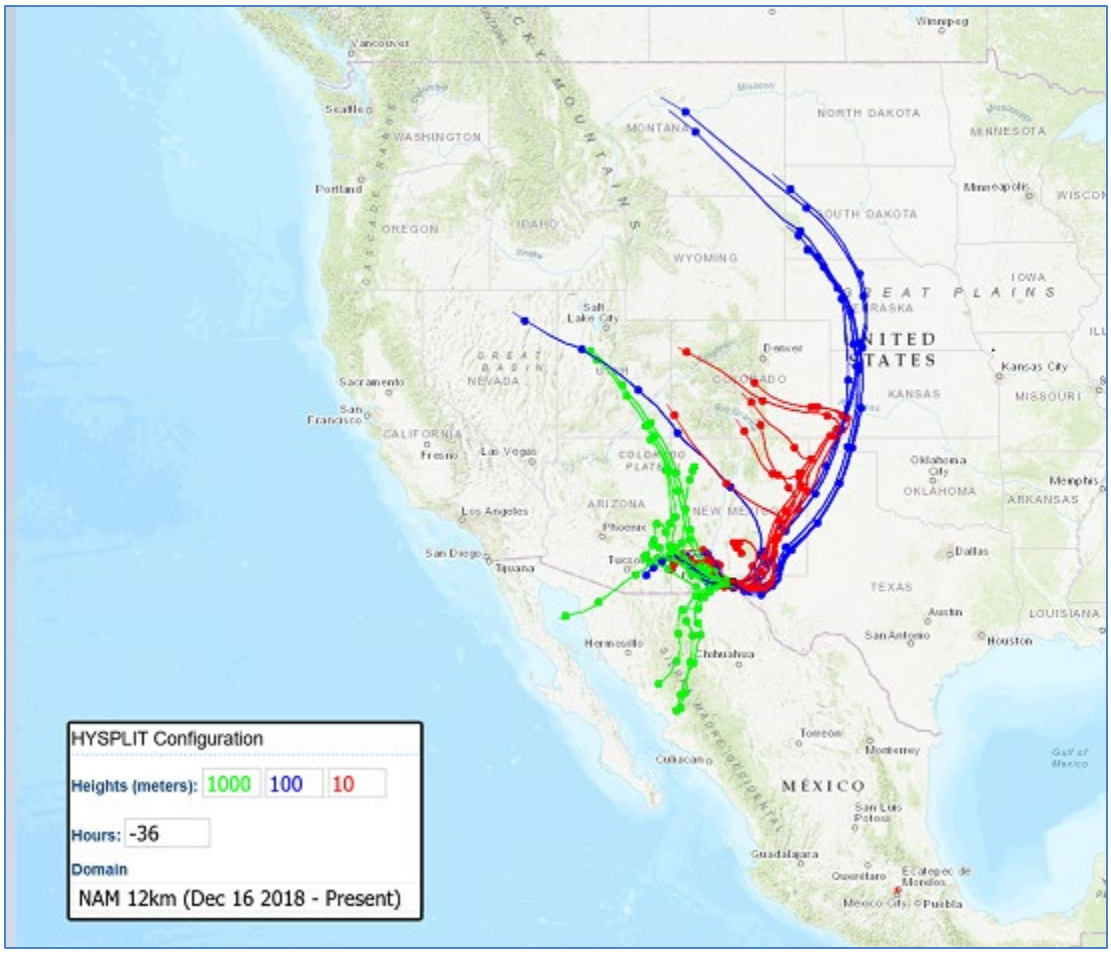

Figure D-2: HYSPLIT Backward Trajectories (June 21, 2021 from 01:00 through 04:00 MDT) at 10, 100, and 1,000 m AGL

D.3 MAP PLOTS OF DAILY PARTICULATE MATTER DATA

The following maps display daily average PM_{10} and $PM_{2.5}$ measurements from the December 6, 2021 event. Maps of the daily average PM_{10} and $PM_{2.5}$ concentrations show the spatial distribution of measurements on the event day, with the flagged measurement identified by site name. PM_{10} concentrations are shown in Figure D-2: *Daily Average PM_{10} Measurements (µg/m³) on December 6, 2021*, and $PM_{2.5}$ concentrations are shown in Figure D-3: *Daily Average $PM_{2.5}$ Measurements (µg/m³) on December 6, 2021*. As shown in Figure D-2, the highest measured PM_{10} values occurred in the eastern portion of El Paso County's PM_{10} monitoring network.

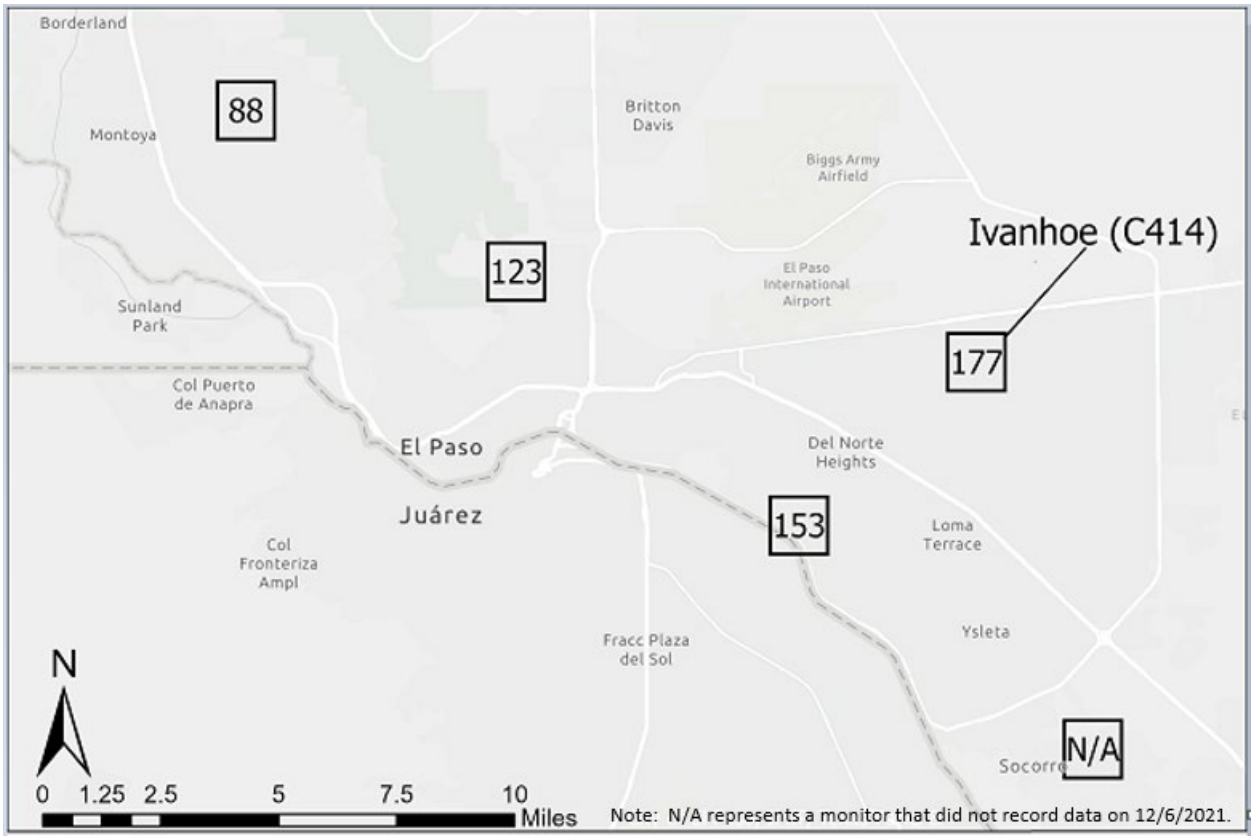

Figure D-2: Daily Average PM_{10} Measurements (µg/m³) on December 6, 2021

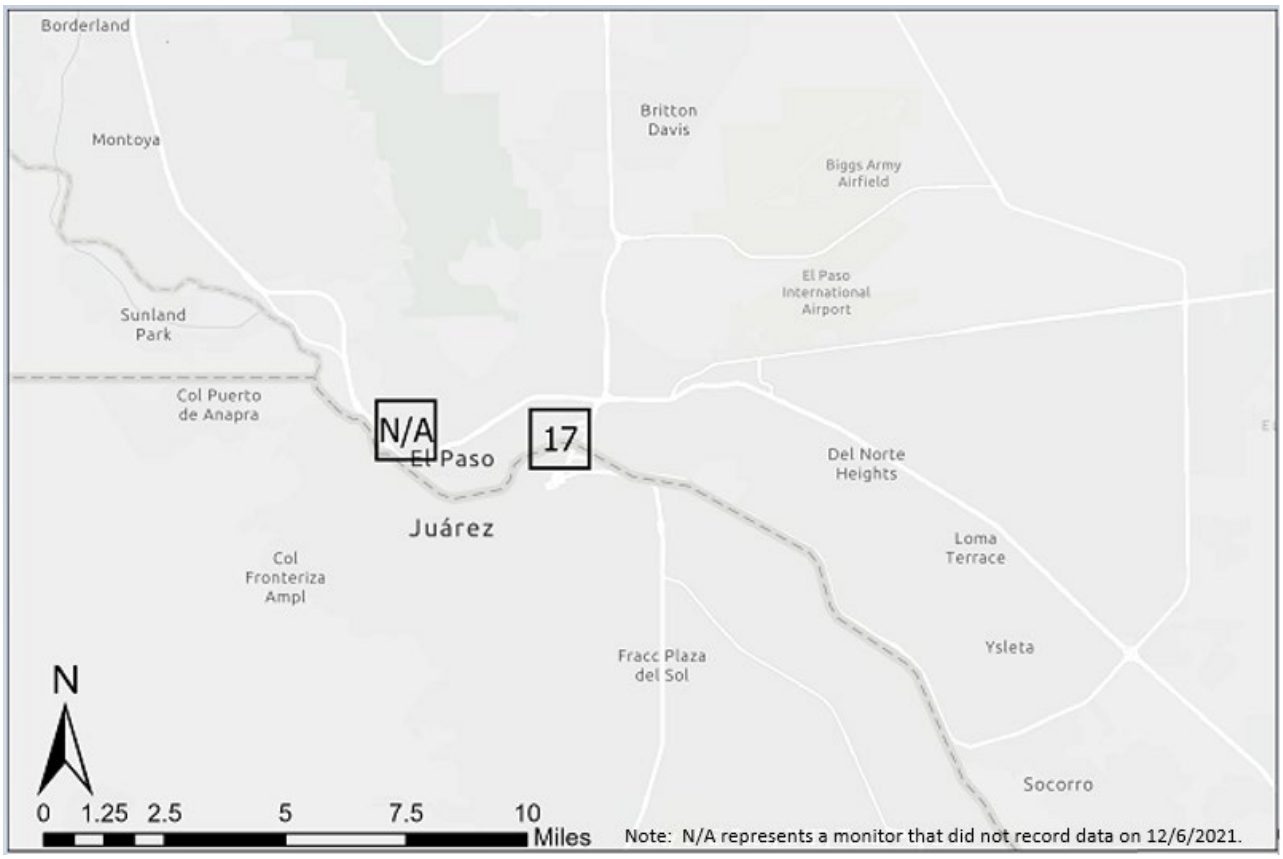

Figure D-3: Daily Average $PM_{2.5}$ Measurements ($\mu g/m^3$) on December 6, 2021

D.4 CONTINUOUS PARTICULATE MATTER AND WIND GRAPHS

Time series graphs, plotting continuous particulate measurements against wind speed measurements, illustrate the nature of dust events with particulate concentrations rising following sustained, high wind speeds. Figure D-4: *Continuous Five-Minute PM_{10} and Peak Area Five-Minute Sustained Wind Speed Measurements on December 6, 2021* demonstrates that El Paso County peak sustained wind speed measurements on December 6, 2021 occurred in the earliest part of the day. Peak PM_{10} concentrations in El Paso County were recorded approximately five hours after peak, local wind speeds. Because the Ivanhoe (C414) monitor does not measure hourly PM_{10} concentrations, the Socorro Hueco (C49) monitor, located approximately 8.5 miles south-southeast of the Ivanhoe (C414) monitor, was used for this study. The gap between peak wind speeds and peak PM_{10} concentrations in Figure D-4 suggests that the source of dust was not immediately outside of El Paso County but a moderate distance beyond. The fact that winds were from the east and southeast indicates that the source of dust was likely the nearby natural undisturbed land in the Chihuahuan Desert east of El Paso County.

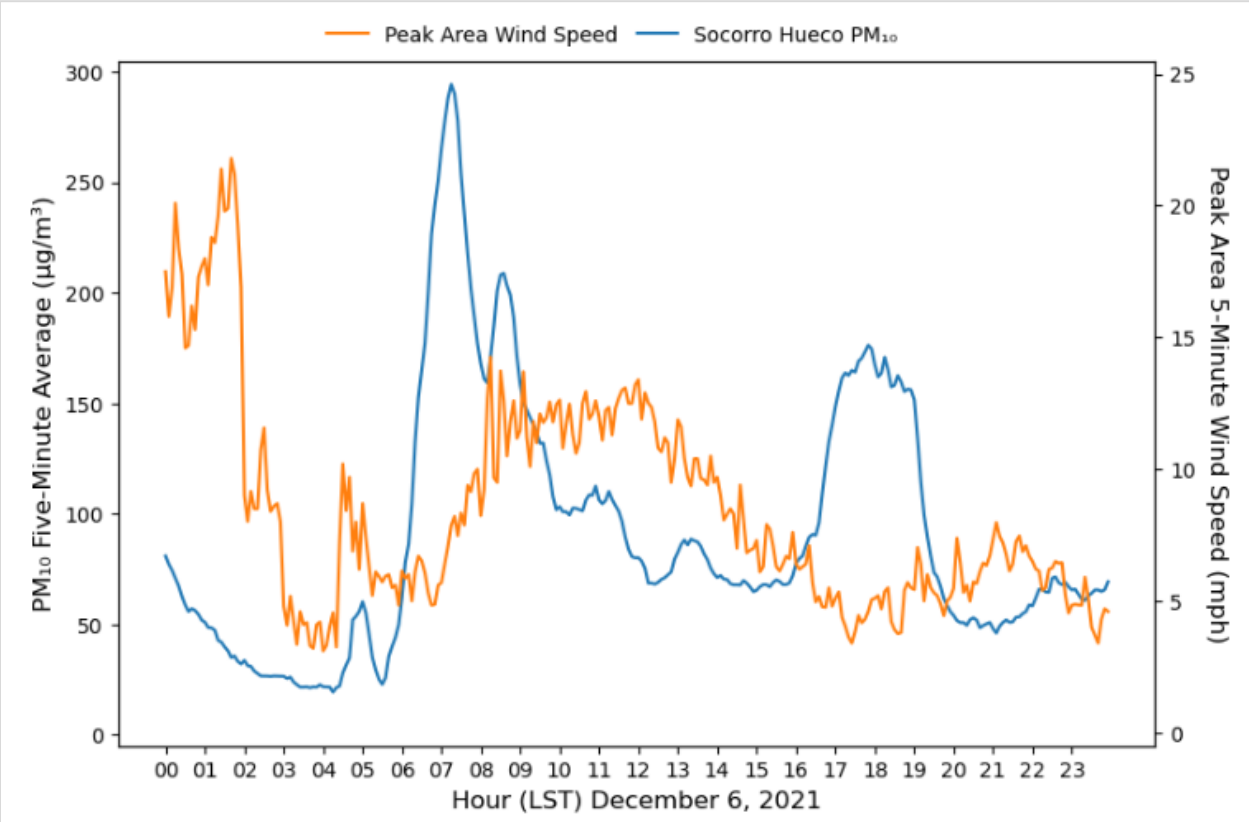

Figure D-4: Continuous Five-Minute PM_{10} and Peak Area Five-Minute Sustained Wind Speed Measurements on December 6, 2021

D.5 SPECIAL WEATHER STATEMENTS

A weather statement issued by the National Weather Service for Midland/Odessa, the office covering the dust source area, states, “Thanks to recent harvest season and antecedent dry conditions over the heavy agriculture to the north, a plume of dust will accompany the higher winds this AM, leading to local vis falling to 2-4 miles at times.” This statement is contained within Figure D-5: *Forecast Discussion Issued by the National Weather Service Midland/Odessa Office on December 6, 2021*.

```
655
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AFDMAF

Area Forecast Discussion
National Weather Service Midland/Odessa TX
520 AM CST Mon Dec 6 2021

...New AVIATION...

.AVIATION...
(12Z TAFS)
Issued at 517 AM CST Mon Dec 6 2021

Only site currently MVFR due to BLDU is KINK, but will see them
improve back to VFR within the next 1-2 hrs. SKC areawide with
gusty N winds slowly scaling back as local pressure gradient
relaxes. Winds will become <12kts by 18z at all terminals out of
the NE, veering out of the SE this afternoon and evening.
Light/VRB winds beyond 03z everywhere but KFST where S/SE winds
overnight hold firm b/w 7-11kts.

&&

.SHORT TERM...
(Today through Tuesday afternoon)
Issued at 246 AM CST Mon Dec 6 2021

Currently have our cold front moving into the I-20 corridor with
gusty north winds post front. Local pressure gradient is stark with
significant pressure rises (+5-10mb/3hrs) behind the front, which is
why we are seeing some elevated winds across the Permian Basin and
Southeast NM at this hour. Focus of the strongest winds will be just
after fropa (Frontal Passage) and 2-3 hrs behind the front thanks
the associated pressure rises. Gusts over 30 mph will be common from
I-10 corridor on north with less gradient pattern across the
southern tier of the forecast area. Thanks to recent harvest season
and antecedent dry conditions over the heavy agriculture to the
north, a plume of dust will accompany the higher winds this AM,
leading to local vis falling to 2-4 miles at times. Have added
blowing dust to the grids given the trend in obs to our north and
recently in our own forecast zones. Cold front will also push
through the Guadalupes this AM with a gap wind event beginning an
hour or so post front as MOS guidance is consistent with 40-45kts
sustained through KGDP due to terrain funneling off NE winds. A High
Wind Warning remains in effect through the AM for the area, but will
see winds fall gracefully by the afternoon as gradient pattern
relaxes.

Temperatures will be the second story of today as cold air advection
behind the front will leave boundary layer temps a solid 15-20C
cooler today than yesterday. Highs will struggle to reach 50-55F
degrees in many locations with some areas unlikely to get to 50F
north of I-20. Winds will settle mid-day as the gradient relaxes and
high pressure builds south into Oklahoma. By the evening, low level
winds will veer quickly out of the southeast with a moderating trend
forecasted in the low-level thermal field. This is a tricky setup as
cold air in place will be tough to scour out and models tend to
overdue the warm push on these setups. Blended guidance was still
pretty chilly for much of the region with 20s and 30s widespread,
but the key was for the Southern Permian Basin where a freeze has
yet to occur over most of that area. Given the trends in guidance
and the overall synoptic pattern, elected to place the southern tier
of the Basin in a Freeze Watch to monitor trends in short term
guidance for a freeze within that 29-32 degree range. Elsewhere,
temperatures will either stay above freezing or will be below
freezing in areas that have already solidified a Freeze/Hard Freeze
criteria. Given the return flow setup for Tuesday, highs will
quickly rebound back into the 70s for many, continuing one crazy
roller coaster trend for temps areawide.

&&

.LONG TERM...
(Tuesday night through Sunday)
Issued at 246 AM CST Mon Dec 6 2021

On Tuesday night zonal flow will extend across the southern tier of
states as a trough sits across CA into the Pacific.  This trough
will weaken and swing east Wednesday reaching the area early
Thursday with another trough moving ashore the West coast later that
day. This next trough will be stronger and quickly move east
reaching the Rockies Friday before moving onto the plains early
Saturday. After that will have break in the upper pattern with
ridging build in from the west.

Tuesday will be warm with temps in the 70s with some 80s south.
Similar above normal conditions can be expected Thursday and Friday.
Saturday will be about 20 degrees colder with highs in the 50s north
of the Pecos and over the west.  Temps begin to recover Sunday.

Looking at multiple days with possibility of high wind for the
Guadalupes Thursday through Saturday... will mention in the HWO.
Friday will have a gusty W wind blowing across the area as a Pacific
front pushes through... then later that night the polar front
arrives with the wind shifting to the N.

Long range models continue to develop a few showers along our
western edge late in the week... will see if it keeps them. The rest
...truncated 34 lines...
```

Figure: D-5 Forecast Discussion Issued by the National Weather Service Midland/Odessa Office on December 6, 2021

D.6 DAILY AVERAGE PARTICULATE MATTER MEASUREMENTS

All available continuous and non-continuous El Paso area daily average particulate measurements from December 6, 2021 are provided in Table D-1: *El Paso County Particulate Matter Measurements on the Exceptional Event Day of December 6, 2021*.

Table D-1: El Paso County Particulate Matter Measurements on the Exceptional Event Day of December 6, 2021

Site	Type	Method	Concentration (µg/m^3)
Ivanhoe (C414)	PM_{10}	FRM	177*
El Paso UTEP (C12)	PM_{10}	C	No data
Riverside/El Paso Mimosa (C9996)	PM_{10}	FRM	153
Socorro Hueco (C49)	PM_{10}	FRM	No data
Socorro Hueco (C49)	PM_{10}	FRQ	No data
Socorro Hueco (C49)	PM_{10}	C	91.4
Van Buren (C693)	PM_{10}	FRM	123
Ojo de Agua (C1021)	PM_{10}	FRM	88
Ojo de Agua (C1021)	PM_{10}	FRQ	No data
El Paso UTEP (C12)	$PM_{2.5}$	FRM	No data
El Paso UTEP (C12)	$PM_{2.5}$	C	No data
El Paso Chamizal (C41)	$PM_{2.5}$	FRM	17.0
El Paso Chamizal (C41)	$PM_{2.5}$	FRQ	No data
El Paso Chamizal (C41)	$PM_{2.5}$	CSN	No data
Socorro Hueco (C49)	$PM_{2.5}$	C	10.3
Ascarate Park SE (C37)	$PM_{2.5}$	C	13.8

Notes:
*Indicates the measurement is proposed as an exceptional event.
Abbreviations:
FRM Federal Reference Method non-continuous monitor
FRQ Federal Reference Method non-continuous quality control (collocated) monitor
C Continuous monitor
CSN Reconstructed $PM_{2.5}$ mass from speciated non-continuous monitor

D.7 CHEMICAL SPECIATION STUDY

Only select $PM_{2.5}$ Chemical Speciation Network (CSN) speciation data were available from the El Paso Chamizal (C41) site for the event day of December 6, 2021. When full data are available, the Interagency Monitoring of Protected Visual Environments (IMPROVE) soil component can be calculated and assist with providing evidence that dust was transported into an area. The IMPROVE soil component is derived using a calculation consisting of speciated $PM_{2.5}$ parameters understood to be the primary constituents in soil that would be representative of transported dust from natural undisturbed land. Available CSN data from December 6, 2021 are presented in Table D-2: *El Paso Chamizal (C41) $PM_{2.5}$ Speciation Summary for December 6, 2021*. As shown in the table, only organic carbon and elemental carbon were recorded. Organic carbon component is generally highest with light winds as it can frequently be attributed to anthropogenic sources such as combustion. On December 6, 2021, the organic carbon and elemental carbon components were greater than their 2019 through 2021 averages. The organic carbon component was also higher than the average for the other two event dates referenced in this demonstration. As such, this metric is not a good determinant of transported dust into an area.

Table D-2: El Paso Chamizal (C41) $PM_{2.5}$ Speciation Summary for the Exceptional Event Day

Species	2019 through 2021*	December 6, 2021	Difference	Percent Change	Percent Difference
FRM	8.777	28.3	19.52	222%	105%
OC	3.251	5.700	2.449	33%	58%
EC	0.722	1.162	0.440	61%	47%

Notes:
All units are in µg/m³.
*Average for 2019 through 2021 including December 6, 2021
Abbreviations:
FRM Federal Reference Method $PM_{2.5}$ concentration
OC IMPROVE organic carbon concentration calculated from speciation data using parameter 88355.
EC Elemental carbon concentration from speciation data.

The speciation data from the Chamizal (C41) monitor in El Paso County show that the IMPROVE organic carbon component is highest with light winds, as would be expected with local contribution during air stagnation. Alternatively, the IMPROVE soil component is highest with high winds. Figure D-5: *El Paso Chamizal (C41) $PM_{2.5}$ IMPROVE Organic Carbon Concentration versus El Paso Chamizal (C41) Daily Peak Hourly Wind Speed for 2019 through 2021* indicates, in general, that the highest local carbon related emission impacts on $PM_{2.5}$ occur with lower wind speeds. Organic carbon is generally highest with light winds as it can frequently be attributed to anthropogenic sources such as combustion.

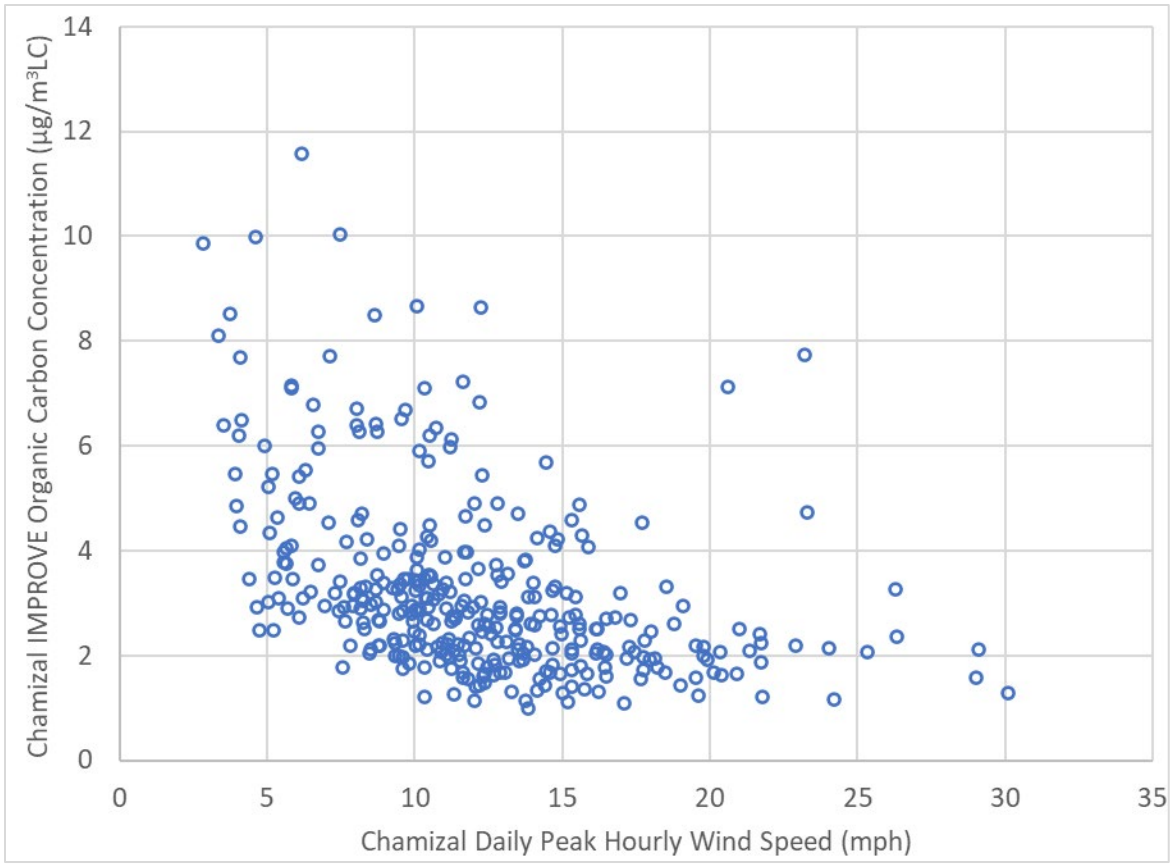


Figure D-5: El Paso Chamizal (C41) $PM_{2.5}$ IMPROVE Organic Carbon Concentration versus El Paso Chamizal (C41) Daily Peak Hourly Wind Speed for 2019 through 2021

Figure D-6: *El Paso Chamizal (C41) $PM_{2.5}$ IMPROVE Soil Concentration versus El Paso Chamizal (C41) Daily Peak Hourly Wind Speed for 2019 through 2021* indicates that the IMPROVE soil component is generally highest with high winds, as is the case for the $PM_{2.5}$ and PM_{10} concentrations previously shown in Figure 2-4: *El Paso County Daily Peak PM_{10} Average for FRM Measurements versus El Paso County Daily Peak Sustained Hourly Wind Speed for 2006 through 2021* and Figure 2-5: *El Paso County Daily Peak $PM_{2.5}$ Average for FRM Measurements versus El Paso County Daily Peak Sustained Hourly Wind Speed for 2006 through 2021*. The IMPROVE soil component does not increase significantly at lower wind speeds, indicating that local dust is not a major contributor to particulate concentrations without high winds.

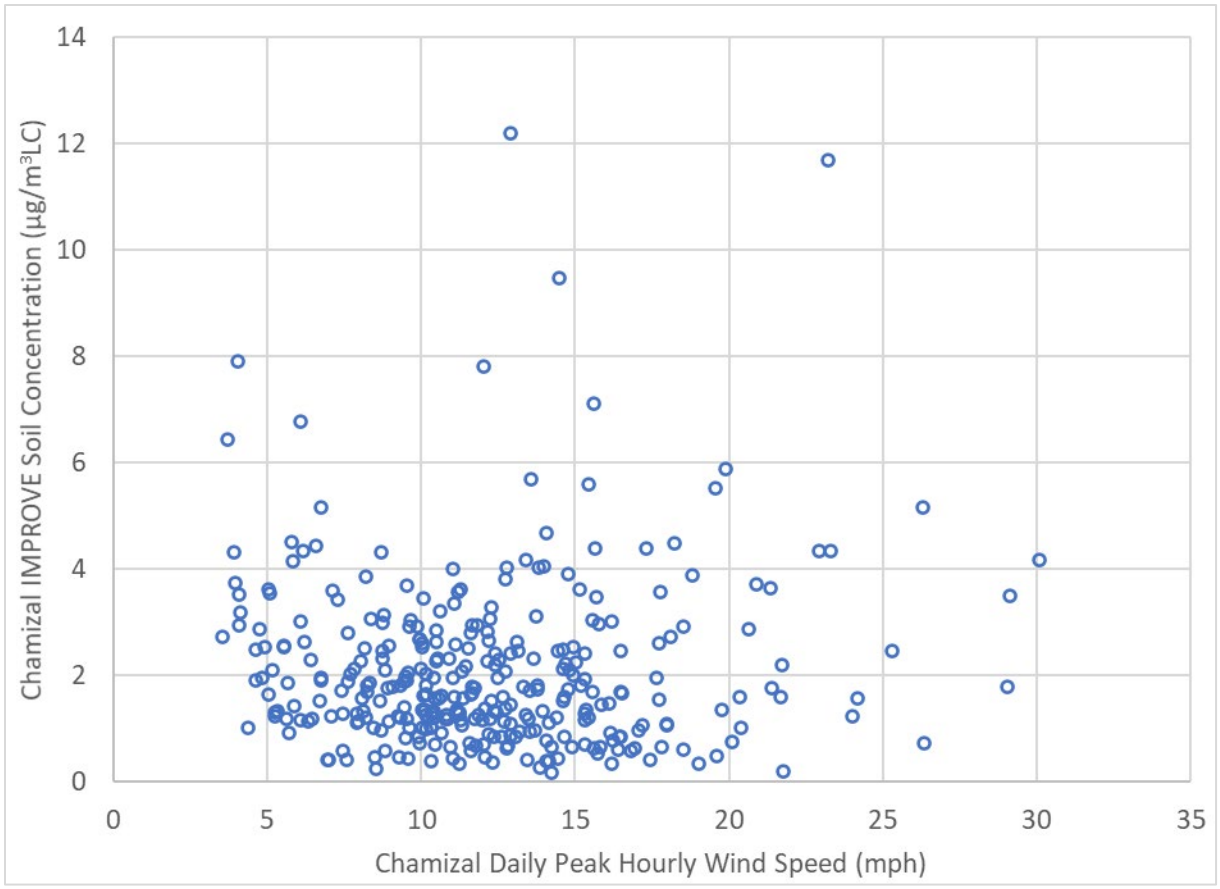


Figure: D-6: El Paso Chamizal (C41) $PM_{2.5}$ IMPROVE Soil Concentration versus El Paso Chamizal (C41) Daily Peak Hourly Wind Speed for 2019 through 2021

D.8 COMPARISON OF EVENT-AFFECTED DAYS TO SIMILAR DAYS WITHOUT ELEVATED PM_{10} CONCENTRATIONS

To illustrate the impact a windblown dust event has on El Paso County versus local anthropogenic dust, the Texas Commission on Environmental Quality (TCEQ) compared the event days to other high wind days that did not have elevated 24-hour PM_{10} concentrations in 2021. Specifically, this comparative analysis focused on identifying days with wind speed and, to a lesser extent, wind direction measurements comparable to the event day but without elevated 24-hour PM_{10} values. PM_{10} data used in this study were collected via a tapered element oscillating microbalance (TEOM) sampler. Due to the once-every-six-days sampling schedule for Federal Reference Method (FRM) PM_{10} results, these data can be unavailable on the days that met the wind criteria; however, in this instance all days found had FRM samples.

Table D-3: *Ivanhoe (C414) Particulate Matter and El Paso Area Wind Measurements on December 6, 2021 and Days with High Winds but Low Particulate Matter Concentrations* provides four representative days in 2021 where wind speed and wind direction are comparable to the event day of December 6, 2021. On each of the identified days, daily average PM_{10} measurements were significantly less than the flagged event day when windblown dust plumes were advecting out of the Chihuahuan Desert area east of El Paso County on December 6, 2021. This analysis provides additional supporting evidence that measured concentrations on the flagged event days were not the result of local anthropogenic sources but were instead caused by transport of widespread dust.

Table: D-3 Ivanhoe (C414) Particulate Matter and El Paso Area Wind Measurements on December 6, 2021 and Days with Similar Winds but Low Particulate Matter Concentrations

Day	PM_{10} FRM	PkWnd	WDR	StDev	Pk1HrPM_{10}C	Time	PM_{10}C
12/6/2021	177	10.9	81.6	17.1	247	10:00	N/A
4/4/2021	18	10.7	102	14.1	111	22:00	25
6/15/2021	30	11.1	98.9	21.3	30.2	10:00	23
8/2/2021	16	10.7	76.0	16.6	38.0	18:00	18
11/18/2021	51	10.6	86.5	21.9	124	13:00	52

Abbreviations:

PM_{10} FRM	non-continuous FRM daily average in µg/m^3 at Ivanhoe (C414)
PkWnd	peak area one-hour average wind speed in mph
WDR	daily wind direction resultant in degrees from north at Socorro Hueco
StDev	wind direction standard deviation at Socorro Hueco
Pk1HrPM_{10}C	peak continuous hourly PM_{10} measurement at Socorro Hueco in µg/m^3
Time	time, in Mountain Standard Time (MST), of peak continuous hourly PM_{10} measurement
PM_{10} C	continuous daily average in µg/m^3 at Socorro Hueco

D.9 SPATIAL AND TEMPORAL VARIABILITY OF PM_{10}

PM_{10} data across El Paso County are presented in Table D-4: *El Paso County PM_{10} Daily Measurements (µg/m³) before and after June 21, 2021*. This information highlights the impact of the windblown dust event on the flagged event day and demonstrates spatial and temporal variability of PM_{10} in El Paso County.

Table D-4: El Paso County PM_{10} Daily Measurements (µg/m³) before and after June 21, 2021

Date	Socorro Hueco (C49) FRM	Socorro Hueco (C49) C	Ivanhoe (C414) FRM	El Paso Chamizal (C41) C	Riverside/El Paso Mimosa (C9996) FRM	Van Buren (C693) FRM	Ojo de Agua (C1021) FRM
11/30/2021	53	38	35	34	56	44	18
12/1/2021	--	46	--	36	--	--	--
12/2/2021	--	61	--	70	--	--	--
12/3/2021	--	56	--	65	--	--	--
12/4/2021	--	37	--	68	--	--	--
12/5/2021	--	50	--	28	--	--	--
12/6/2021	NA	91	177*	128	153	123	88
12/7/2021	--	66	--	91	--	--	--
12/8/2021	--	60	--	40	--	--	--
12/9/2021	77	63	--	44	--	--	--
12/10/2021	--	45	--	9	--	--	--
12/11/2021	--	24	--	13	--	--	--
12/12/2021	NA	34	23	43	50	18	23

Notes:
* indicates proposed exceptional event day measurement.
-- sample collection was not scheduled for listed day.
Abbreviations:
FRM Federal Reference Method monitor PM_{10} concentration (µg/m³)
C continuous monitor PM_{10} concentration (µg/m³)
NA valid data were not recorded on these scheduled sample days

D.10 AIR QUALITY FORECAST ON THE EVENT DAY

The TCEQ provides the United States Environmental Protection Agency (EPA) Air Quality Index (AQI) forecasts for the current day and the next three to four days for 17 areas in Texas, including the El Paso area, for ozone, particulate matter of 2.5 microns or less in aerodynamic diameter ($PM_{2.5}$), and PM_{10}. These forecasts are available to the public on the Today's Texas Air Quality Forecast webpage (http://www.tceq.texas.gov/airquality/monops/forecast_today.html) (TCEQ2, 2021) and on the EPA AIRNOW website (http://airnow.gov/) (EPA3, 2021). These notifications are forecasts, and although the forecast did predict blowing dust, the PM_{10} levels were not predicted to be as high as what occurred. The Today's Texas Air Quality webpage forecast discussion for the event day is presented below:

> **Monday 12/6/2021**
>
> Elevated afternoon and evening winds behind a cold front pushing through Texas may be strong enough to generate and transport light amounts of patchy blowing dust through portions of the South Plains and Permian Basin, although the intensity and duration of the dust is not expected to be enough to raise the daily PM_{10} AQI beyond the "Good" range throughout most of the impacted regions, which includes the Lubbock and Midland-Odessa areas.
>
> Elsewhere in the state, the cold front will continue to move through the majority of Texas throughout the day, bringing with it increased cloud cover, precipitation, and moderate to strong winds. All of these will help with dispersion and in addition to lower incoming background levels, should keep the air quality in the "Good" range in most spots statewide.

D.11 MAP OF WIND SPEED AND DIRECTION

The EPA's High Wind Dust Event Guidance (EPA, 2019) suggests a minimum sustained wind speed of 25 mph for western states including Texas, or development of an alternate area-specific high wind threshold at which a dust event could occur. The event meets the strictest definition of this threshold with peak area hourly wind speeds greater than 25 mph. High, area winds in surrounding areas indicate that PM_{10} concentrations recorded were influenced by regional transport from surrounding areas.

The TCEQ used NOAA Air Resources Laboratory (ARL) meteorological model results to display wind speeds and direction in the source areas east of El Paso County for December 6, 2021 where high winds over natural, undisturbed land transported particulate matter into El Paso County. Specifically, the TCEQ used the 12-kilometer (km) North American Model (NAM) hourly wind speeds and wind vectors at a 10-meter height. Figure D-7: *NOAA ARL Model Wind Field in El Paso County at 10:00 Mountain Standard Time (MST) on December 6, 2021* illustrates the predicted wind speeds in dust source areas east of El Paso County for the event day of December 6, 2021. This model supports the occurrence of windblown dust from source areas east of El Paso County at wind speeds depicted in this figure that range to 24 nautical mph or just above 27 mph.

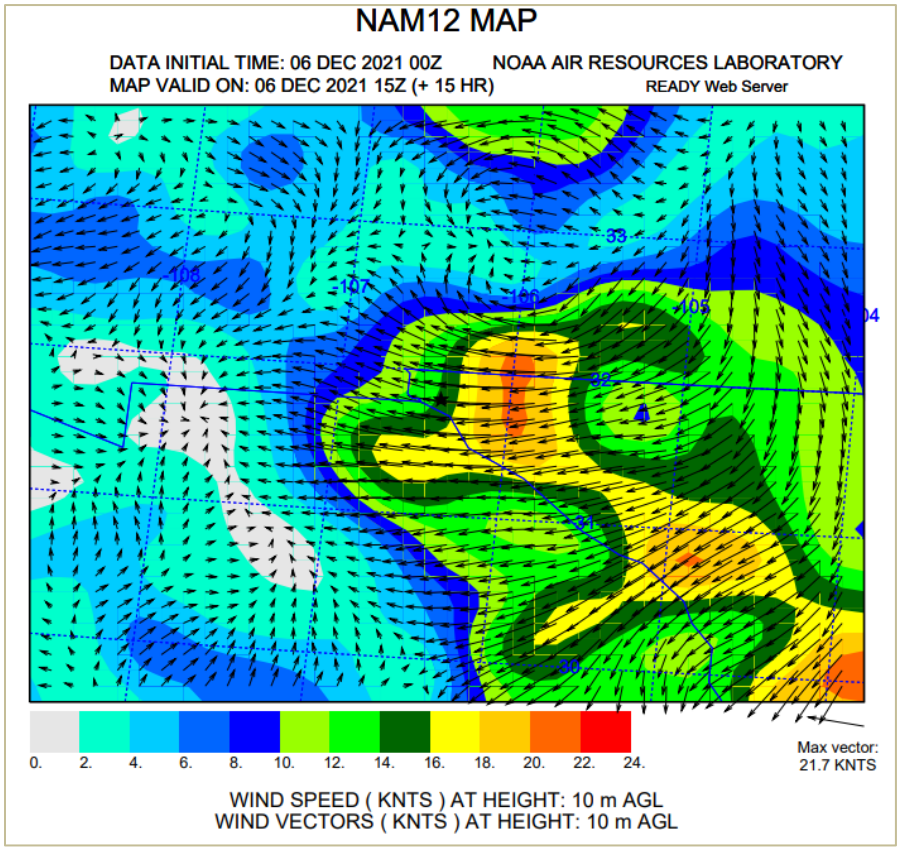


Figure D-7: NOAA ARL Model Wind Field in El Paso County at 10:00 Mountain Standard Time (MST) on December 6, 2021

A study conducted by Novlan et al. (2007) of over 1,000 significant dust events in El Paso from 1932 through 2005 observed that transport of blowing dust into El Paso County can occur at wind speeds of approximately 10 to 20 mph. Rivera Rivera (2006) examined nine dust events from 2002 and 2003 with the NOAA HYSPLIT model and noted that source area wind speeds for periods associated with dust events were at least 10 meters per second (m/s) (22 mph) compared to 4 m/s (9 mph) during non-dust events. These studies indicate windblown dust can even impact El Paso County at wind speeds below 25 mph.

D.12 WIND AND PARTICULATE MATTER MEASUREMENTS

A list of the PM_{10} concentration and wind measurements on the event day of June 21, 2021 at monitors that exceeded the standard is provided in Table D-5: *El Paso Area Wind Measurements and PM_{10} Concentrations*. The event day had peak sustained winds measured in excess of the suggested 25 mph threshold for blowing dust cited in the EPA's High Wind Dust Event Guidance (EPA, 2019).

Table D-5: El Paso Area Wind Measurements and PM_{10} Concentrations

Date	Ivanhoe (C414) FRM PM_{10} ($\mu g/m^3$)	Peak KELP 5-Second Wind Speed (mph)	Peak Area[1] Hourly Wind Speed (mph)	Wind Direction at Peak, Area[1] Hourly Wind Speed (degrees)	Peak Ivanhoe (C414) Hourly Wind Speed (mph)
December 6, 2021	177	25.1	44	70	10.9

Note: Only the flagged particulate matter concentration at the Ivanhoe (C414) monitor on December 6, 2021 is listed in this table. See Table D-1: *El Paso County Particulate Matter Measurements on the Exceptional Event Day of December 6, 2021* for all available particulate matter measurements on this day. Wind measurements are from the NWS El Paso International Airport weather station (KELP) and from the Ivanhoe (C414) site. The peak wind speeds depicted include sustained five-second averages, and hourly averages. The peak wind direction is in degrees clockwise from true north and indicates the direction from which the wind was blowing at the time of peak sustained five-minute and hourly wind speeds.

1. This monitor is located approximately 100 miles east of the Ivanhoe (C414) monitor. Additionally, the Culberson County Airport (KVHN) monitor, located approximately 108 miles east-southeast of the Ivanhoe (C414) monitor, recorded an hourly sustained wind speed of 45 mph.

APPENDIX E

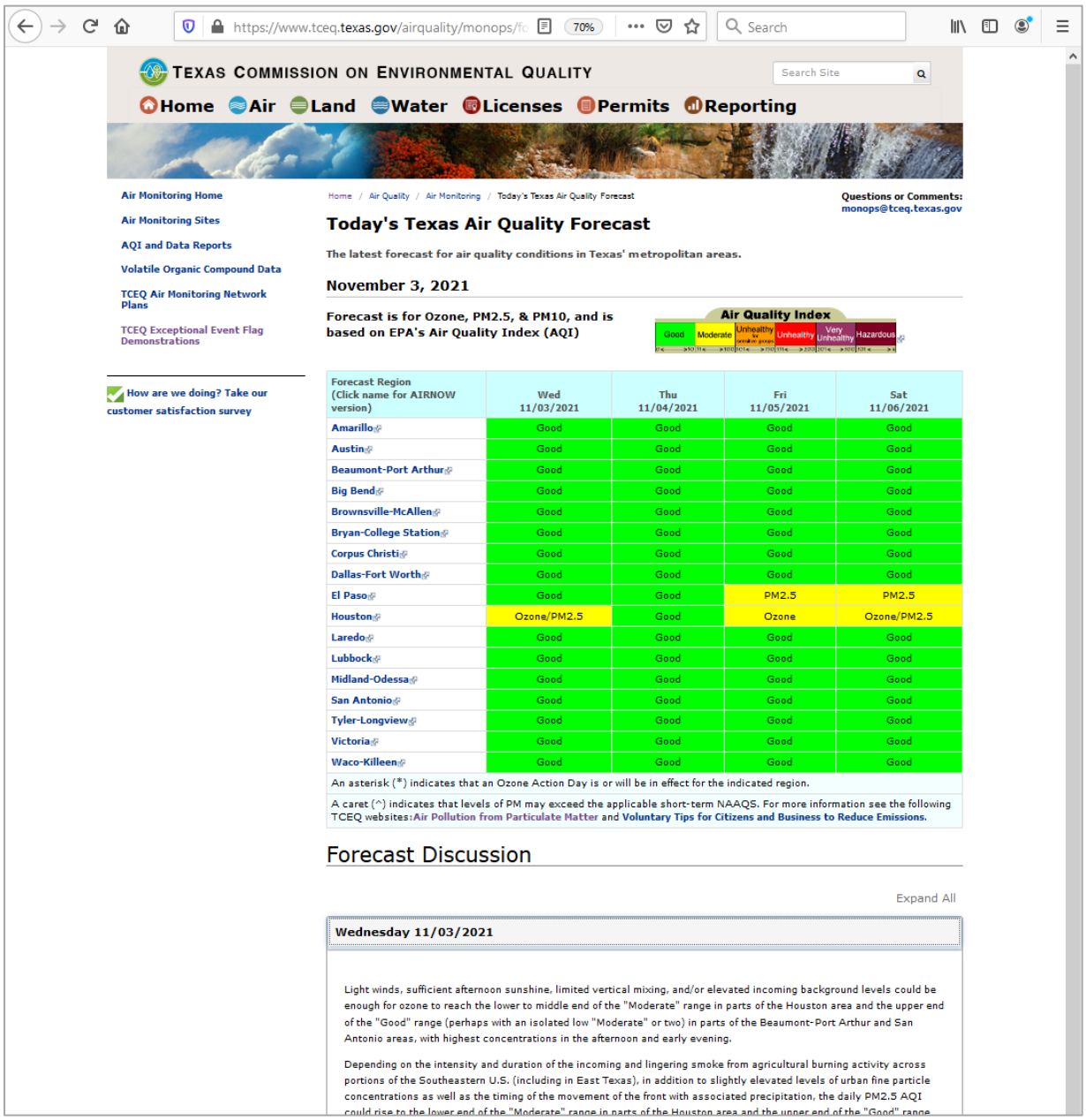
WEBPAGE EXAMPLES

EXCEPTIONAL EVENT DEMONSTRATION FOR PARTICULATE MATTER OF 10 MICRONS OR LESS IN AERODYNAMIC DIAMETER (PM_{10}) FOR JANUARY 16, 2021; JUNE 21, 2021; AND DECEMBER 6, 2021

1987 PM_{10} STANDARD

E.1 WEBPAGE EXAMPLES

The Figures in this appendix show examples of webpages cited by links in Chapter 6: *Mitigation of Exceptional Events.*



TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

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Questions or Comments: monops@tceq.texas.gov

Today's Texas Air Quality Forecast

The latest forecast for air quality conditions in Texas' metropolitan areas.

November 3, 2021

Forecast is for Ozone, PM2.5, & PM10, and is based on EPA's Air Quality Index (AQI)

Air Quality Index: Good | Moderate | Unhealthy for sensitive groups | Unhealthy | Very Unhealthy | Hazardous

Forecast Region (Click name for AIRNOW version)	Wed 11/03/2021	Thu 11/04/2021	Fri 11/05/2021	Sat 11/06/2021
Amarillo	Good	Good	Good	Good
Austin	Good	Good	Good	Good
Beaumont-Port Arthur	Good	Good	Good	Good
Big Bend	Good	Good	Good	Good
Brownsville-McAllen	Good	Good	Good	Good
Bryan-College Station	Good	Good	Good	Good
Corpus Christi	Good	Good	Good	Good
Dallas-Fort Worth	Good	Good	Good	Good
El Paso	Good	Good	PM2.5	PM2.5
Houston	Ozone/PM2.5	Good	Ozone	Ozone/PM2.5
Laredo	Good	Good	Good	Good
Lubbock	Good	Good	Good	Good
Midland-Odessa	Good	Good	Good	Good
San Antonio	Good	Good	Good	Good
Tyler-Longview	Good	Good	Good	Good
Victoria	Good	Good	Good	Good
Waco-Killeen	Good	Good	Good	Good

An asterisk (*) indicates that an Ozone Action Day is or will be in effect for the indicated region.

A caret (^) indicates that levels of PM may exceed the applicable short-term NAAQS. For more information see the following TCEQ websites: Air Pollution from Particulate Matter and Voluntary Tips for Citizens and Business to Reduce Emissions.

Forecast Discussion

Expand All

Wednesday 11/03/2021

Light winds, sufficient afternoon sunshine, limited vertical mixing, and/or elevated incoming background levels could be enough for ozone to reach the lower to middle end of the "Moderate" range in parts of the Houston area and the upper end of the "Good" range (perhaps with an isolated low "Moderate" or two) in parts of the Beaumont-Port Arthur and San Antonio areas, with highest concentrations in the afternoon and early evening.

Depending on the intensity and duration of the incoming and lingering smoke from agricultural burning activity across portions of the Southeastern U.S. (including in East Texas), in addition to slightly elevated levels of urban fine particle concentrations as well as the timing of the movement of the front with associated precipitation, the daily PM2.5 AQI could rise to the lower end of the "Moderate" range in parts of the Houston area and the upper end of the "Good" range

Figure E-1: Sample of a Portion of the TCEQ Today's Texas Air Quality Forecast Webpage

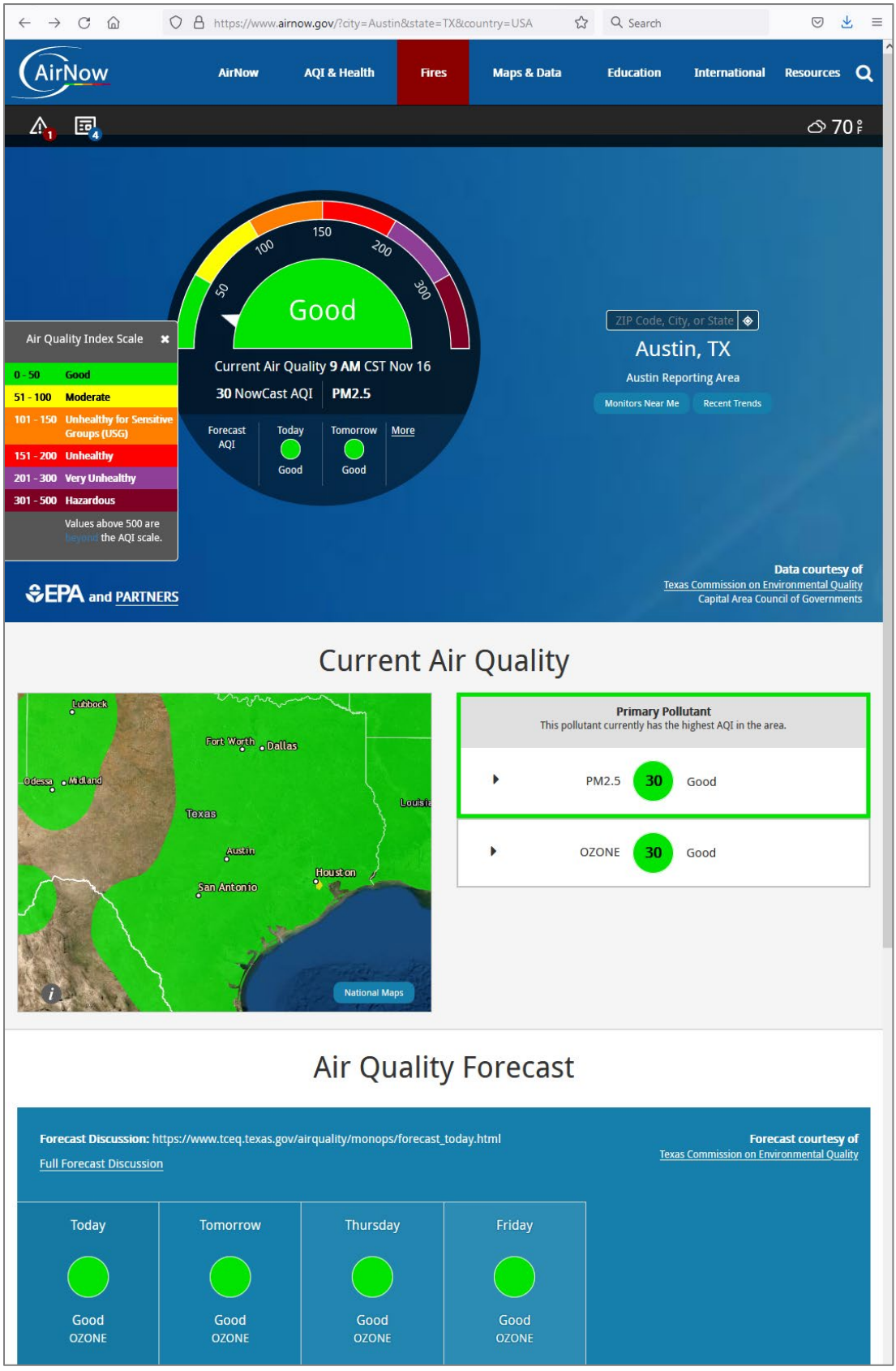

Figure E-2: Sample of the EPA AIRNOW Webpage

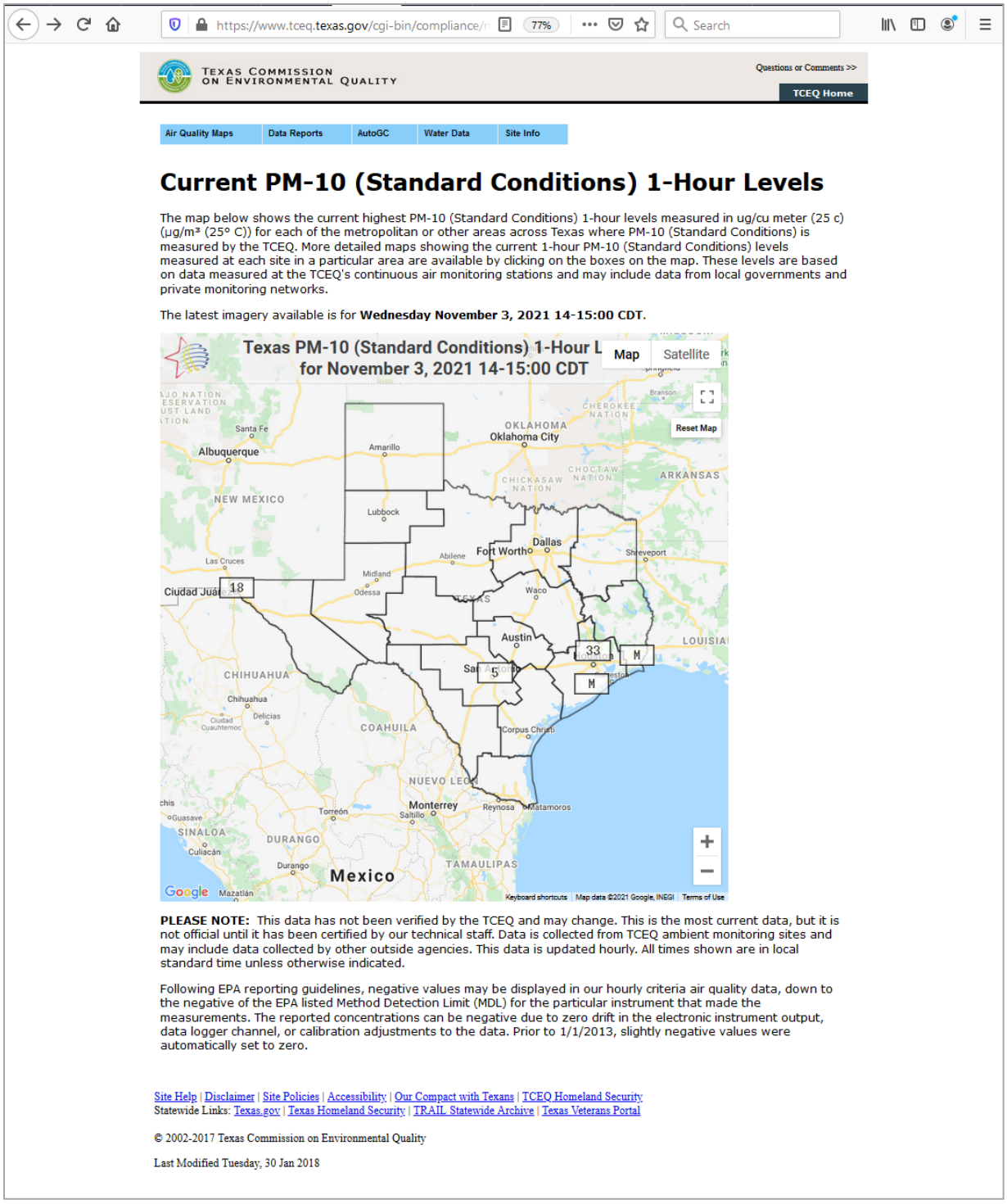

Figure E-3: Sample of the TCEQ Map of Current PM_{10} Levels

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Calibrations | Air Quality Maps | Data Reports | AutoGC | Water Data | Comms | Log Files | Configuration | Site Info

Air Quality Index Report

The U. S. Environmental Protection Agency (EPA) has provided a scale called the Air Quality Index (AQI) for rating air quality. This scale is based on the National Ambient Air Quality Standards (NAAQS) and is described in the Code of Federal Regulations, Part 58, Appendix G. This report is based on the AQI standards. More information on the AQI can be found on the EPA's AirNow web site.

- Interpreting the AQI

Reporting for June 21, 2021 — June | 21 | 2021 | Select a Different Date

Emulate WWW

Metropolitan Area or Non-Metropolitan County	Air Quality Rating	Critical Pollutant	Air Quality Index															
			Ozone				Carbon Monoxide		Sulfur Dioxide		Nitrogen Dioxide		PM-10 (Std Cond)		PM-2.5 (Lcl Acpt)		PM-2.5 (Lcl Cond)	
			1-Hour		8-Hour		8-Hour		1-Hour		1-Hour		24-Hour		24-Hour		24-Hour	
			AQI	ppb	AQI	ppb	AQI	ppm	AQI	ppb	AQI	ppb	AQI	µg/m³ (25° C)	AQI	µg/m³ LC	AQI	µg/m³ LC
Amarillo -- Region 1																		
Amarillo	Good	Sulfur Dioxide							35	24.7							25	6.0
Lubbock -- Region 2																		
Lubbock	Good	PM-2.5															30	7.2
Dallas-Fort Worth -- Region 4																		
Dallas	Good	PM-2.5	*	54	44	47	1	0.1	1	0.9	14	14.8			50	11.9	35	8.5
Fort Worth-Arlington	Good	PM-2.5	*	45	37	40	5	0.4			11	11.6					45	10.7
Tyler-Longview-Marshall -- Region 5																		
Longview-Marshall	Good	PM-2.5	*	33	27	29			1	0.5	4	4.3					41	9.8
Texarkana	Good	PM-2.5															39	9.4
Tyler	Good	Ozone	*	31	28	28			23	16.3	0	0.5						
El Paso-Juarez -- Region 6																		
Brewster County	Good	PM-2.5															48	11.0
El Paso [1]	Unhealthy for sensitive groups	PM-2.5	*	64	61	55	2	0.2	0	0.1	17	17.8	95	149.8	135	49.4	64	27.5
Odessa-Midland -- Region 7																		
Odessa-Midland	Good	PM-2.5							5	5.5							32	7.8

Figure E-4: Sample of a Portion of the TCEQ Air Quality Index Report

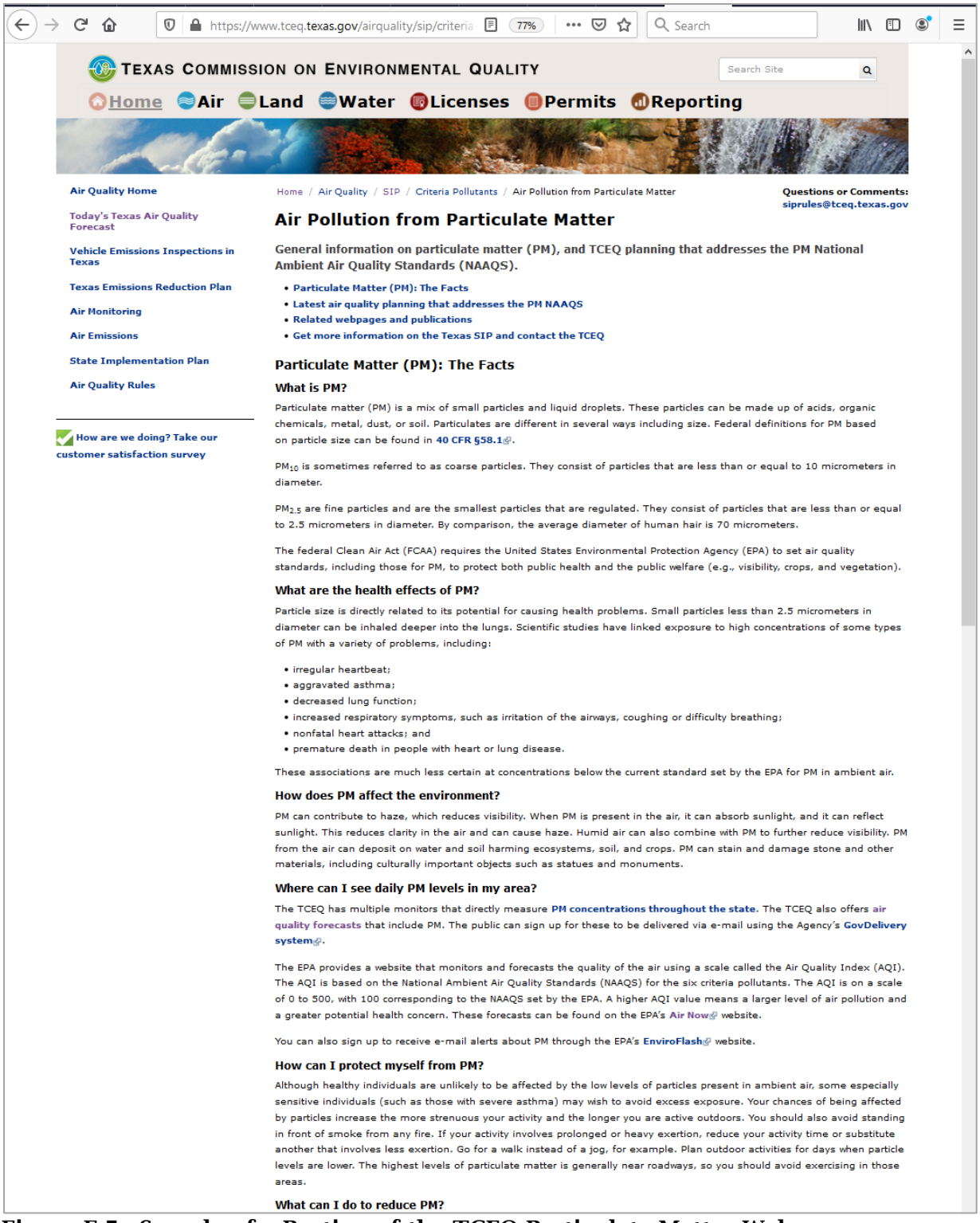

Figure E-5: Sample of a Portion of the TCEQ Particulate Matter Webpage

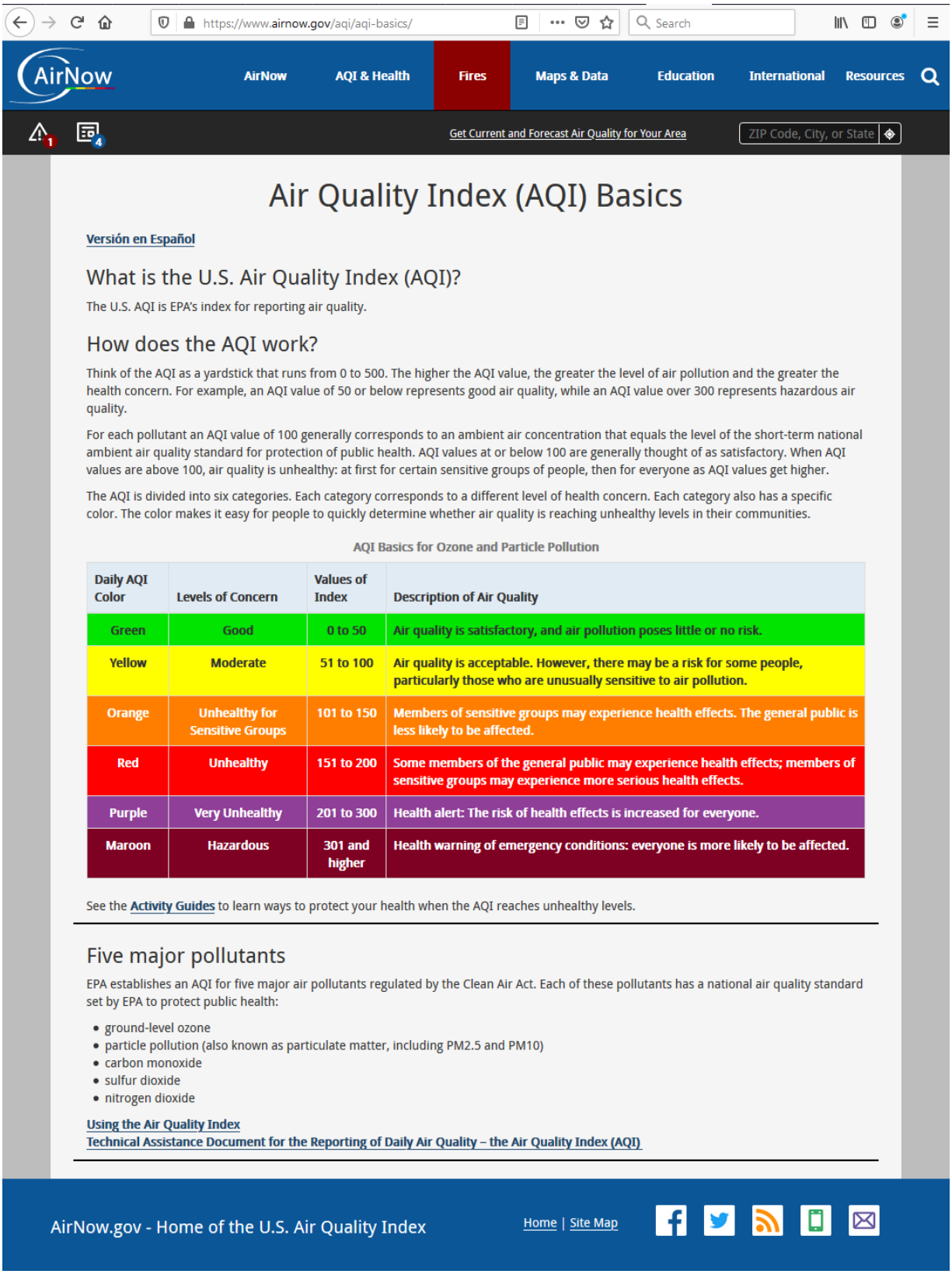

Figure E-6: Sample of a Portion of the EPA Air Quality Index Guide