2016 Exceptional Events Demonstration

High Wind Blowing Dust Events in Doña Ana and Luna Counties

Air Quality Bureau **10/22/19** **Final Document**

The New Mexico Environment Department's Air Quality Bureau prepared this document. It is available for review at the website located at www.env.nm.gov/air-quality/ or in person at the address listed below. The Air Quality Bureau will accept public comment on this document from August 14, 2019 to September 13, 2019. For further information or to request a copy of this document, please contact the bureau by phone or in writing at:

NMED AQB
Planning Section
525 Camino de los Marquez, Suite 1 Santa Fe, NM 87505
Phone: (505) 476-4300

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1. Introduction

Purpose

The U.S. Environmental Protection Agency (EPA) sets National Ambient Air Quality Standards (NAAQS) for Particulate Matter (PM) with an aerodynamic diameter of 10 microns or less (PM_{10}). The level of the PM_{10} NAAQS is set at 150 µg/m^3 for a 24-hour average concentration.

From January 1-December 31, 2016, the New Mexico Environment Department (NMED) Air Quality Bureau (AQB) recorded 28 exceedances of the PM_{10} NAAQS. The exceedances occurred on 11 days and were the result of exceptional events, specifically high wind dust events.

The AQB submits this exceptional event demonstration for the exceedances of the PM_{10} NAAQS that occurred in 2016 in Doña Ana and Luna Counties of southern New Mexico (NM). The evidence provided in this demonstration substantiates the AQB's request to exclude exceedance data from a compliance determination for these counties for the PM_{10} NAAQS. Table 1 lists the dates, 24-hour average concentrations, monitoring sites and other identifying information for NM's exclusion request.

Date	Anthony (35-013-0016)	Chaparral (35-013-0020)	Desert View (35-013-0021)	Holman (35-013-0019)	West Mesa (35-013-0024)	Deming (35-029-0003)
March 12	129	166 (POC #1)	141	149	98	154
March 22	164	107 (POC #1)	199	89	41	165
March 23	146	162 (POC #1)	189	67	61	142
March 29	219	128 (POC #1)	212	143	77	98
April 15	114	80 (POC #1) 101 (POC #2)	237	29	23	60
April 25	247	163 (POC #1) 225 (POC #2)	221	45	30	61
May 6	252	230 (POC #1) 269 (POC #2)	184	84	64	115
July 15	289	214 (POC #2)	132	113	55	278
July 24	35	19 (POC #2)	195	18	16	21
December 16	112	172 (POC #2)	86	No Data	No Data	47
December 17	268	689 (POC #2)	363	209	246	266

Table 1-1. Dates, Monitoring Sites (including AQS ID), and 24-Hour Average PM_{10} Concentrations (µg/m^3) for 2016 high wind blowing dust events requested for exclusion under the EER. The Parameter Occurrence Code (POC) is used to differentiate similar monitoring equipment at a site.

2. Background

Climatology of High Wind Blowing Dust in Southern New Mexico

Large- and small-scale weather systems provide the ideal meteorological conditions for high wind blowing dust events in Doña Ana and Luna Counties. These events can occur at any time of year, but the highest incidence of exceedances occurs during the Spring, New Mexico's traditional windy season. The most common weather system responsible for these events occurs when Pacific storms and associated cold fronts traverse the state from west to east. On the windiest days, the storm's center of low pressure is located along the Colorado-New Mexico border and upper level winds align in the same direction as surface winds. This alignment increases surface wind speeds in southeastern Arizona, southwestern NM and northwestern Chihuahua, MX. Diurnal heating allows higher level winds to mix down to the lower levels of the atmosphere, intensifying wind speeds and creating the turbulence required for dust entrainment and transport.

The second large-scale weather systems responsible for blowing dust in NM are back door cold fronts whose low-pressure centers and cold air approach the state from the north or the east. The last system responsible for high wind blowing dust events in NM occurs during the monsoon season when small-scale conditions create thunderstorms. These storms are the result of convective heating during the summer months that create updrafts of moist air and allow cloud formation. Rain from these clouds causes wet and dry microbursts releasing massive amounts of energy in the form of outflow winds. These events are often hard to forecast with accuracy for a given area and can cause massive damage and threats to health and safety. These events are referred to as Haboobs and often receive major news coverage due to their sudden formation and dramatic nature.

High wind conditions alone do not automatically create blowing dust. Winds must also impart enough energy on dust sources to begin the erosion process with the movement of larger sand particles (PM_{90-200}). The movement of these particles (creep) creates impacts with medium sized particles (PM_{50-90}) that begin to bounce along the surface (saltation). These particles in turn collide with PM_{50} and smaller particles creating entrained dust. Particles in the PM_{20-50} size range may quickly drop out of the atmosphere whereas smaller particles (PM_{10}) may stay suspended in the atmosphere for days. Other factors affecting the erodibility of soils include surface roughness, soil moisture content, vegetative cover, nonerodable elements (e.g., clods), frequency of disturbance and crust formation.

Exceptional Events Rule

The EPA has recognized the need for policies and rules regarding data affected by exceptional events for which the normal planning and regulatory processes are not appropriate, since the implementation of the Clean Air Act (CAA) in 1970. In 1996 EPA formalized their response to naturally occurring events by implementing the Natural Events Policy (NEP). Under this policy, Natural Events Action Plans (NEAPs) were developed to protect public health and document data handling and exclusion requests. In response to changes in the federal CAA, EPA developed the Exceptional Events Rule (EER) in 2007 to govern exclusion requests of air quality data when determining compliance with a given NAAQS (40 CFR 50.14), superseding the requirements of NEAPs. Under the EER, the EPA may exclude data from compliance determinations if a state meets the technical and administrative requirements of the rule and demonstrates that an exceptional event caused the exceedance. EPA last revised this rule in 2016.

Technical and Administrative Criteria

The EER provides technical and administrative criteria that air quality management agencies (i.e., AQB) must follow in order for EPA to concur with a claimed event and exclude the requested data. The first requirement is to engage EPA in the Initial Notification of Potential Exceptional Event process (40 CFR 50.14(c)(2)) by flagging data and creating an initial event description in EPA's AQS database. This begins the process of regular communication and consultation between the AQB and EPA regarding the development of a demonstration to exclude data affected by high wind exceptional events. The AQB submitted a formal letter indicating our intention of submitting a demonstration to EPA on July 20, 2018. A copy of this letter may be found in Appendix A of this document.

The AQB developed this demonstration to include the following elements of the 2016 EER (40 CFR 50.14(c)(3)(iv)) to exclude high wind exceptional events:

1. A narrative conceptual model that describes the event that caused the exceedance or violation and a discussion of how emissions from the event 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 (CCR) 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 (nRCP); and
5. A demonstration that the event was caused by human activity that is unlikely to recur at a particular location or was a natural event. High wind dust events are considered natural events when windblown dust originates from entirely natural sources or all anthropogenic sources are reasonably controlled (40 CFR 50.14(b)(5)(ii)).

In addition, under 40 CFR 50.14(c)(3)(v), the air agency must follow the public comment process and provide documentation that this requirement was fulfilled. Appendix B contains copies of public notices and listserv emails announcing the public comment period, public comments received and AQB responses to those comments. Public notification requirements under 40 CFR 50.14(c)(1) and 40 CFR 50.930(a) were also met through press releases, informational flyers and brochures, and the AQB's Dust and Monitoring websites.

High Wind Threshold and Tiered Demonstrations

The EPA uses the nRCP criteria of the EER to determine if an exceedance, due to a high wind dust event, was caused in whole or in part by anthropogenic dust sources without reasonable controls in place. Exceedances caused by uncontrolled anthropogenic dust sources may not be eligible to be treated as exceptional events under the EER (see technical requirement 5 above). Evidence provided in this demonstration for nRCP include:

1. Sustained wind speed;
2. Contributing sources of windblown dust;
3. Approved reasonable controls in the State Implementation Plan (SIP), if required; and
4. Implementation and enforcement of reasonable controls;

To address the various requirements and the degree of event-specific evidence needed to demonstrate nRCP, the AQB uses a three-tiered approach in this demonstration. Tier 1 demonstrations will be used for large-scale and high-energy high wind dust events (40 CFR 50.14(b)(5)(vi)) provided that:

1. A Dust Storm Warning was issued by The National Weather Service (NWS) due to the event;
2. Sustained wind speeds were greater than or equal to 17.8 m/s (40 mph); and
3. Visibility was reduced to 0.5 miles or less.

Tier 2 demonstrations were developed for events with sustained wind speeds at or above the high wind threshold of 11.2 m/s (25 mph) for western states found at 40 CFR 50.14(b)(5)(iii). This threshold represents the minimum wind speed capable of overwhelming reasonable controls. For exceedances that do not meet the high wind threshold, Tier 3 demonstrations were developed where the largest amount of evidence is provided in the controls analysis for the nRCP criteria. Table 2-1 below provides examples of data and information provided for each Tier described above.

Tier Level	Control Analysis Elements
Large Scale and High Energy (Tier 1)	▪ NWS Dust Storm Warning; ▪ Sustained wind speeds of 17.8 m/s; and ▪ Reduced visibility
Basic Controls Analysis (Tier 2)	▪ Anthropogenic Sources and existing controls; ▪ Natural sources and existing controls, if any ▪ Effective implementation and enforcement of reasonable control measures; ▪ Reasonableness of controls; and ▪ How emissions occurred despite controls;
Comprehensive Controls Analysis (Tier 3)	▪ All elements of a Basic Control Analysis; plus ▪ Trajectories of source area; ▪ Source-specific emissions inventories; and ▪ Transport modeling

Table 2-1. Three-tiered approach to supply evidence for nRCP analysis in Exceptional Events Demonstrations.

Designation Status and SIP requirements

The Anthony Area in Doña Ana County was designated nonattainment for the 1987 PM_{10} NAAQS in 1991 (Figure 2-1). Monitoring for PM_{10} in Doña Ana County began at the Anthony site in 1989 with exceedances of the standard recorded every year since. The CAA Amendments of 1990 (CAAA) directed EPA to designate those areas that do not meet a NAAQS as nonattainment by operation of law, regardless of the cause of nonattainment. Prior to the CAAA and nonattainment designation, EPA treated Doña Ana County as a Rural Fugitive Dust Area. Under EPA policy these areas were not required to implement control measures due to the lack of anthropogenic sources in the area. The AQB developed a SIP for the Anthony nonattainment area (NAA) in 1993 (Appendix C), requesting and receiving a waiver for implementing control measures. The status of the Anthony NAA has not changed since the development of this SIP.

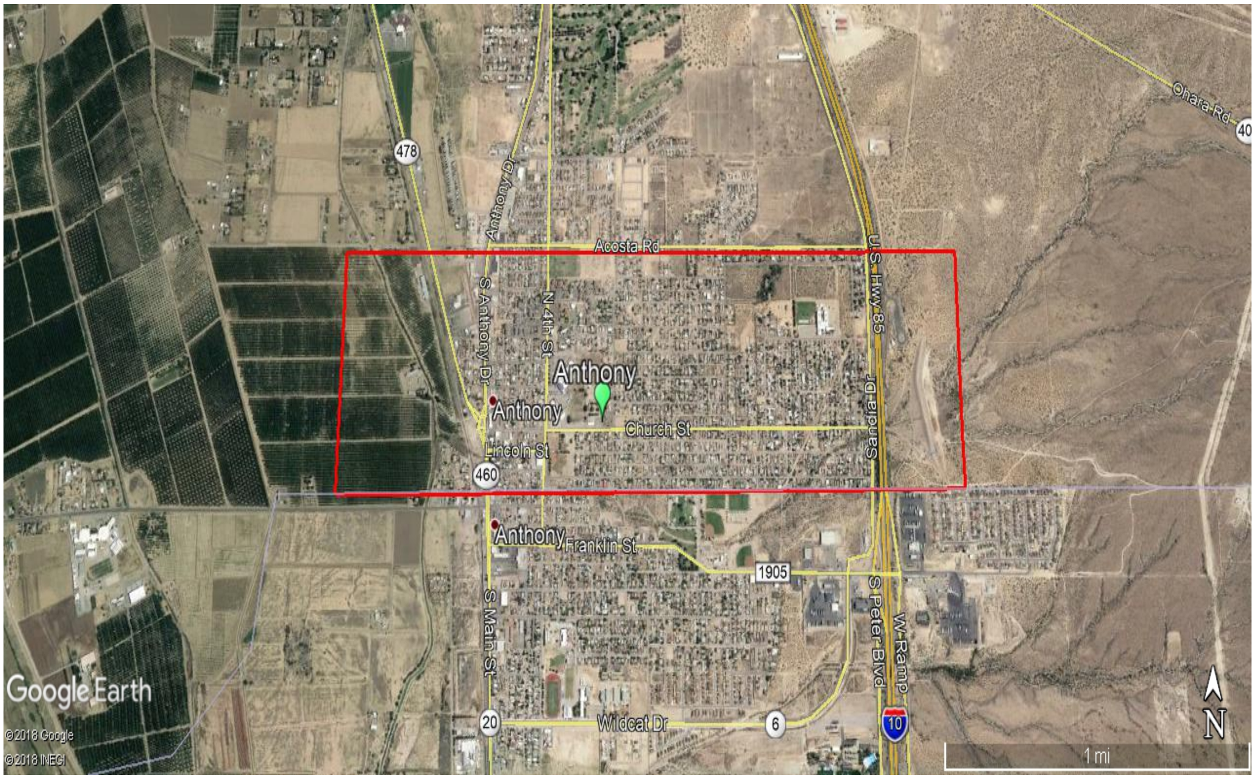

Figure 2-1. Anthony PM_{10} nonattainment area.

Natural Events Action Plans and Reasonable Control Measures

As monitoring expanded in southern New Mexico, exceedances and violations of the PM_{10} NAAQS continued to be recorded throughout Doña Ana and Luna Counties. Under the 1996 NEP, EPA required the AQB to develop and implement NEAPs in lieu of nonattainment designations for the remainder of Doña Ana County (i.e., outside of the Anthony NAA) and all of Luna County. NEAPs were developed to include five guiding principles with the protection of public health as the highest priority. Another guiding principle or element of NEAPs required reasonably available control measures (RACM) for dust sources. The AQB worked closely with local governments to adopt and implement ordinances containing RACM or better. NMED also entered into memorandums of understanding (MOUs) with large land managers, state and federal departments and agencies, the military and public institutions to ensure that dust control measures and best management practices would be used for soil disturbance and dust generating activities. Copies of the ordinances for Doña Ana County, the City of Las Cruces, Luna County and the City of Deming may be found in Appendix D. The City of Las Cruces has a full time Environmental Compliance Officer focusing efforts on controlling sources of fugitive dust during periods of high winds exceeding 11.2 m/s. The City of Anthony provided NMED a letter dated September 18, 2019 indicating the streets that have been paved since the incorporation of the City in 2010 (Appendix C).

Monitoring Network and Data Collection

The AQB operates a State and Local Air Monitoring Stations network to measure the concentration of criteria pollutants and meteorological parameters. The AQB maintains five PM_{10} monitoring sites in Doña Ana County and one monitoring site in Luna County to track windblown dust in southern New Mexico. All monitoring sites in Doña Ana and Luna Counties are equipped with continuous Federal

Equivalent Method instruments, while the Anthony site (Doña Ana County) is also equipped with a Federal Reference Method instrument. In 2016, the Anthony site did not have a standard 10-meter tower for measuring meteorological parameters and data from the La Union site is used as a proxy in this demonstration. Meteorological parameters from the Santa Teresa monitoring site are also used as it informs wind speeds at nearby, upwind source areas of PM_{10}, especially those monitors located in the southern half of Doña Ana County. Figure 2-2 shows the location of monitoring sites in the border area used in this demonstration.

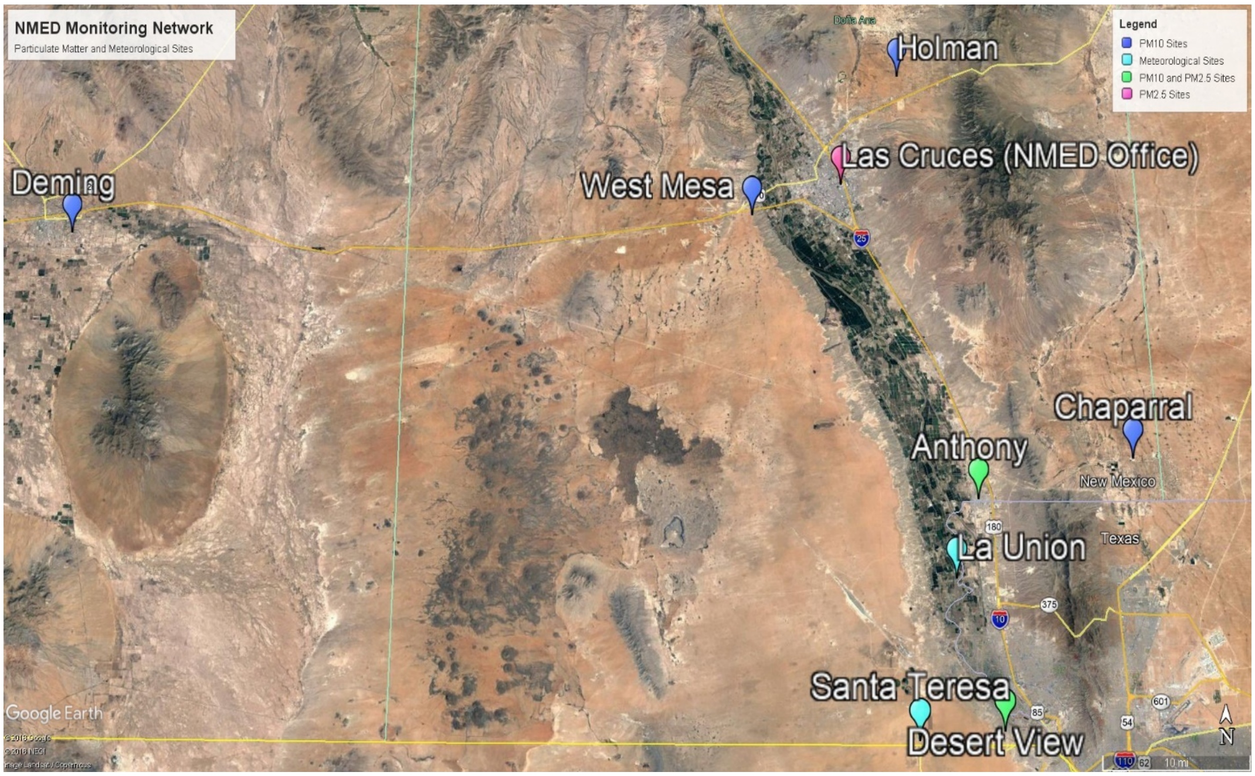

Figure 2-2. NMED monitoring network sites in Doña Ana and Luna Counties.

3. HIGH WIND EXCEPTIONAL EVENT: March 12, 2016

Conceptual Model

A Pacific cold front caused high winds and blowing dust in Doña Ana County resulting in an exceedance of the PM_{10} NAAQS at the Chaparral monitoring site on this date. In accordance with the EER, the AQB submitted this data to EPA's AQS database and flagged it (coded as RJ) as a high wind dust event (Table 3-1).

AQS Flag	AQS ID	Site Name	24-Hour Average Concentration	Max 1-Hour Wind Speed	Max Gust
RJ	35-013-0020	6ZK Chaparral	166 µg/m³ (POC #1)	12.4 m/s	20.7 m/s

Table 3-1. 2016 PM_{10} Data flagged by NMED for exclusion pursuant to the EER.

As the storm system moved through the state, a pressure gradient formed over southeastern Arizona, southwestern New Mexico and northern Mexico (Figure 3-1). At the 0900 hour, an area of low pressure moved over the state of Colorado. Aloft, the low-pressure center of the storm system hovered in north-central New Mexico. As the day progressed, upper level winds aligned with the surface wind direction (Figure 3-2). Diurnal heating of the surface allowed winds aloft to mix down, increasing the surface wind velocities and provided the turbulence required for vertical mixing and entrainment of dust.

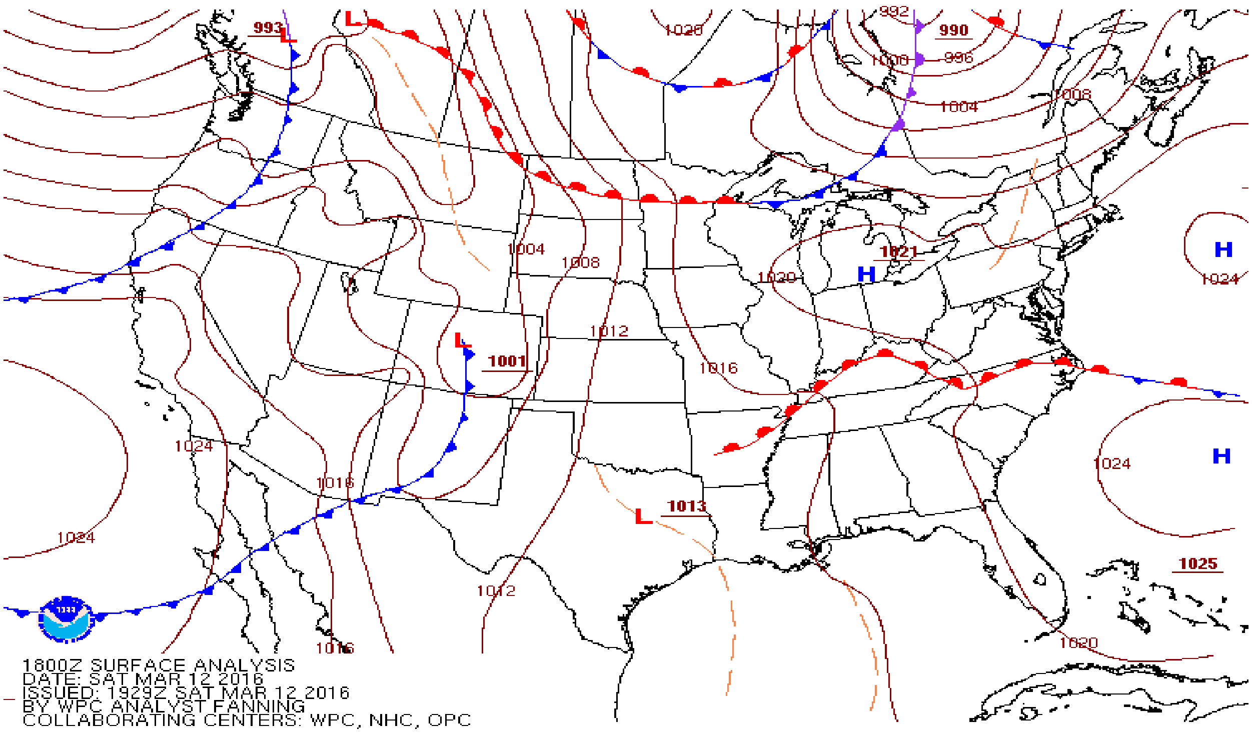

Figure 3-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

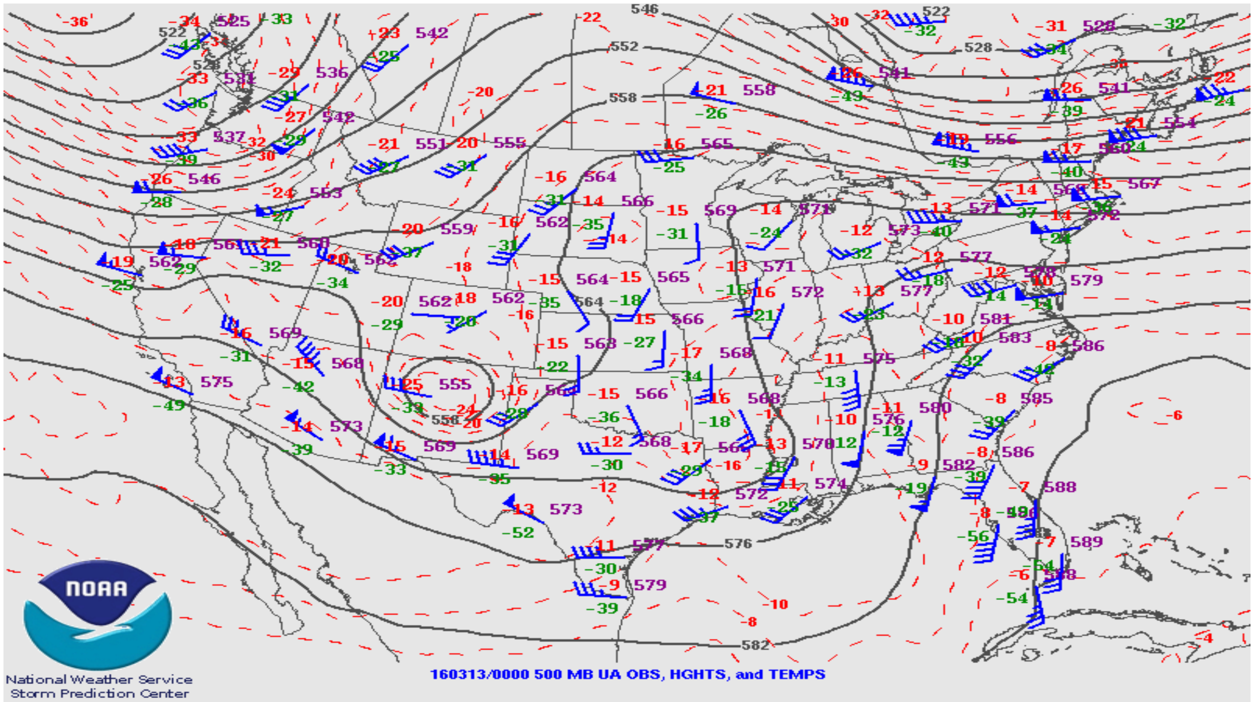

Figure 3-2. Upper air weather map for March 12, 2016 at the 1800 hour. Wind barbs depict wind speed (knots) and direction.

As the event unfolded, the wind blew from the southwest throughout the border region. These high velocity winds passed over large areas of desert within New Mexico and Mexico (Figure 3-3). Anthropogenic sources of dust near NMED's monitoring sites include disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

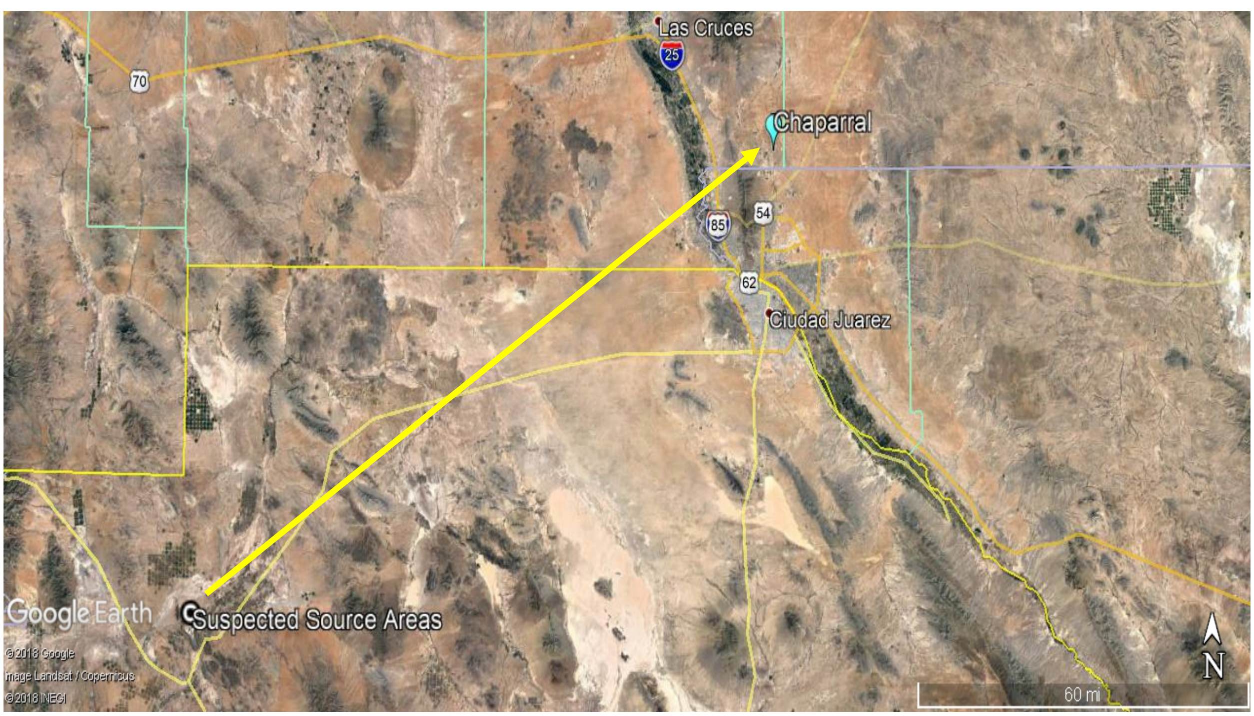

Figure 3-3. Map of NMED monitoring sites with a recorded exceedance of the NAAQS, predominant wind direction and suspected source locations for the high wind blowing dust event.

The co-occurrence of high winds and elevated levels of blowing dust, little to no point sources in the area, and high hourly and daily PM_{10} concentrations support the assertion that this was a natural event, specifically a high wind dust event. Sustained hourly wind speeds exceeding 11.2 m/s (~25 mph) were recorded at NMED monitoring sites beginning at the 0900 hour and lasted through the 2100 hour. PM_{10} concentrations began to exceed the NAAQS at the Chaparral monitoring site beginning at the 0900 hour. Hourly concentrations remained elevated through the 2100 hour coinciding with high wind. Table 3-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event.

Hour	Chaparral Monitoring Site		
	PM_{10} (µg/m^3)	Wind Speed (m/s)	Wind Gust (m/s)
1100	176	10.2	17.7
1200	182	10.8	17.3
1300	973	12.4	20.7
1400	188	10.7	18.4
1500	178	11.1	18
1600	452	11.5	20
1700	335	11.8	18.2
1800	236	10.3	16.6
1900	197	12.1	18.9
2000	175	11.3	18.3
2100	338	12.1	19.9

Table 3-2. Hourly PM_{10}, wind speed and wind gust data during the peak hours of the event.

Meteorologists forecasted the high wind blowing dust event to occur this day, as the spring windy season begins in March for most of the southwestern United States. Forecasts predicted strong winds as the storm approached the area with the area of low pressure tracking from west to east just south of the four corners in the morning and moving across New Mexico in the afternoon. The storm system's movement across the area timed well with daytime heating and mixing, generating a deep trough to the east as stronger winds aloft moved into the area. Many outlets also forecasted a high probability of blowing and entrained dust throughout the area and haze in the afternoon, especially in the desert areas of southern New Mexico (Figure 3-4).

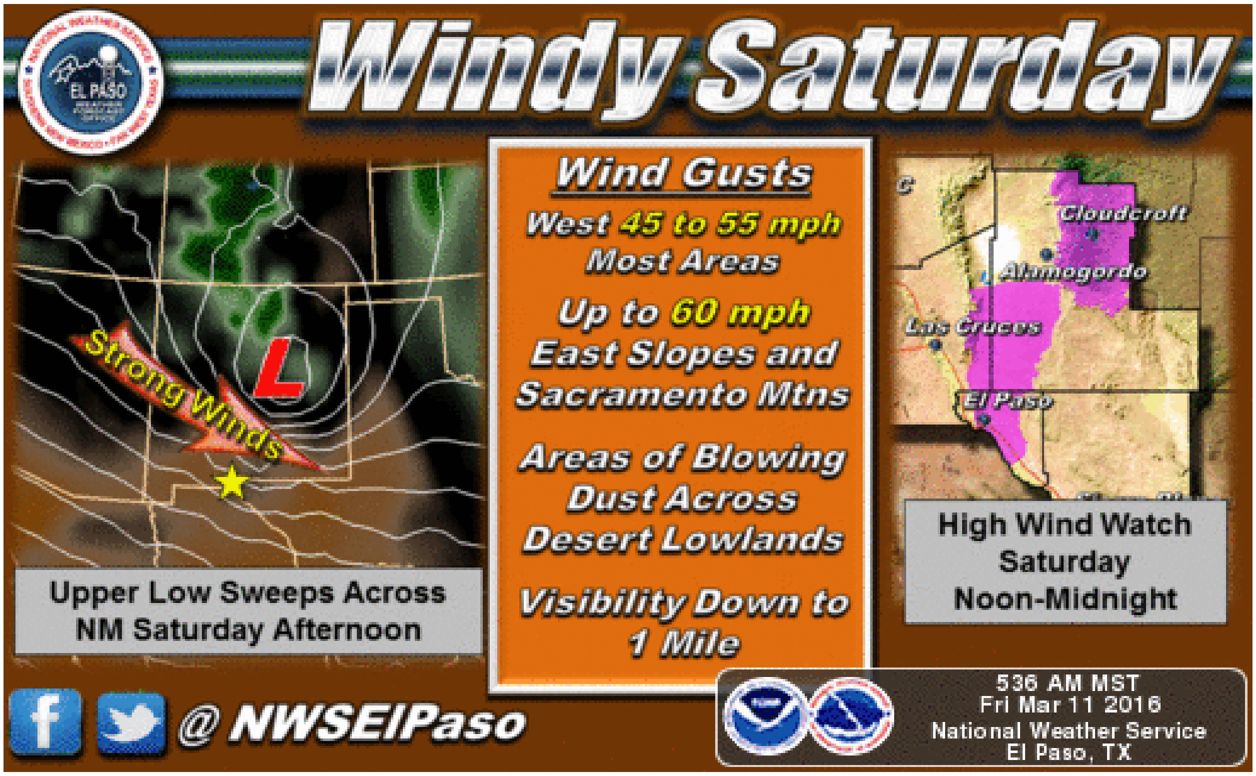

Figure 3-4. NWS Forecast Graphic for the event.

Not Reasonably Controllable or Preventable (nRCP)

Not Reasonably Preventable

This demonstration does not provide a showing of not reasonably preventable pursuant to 40 CFR 50.14(b)(5)(iv) that states, in part, "the State shall not be required to provide a case-specific justification for a high wind dust event."

Not Reasonably Controllable

The documentation provided in this section demonstrates that the wind speeds and other meteorological conditions overwhelmed the reasonable control measures in place for anthropogenic sources, causing emissions of dust that were transported to NMED's monitors.

Sustained Wind Speeds

EPA has indicated 11.2 m/s (25 mph) as the wind speed threshold at which natural or controlled anthropogenic sources will emit dust. The Chaparral monitoring site recorded hourly wind speeds above this threshold for 9 hours from noon to the 2100 hour (Figure 3-5). The hourly wind speeds at other NMED monitoring sites also met or surpassed the high wind threshold for several hours on this day. Based on the sustained wind speeds in the region, control measures were overwhelmed allowing for the emission of dust.

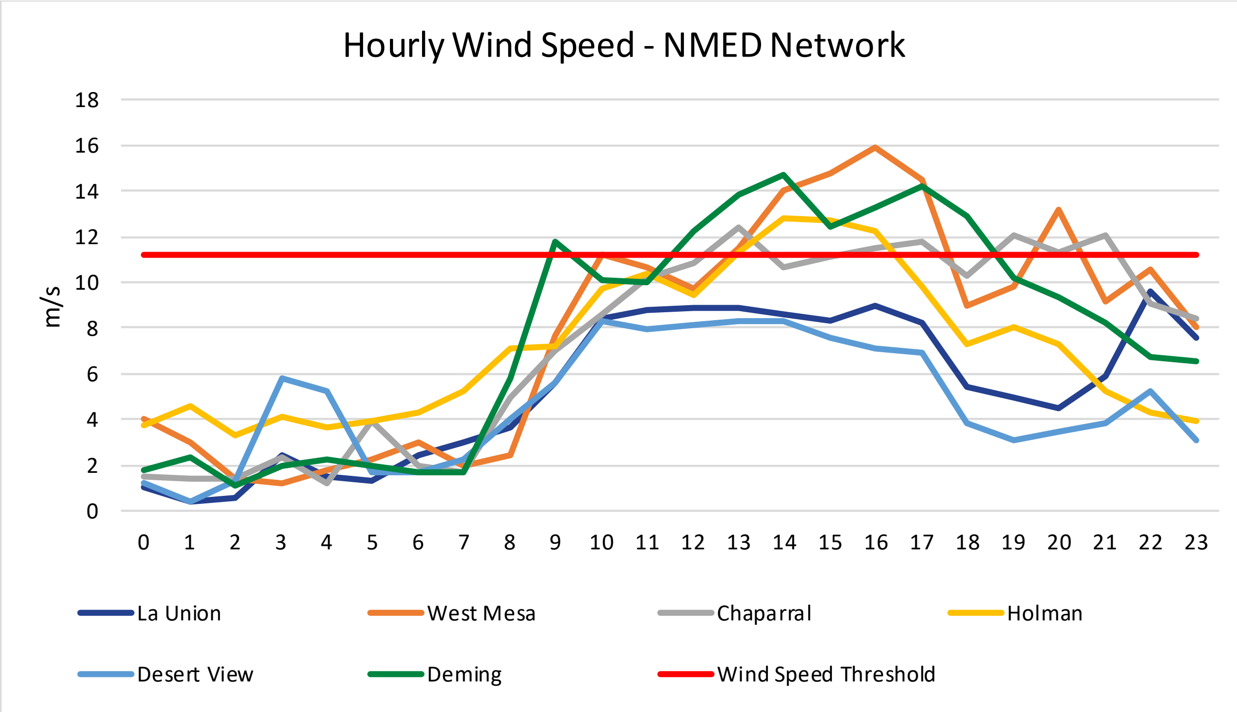

Figure 3-5. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

Level of Controls Analysis

Based on the sustained winds speeds monitored in the area during the event a basic controls analysis will be provided.

Basic Controls Analysis

Implementation and Enforcement of Control Measures

Reasonable controls for anthropogenic sources of dust are based on an area's attainment status for the PM_{10} NAAQS. It is not reasonable for areas designated as attainment, unclassifiable or maintenance to have the same level of controls as areas that are nonattainment for the standard. However, southern New Mexico has a long history of high wind blowing dust events with NMED developing a nonattainment SIP for the Anthony Area and NEAPs for the remaining portion of Doña Ana County and all of Luna County. As discussed in the Background section, NMED worked with local governments to help them develop and adopt dust control ordinances based on BACM. Based on the area's attainment status and SIP waiver, NMED believes these ordinances constitute reasonable controls.

The ordinances developed and adopted under the NEAPs are implemented and enforced at the local level with NMED playing a supporting role to ensure effective and enforceable implementation of control measures. Under the regulatory framework applicable to the two counties, NMED's purview does not include oversight of the extent of the effectiveness and enforcement of local ordinances. However, NMED believes that these ordinances are appropriately implemented at the local level.

Suspected Source Areas and Categories Contributing to the Event

Anthropogenic sources of dust in New Mexico include disturbed lands, construction and demolition activities, vacant parking lots and materials handling and transportation. Area sources account for a much larger portion of overall PM_{10} emissions than point sources. On the day of the event, no unusual PM_{10} producing activities occurred and anthropogenic point source emissions remained constant before, during and after the event. Natural areas of the Chihuahuan Desert in Doña Ana County are the most likely sources, under NMED's jurisdiction, contributing to the high wind blowing dust event. Other area sources located in Chihuahua, MX likely contributed to the exceedance on this day. Controlling dust from the natural desert terrain is cost prohibitive and falls outside NMED's jurisdiction when it is transported from intrastate and international sources.

The documentation and analysis presented in this section demonstrates that all identified sources that may have caused or contributed to the exceedance were subject to reasonable controls, implemented and enforced at the time of the event, therefore emissions associated with the high wind dust event were not reasonably controllable or preventable.

Clear Causal Relationship (CCR)

Occurrence and Geographic Extent of the Event

Satellite Imagery

The event was captured on satellite imagery with dust plumes originating upwind of NMED's monitoring sites near Ascension and Janos, Chih., MX. This area is largely rural with the largest area sources of PM originating from agricultural activities as well as the vast desert areas and playas in northern Mexico (Figure 3-6). Another large plume that did not contribute to this event, can be seen coming off of White Sands National Monument and carrying over the Sacramento Mountains. The dust plumes of interest appear to be limited to Mexico, orientated in a southwest to northeast fashion and traveling toward El Paso and NMED's Chaparral monitoring site at the time of the satellite pass (1100 hour MDT) that captured the image.

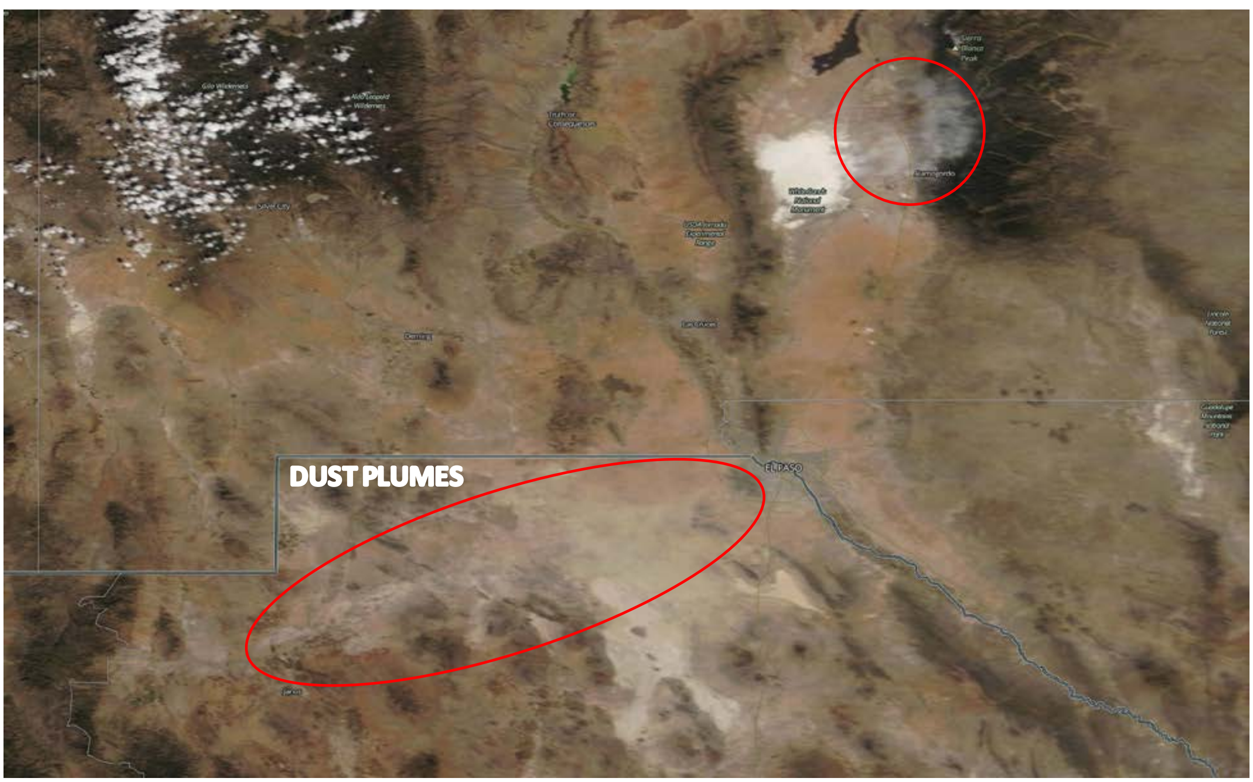

Figure 3-6. MODIS natural color imagery from the Terra Satellite showing southwestern New Mexico, northern Chihuahua and western Texas. Imagery obtained from NASA's EOSDIS Worldview website.

Weather Statements, Advisories, News and Other Media Reports Covering the Event

The National Weather Service (NWS) issued a Wind Advisory for the area on this date. A Wind Advisory is issued by NWS when sustained winds of 30 to 39 mph are expected for 1 hour or longer. This advisory was in place for southwestern New Mexico and west Texas to warn the public of the high wind event. An excerpt from the NWS Wind Advisory can be found below:

STRONG WESTERLY WINDS TODAY IN THE 25 TO 35 MPH RANGE WITH GUSTS TO 50 MPH EXPECTED. AREAS OF PATCHY BLOWING DUST MAY REDUCE VISIBILITY BELOW 1 MILE...ESPECIALLY ACROSS THE SOUTHERN DESERTS.

Spatial and Transport Analysis

HYSPLiT Back trajectory Analysis

A back-trajectory analysis using the NOAA Air Resources Laboratory HYSPLIT transport and dispersion model (Draxler et al., 2015; Rolph et al., 2017) shows that the air masses traveled from Chihuahua, MX into the southern New Mexico area and on to the NMED Chaparral monitoring site. The model was run using GDAS meteorological data for the six hours preceding the start of elevated PM_{10} concentrations during the event (Figure 3-7). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

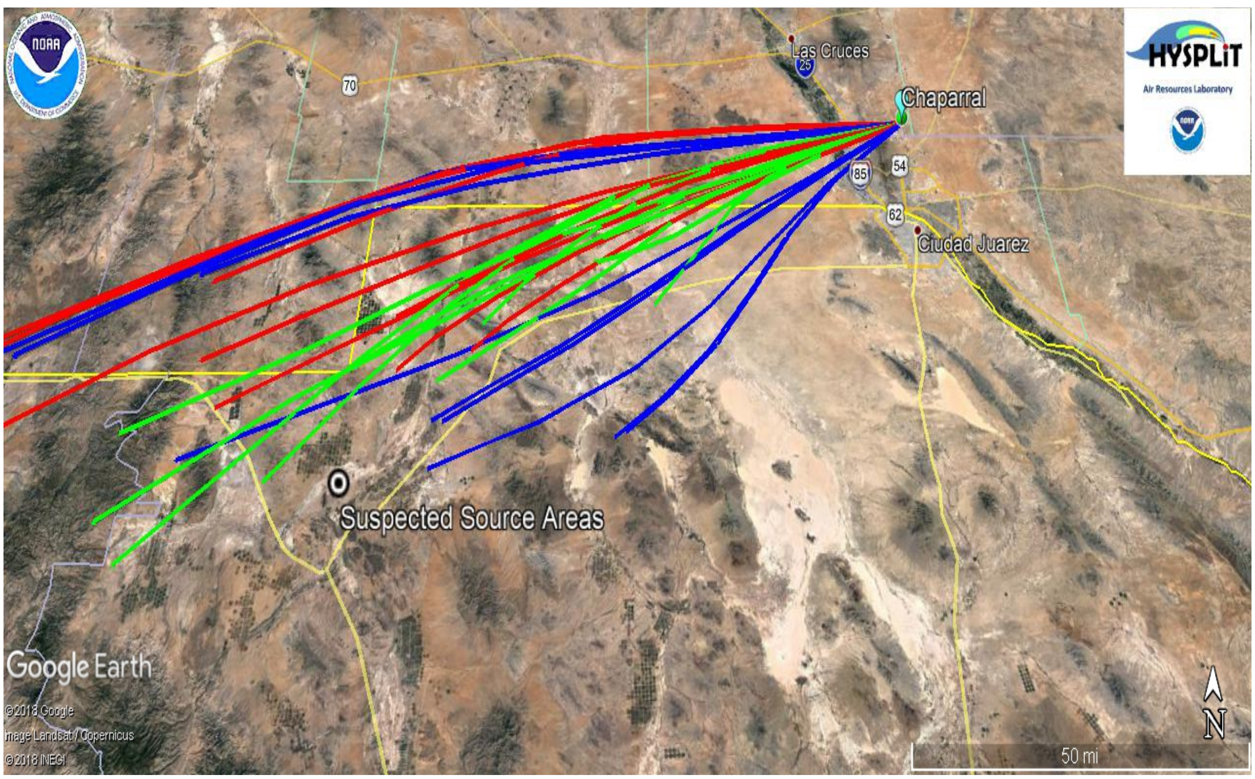

Figure 3-7. HYSPLiT back-trajectory analyses using the Ensemble mode.

Wind Direction and Elevated PM_{10} Concentrations

A pollution rose (Figure 3-8) was created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m^3 (1100 -2100 hour). During the event, winds blew from the west approximately 70% of the time coinciding with peak PM_{10} concentrations.

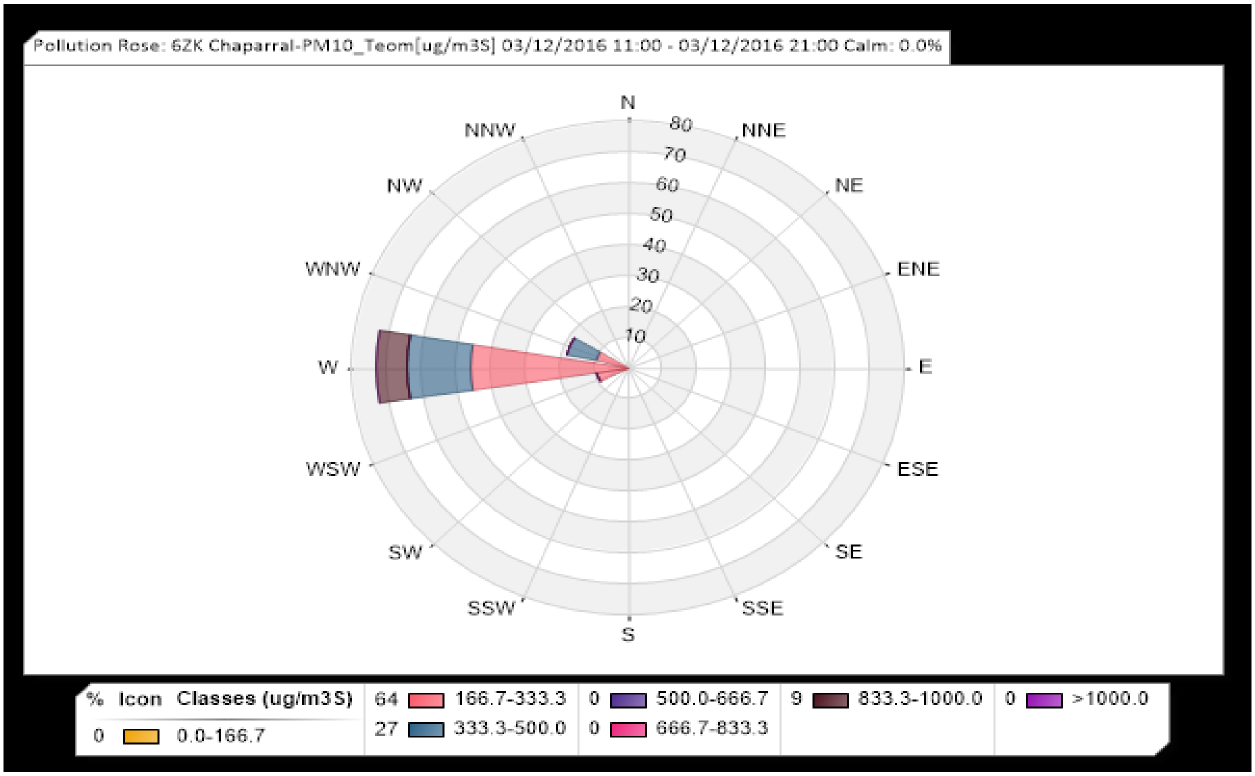

Figure 3-8. PM_{10} Pollution rose for the hours affected by the event at the Chaparral monitoring site.

Temporal Relationship of High Wind and Elevated PM_{10} Concentrations

The high wind blowing dust event generated strong west to southwesterly winds beginning at the 1100 hour and lasting through the 2100 hour. During this time, peak hourly PM_{10} concentrations ranged from 397 to 985 µg/m^3 at NMED monitoring sites (Figure 3-9). Although only one NMED monitoring site recorded an exceedance of the NAAQS, hourly PM_{10} data spiked at approximately the same time throughout the network. Sustained hourly average wind speeds of 15.9 m/s (~35 mph) were recorded at the NMED West Mesa monitoring site during the peak PM_{10} concentrations of the event. The time series plot in Figure 3-10 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

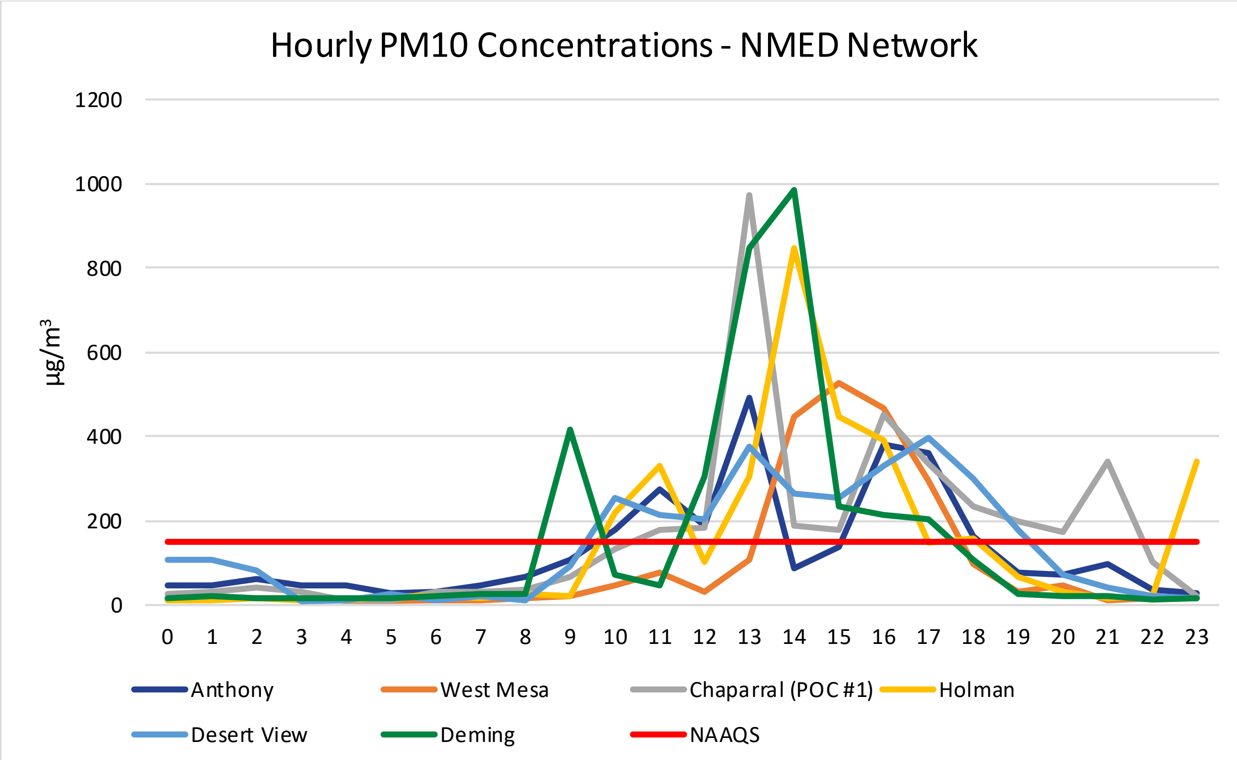

Figure 3-9. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

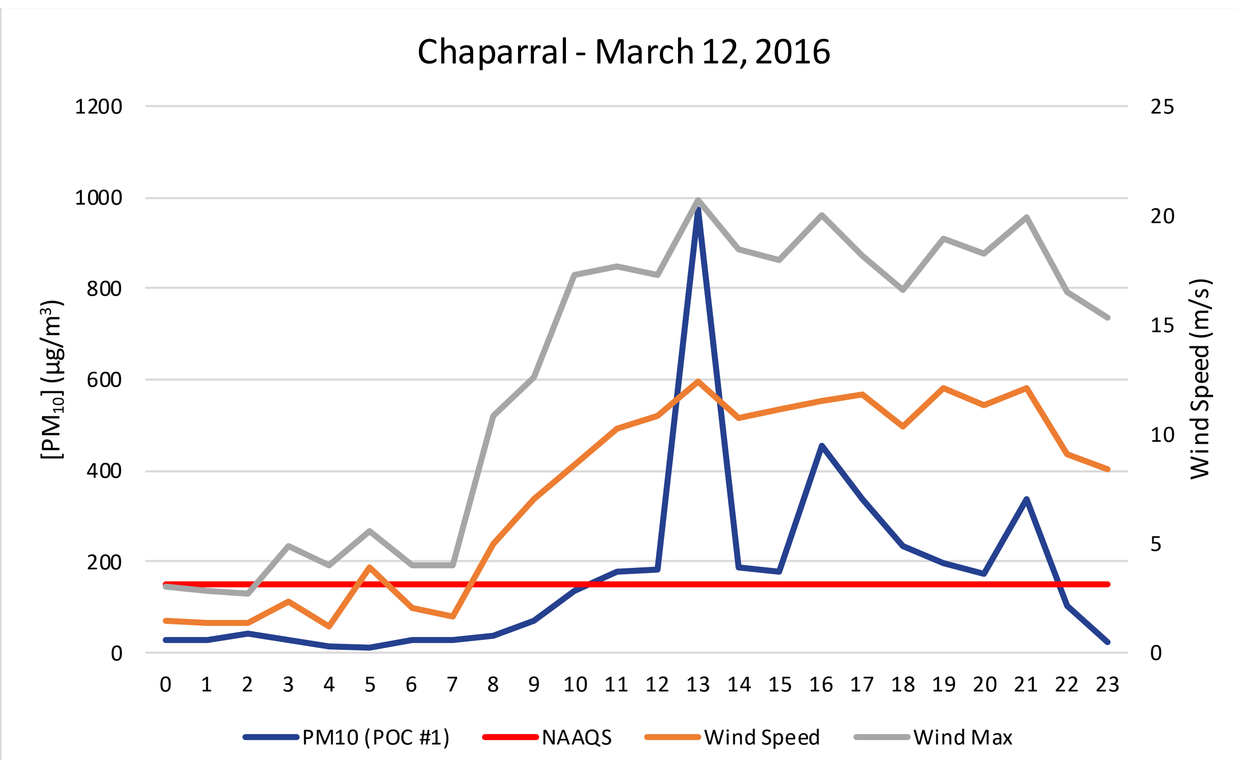

Figure 3-10. Chaparral monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2011-2015, the NMED Chaparral monitoring site recorded 43 exceedances of the PM_{10} NAAQS (Figure 3-11). The maximum 24-hour average PM_{10} concentration at this site was 1,606 µg/m³ recorded in 2012. High wind blowing dust events in southern New Mexico can occur at any time of the year, but the majority of these days occur during the spring windy season, from March through May. NMED has documented that all exceedances have been caused by high wind blowing dust events.

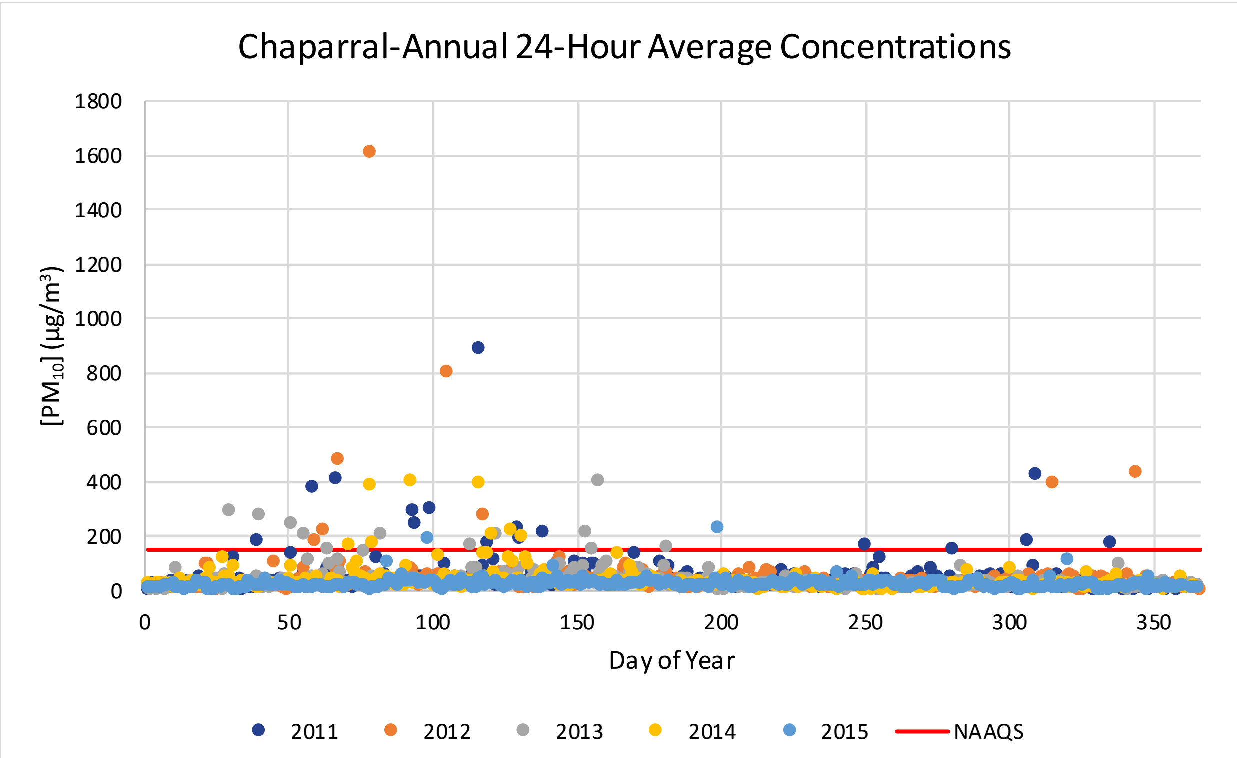

Figure 3-11. 24-hour averages by day of year from 2011-2015.

Spatial and Temporal Variability

As demonstrated in Figure 3-12, all NMED monitoring sites recorded elevated 24-Hour Average PM_{10} concentrations compared to the days preceding and following the event. Daily averages for the days surrounding the event did not surpass 60 µg/m³, demonstrating the influence high winds have on PM_{10} concentrations in the area.

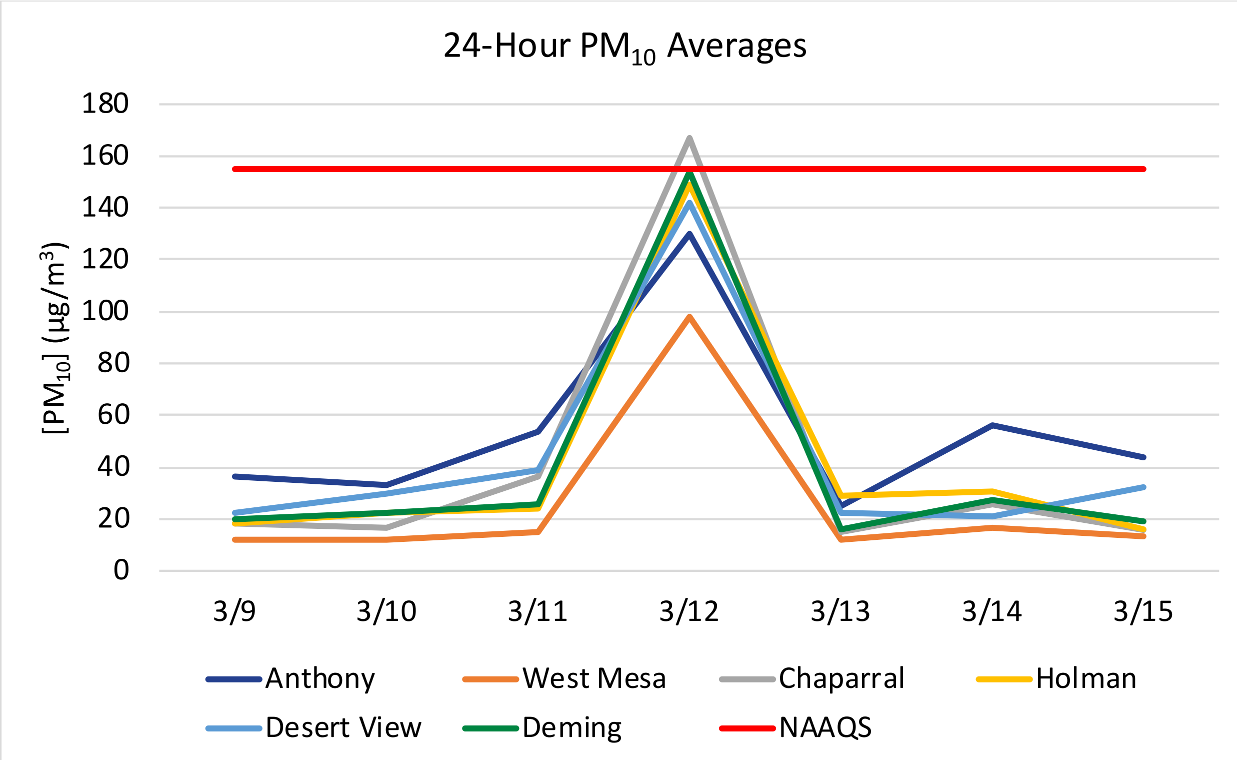

Figure 3-12. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

Percentile Ranking

Table 3-3 shows the 24-Hour Average PM_{10} data distribution recorded at NMED monitoring sites, including high wind blowing dust events flagged with a request to exclude data in the AQS database for exceedances of the standard from 2011-2015. The recorded value for this day (166 µg/m³) is above the 95th percentile of historical data.

Statistic\Monitoring Site	Anthony	West Mesa	Chaparral	Holman	Desert View	Deming
Max	1739	487	1606	1449	1691	1098
99th Percentile	307	160	255	198	253	254
95th Percentile	99	59	91	68	99	68
75th Percentile	54	23	36	31	42	30
50th Percentile	38	16	24	21	28	20
25th Percentile	25	11	16	14	19	13
5th Percentile	13	5	6	6	9	6
Mean	49	23	36	30	40	30

Table 3-3. NMED monitoring sites PM_{10} 24-hour average data distribution. Includes data flagged in AQS for exclusion due to high wind blowing dust events (RJ).

CCR Conclusion

On this day a high wind blowing dust event occurred, generating PM_{10} emissions that resulted in elevated concentrations at the Chaparral monitoring site. The monitored PM_{10} 24-Hour Average of 166 µg/m³ is above the 95th percentile of data monitored over the previous five years. Meteorological conditions were consistent with past event days and elevated PM_{10} concentrations. The comparisons and analyses provided in the CCR section of this demonstration support NMED's position that the event affected air quality in such a way that a clear causal relationship exists between the high wind blowing dust event and the monitored exceedance on this day, satisfying the CCR criterion.

Natural Event

The CCR and nRCP analyses show that this was a natural event caused by high wind and blowing dust. Based on the documentation provided in this demonstration, the event qualifies as a natural event. The exceedance associated with the event meets the regulatory definition of a natural event at 40 CFR 50.14(b)(8). This event transported windblown dust from natural and reasonably controlled anthropogenic sources and accordingly, NMED has demonstrated that the event is a natural event and may be considered for treatment as an exceptional event.

4. HIGH WIND EXCEPTIONAL EVENT: March 22, 2016

Conceptual Model

A Pacific cold front and associated storm system caused high winds and blowing dust in Doña Ana and Luna Counties resulting in an exceedance of the PM_{10} NAAQS at the Anthony, Desert View, and Deming monitoring sites on this date. In accordance with the EER, the AQB submitted this data to EPA's AQS database and flagged it (coded as RJ) as a high wind dust event (Table 4-1).

AQS Flag	AQS ID	Site Name	24-Hour Average Concentration	Max 1-Hour Wind Speed	Max Gust
RJ	35-013-0016	6CM Anthony	164 µg/m³	10.5 m/s	18.4 m/s
RJ	35-013-0021	6ZM Desert View	199 µg/m³	8.9 m/s	17.4 m/s
RJ	35-029-0003	7E Deming	165 µg/m³	12.4 m/s	21.9 m/s

Table 4-1. 2016 PM_{10} Data flagged by NMED for exclusion pursuant to the EER.

In the morning an upper low and trough was moving into the Pacific Northwest and California before moving across the Great Basin in Utah and Arizona and into the Rocky Mountains, New Mexico and west Texas. As this weather pattern established itself over northeast Colorado, mid- and low-level pressure gradients strengthened and extended into southern New Mexico (Figure 4-1). The resulting strong southwest winds at the surface brought warm and dry air into the area allowing stronger flow aloft to mix to the ground. (Figure 4-2). These conditions generated windy conditions at the surface and provided the turbulence required for vertical mixing and entrainment of dust. As the cold front moved through the area a second low pressure system moved across the region keeping wind speeds high the following day as well (see Section 5).

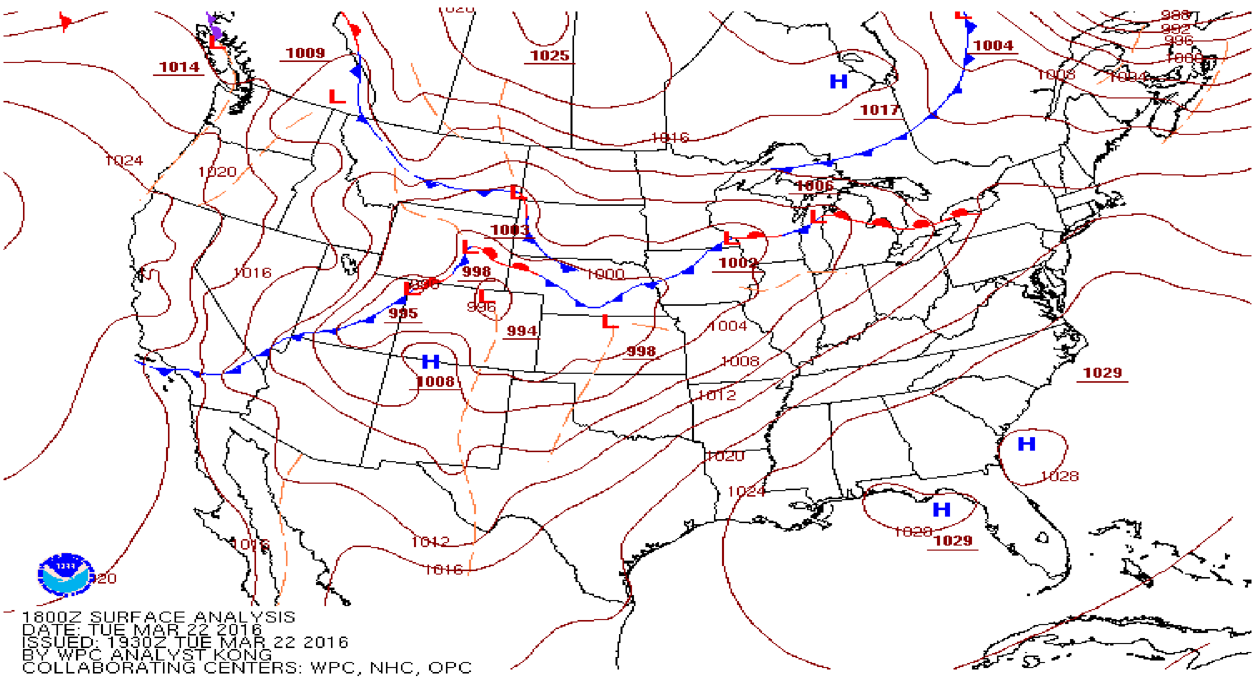

Figure 4-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

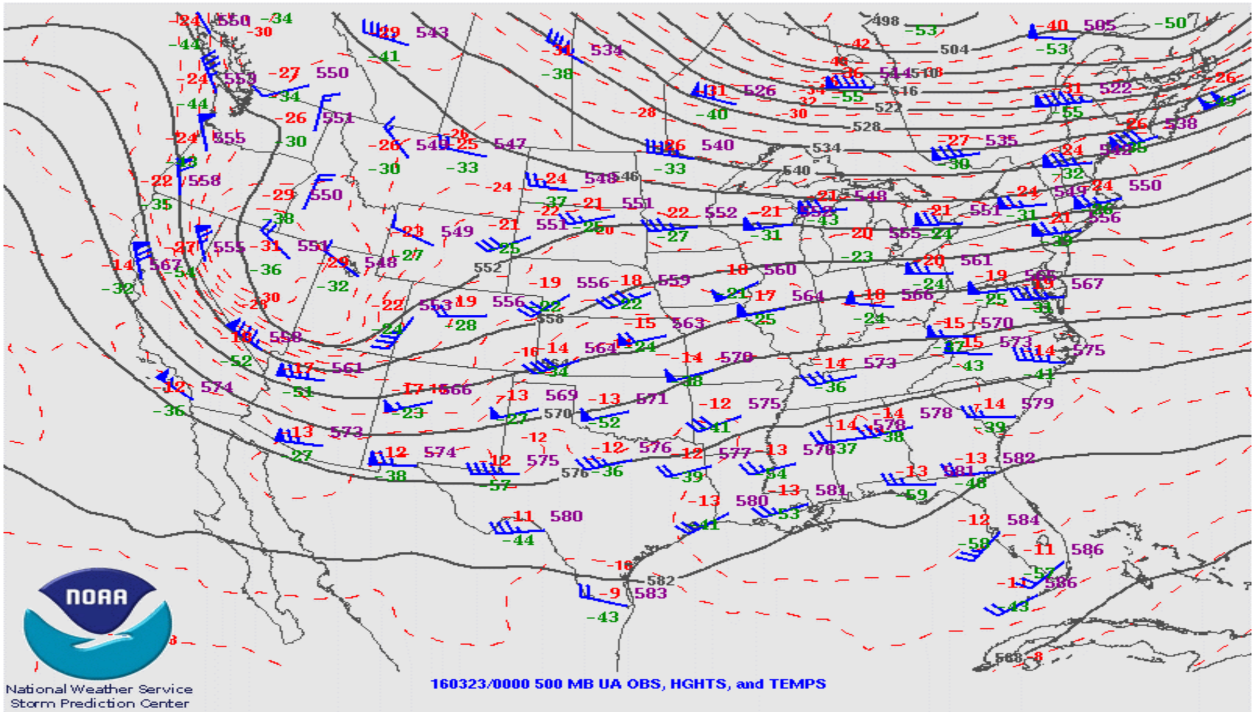

Figure 4-2. Upper air weather map for March 22, 2016 at the 1800 hour. Wind barbs depict wind speed (knots) and direction.

As the event unfolded, the wind blew from the west to southwest throughout the border region. These high velocity winds passed over large areas of desert within New Mexico and Mexico (Figure 4-3). Anthropogenic sources of dust near NMED's monitoring sites include: disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

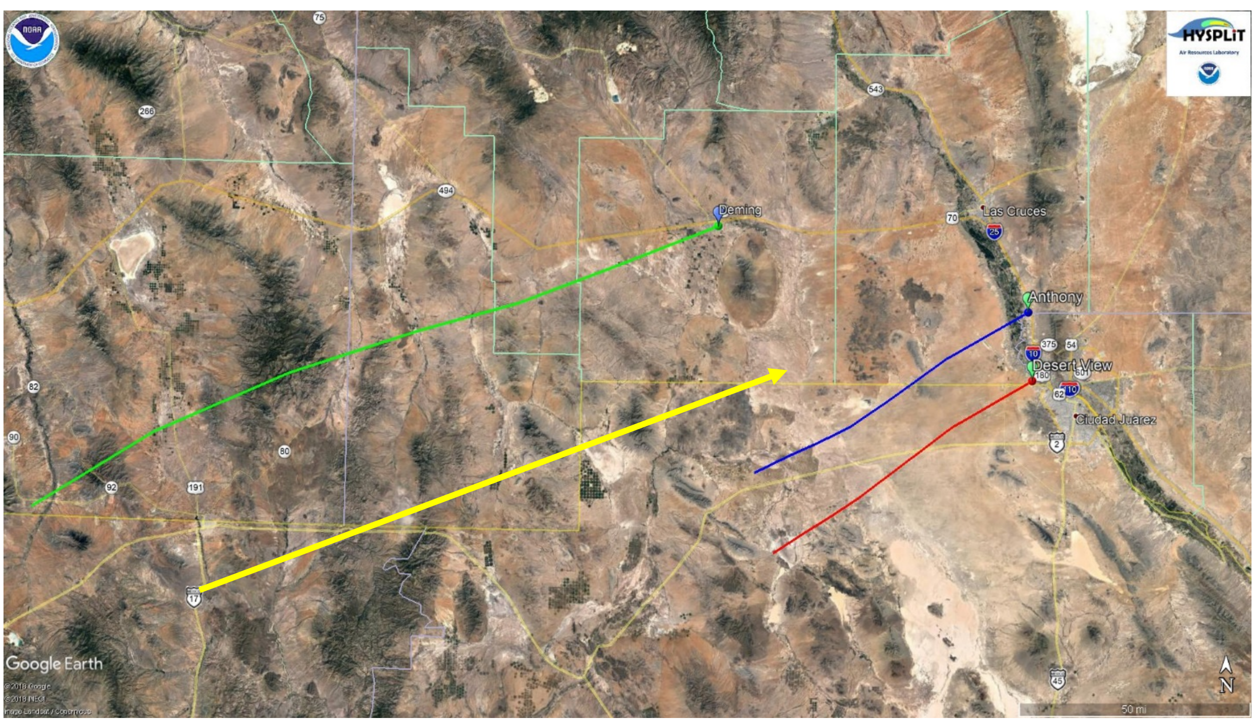

Figure 4-3. Map of NMED monitoring sites with a recorded exceedance of the NAAQS, predominant wind direction and suspected source locations for the high wind blowing dust event.

The co-occurrence of high winds and elevated levels of blowing dust, little to no point sources in the area, and the high hourly and daily PM_{10} concentrations support the assertion that this was a natural event, specifically a high wind dust event. Sustained hourly wind speeds exceeding 9 m/s (~20 mph) were recorded at Anthony, Desert View, and Deming monitoring sites beginning at the 1000 hour and lasted through the 1800 hour. PM_{10} concentrations began to exceed the NAAQS at the Deming monitoring site beginning at the 1000 hour. Hourly concentrations remained elevated through the 2100 hour. Table 4-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event.

Hour	6CM Anthony			6ZM Desert View			7E Deming		
	PM_{10} (µg/m^3)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m^3)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m^3)	Wind Speed (m/s)	Wind Gust (m/s)
1000	417	7.7	13.9	41	5.9	11	138	9.8	14.8
1100	182	8.5	14.4	196	8.1	15.8	48	8.8	14.7
1200	211	8	17	203	9.5	18.3	153	7.5	15.1
1300	308	9.1	15.7	242	7.9	14.5	295	10.8	20.3
1400	354	10	17.5	432	7.5	15.6	343	12.2	21.9
1500	333	8.8	14.8	591	8.9	17	286	12	19
1600	502	9.4	18.1	750	8.5	17.4	595	12.4	21
1700	460	10.5	18.4	563	8.1	15.8	684	12.3	20.5
1800	190	6.8	12.8	405	6.1	11.7	289	10.4	17.5
1900	149	7.1	11.7	694	5.7	12.7	162	6.7	11.7
2000	116	7	12.4	187	4.9	9.6	242	5.9	8.9
2100	55	6	9.8	90	4.5	9.1	152	5.5	8.2

Table 4-2. Hourly PM_{10}, wind speed and wind gust data during the peak hours of the event.

Meteorologists forecasted the high wind blowing dust event to occur this day, as the spring windy season begins in March for most of the southwestern United States. Forecasts predicted strong winds as the storm approached the area with the area of low pressure tracking from west to east just south of the four corners in the morning and moving across New Mexico in the afternoon. The systems movement across the area timed well with daytime heating and mixing generating a deep trough to the east as stronger winds aloft moved into the area. Many outlets also forecasted a high probability of blowing and entrained dust throughout the area and haze in the afternoon, especially in the desert areas of southern New Mexico (Figure 4-4).

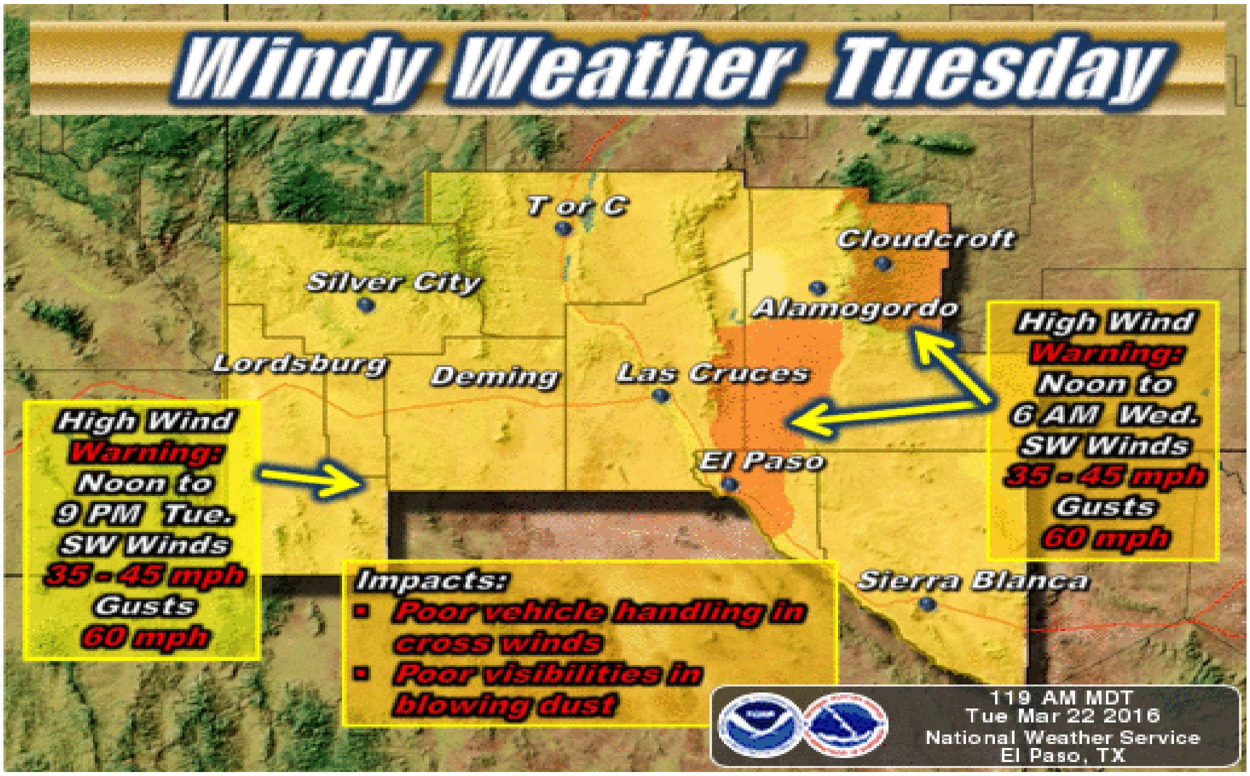

Figure 4-4. NWS Forecast Graphic for the event.

Not Reasonably Controllable or Preventable (nRCP)

Not Reasonably Preventable

This demonstration does not provide a showing of not reasonably preventable pursuant to 40 CFR 50.14(b)(5)(iv) that states, in part, "the State shall not be required to provide a case-specific justification for a high wind dust event."

Not Reasonably Controllable

The documentation provided in this section demonstrates that the wind speeds and other meteorological conditions overwhelmed the reasonable control measures in place for anthropogenic sources, causing emissions of dust that were transported to NMED's monitors.

Sustained Wind Speeds

EPA has indicated 11.2 m/s (25 mph) as the wind speed threshold at which natural or controlled anthropogenic sources will emit dust. The Chaparral, Holman, and West Mesa monitoring sites recorded wind speeds near, at or above this threshold for 3 hours from the 1400 to the 1700 hour (Figure 4-5). The Wind speeds at the upwind Deming monitoring site also reached the high wind threshold.

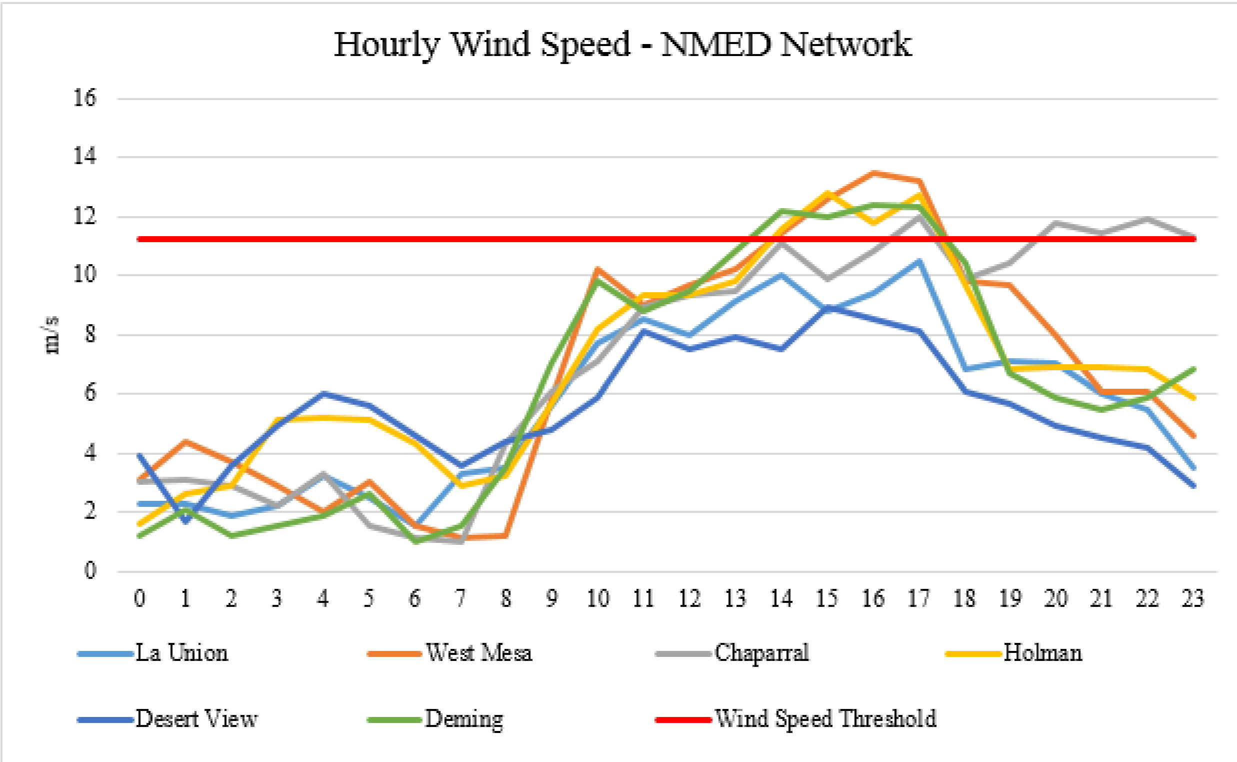

Figure 4-5. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

Level of Controls Analysis

Based on the sustained winds speeds monitored in the area during the event a basic controls analysis will be provided.

Basic Controls Analysis

Implementation and Enforcement of Control Measures

Reasonable controls for anthropogenic sources of dust are based on an area's attainment status for the PM_{10} NAAQS. It is not reasonable for areas designated as attainment, unclassifiable or maintenance to have the same level of controls as areas that are nonattainment for the standard. However, southern New Mexico has a long history of high wind blowing dust events with NMED developing a nonattainment SIP for the Anthony Area and NEAPs for the remaining portion of Doña Ana County and all of Luna County. As discussed in the Background section, NMED worked with local governments to help them develop and adopt dust control ordinances based on BACM. Based on the area's attainment status and SIP waiver, NMED believes these ordinances constitute reasonable controls.

The ordinances developed and adopted under the NEAPs are implemented and enforced at the local level with NMED playing a supporting role to ensure effective and enforceable implementation of control measures. Under the regulatory framework applicable to the two counties, NMED's purview does not include oversight of the extent of the effectiveness and enforcement of local ordinances. However, NMED believes that these ordinances are appropriately implemented at the local level.

Suspected Source Areas and Categories Contributing to the Event

Anthropogenic sources of dust in New Mexico include disturbed lands, construction and demolition activities, vacant parking lots and materials handling and transportation. Area sources account for a

much larger portion of overall PM_{10} emissions than point sources. On the day of the event, no unusual PM_{10} producing activities occurred and anthropogenic point source emissions remained constant before, during and after the event. Natural areas of the Chihuahuan Desert in Doña Ana County are the most likely sources, under NMED's jurisdiction, contributing to the high wind blowing dust event. Other area sources located in Chihuahua, MX likely contributed to the exceedance on this day. Controlling dust from the natural desert terrain is cost prohibitive and falls outside NMED's jurisdiction when it is transported from intrastate and international sources.

The documentation and analysis presented in this section demonstrates that all identified sources that may have caused or contributed to the exceedance were subject to reasonable controls, implemented and enforced at the time of the event, therefore emissions associated with the high wind dust event were not reasonably controllable or preventable.

Clear Causal Relationship (CCR)

Occurrence and Geographic Extent of the Event

Satellite Imagery

The event was captured on satellite imagery with dust plumes originating upwind of NMED's monitoring sites near Ascension and Janos, Chih. This area is largely rural with the largest area sources of PM originating from agricultural activities as well as the vast desert areas and playas in northern Mexico (Figure 4-6). The dust plumes of interest appear to be limited to Mexico, orientated in a southwest to northeast fashion and traveling toward El Paso and NMED's monitoring sites at the time of the satellite pass (1100 hour MDT) that captured the imagery.

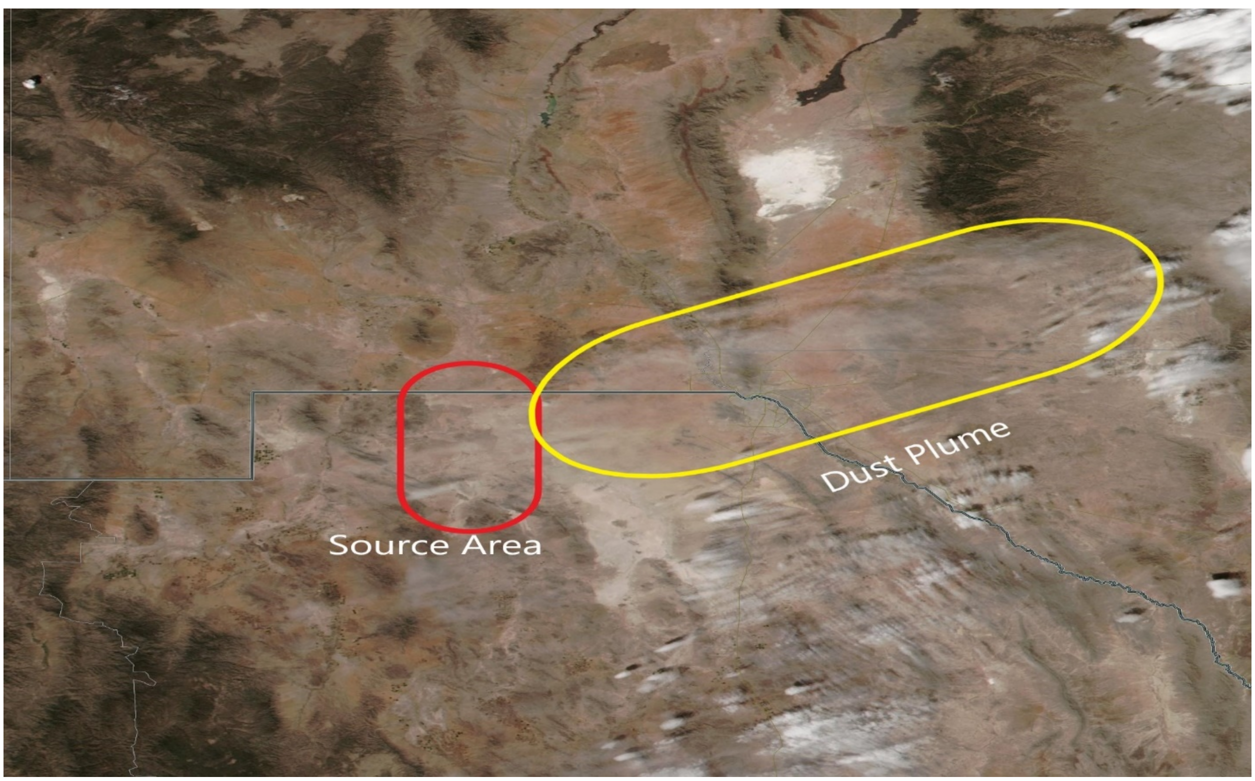

Figure 4-6. Natural color imagery from the Suomi NPP VIIRS Satellite showing southwestern New Mexico, northern Chihuahua and western Texas. Imagery obtained from NASA's EOSDIS Worldview website.

The event was also featured on the NM Border Air Quality Blog dated March 28, 2016 posted by State Climatologist Dr. Dave Dubois:

March 22, 2016 dust event

“A strong synoptic dust storm impacted most of the border country on March 22 and 23. High winds started early on the 22nd across the region and peaked late in the afternoon.
Traffic cameras along I-10 recorded times of near-zero visibility in the afternoon. The cameras west of Lordsburg showed episodes of blowing dust from the playa or dry lakebed. At the peak of the dust storm at about 1611 MDT the mile marker 11 camera (view toward the west) looked like this. A few minutes later at 1614 visibility increased a little but still a dangerous situation.”

Figure 4-7. Imagery of blowing dust on I-10 west of Lordsburg, NM at 1611 and 1614. on March 22, 2016. Courtesy of NMDOT.

Weather Statements, Advisories, News and Other Media Reports Covering the Event

The National Weather Service (NWS) issued a Wind Advisory and a Blowing Dust Advisory for this date (Figure 4-4). A Wind Advisory is issued by NWS when sustained winds of 30 to 39 mph are expected for 1 hour or longer. A Blowing Dust Advisory is issued when blowing dust is expected to reduce visibility to between ¼ to 1 mile, generally with winds of 25 mph or greater. These were in place for southwestern New Mexico and west Texas to warn the public of the high wind event. An excerpt from the NWS Wind Advisory can be found below:

```
STRONG SOUTHWEST SUSTAINED WINDS OF 35 TO 45 MPH WITH GUSTS OF OVER 60
MPH. WINDS WILL PRODUCE WIDESPREAD BLOWING DUST ACROSS THE LOWER ELEVATIONS
WITH VISIBILITIES UNDER A MILE OVER MANY LOCATIONS

HIGH WIND WARNING REMAINS IN EFFECT UNTIL 9 PM MDT…...BLOWING DUST ADVISORY
REMAINS IN EFFECT UNTIL 6 PM MDT
```

Spatial and Transport Analysis

HYSPLiT Backtrajectory Analysis

A back-trajectory analysis using the NOAA Air Resources Laboratory HYSPLIT transport and dispersion model (Draxler et al., 2015; Rolph et al., 2017) shows that the air masses traveled from Chihuahua, MX into the southern New Mexico and El Paso, TX area and on to the NMED monitoring site(s). The model was run using GDAS meteorological data for the six hours preceding the start of elevated PM_{10} concentrations during the event (Figures 4-8 through 4-10). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

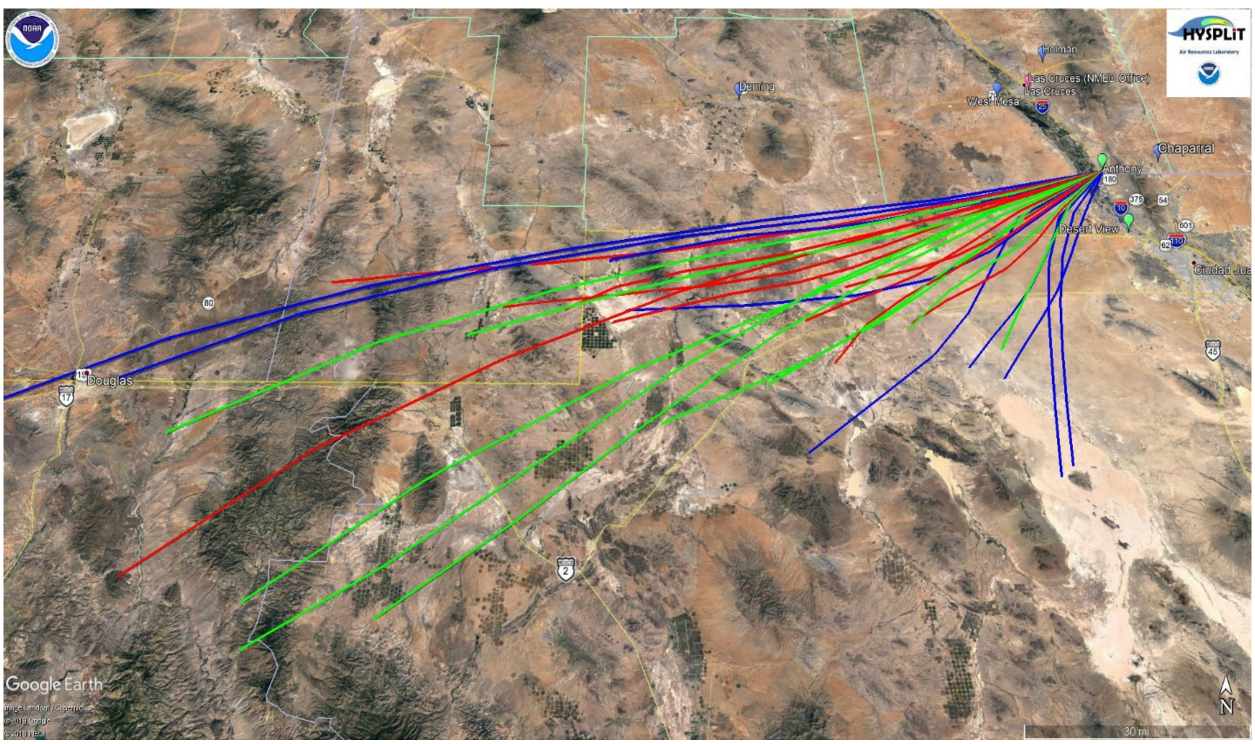

Figure 4-8. HYSPLiT back-trajectory analyses of Anthony monitoring site using the Ensemble mode.

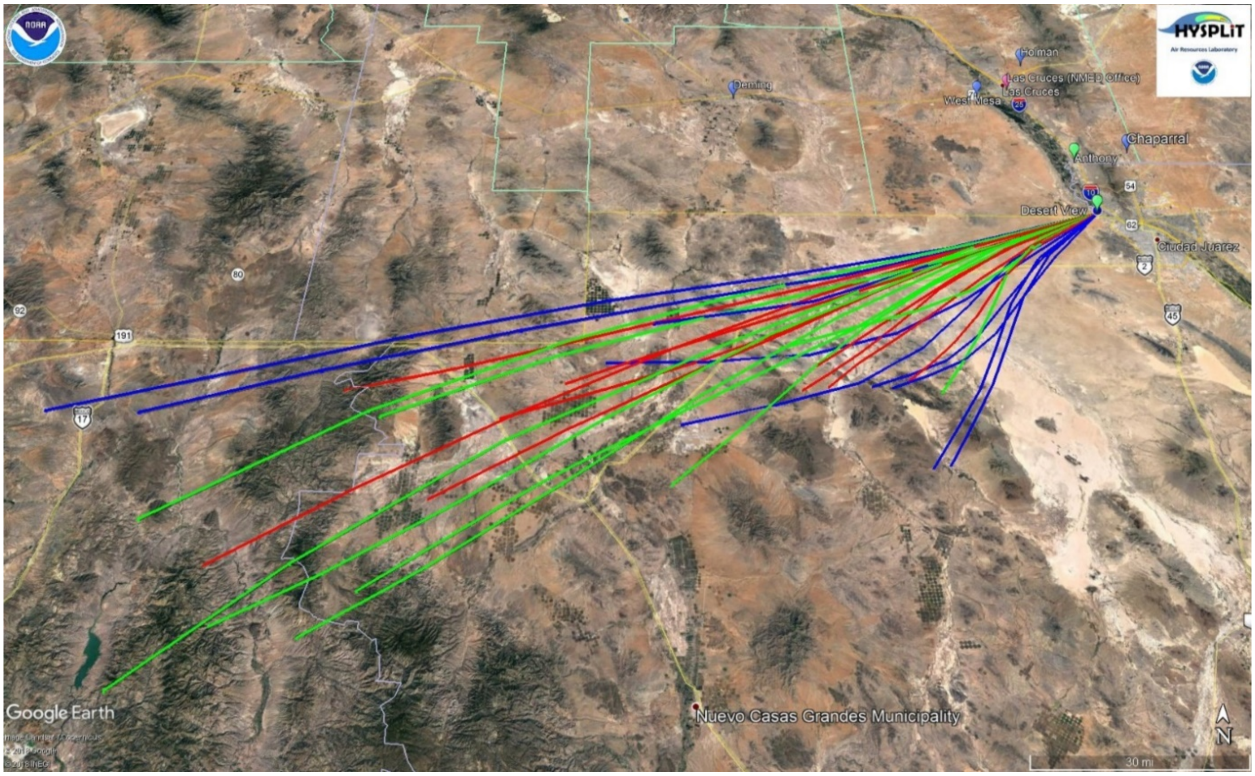

Figure 4-9. HYSPLiT back-trajectory analyses of Desert View monitoring site using the Ensemble mode.

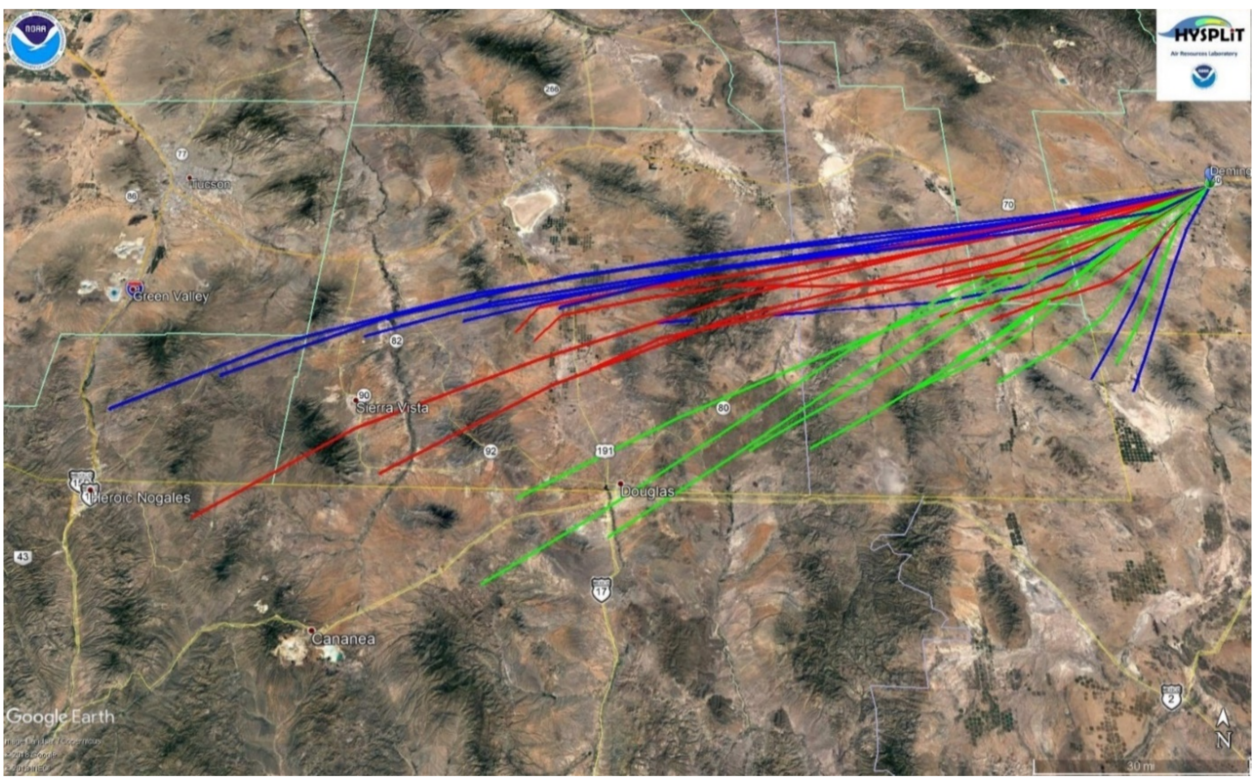

Figure 4-10. HYSPLiT back-trajectory analyses of Deming monitoring site using the Ensemble mode.

Wind Direction and Elevated PM_{10} Concentrations

Pollution roses (Figures 4-11 through 4-13) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m³ (1300 -1800 hour). During the event, winds blew from the west southwest approximately 80-100% of the time coinciding with peak PM_{10} concentrations.

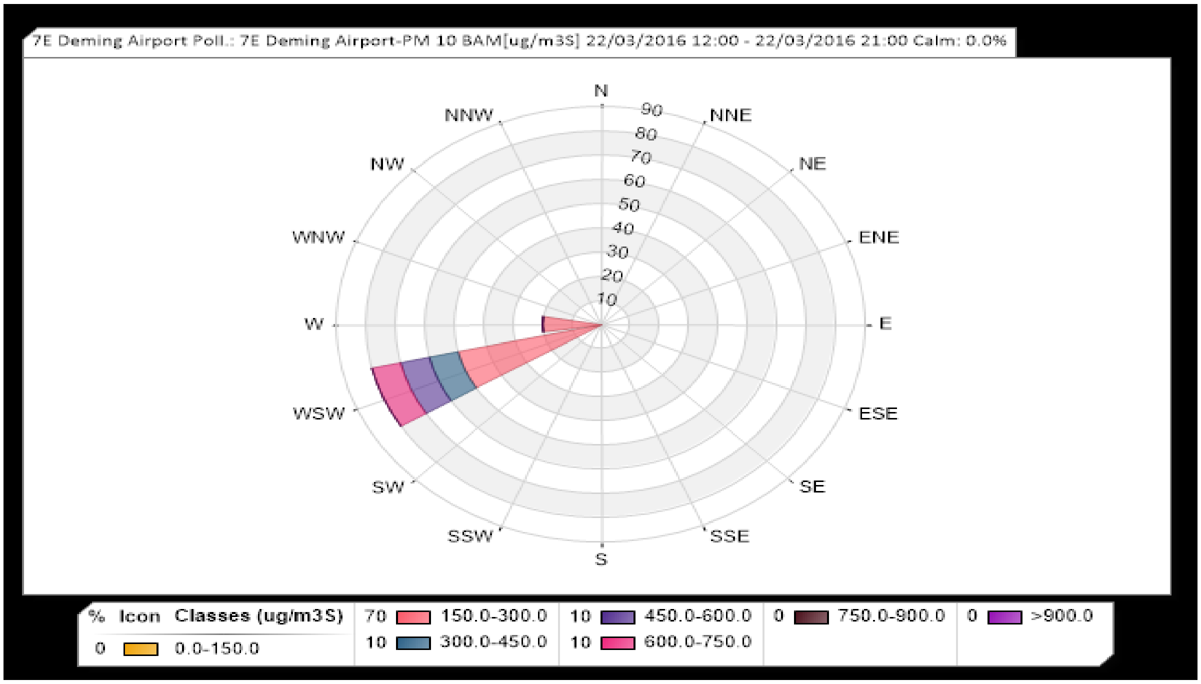

Figure 4-11. Pollution Rose for Deming Monitoring Site

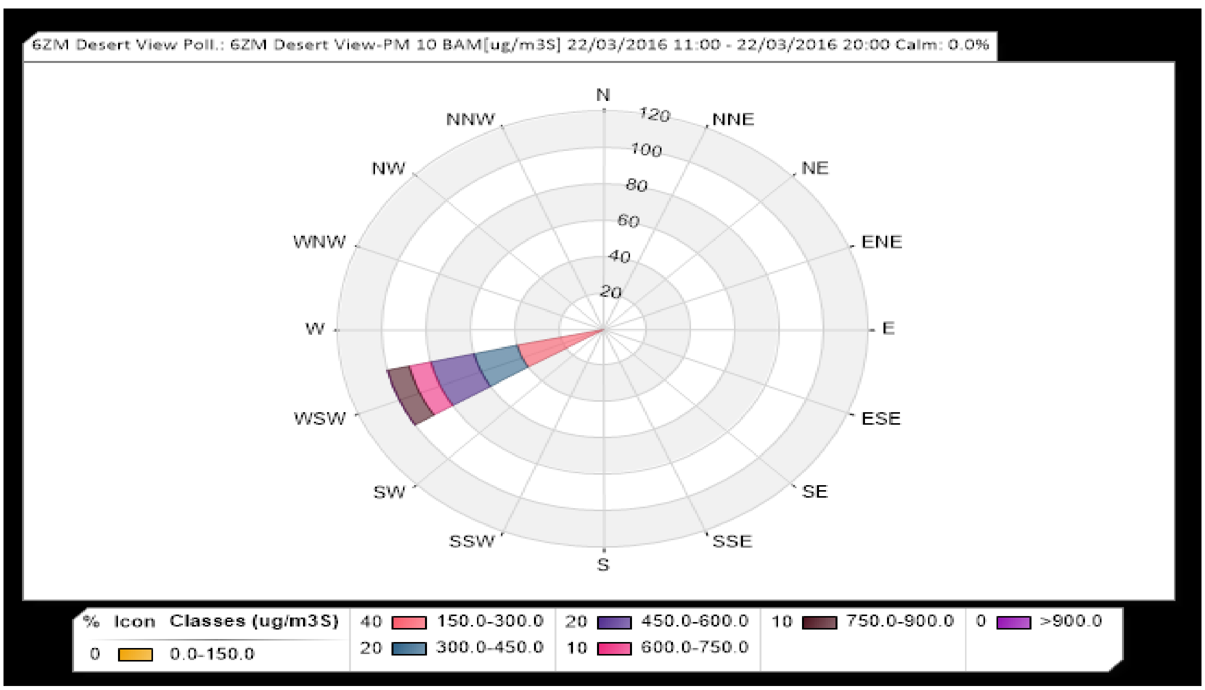

Figure 4-12. Pollution Rose for Desert View Monitoring Site

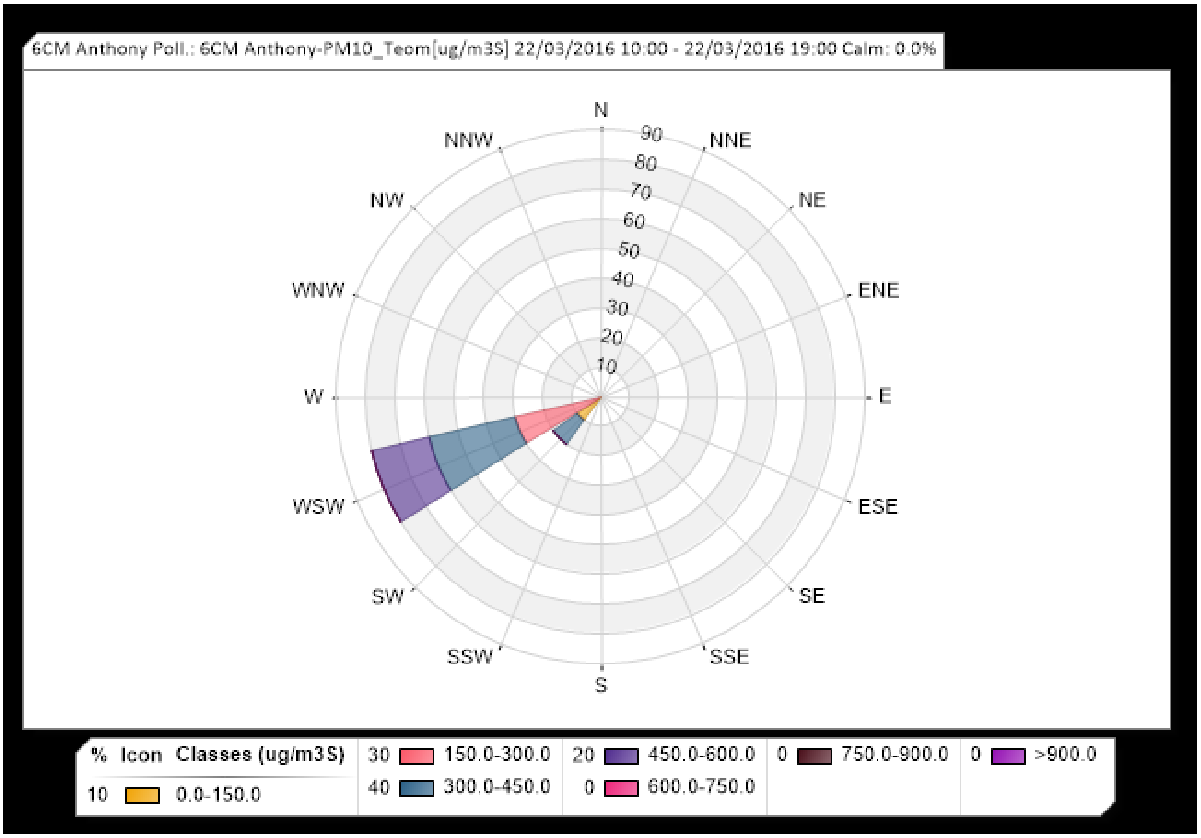

Figure 4-13. Pollution Rose for Anthony Monitoring Site

Temporal Relationship of High Wind and Elevated PM_{10} Concentrations

The high wind blowing dust event generated strong southwesterly winds beginning at the 1400 hour and lasting through the 1700 hour. During this time, peak hourly PM_{10} concentrations ranged from 343 to 750 µg/m^3 at NMED monitoring sites (Figure 4-14). Although not all NMED monitoring sites recorded an exceedance of the NAAQS, hourly PM_{10} data spiked at approximately the same time throughout the network. Sustained hourly average wind speeds of 11.4 to 12.4 m/s were recorded at West Mesa and Deming monitoring sites during the peak PM_{10} concentrations of the event. The time series plots in Figures 4-15 through 4-17 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

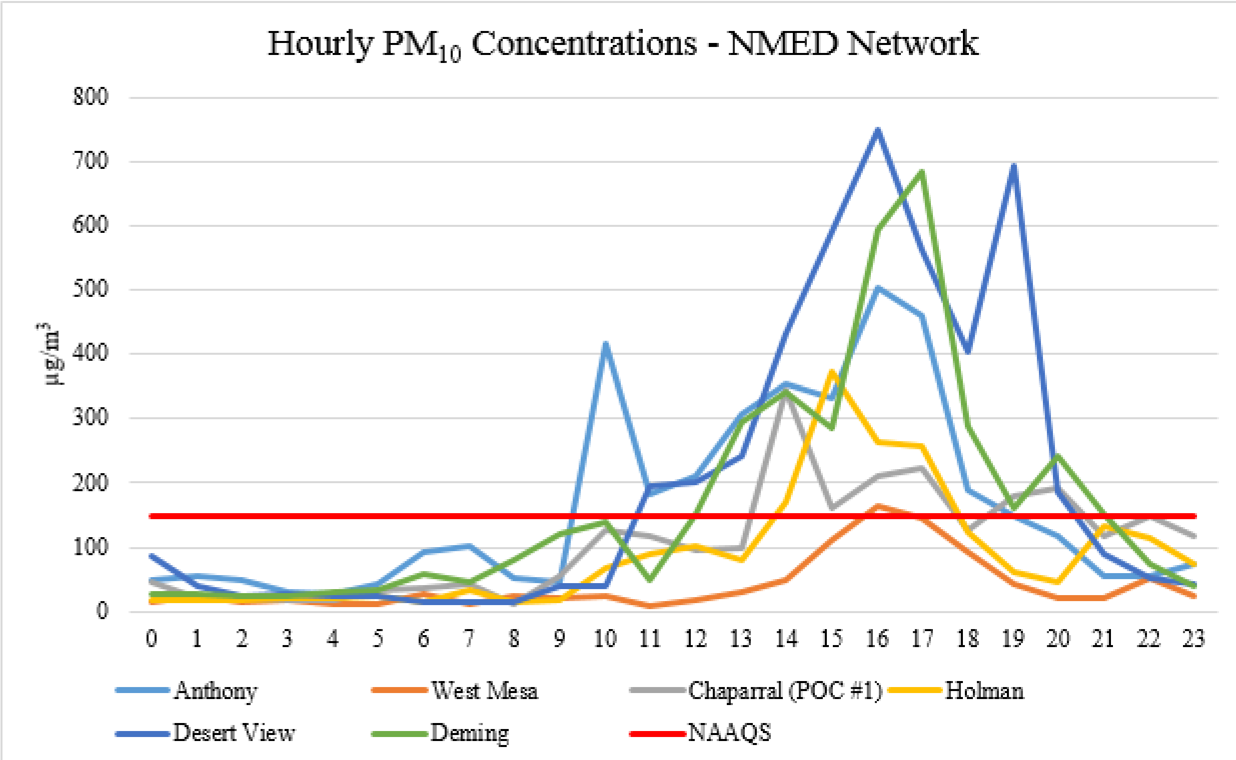

Figure 4-14. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

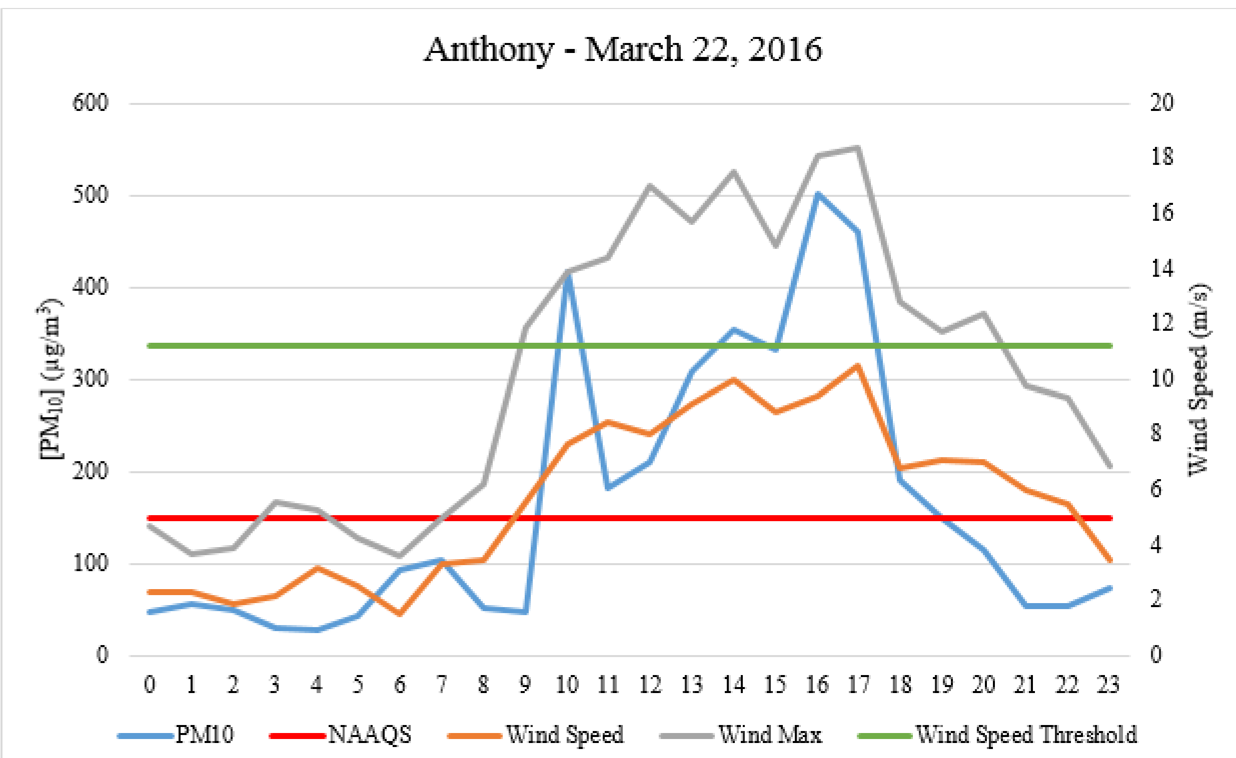

Figure 4-15. Anthony monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

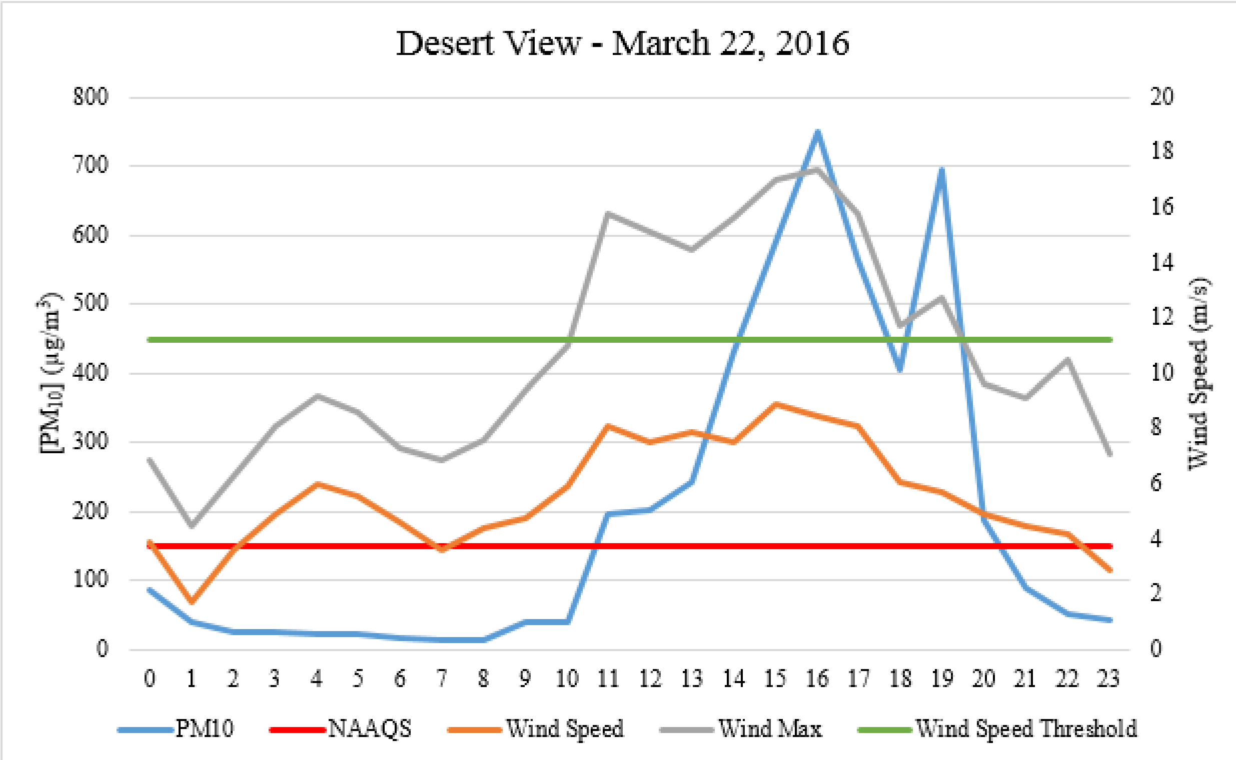

Figure 4-16. Desert View monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

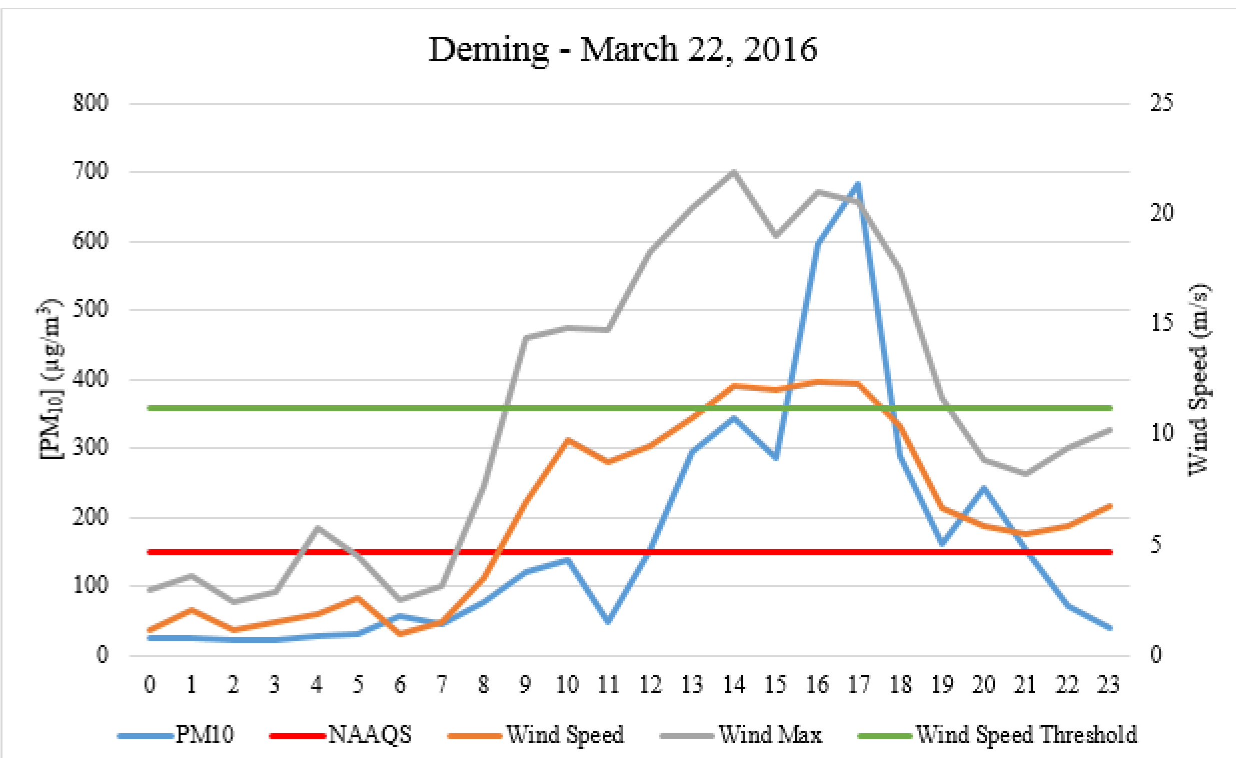

Figure 4-17. Deming monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2011-2015, both the Chaparral and Desert View monitoring sites each recorded 43 exceedances of the PM_{10} NAAQS (Figures 4-18 through-4-20). The maximum 24-hour average PM_{10} concentration at these sites were 1606 & 1691 µg/m^3 recorded in 2012. High wind blowing dust events in southern New Mexico can occur at any time of the year, but the majority of these days occur during the spring windy season, from March through May. NMED has documented that all exceedances have been caused by high wind blowing dust events.

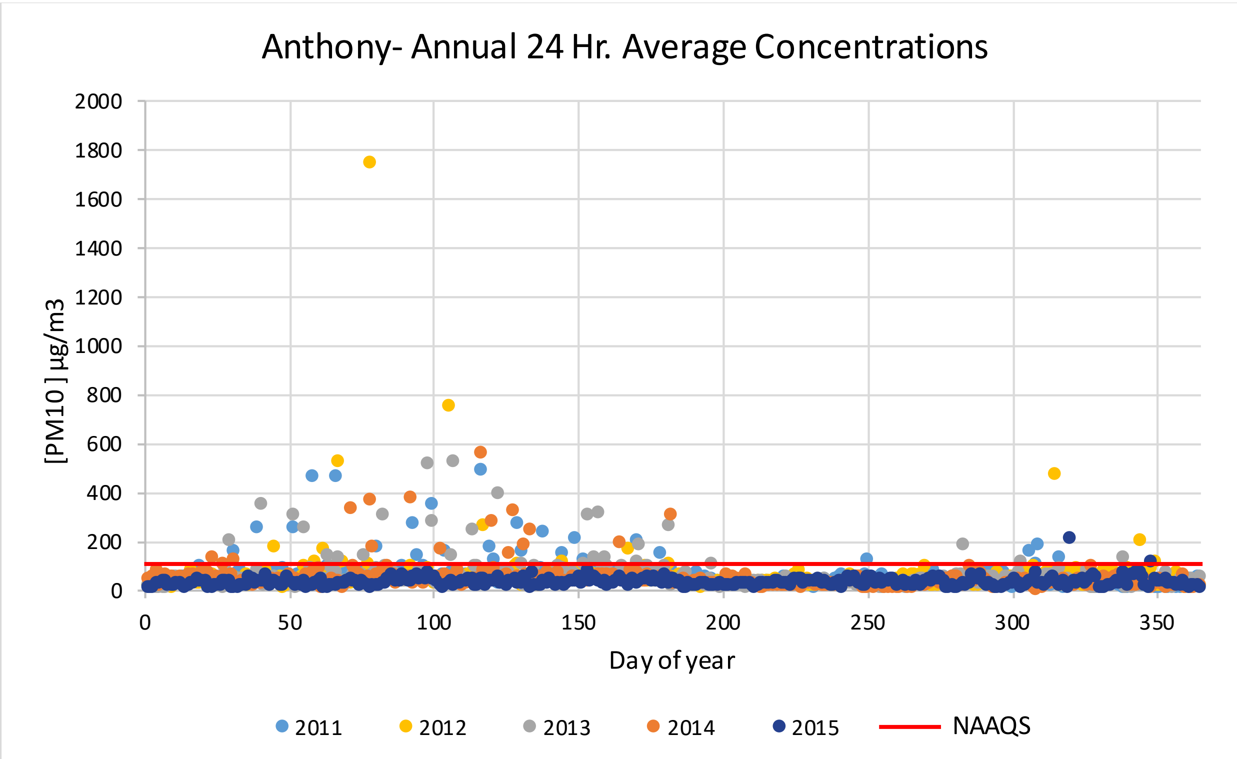

Figure 4-18. 24-hour averages for Anthony monitoring site by day of year from 2011-2015.

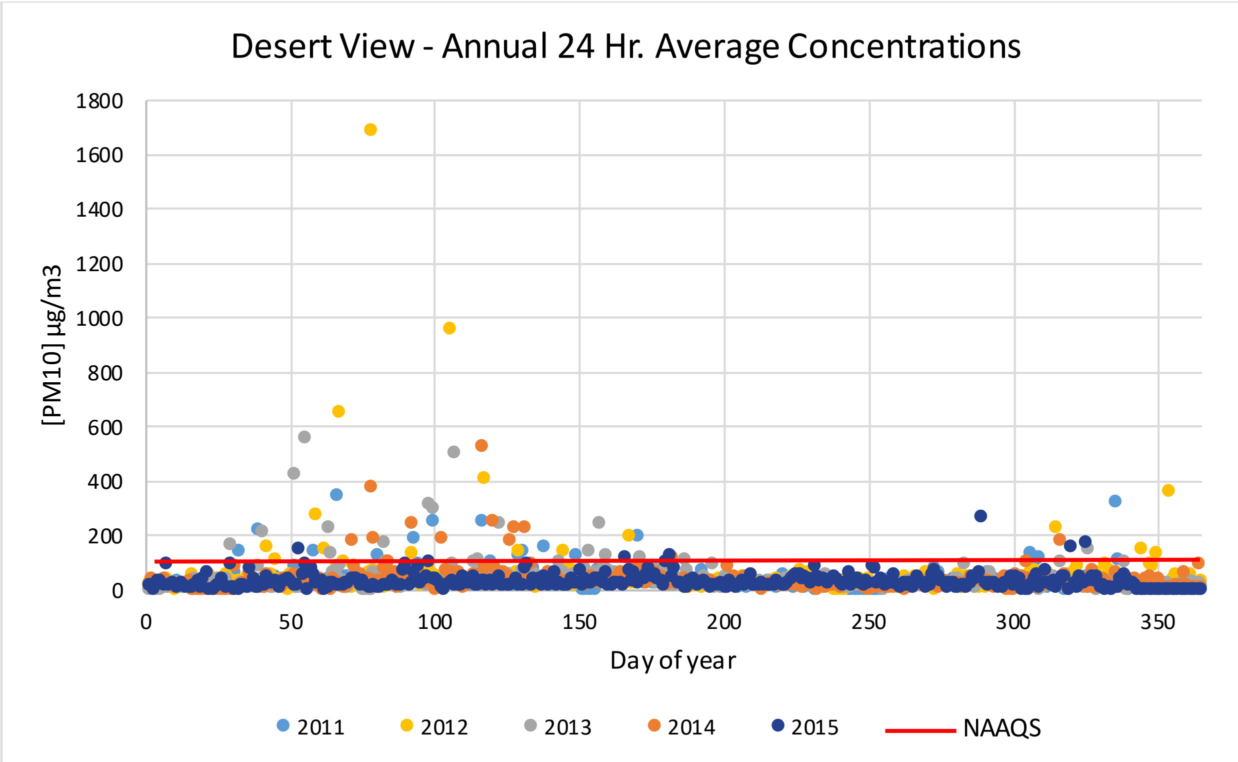

Figure 4-19. 24-hour averages for Desert View monitoring site by day of year from 2011-2015.

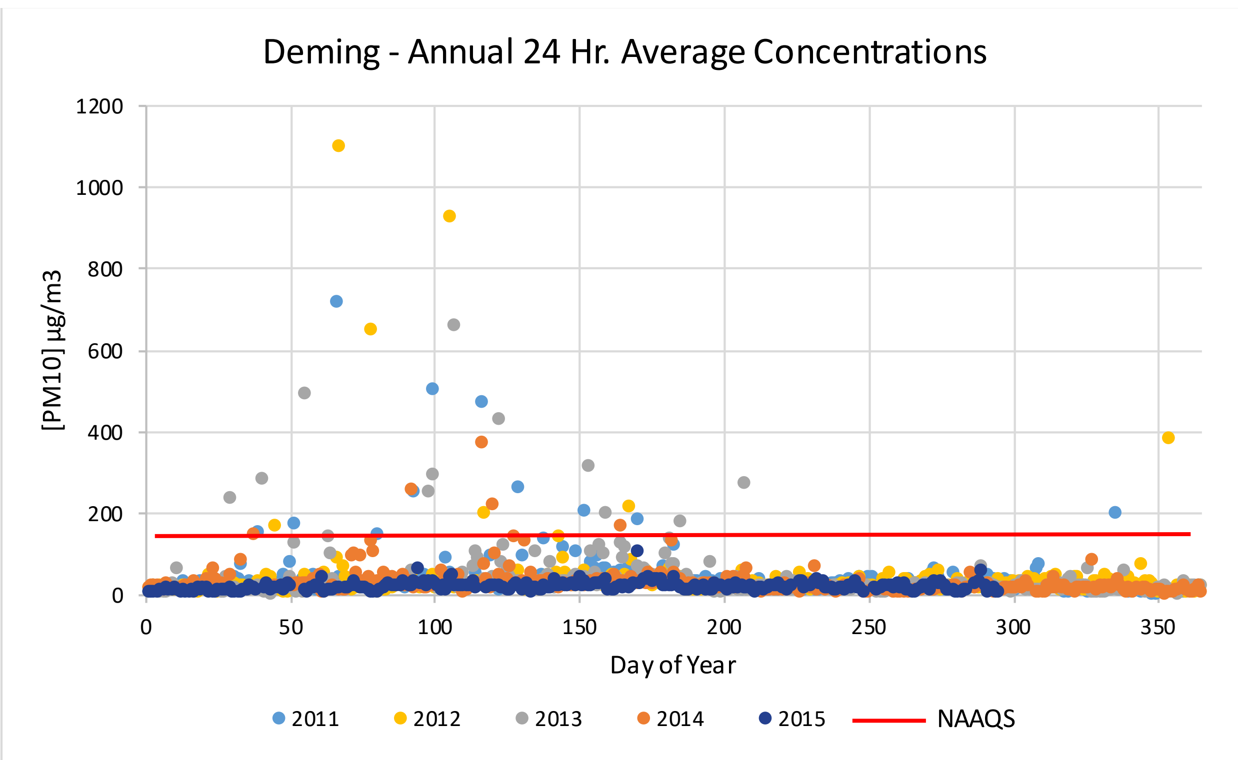

Figure 4-20. 24-hour averages for Deming monitoring site by day of year from 2011-2015.

Spatial and Temporal Variability

As demonstrated in Figure 4-21, all NMED monitoring sites recorded elevated 24-Hour Average PM_{10} concentrations compared to the days preceding and following the event. Daily averages for the days surrounding the event did not surpass 100 µg/m^3, demonstrating the influence high winds have on PM_{10} concentrations in the area.

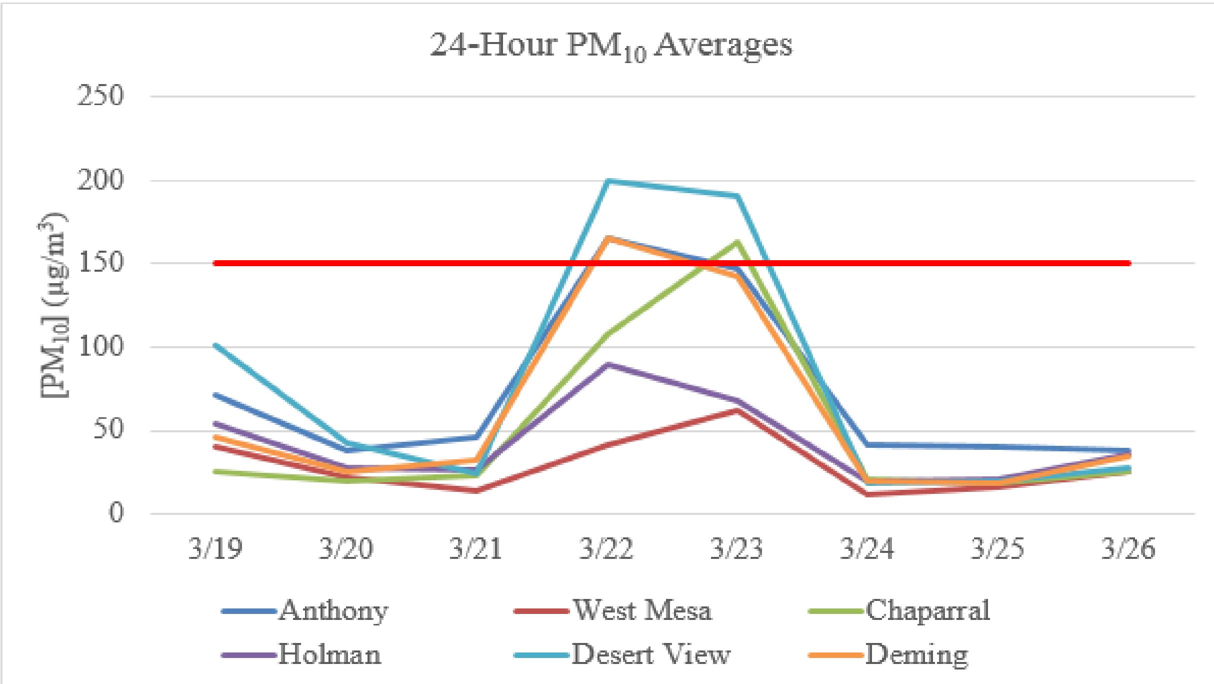

Figure 4-21. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

Percentile Ranking

Table 4-3 shows the 24-Hour Average PM_{10} data distribution recorded at NMED monitoring sites, including high wind blowing dust events flagged with a request to exclude data in the AQS database for exceedances of the standard from 2011-2015. The recorded value for this day 164 (Anthony), 199 (Desert View), & 165 (Deming) µg/m^3 are above the 95th percentile of historical data.

Statistic\Monitoring Site	Anthony	West Mesa	Chaparral	Holman	Desert View	Deming
Max	1739	487	1606	1449	1691	1098
99th Percentile	307	160	255	198	253	254
95th Percentile	99	59	91	68	99	68
75th Percentile	54	23	36	31	42	30
50th Percentile	38	16	24	21	28	20
25th Percentile	25	11	16	14	19	13
5th Percentile	13	5	6	6	9	6
Mean	49	23	36	30	40	30

Table 4-3. NMED monitoring sites PM_{10} 24-hour average data distribution. Includes data flagged in AQS for exclusion due to high wind blowing dust events (RJ).

CCR Conclusion

On this day a high wind blowing dust event occurred, generating PM_{10} emissions that resulted in elevated concentrations at Anthony, Desert View, and Deming monitoring sites. The monitored PM_{10} 24-

Hour Averages of 164 (Anthony), 199 (Desert View), and 165 (Deming) µg/m^3 are above the 95th percentile of data monitored over the previous five years. Meteorological conditions were consistent with past event days and elevated PM_{10} concentrations. The comparisons and analyses provided in the CCR section of this demonstration support NMED's position that the event affected air quality in such a way that a clear causal relationship exists between the high wind blowing dust event and the monitored exceedances on this day, satisfying the CCR criterion.

Natural Event

The CCR and nRCP analyses show that this was a natural event caused by high wind and blowing dust. Based on the documentation provided in this demonstration, the event qualifies as a natural event. The exceedances associated with the event meets the regulatory definition of a natural event at 40 CFR 50.14(b)(8). This event transported windblown dust from natural and anthropogenic sources that have been reasonably controlled and accordingly, NMED has demonstrated that the event is a natural event and may be considered for treatment as an exceptional event.

5. HIGH WIND EXCEPTIONAL EVENT: March 23, 2016

Conceptual Model

A Pacific cold front caused high winds and blowing dust in Doña Ana County resulting in an exceedance of the PM_{10} NAAQS at the Desert View and Chaparral monitoring sites on this date. In accordance with the EER, the AQB submitted this data to EPA's AQS database and flagged it (coded as RJ) as a high wind dust event (Table 5-1).

AQS Flag	AQS ID	Site Name	24-Hour Average Concentration	Max 1-Hour Wind Speed	Max Gust
RJ	35-013-0016	6ZK Chaparral	162 µg/m³	13.9 m/s	23.7 m/s
RJ	35-013-0021	6ZM Desert View	189 µg/m³	9.9 m/s	20.3 m/s

Table 5-1. 2016 PM_{10} Data flagged by NMED for exclusion pursuant to the EER.

A deep and unusually large surface low pressure system was located over eastern Colorado. A high-pressure system is extending through eastern New Mexico and west Texas as the system is keeping low level gradients rather tight. A cold front is moving eastwardly into the plains while an upper trough passes through the central and southern Rockies. Windy conditions will be sustained with this pattern across the area with a wind advisory in place.

As the storm system moved through the state, a pressure gradient formed over southeastern Arizona, southwestern New Mexico and northern Mexico (Figure 5-1). At the 1800 hour, an area of low pressure moved over the panhandle of Oklahoma and central Kansas. Aloft, the low-pressure center of the storm system hovered in Colorado. As the day progressed this low-pressure aloft traveled east and aligned itself with New Mexico and the surface wind direction (Figure 5-2). Diurnal heating of the surface allowed winds aloft to mix down, increasing the surface wind velocities and provided the turbulence required for vertical mixing and entrainment of dust.

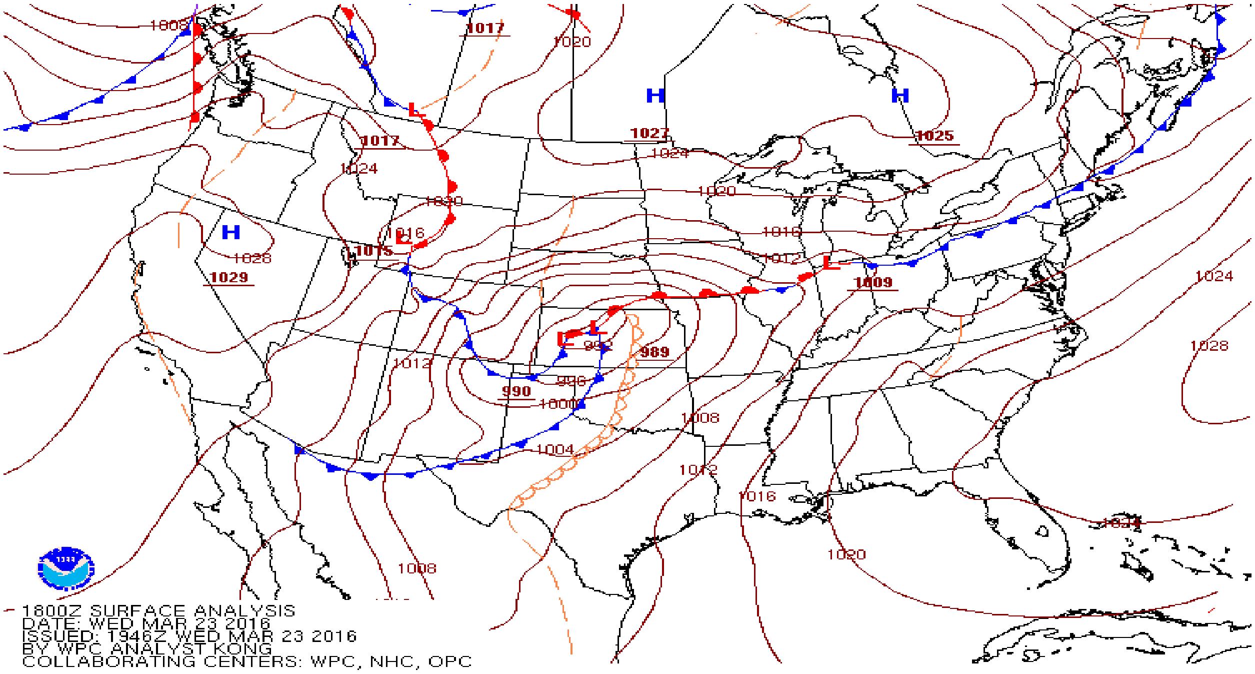

Figure 5-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

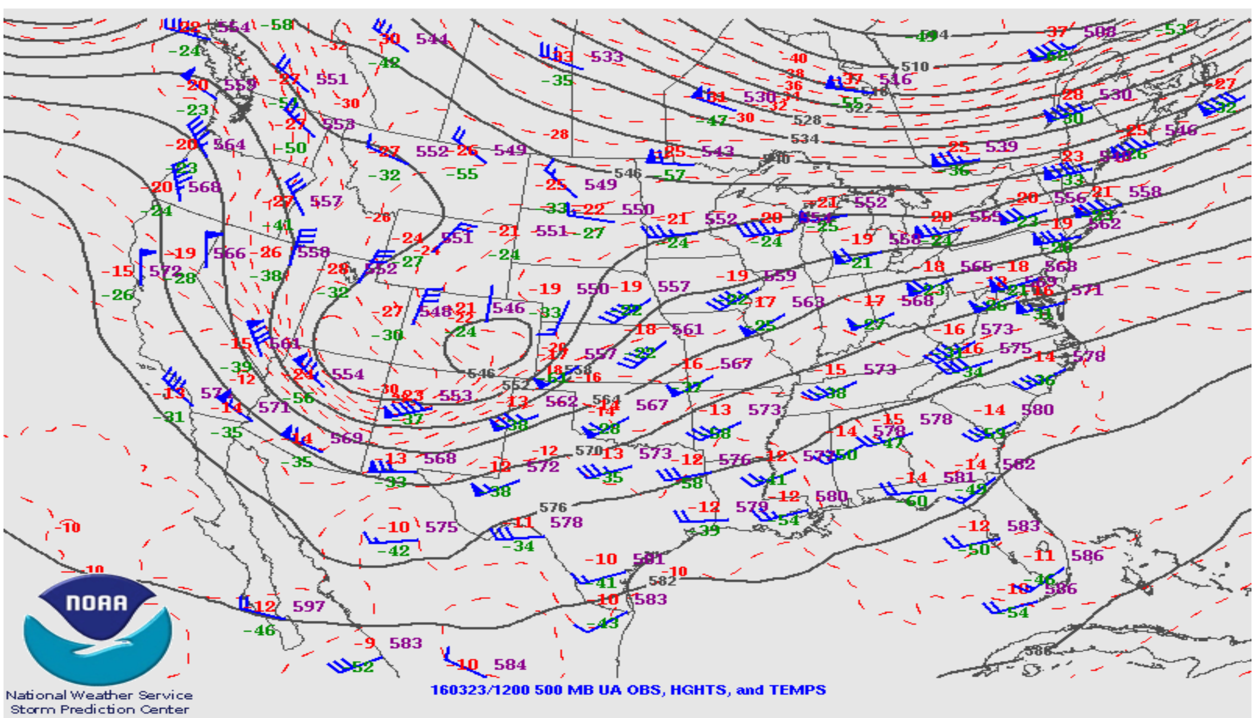

Figure 5-2. Upper air weather map for March 23, 2016 at the 1200 hour. Wind barbs depict wind speed (knots) and direction.

As the event unfolded, the wind blew from the west northwest throughout the border region. These high velocity winds passed over large areas of desert within New Mexico(Figure 5-3). Anthropogenic sources of dust near NMED's monitoring sites include: disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

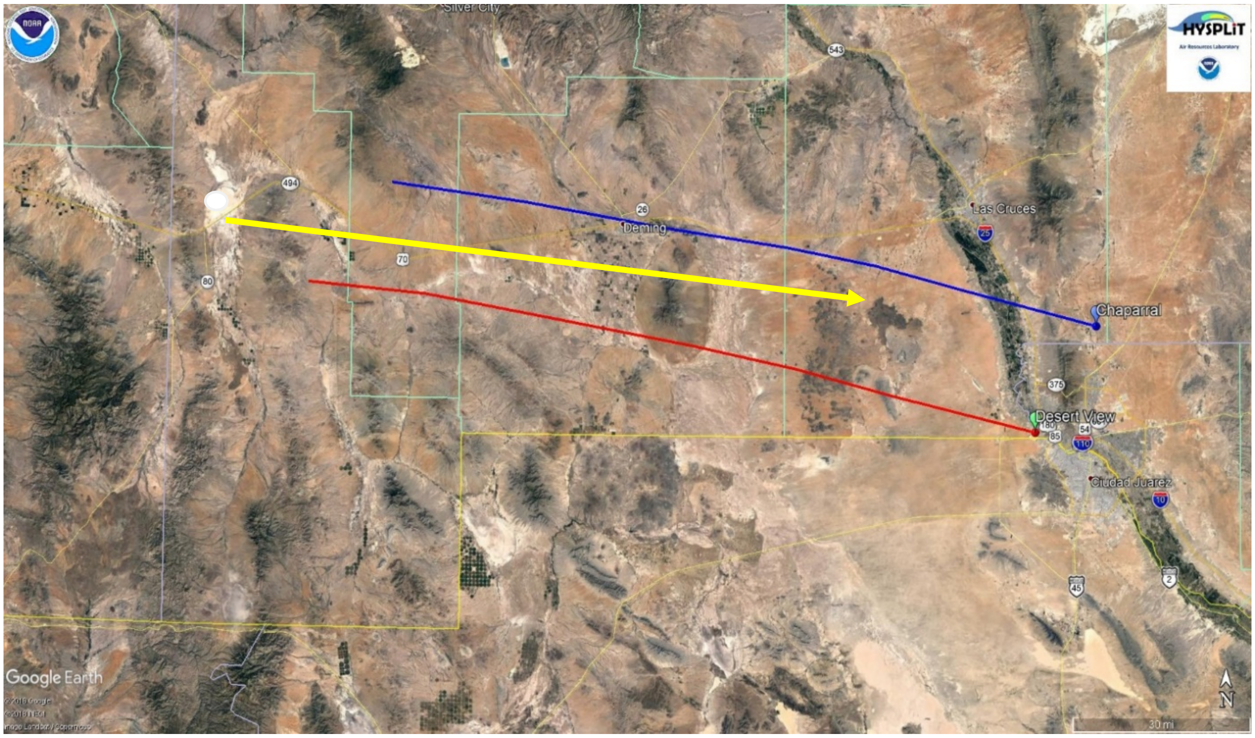

Figure 5-3. Map of NMED monitoring sites with a recorded exceedance of the NAAQS, predominant wind direction and suspected source locations for the high wind blowing dust event.

The co-occurrence of high winds and elevated levels of blowing dust, little to no point sources in the area, and the high hourly and daily PM_{10} concentrations support the assertion that this was a natural event, specifically a high wind dust event. Sustained hourly wind speeds exceeding 9 m/s (~20 mph) were recorded at Deming, Desert View and Chaparral monitoring sites beginning at the 0800 hour and lasted through the 1700 hour. PM_{10} concentrations began to exceed the NAAQS at the Desert View and Chaparral monitoring sites beginning at the 1000 hour. Hourly concentrations remained elevated through the 1700 hour. Table 5-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event.

Hour	Deming			Chaparral			Desert View		
	PM_{10} (µg/m^3)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m^3)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m^3)	Wind Speed (m/s)	Wind Gust (m/s)
0800	215	11.2	17.1	44	8.5	14.5	137	6.7	13.1
0900	175	11.7	18.6	130	10.5	18.1	125	7.2	13.6
1000	275	13	20	201	11.7	19.4	112	6.9	14.4
1100	433	13.3	21.4	296	11.9	19.8	236	8.1	17.3
1200	501	13.9	22.6	868	13.7	21.8	331	8.6	17.4
1300	711	14.3	22	353	12.7	21	332	8.5	17.5
1400	527	13.7	19.8	623	13.9	23.7	553	9.4	20.3
1500	95	11.7	15.6	682	13.9	22.2	953	9.9	19.2
1600	15	9.4	14.3	148	11.6	20.3	706	9.7	20.3
1700	9	8.1	10.7	27	8.4	14.2	158	7.9	16

Table 5-2. Hourly PM_{10}, wind speed and wind gust data during the peak hours of the event.

Meteorologists forecasted the high wind blowing dust event to occur this day, as the spring windy season begins in March for most of the southwestern United States. Forecasts predicted strong winds as the storm approached the area with the area of low pressure tracking from west to east just south of the four corners in the morning and moving across New Mexico in the afternoon. The systems movement across the area timed well with daytime heating and mixing generating a deep trough to the east as stronger winds aloft moved into the area. Many outlets also forecasted a high probability of blowing and entrained dust throughout the area and haze in the afternoon, especially in the desert areas of southern New Mexico (Figure 5-4).

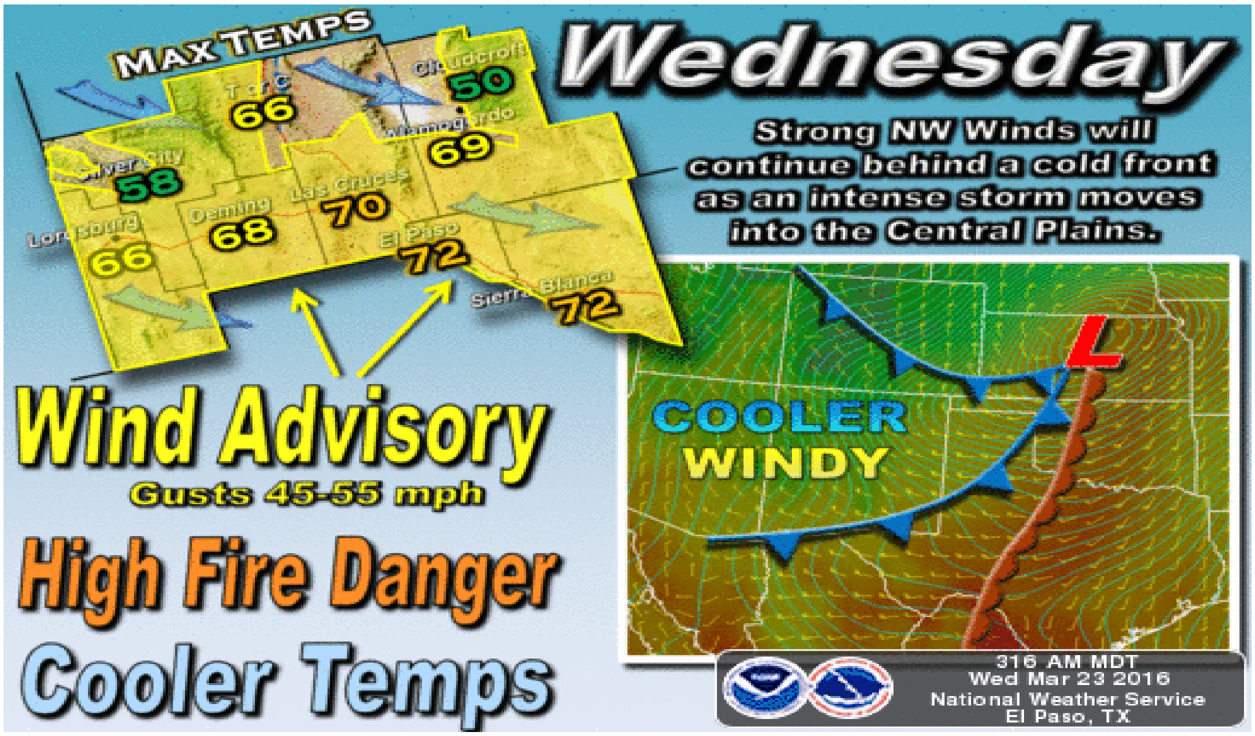

Figure 5-4. NWS Forecast Graphic for the event.

Not Reasonably Controllable or Preventable (nRCP)

Not Reasonably Preventable

This demonstration does not provide a showing of not reasonably preventable pursuant to 40 CFR 50.14(b)(5)(iv) that states, in part, "the State shall not be required to provide a case-specific justification for a high wind dust event."

Not Reasonably Controllable

The documentation provided in this section demonstrates that the wind speeds and other meteorological conditions overwhelmed the reasonable control measures in place for anthropogenic sources, causing emissions of dust that were transported to NMED's monitors.

Sustained Wind Speeds

EPA has indicated 11.2 m/s (25 mph) as the wind speed threshold at which natural or controlled anthropogenic sources will emit dust. The Deming, West Mesa, Chaparral, and Holman monitoring sites recorded wind speeds above this threshold for 8 hours from the 0800 to the 1600 hour (Figure 5-5). The Wind speeds at the upwind La Union monitoring site also reached the high wind threshold.

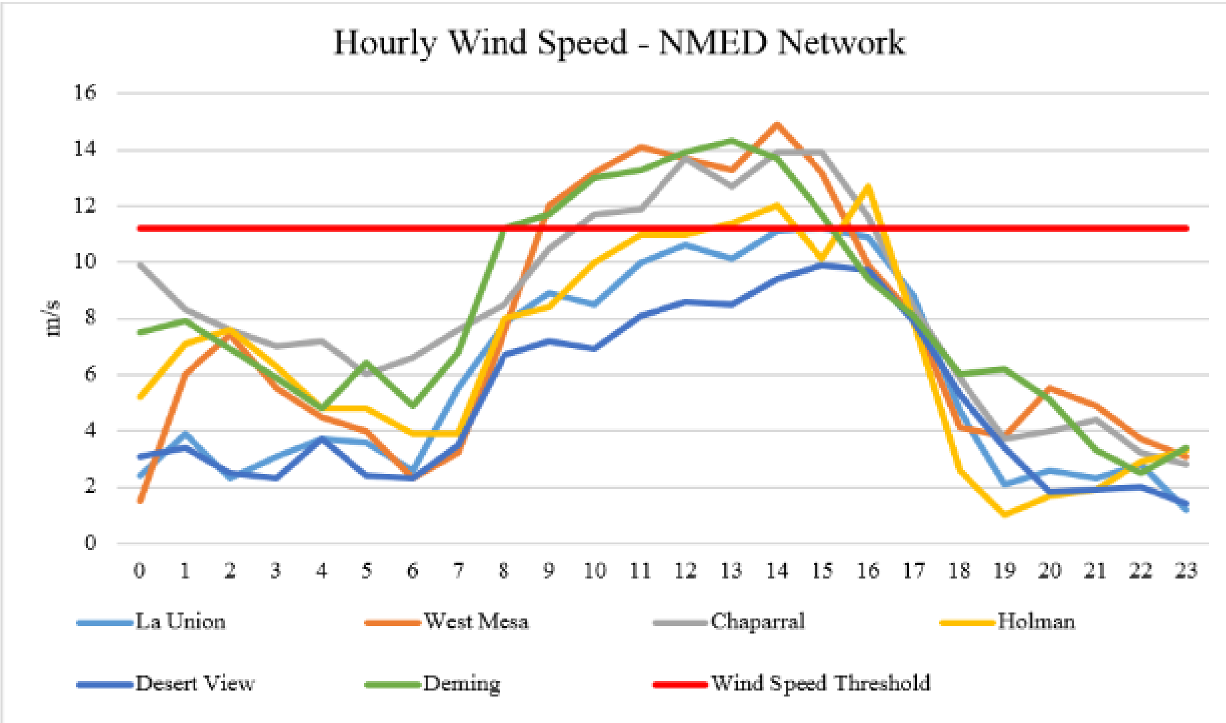

Figure 5-5. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

Level of Controls Analysis

Based on the sustained winds speeds monitored in the area during the event a basic controls analysis will be provided.

Basic Controls Analysis

Implementation and Enforcement of Control Measures

Reasonable controls for anthropogenic sources of dust are based on an area's attainment status for the PM_{10} NAAQS. It is not reasonable for areas designated as attainment, unclassifiable or maintenance to have the same level of controls as areas that are nonattainment for the standard. However, southern New Mexico has a long history of high wind blowing dust events with NMED developing a nonattainment SIP for the Anthony Area and NEAPs for the remaining portion of Doña Ana County and all of Luna County. As discussed in the Background section, NMED worked with local governments to help them develop and adopt dust control ordinances based on BACM. Based on the area's attainment status and SIP waiver, NMED believes these ordinances constitute reasonable controls.

The ordinances developed and adopted under the NEAPs are implemented and enforced at the local level with NMED playing a supporting role to ensure effective and enforceable implementation of control measures. Under the regulatory framework applicable to the two counties, NMED's purview does not include oversight of the extent of the effectiveness and enforcement of local ordinances. However, NMED believes that these ordinances are appropriately implemented at the local level.

Suspected Source Areas and Categories Contributing to the Event
Anthropogenic sources of dust in New Mexico include disturbed lands, construction and demolition activities, vacant parking lots and materials handling and transportation. Area sources account for a much larger portion of overall PM_{10} emissions than point sources. On the day of the event, no unusual PM_{10} producing activities occurred and anthropogenic point source emissions remained constant before, during and after the event. Natural areas of the Chihuahuan Desert in Doña Ana, Luna, Hidalgo and Grant Counties are the most likely sources, under NMED's jurisdiction, contributing to the high wind blowing dust event. Other area sources located in Arizona and Chihuahua, MX likely contributed to the exceedances on this day. Controlling dust from the natural desert terrain is cost prohibitive and falls outside NMED's jurisdiction when it is transported from intrastate and international sources.

The documentation and analysis presented in this section demonstrates that all identified sources that may have caused or contributed to the exceedance were reasonably controlled, implemented and enforced at the time of the event, therefore emissions associated with the high wind dust event were not reasonably controllable or preventable.

Clear Causal Relationship (CCR)

Occurrence and Geographic Extent of the Event

Satellite Imagery
The event was captured on satellite imagery with dust plumes originating upwind of NMED's monitoring sites near Ascension and Janos, Chih. This area is largely rural with the largest area sources of PM originating from agricultural activities as well as the vast desert areas and playas in northern Mexico (Figure 5-6). The northwesterly winds pushing the dust plumes of interest appear to be limited to Mexico and Arizona, orientated in a southeast fashion and traveling toward El Paso and NMED's monitoring sites at the time of the satellite pass (1344 hour MDT) that captured the imagery.

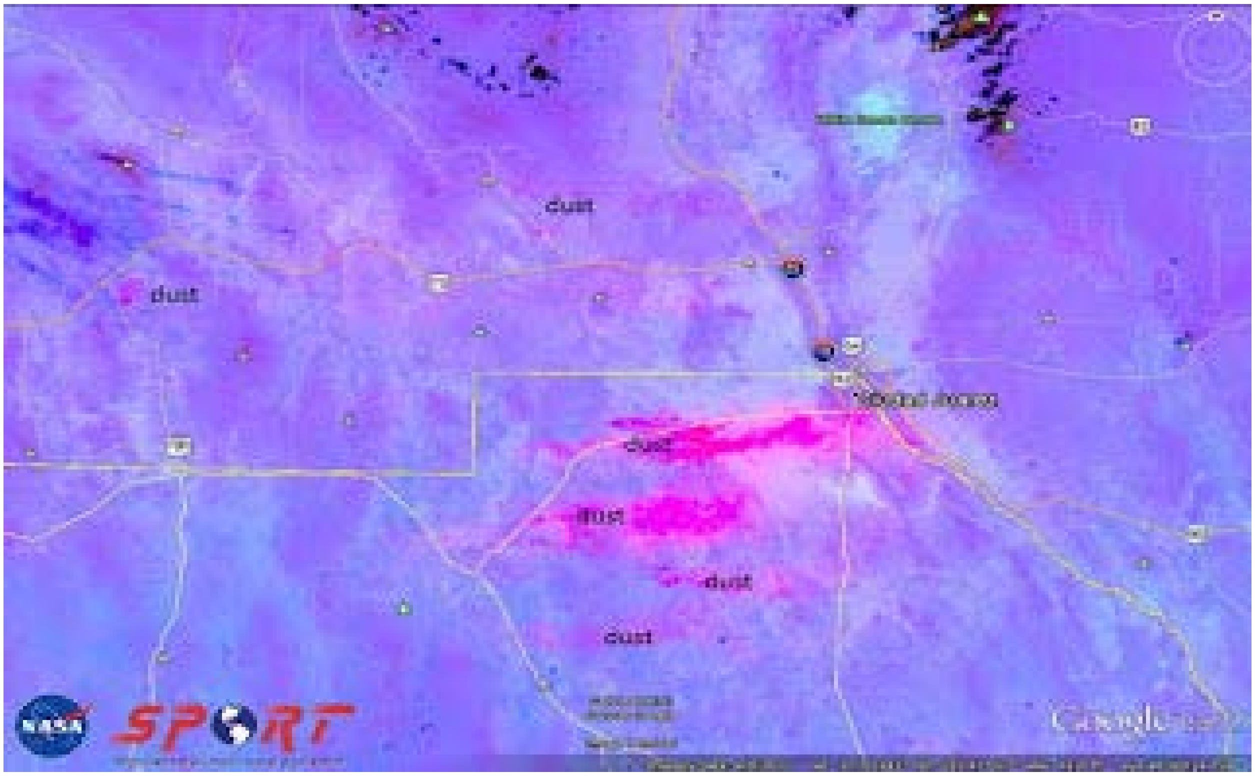

Figure 5-6. VIIRS dust product imagery obtained from NASA's SPoRT website showing southwestern New Mexico, northern Chihuahua and western Texas. Image taken from the NM Border Air Quality Blog posted by Dr. Dave Dubois, State Climatologist.

Weather Statements, Advisories, News and Other Media Reports Covering the Event

The National Weather Service (NWS) issued a Wind Advisory and a Blowing Dust Advisory for this date (Figure 5-4). A Wind Advisory is issued by NWS when sustained winds of 30 to 39 mph are expected for 1 hour or longer. A Blowing Dust Advisory is issued when blowing dust is expected to reduce visibility to between ¼ to 1 mile, generally with winds of 25 mph or greater. These were in place for southwestern New Mexico and west Texas to warn the public of the high wind event. An excerpt from the NWS Wind Advisory can be found below:

```
WEST TO NORTHWEST SURFACE WINDS WILL GUST FROM 45 TO 55 MPH THROUGH MID
AFTERNOON…WIND ADVISORY UNTIL 6 PM MDT
```

Spatial and Transport Analysis

HYSPLiT Backtrajectory Analysis

A back-trajectory analysis using the NOAA Air Resources Laboratory HYSPLIT transport and dispersion model (Draxler et al., 2015; Rolph et al., 2017) shows that the air masses traveled from eastern Arizona and Chihuahua, MX into the southern New Mexico and El Paso, TX area and on to the NMED monitoring sites. The model was run using GDAS meteorological data for the six hours preceding the start of elevated PM_{10} concentrations during the event (Figures 5-7 & 5-8). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

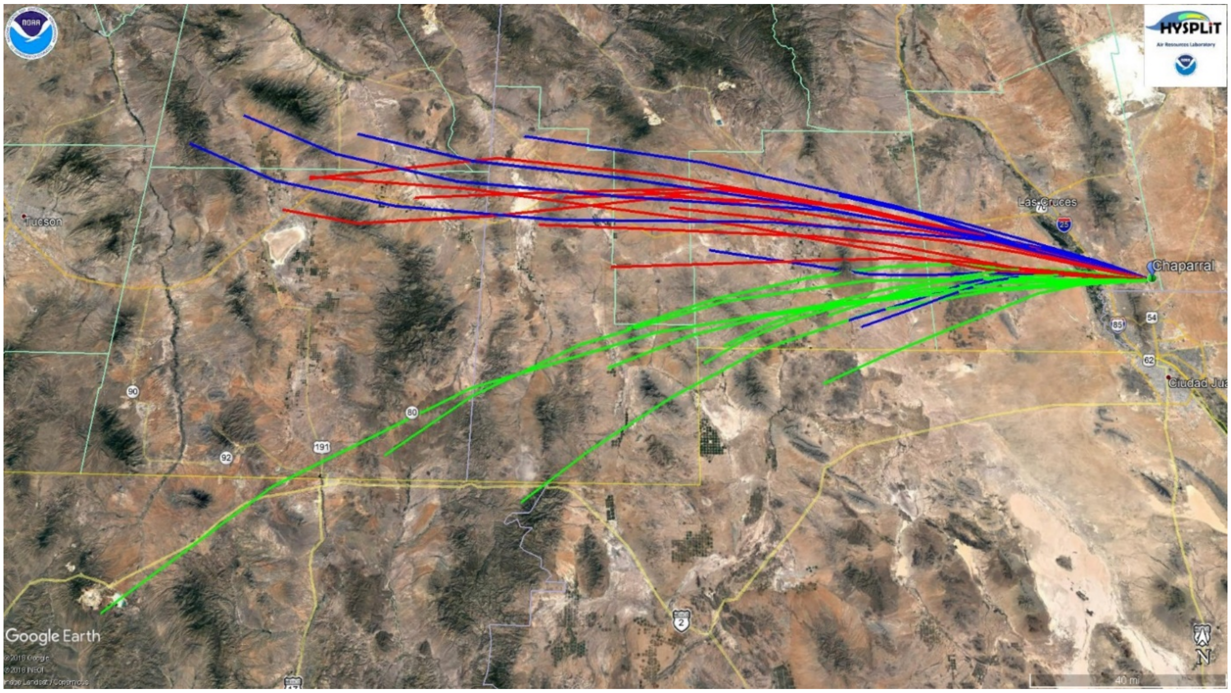

Figure 5-7. HYSPLiT back-trajectory analyses using the Ensemble mode for Chaparral monitoring site.

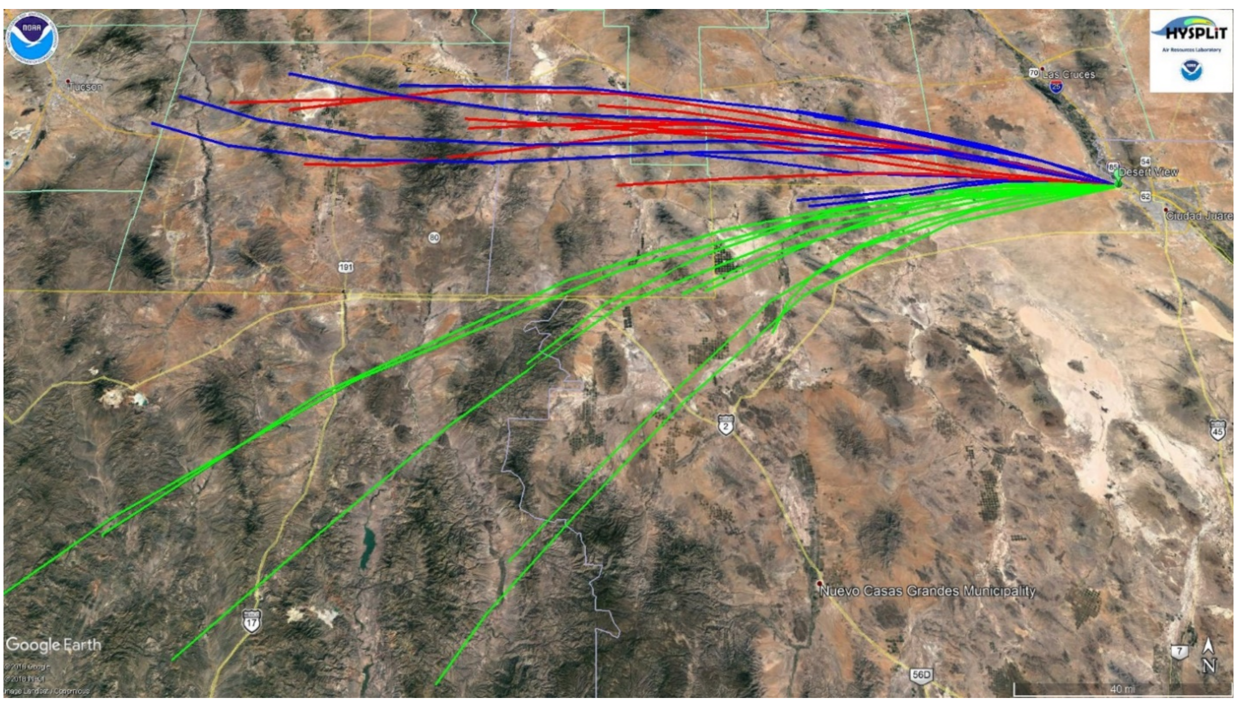

Figure 5-8. HYSPLiT back-trajectory analyses using the Ensemble mode for Desert View monitoring site.

Wind Direction and Elevated PM_{10} Concentrations

Pollution roses (Figures 5-8 & 5-9) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m^3 (1000 -1700 hour). During the event, winds blew from the west northwest approximately 100% of the time coinciding with peak PM_{10} concentrations.

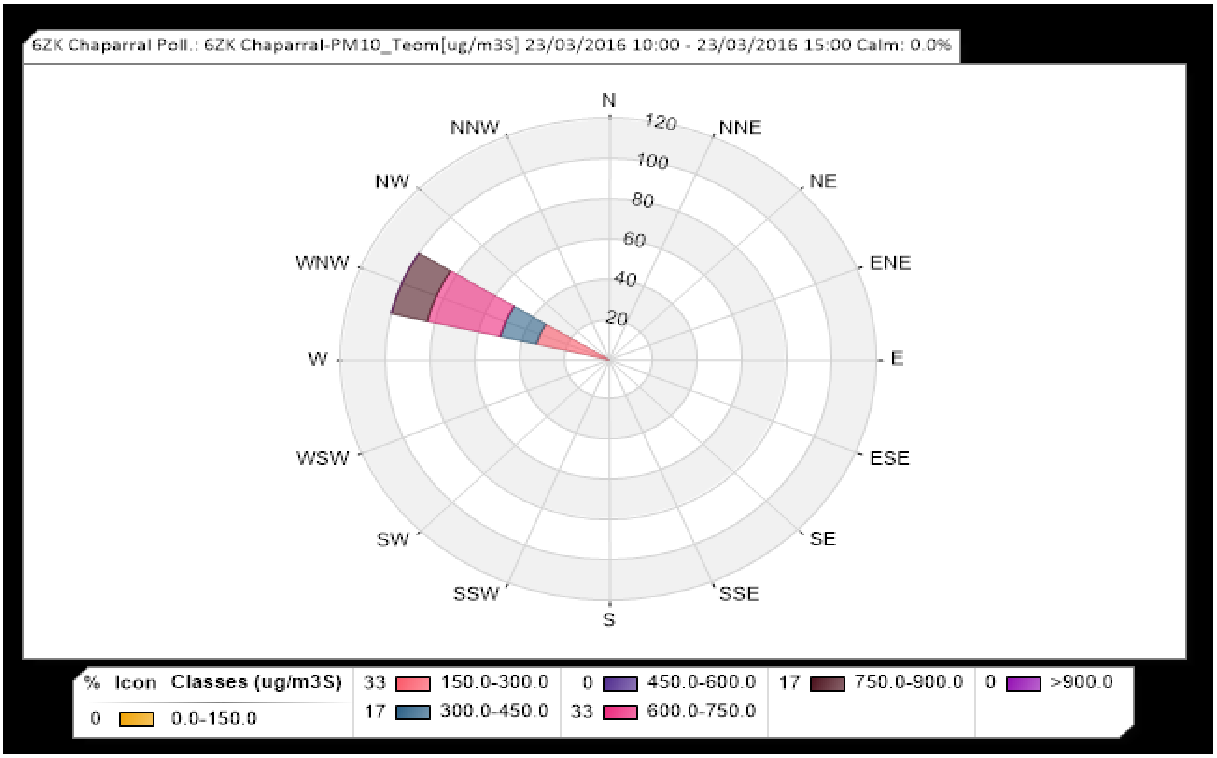

Figure 5-8. Pollution Rose for Chaparral Monitoring Site

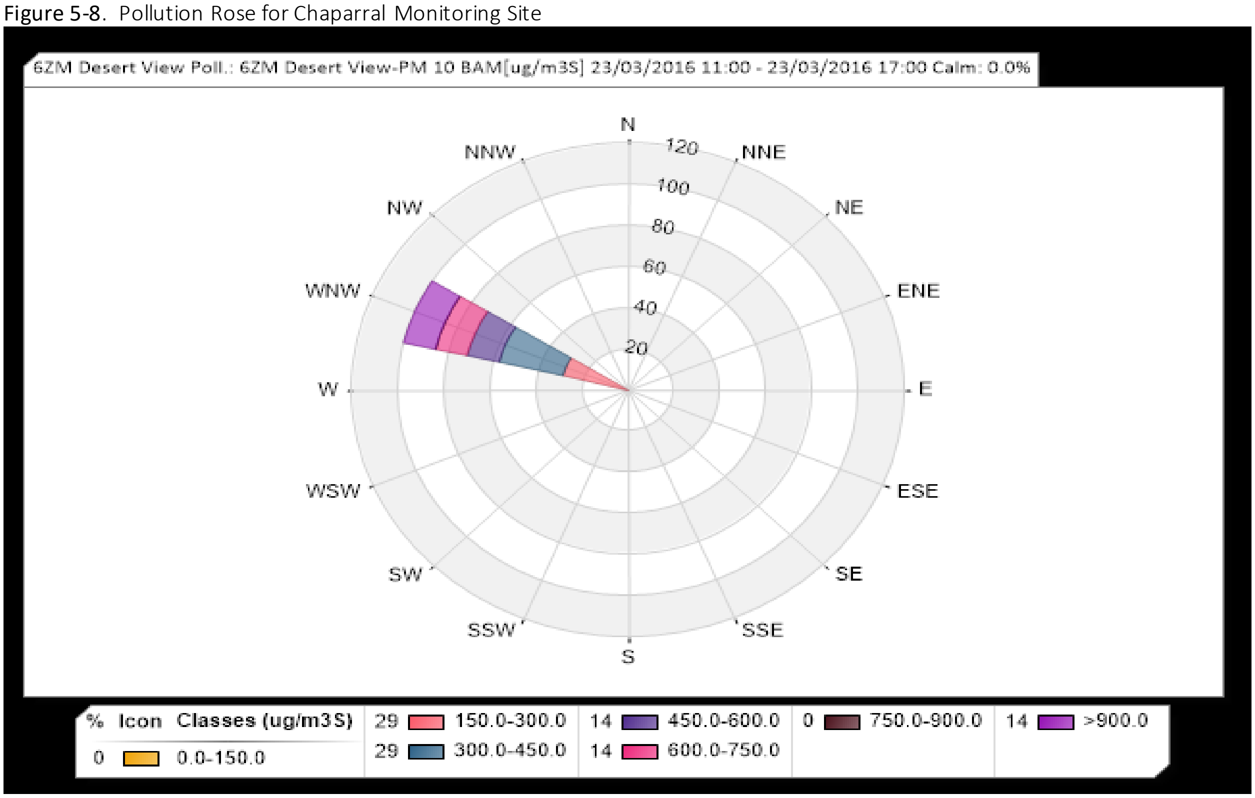

Figure 5-9. Pollution Rose for Desert View Monitoring Site

Temporal Relationship of High Wind and Elevated PM_{10} Concentrations

The high wind blowing dust event generated strong west northwesterly winds beginning at the 0800 hour and lasting through the 2100 hour. During this time, peak hourly PM_{10} concentrations ranged from

262 to 953 µg/m³ at NMED monitoring sites (Figure 5-10). Although not all NMED monitoring sites recorded an exceedance of the NAAQS, hourly PM_{10} data spiked at approximately the same time throughout the network. Sustained hourly average wind speeds of 8.5 to 14.9 m/s were recorded at the West Mesa monitoring site(s) during the peak PM_{10} concentrations of the event. The time series plot in Figures 5-11 & 5-12 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

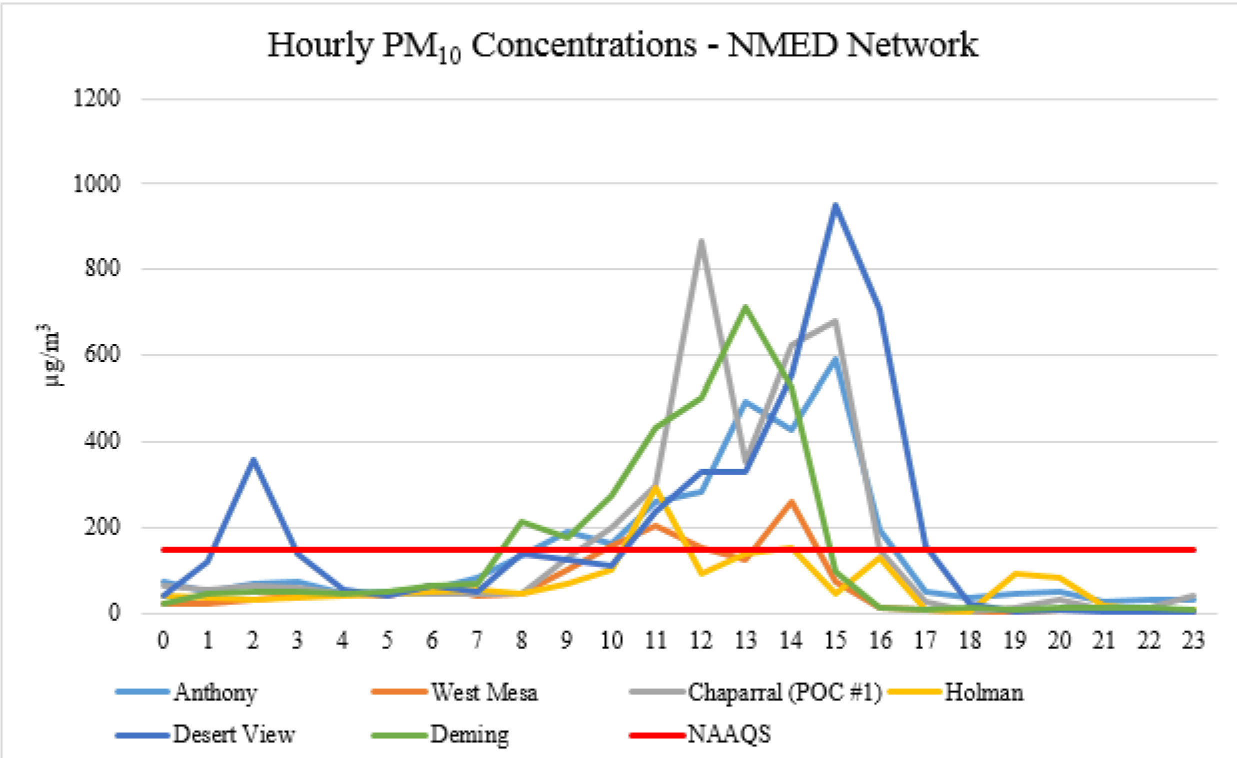

Figure 5-10. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

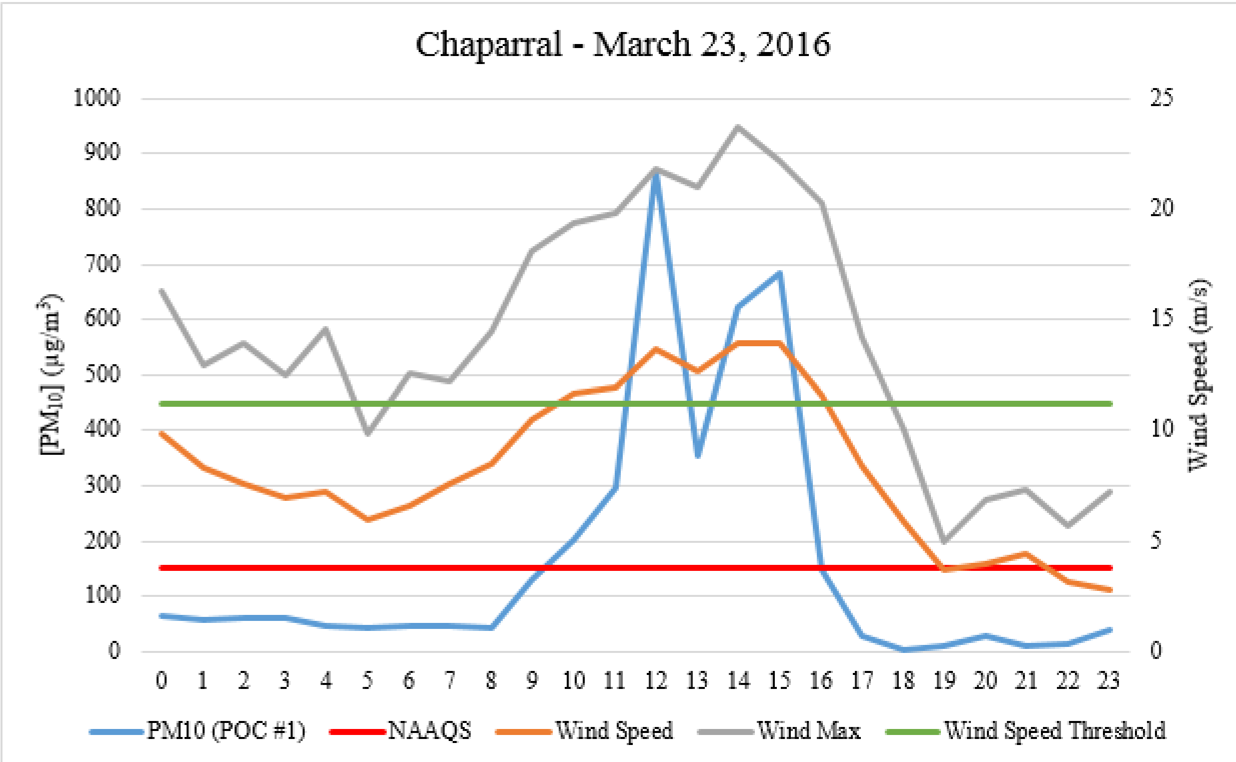

Figure 5-11. Chaparral monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

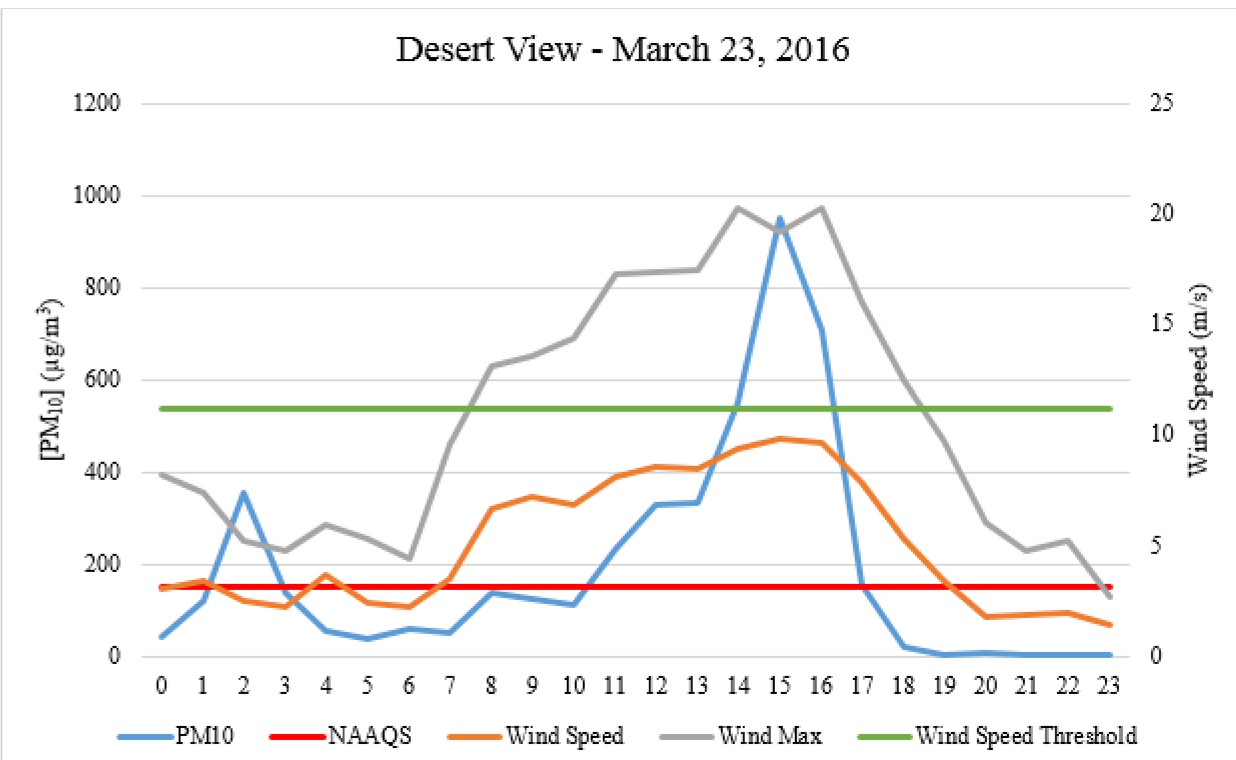

Figure 5-12. Desert View monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2011-2015, both the Chaparral & Desert View monitoring sites each recorded 43 exceedances of the PM_{10} NAAQS (Figures 5-13 & 5-14). The maximum 24-hour average PM_{10} concentrations at Chaparral and Desert View were 1606 & 1691 µg/m³, respectively, recorded in 2012. High wind blowing dust events in southern New Mexico can occur at any time of the year, but the majority of these days occur during the spring windy season, from March through May. NMED has documented that all exceedances have been caused by high wind blowing dust events.

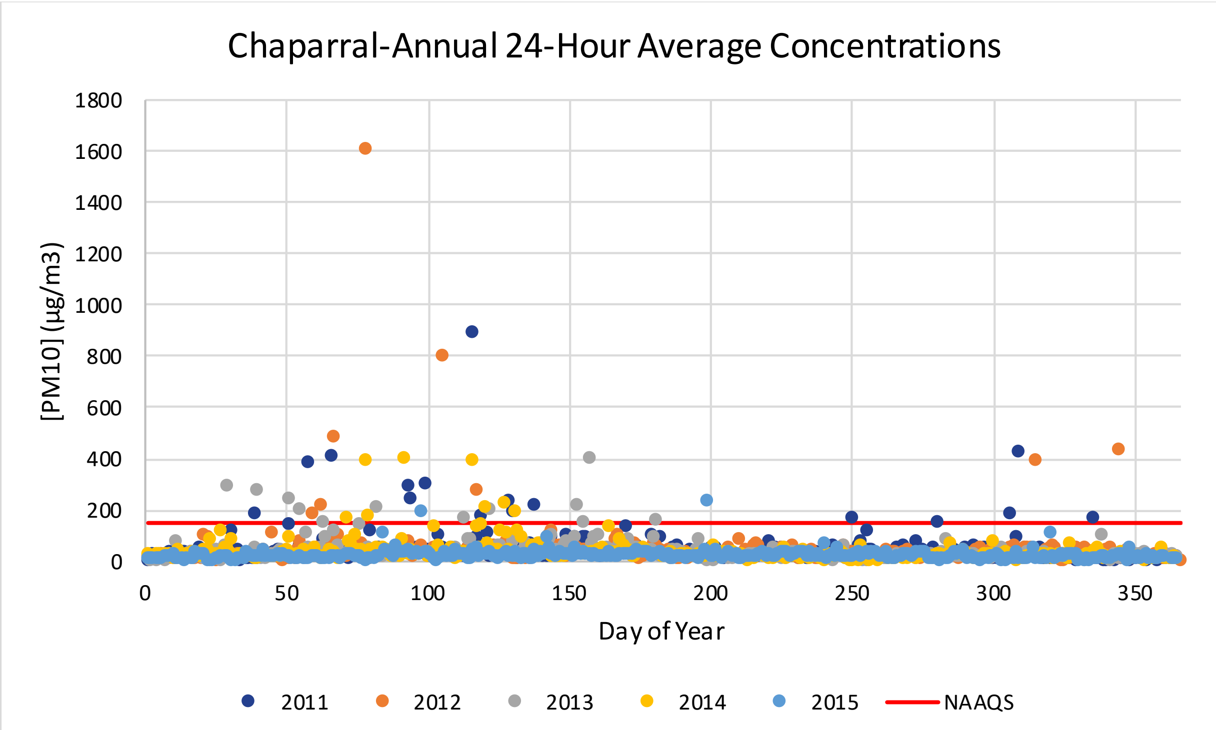

Figure 5-13. 24-hour averages by day of year from 2011-2015 for Chaparral monitoring site.

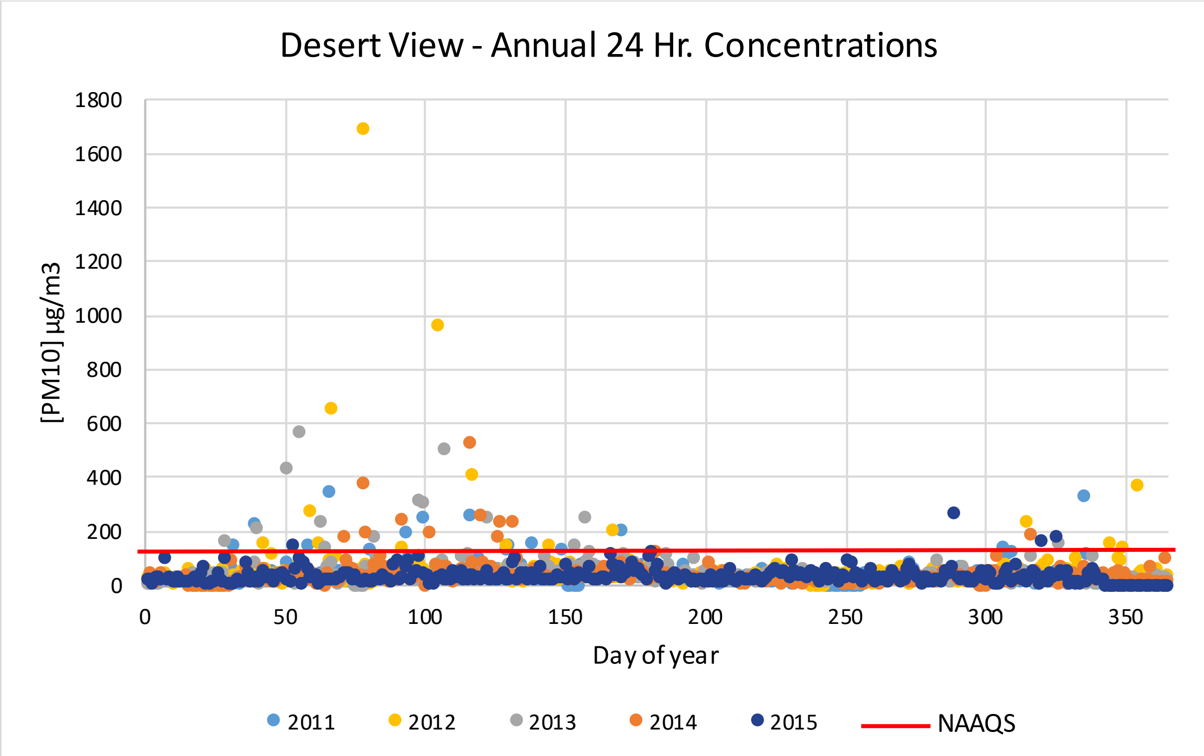

Figure 5-14. 24-hour averages by day of year from 2011-2015 for Desert View monitoring site.

Spatial and Temporal Variability

As demonstrated in Figure 5-15, all NMED monitoring sites recorded elevated 24-Hour Average PM_{10} concentrations compared to the days preceding and following the event. Daily averages for the days surrounding the event did not surpass 100 µg/m^3, demonstrating the influence high winds have on PM_{10} concentrations in the area.

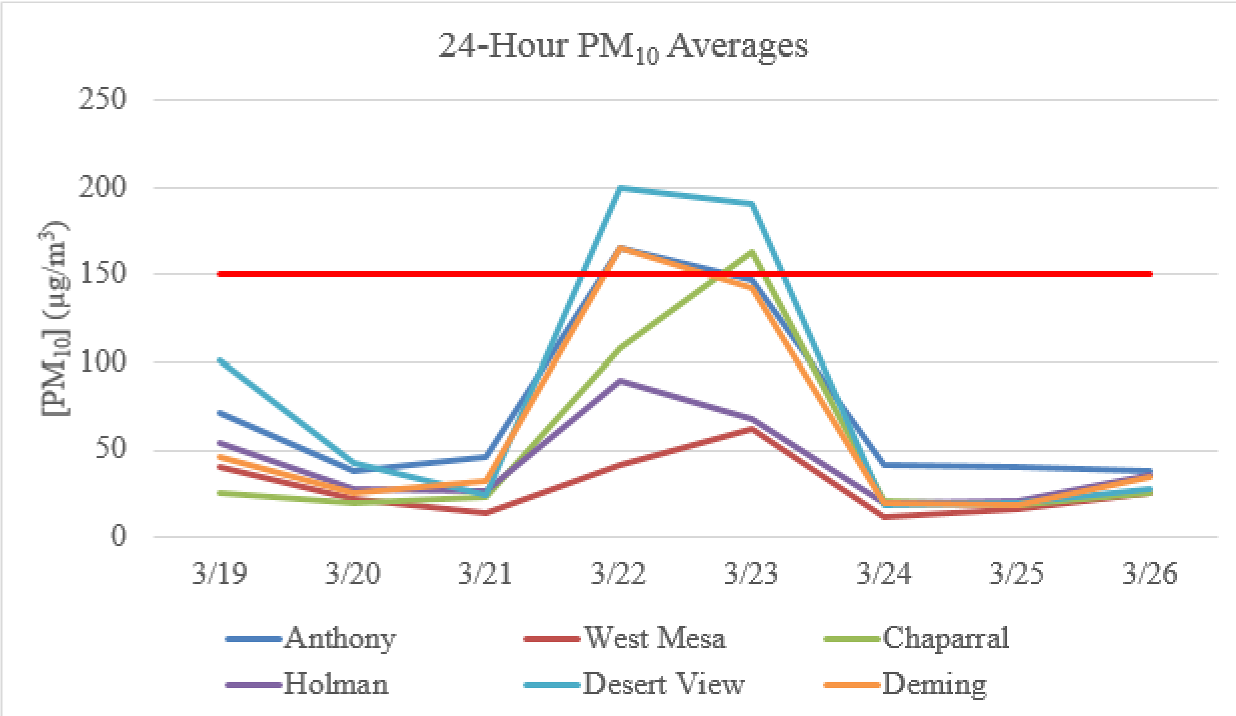

Figure 5-15. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

Percentile Ranking

Table 5-3 shows the 24-Hour Average PM_{10} data distribution recorded at NMED monitoring sites, including high wind blowing dust events flagged with a request to exclude data in the AQS database for exceedances of the standard from 2011-2015. The recorded values for this day at Chaparral and Desert View (162 & 189 µg/m^3, respectively) is above the 95th percentile of historical data.

Statistic\Monitoring Site	Anthony	West Mesa	Chaparral	Holman	Desert View	Deming
Max	1739	487	1606	1449	1691	1098
99th Percentile	307	160	255	198	253	254
95th Percentile	99	59	91	68	99	68
75th Percentile	54	23	36	31	42	30
50th Percentile	38	16	24	21	28	20
25th Percentile	25	11	16	14	19	13
5th Percentile	13	5	6	6	9	6
Mean	49	23	36	30	40	30

Table 5-3. NMED monitoring sites PM_{10} 24-hour average data distribution. Includes data flagged in AQS for exclusion due to high wind blowing dust events (RJ).

CCR Conclusion

On this day a high wind blowing dust event occurred, generating PM_{10} emissions that resulted in elevated concentrations at Chaparral and Desert View monitoring sites. The monitored PM_{10} 24-Hour Averages of 162 & 189 µg/m^3, respectively, are above the 95th percentile of data monitored over the previous five years. Meteorological conditions were consistent with past event days and elevated PM_{10} concentrations. The comparisons and analyses provided in the CCR section of this demonstration support NMED's position that the event affected air quality in such a way that a clear causal relationship exists between the high wind blowing dust event and the monitored exceedances on this day, satisfying the CCR criterion.

Natural Event

The CCR and nRCP analyses show that this was a natural event caused by high wind and blowing dust. Based on the documentation provided in this demonstration, the event qualifies as a natural event. The exceedances associated with the event meets the regulatory definition of a natural event at 40 CFR 50.14(b)(8). This event transported windblown dust from natural and anthropogenic sources that have been reasonably controlled and accordingly, NMED has demonstrated that the event is a natural event and may be considered for treatment as an exceptional event.

6. HIGH WIND EXCEPTIONAL EVENT: March 29, 2016

Conceptual Model

A Pacific cold front caused high winds and blowing dust in Doña Ana County resulting in an exceedance of the PM_{10} NAAQS at the Anthony and Desert View monitoring sites on this date. In accordance with the EER, the AQB submitted this data to EPA's AQS database and flagged it (coded as RJ) as a high wind dust event (Table 6-1).

AQS Flag	AQS ID	Site Name	24-Hour Average Concentration	Max 1-Hour Wind Speed	Max Gust
RJ	35-013-0016	6CM Anthony	219µg/m³	12.2m/s	19.5m/s
RJ	35-013-0021	6ZM Desert View	212µg/m³	8.7m/s	17.5m/s

Table 6-1. 2016 PM_{10} Data flagged by NMED for exclusion pursuant to the EER.

As the storm system moved through the state, a pressure gradient formed over southeastern Arizona, southwestern New Mexico and northern Mexico (Figure 6-1). At the 1800 hour, an area of low pressure moved over the Four Corners area. Aloft, the low-pressure center of the storm system hovered over eastern Nevada and western Utah. As the day progressed this low-pressure aloft traveled east and aligned itself with New Mexico and the surface wind direction (Figure 6-2). Diurnal heating of the surface allowed winds aloft to mix down, increasing the surface wind velocities and provided the turbulence required for vertical mixing and entrainment of dust.

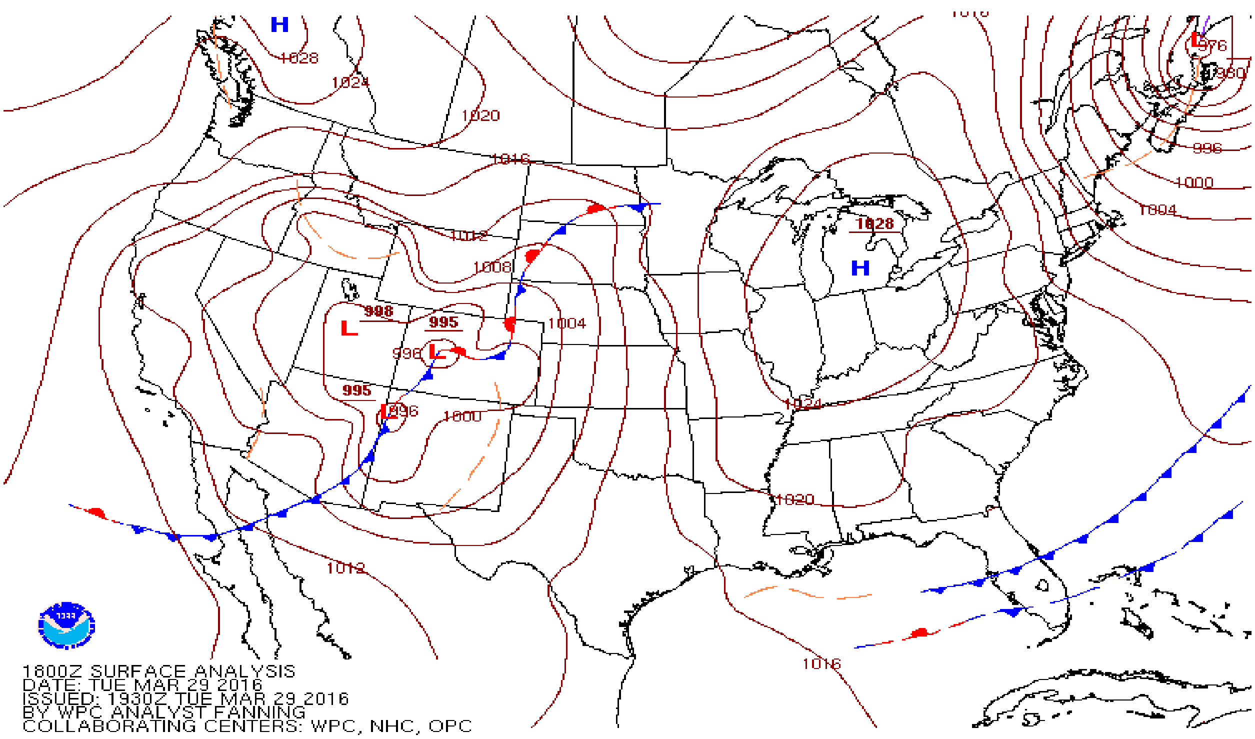

Figure 6-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

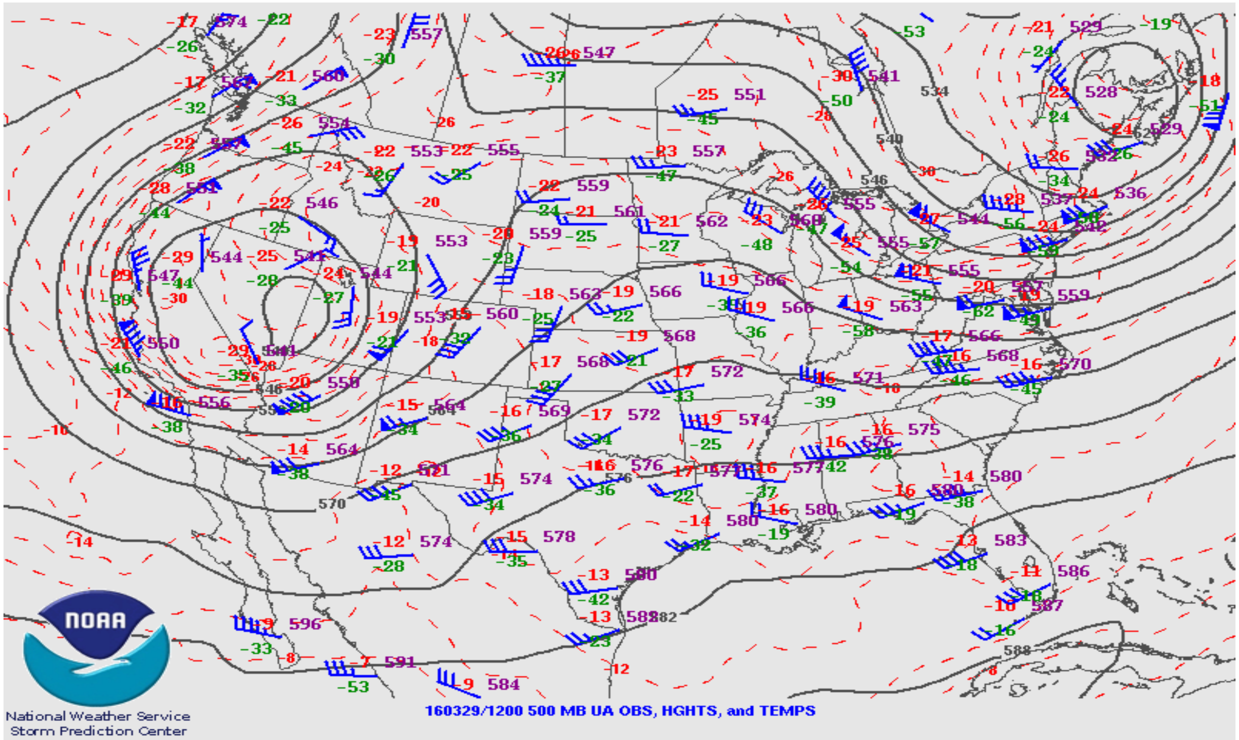

Figure 6-2. Upper air weather map for March 29, 2016 at the 1200 hour. Wind barbs depict wind speed (knots) and direction.

As the event unfolded, the wind blew from the southwest throughout the border region. These high velocity winds passed over large areas of desert within New Mexico and Mexico (Figure 6-3). Anthropogenic sources of dust near NMED's monitoring sites include: disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

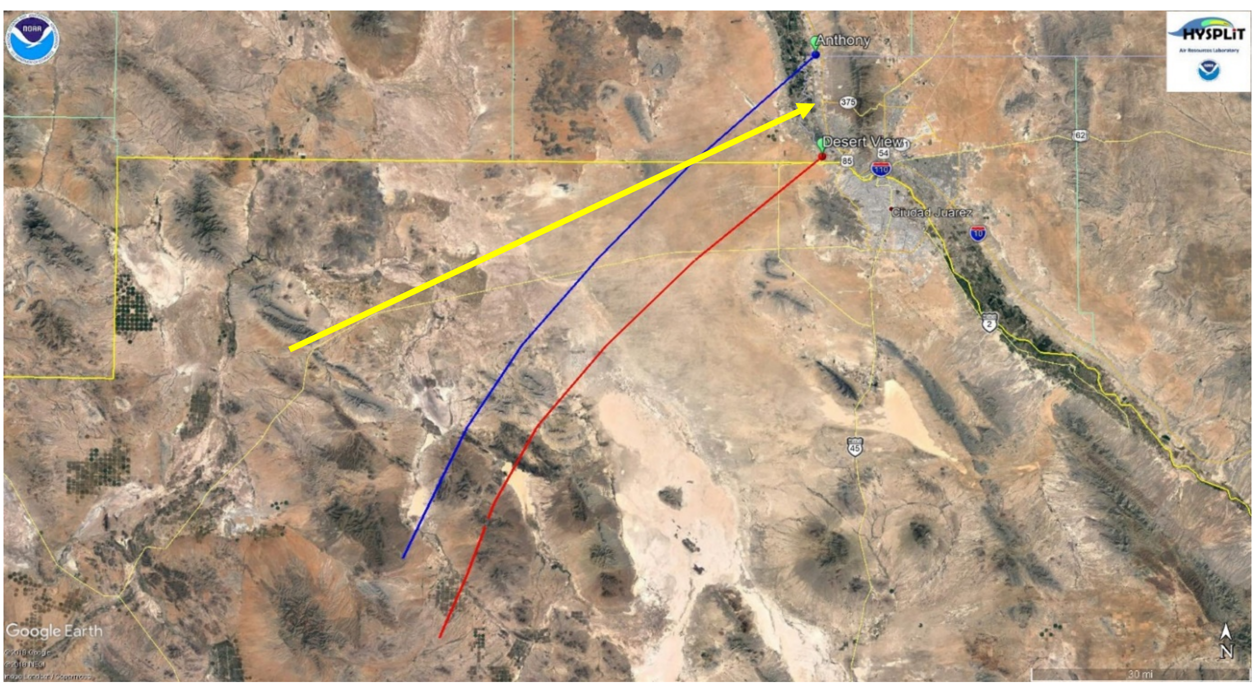

Figure 6-3. Map of NMED monitoring sites with a recorded exceedance of the NAAQS, predominant wind direction and suspected source locations for the high wind blowing dust event.

The co-occurrence of high winds and elevated levels of blowing dust, little to no point sources in the area, and the high hourly and daily PM_{10} concentrations support the assertion that this was a natural event, specifically a high wind dust event. Sustained hourly wind speeds exceeding 9 m/s (~20 mph) were recorded at the West Mesa, Holman, and Deming, monitoring sites beginning at the 1000 hour and lasted through the 2200 hour. PM_{10} concentrations began to exceed the NAAQS at the Holman monitoring site beginning at the 1000 hour. Hourly concentrations remained elevated through the 2100 hour. Table 6-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event.

Hour	Holman			Anthony			Desert View		
	PM_{10} (μg/m^3)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (μg/m^3)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (μg/m^3)	Wind Speed (m/s)	Wind Gust (m/s)
1000	182	12.5	20.8	84	5.8	11.9	76	6.3	12.1
1100	457	14.2	21.8	173	6.7	13.2	69	5.9	11.6
1200	333	13.8	22.6	74	5.8	10.7	31	4.3	10
1300	985	15	24.8	47	6.3	11.5	111	5.9	13
1400	425	14.2	22.1	396	7.9	14	367	6.4	14.7
1500	331	12.8	22.1	1209	10.4	19	985	7.5	14.1
1600	153	10.8	17.3	1158	12.2	19.5	985	8.7	17.5
1700	78	9.4	15.7	769	10.8	17.5	695	8.4	15.3
1800	39	6.2	12.4	399	9.1	15.2	528	7.9	16
1900	27	6.7	11.4	248	8.1	12.9	224	7	13.6
2000	16	8.2	14.3	151	7.7	13.8	511	7.8	14.6
2100	23	6.9	10.9	133	8.5	15.3	174	7.6	15.2

Table 6-2. Hourly PM_{10}, wind speed and wind gust data during the peak hours of the event.

Meteorologists forecasted the high wind blowing dust event to occur this day, as the spring windy season begins in March for most of the southwestern United States. Forecasts predicted strong winds as the storm approached the area with the area of low pressure tracking from west to east from upper Nevada down to western Arizona. The high-pressure system pushed down towards the Baja Peninsula to make its way northeast across New Mexico. The system's movement across the area timed well with daytime heating and mixing generating a deep trough to the east as stronger winds aloft moved into the area. Many outlets also forecasted a high probability of blowing and entrained dust throughout the area and haze in the afternoon, especially in the desert areas of southern New Mexico (Figure 6-2).

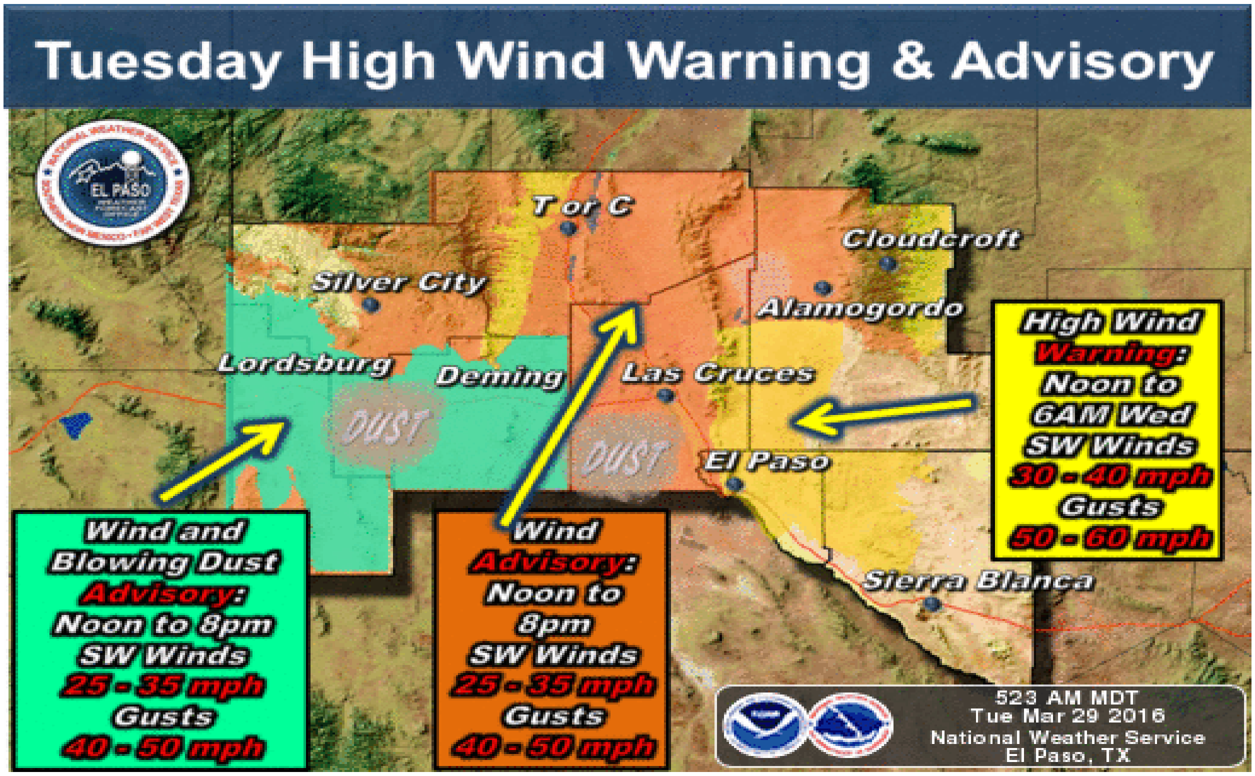

Figure 6-4. NWS Forecast Graphic for the event.

Not Reasonably Controllable or Preventable (nRCP)

Not Reasonably Preventable

This demonstration does not provide a showing of not reasonably preventable pursuant to 40 CFR 50.14(b)(5)(iv) that states, in part, “the State shall not be required to provide a case-specific justification for a high wind dust event.”

Not Reasonably Controllable

The documentation provided in this section demonstrates that the wind speeds and other meteorological conditions overwhelmed the reasonable control measures in place for anthropogenic sources, causing emissions of dust that were transported to NMED’s monitors.

Sustained Wind Speeds

EPA has indicated 11.2 m/s (25 mph) as the wind speed threshold at which natural or controlled anthropogenic sources will emit dust. The West Mesa and Holman monitoring sites recorded wind speeds above this threshold for 7 hours from the 1000 to the 1700 hour (Figure 6-5). The wind speeds at the upwind Deming monitoring site also reached the high wind threshold.

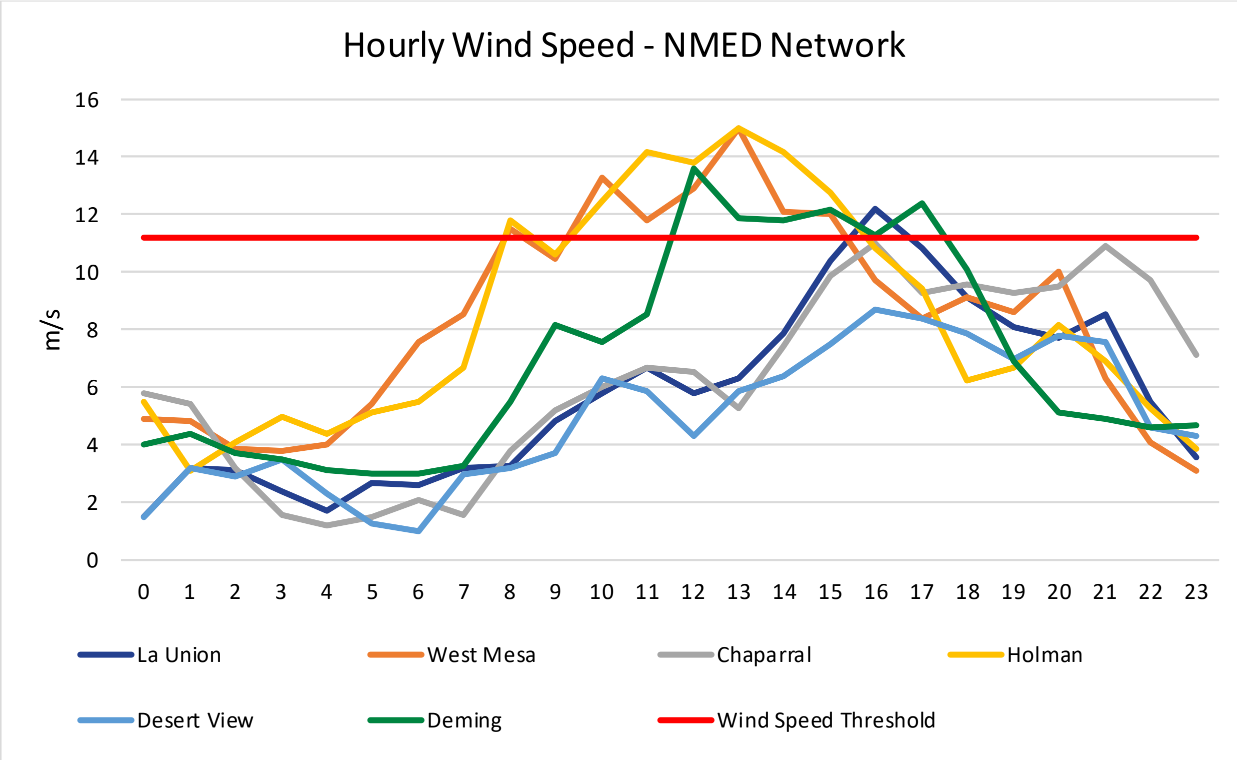

Figure 6-5. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

Level of Controls Analysis

Based on the sustained winds speeds monitored in the area during the event a basic controls analysis will be provided.

Basic Controls Analysis

Implementation and Enforcement of Control Measures

Reasonable controls for anthropogenic sources of dust are based on an area's attainment status for the PM_{10} NAAQS. It is not reasonable for areas designated as attainment, unclassifiable or maintenance to have the same level of controls as areas that are nonattainment for the standard. However, southern New Mexico has a long history of high wind blowing dust events with NMED developing a nonattainment SIP for the Anthony Area and NEAPs for the remaining portion of Doña Ana County and all of Luna County. As discussed in the Background section, NMED worked with local governments to help them develop and adopt dust control ordinances based on BACM. Based on the area's attainment status and SIP waiver, NMED believes these ordinances constitute reasonable controls.

The ordinances developed and adopted under the NEAPs are implemented and enforced at the local level with NMED playing a supporting role to ensure effective and enforceable implementation of control measures. Under the regulatory framework applicable to the two counties, NMED's purview does not include oversight of the extent of the effectiveness and enforcement of local ordinances. However, NMED believes that these ordinances are appropriately implemented at the local level.

Suspected Source Areas and Categories Contributing to the Event

Anthropogenic sources of dust in New Mexico include disturbed lands, construction and demolition activities, vacant parking lots and materials handling and transportation. Area sources account for a

much larger portion of overall PM_{10} emissions than point sources. On the day of the event, no unusual PM_{10} producing activities occurred and anthropogenic point source emissions remained constant before, during and after the event. Natural areas of the Chihuahuan Desert in Doña Ana, Luna, Hidalgo and Grant Counties) are the most likely sources, under NMED's jurisdiction, contributing to the high wind blowing dust event. Other area sources located in Arizona and Chihuahua, MX likely contributed to the exceedances on this day. Controlling dust from the natural desert terrain is cost prohibitive and falls outside NMED's jurisdiction when it is transported from intrastate and international sources.

The documentation and analysis presented in this section demonstrates that all identified sources that may have caused or contributed to the exceedance were reasonably controlled, implemented and enforced at the time of the event, therefore emissions associated with the high wind dust event were not reasonably controllable or preventable.

Clear Causal Relationship (CCR)

Occurrence and Geographic Extent of the Event

Weather Statements, Advisories, News and Other Media Reports Covering the Event

The National Weather Service (NWS) issued a Wind Advisory and a Blowing Dust Advisory for this date (Figure 6-4). A Wind Advisory is issued by NWS when sustained winds of 30 to 39 mph are expected for 1 hour or longer. A Blowing Dust Advisory is issued when blowing dust is expected to reduce visibility to between ¼ to 1 mile, generally with winds of 25 mph or greater. These were in place for southwestern New Mexico and west Texas to warn the public of the high wind event. An excerpt from the NWS Wind Advisory can be found below:

```
VERY WINDY DAY TODAY…BLOWING DUST ADVISORY TO DESERT AREAS WEST OF LAS
CRUCES…HIGH WIND WARNING FROM NOON TODAY TO 6 AM MDT WEDNESDAY…BLOWING DUST
ADVISORY FROM NOON TODAY TO 8 PM MDT THIS EVENING
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The NM Department of Transportation issued a press release dated March 29, 2016 titled "High Winds Expected with Blowing Dust" to inform the public of the dangers while driving in low visibility conditions due to blowing dust caused by high winds (Figure 6-6).

New Mexico DEPARTMENT OF TRANSPORTATION
MOBILITY FOR EVERYONE

Susana Martinez
Governor

Tom Church
Cabinet Secretary

March 29, 2016

Press Release

High Winds Expected With Blowing Dust

Las Cruces, NM — The New Mexico Department of Transportation (NMDOT) will be monitoring roadway conditions with law enforcement as high wind advisories have been issued by the National Weather Service. The NMDOT would like to remind the traveling public that blowing dust can escalate to blinding dust storms as they move quickly through remote areas. If you must travel, we recommend that you monitor local forecast conditions prior to starting your trip, and visit our web site as roadway conditions change throughout the state of New Mexico.

Roadway advisories will be posted on www.nmroads.com, or by calling 511. If you are approaching a dust storm or caught in a dust storm, the below tips can help keep you safe.

- Avoid driving into or through a dust storm.
- Do not wait until poor visibility makes it difficult to safely pull off the roadway — do it as soon as possible. Completely exit the highway if you can.
- If you encounter a dust storm, check traffic immediately around your vehicle (front, back and to the side) and begin slowing down.
- Do not stop in the roadway; pull completely out of the travel lanes and as far into the right shoulder as possible.
- Stop the vehicle in a position ensuring it is a safe distance from the main roadway and away from where other vehicles may travel.
- Turn off all vehicle lights, including your emergency flashers.
- Set your emergency brake and take your foot off the brake.
- Stay in the vehicle with your seat belts buckled and wait for the storm to pass.
- Drivers of high-profile vehicles should be especially aware of changing weather conditions and travel at reduced speeds.

For questions regarding this release you may contact Bridget Spedalieri NMDOT (575) 525-7340, email bridget.spedalieri@state.nm,.us

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Figure 6-6. NM Department of Transportation "High wind Dust Event" press release dated March 29, 2016.

Spatial and Transport Analysis

HYSPLiT Backtrajectory Analysis

A back-trajectory analysis using the NOAA Air Resources Laboratory HYSPLIT transport and dispersion model (Draxler et al., 2015; Rolph et al., 2017) shows that the air masses traveled from Chihuahua, MX into the southern New Mexico and El Paso, TX area and on to the NMED monitoring sites. The model was run using GDAS meteorological data for the six hours preceding the start of elevated PM_{10} concentrations during the event (Figures 6-7 & 6-8). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

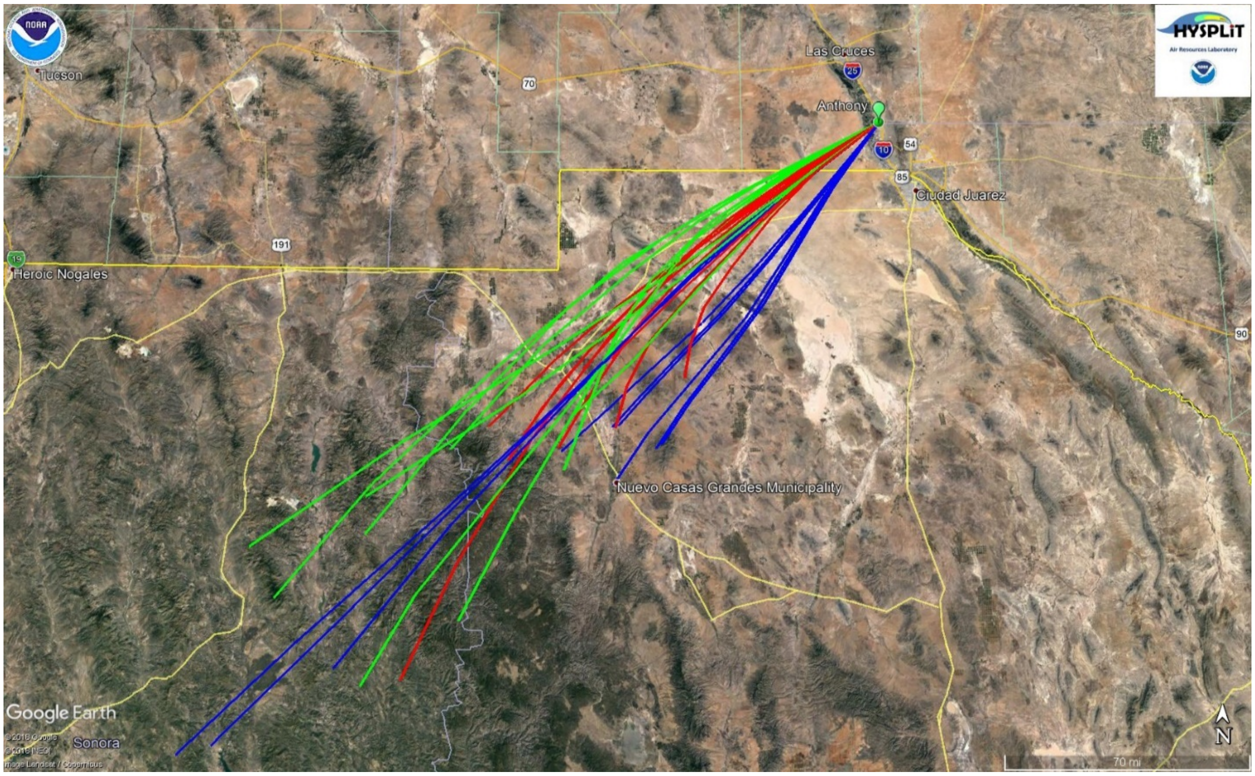

Figure 6-7. HYSPLiT back-trajectory analyses for Anthony monitoring station using the Ensemble mode.

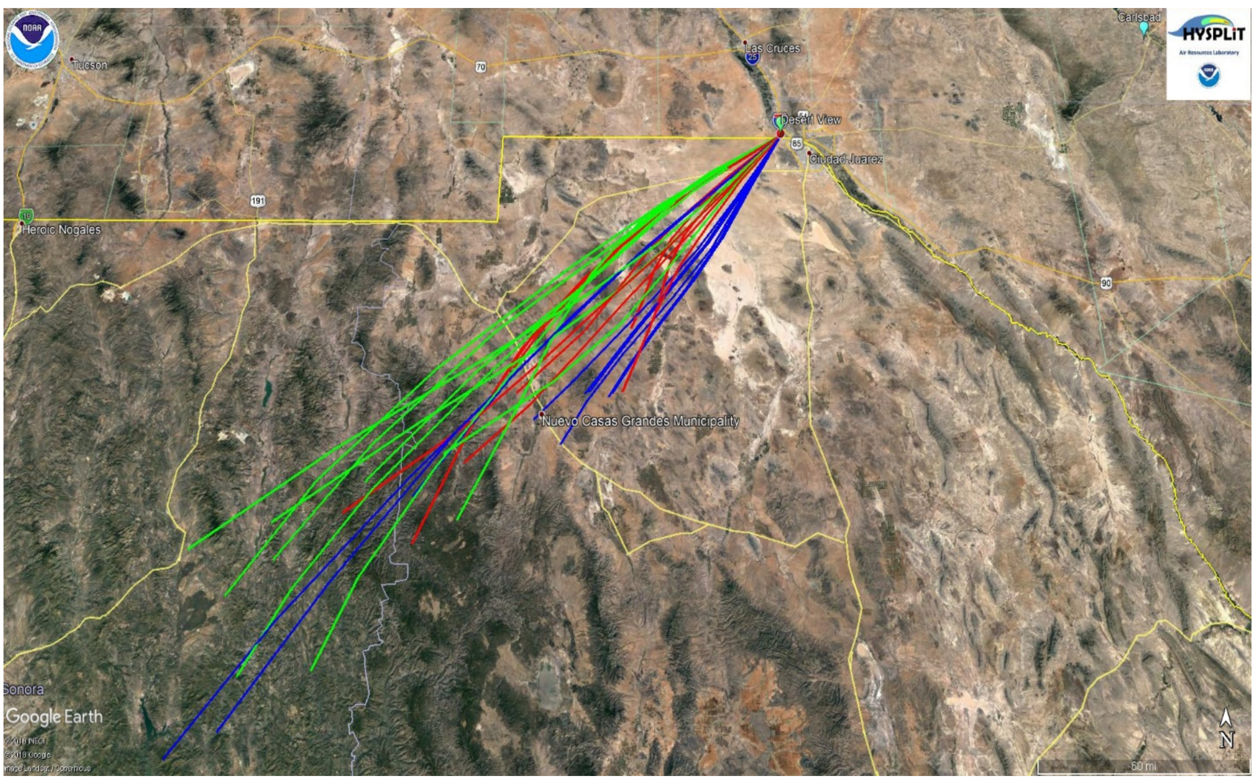

Figure 6-8. HYSPLiT back-trajectory analyses for Desert View monitoring station using the Ensemble mode.

Wind Direction and Elevated PM_{10} Concentrations

Pollution roses (Figures 6-9 & 6-10) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m³ (1400 -2100 hour). During the event, winds blew from the west southwest approximately 100% of the time coinciding with peak PM_{10} concentrations.

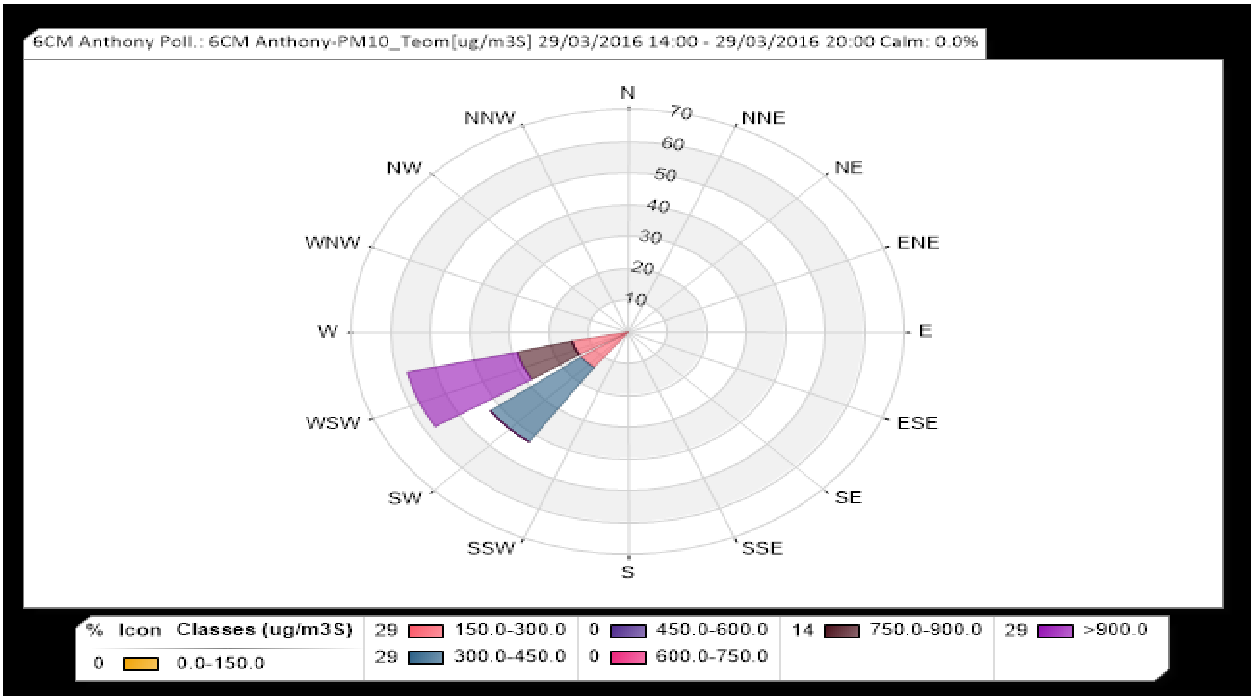

Figure 6-9. Pollution Rose for Anthony Monitoring Site

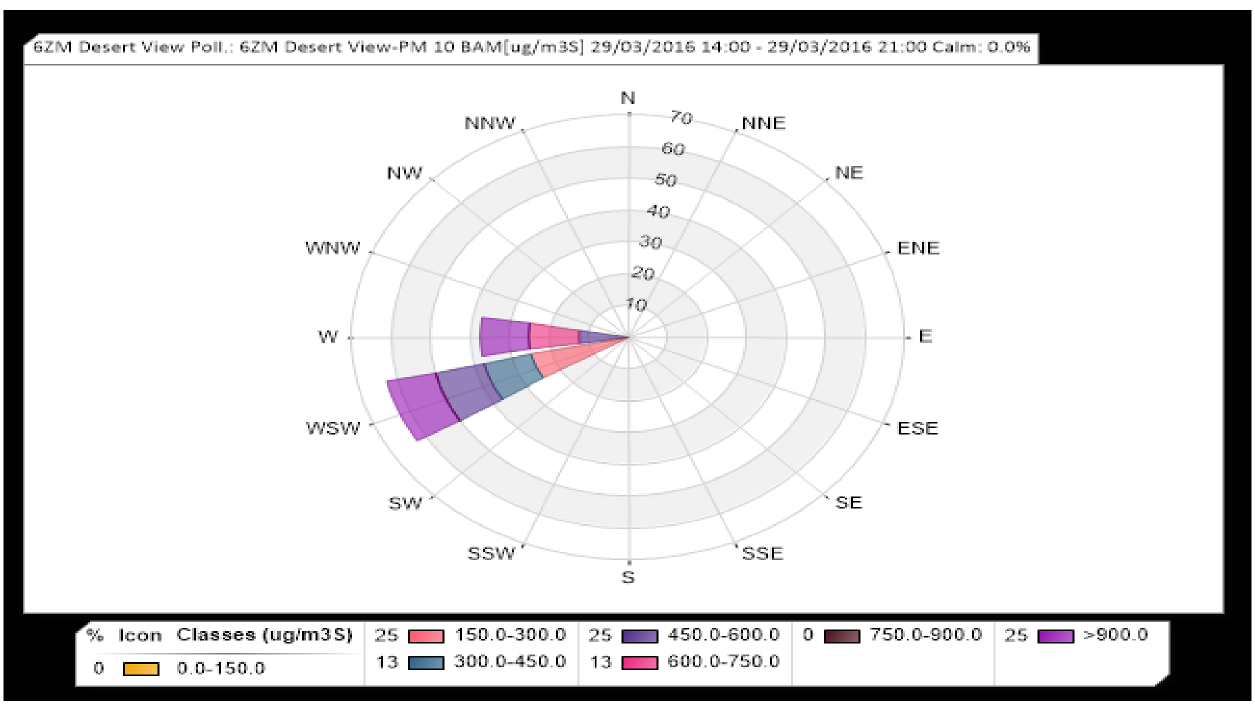

Figure 6-10. Pollution Rose for Desert View Monitoring Site

Temporal Relationship of High Wind and Elevated PM_{10} Concentrations

The high wind blowing dust event generated strong southwesterly winds beginning at the 1000 hour and lasting through the 1700 hour. During this time, peak hourly PM_{10} concentrations ranged from 153 to 1209 µg/m^3 at NMED monitoring sites (Figure 6-11). Although not all NMED monitoring sites recorded an exceedance of the NAAQS, hourly PM_{10} data spiked at approximately the same time throughout the network. Sustained hourly average wind speeds of 12.4 to 15 m/s were recorded at West Mesa, Holman, and Deming monitoring sites during the peak PM_{10} concentrations of the event. The time series plot in Figures 6-12 & 6-13 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

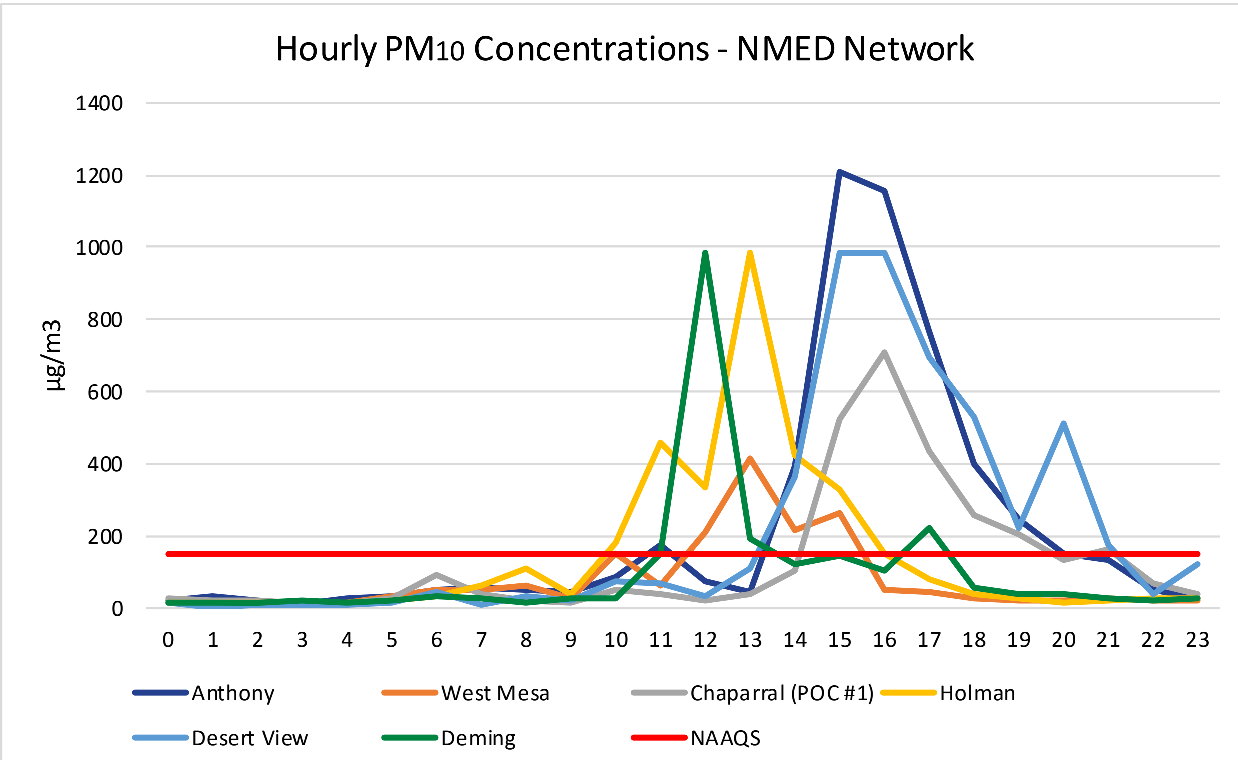

Figure 6-11. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

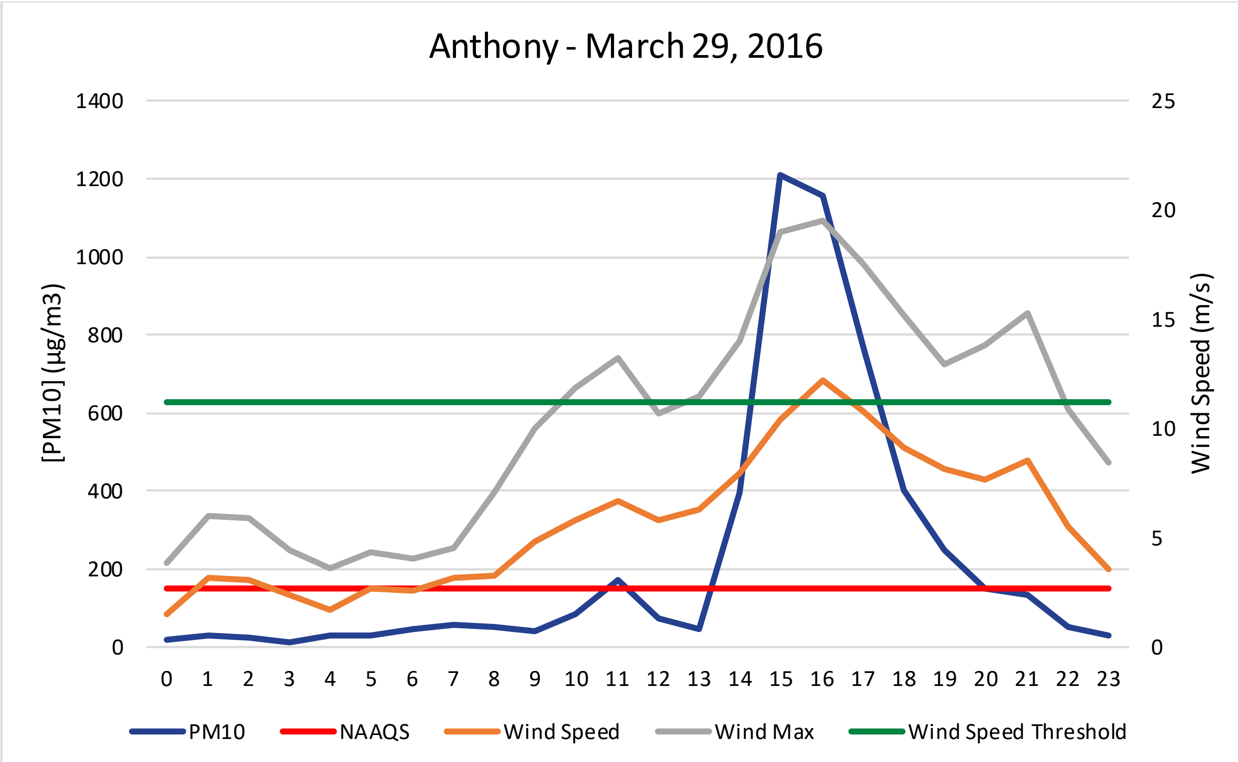

Figure 6-12. Anthony monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

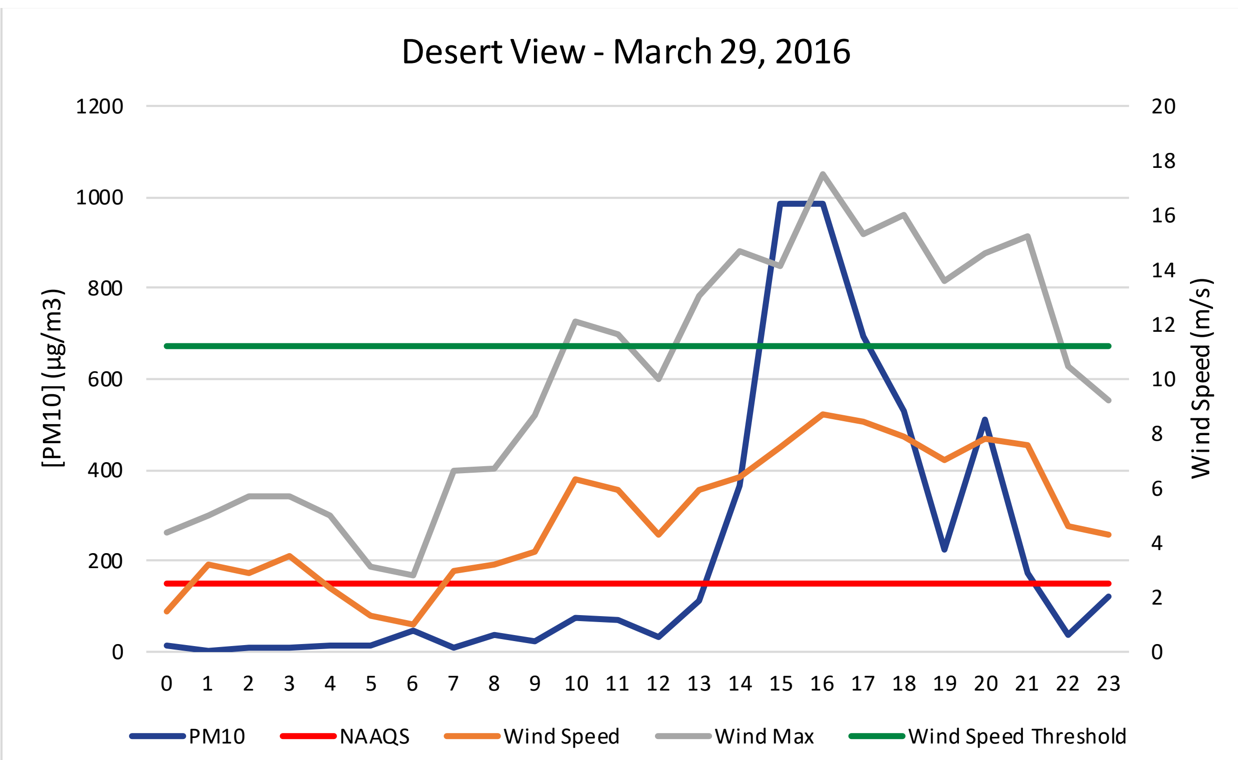

Figure 6-13. Desert view monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2011-2015, the Anthony and Desert View monitoring sites recorded 54 and 43 exceedances of the PM_{10} NAAQS (Figure 6-14 & 6-15). The maximum 24-hour average PM_{10} concentrations at the Anthony and Desert View sites were 1739 & 1691 µg/m^3, respectively, recorded in 2012. High wind blowing dust events in southern New Mexico can occur at any time of the year, but the majority of these days occur during the spring windy season, from March through May. NMED has documented that all exceedances have been caused by high wind blowing dust events.

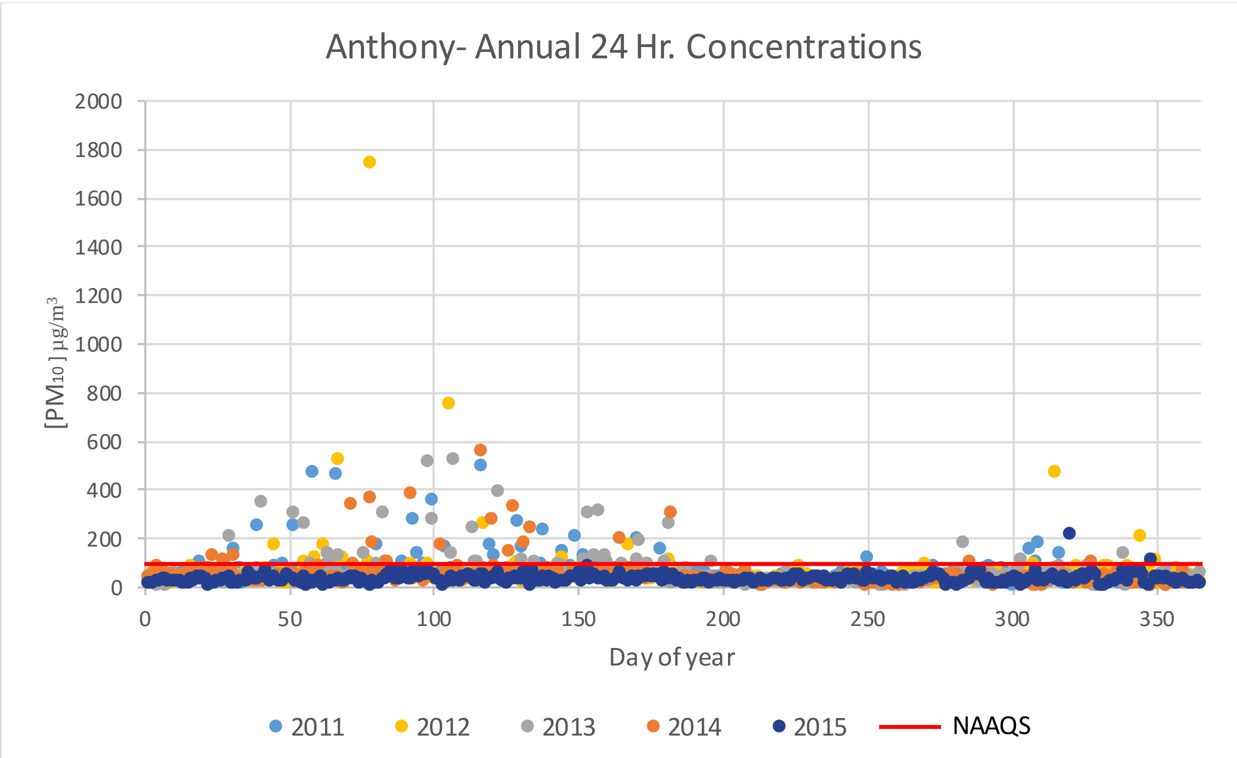

Figure 6-14. 24-hour averages by day of year from 2011-2015 for Anthony monitoring site.

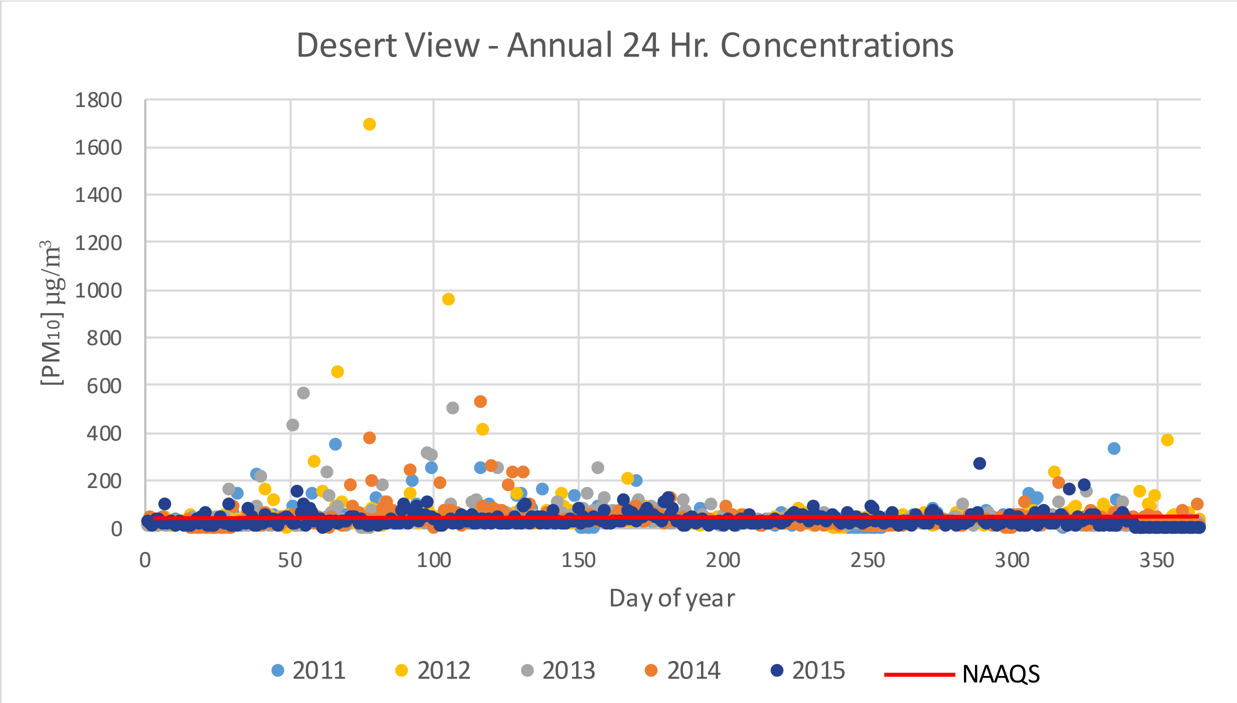

Figure 6-15. 24-hour averages by day of year from 2011-2015 for Desert View monitoring site.

Spatial and Temporal Variability

As demonstrated in Figure 6-16, all NMED monitoring sites recorded elevated 24-Hour Average PM_{10} concentrations compared to the days preceding and following the event. Daily averages for the days surrounding the event did not surpass 54 µg/m^3, demonstrating the influence high winds have on PM_{10} concentrations in the area.

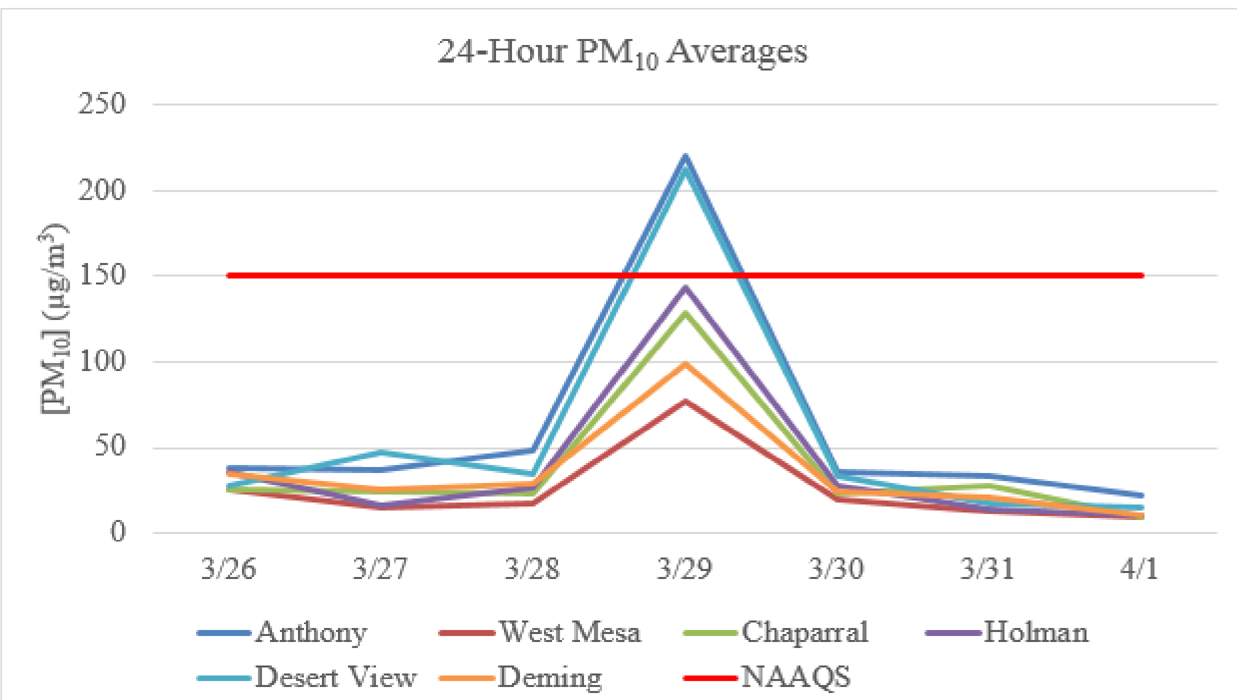

Figure 6-16. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

Percentile Ranking

Table 6-3 shows the 24-Hour Average PM_{10} data distribution recorded at Anthony and Desert View monitoring sites, including high wind blowing dust events flagged with a request to exclude data in the AQS database for exceedances of the standard from 2011-2015. The recorded values for this day (219 & 212 µg/m^3, respectively) are above the 95^{th} percentile of historical data.

Statistic\MonitoringSite	Anthony	West Mesa	Chaparral	Holman	Desert View	Deming
Max	1739	487	1606	1449	1691	1098
99th Percentile	307	160	255	198	253	254
95th Percentile	99	59	91	68	99	68
75th Percentile	54	23	36	31	42	30
50th Percentile	38	16	24	21	28	20
25th Percentile	25	11	16	14	19	13
5th Percentile	13	5	6	6	9	6
Mean	49	23	36	30	40	30

Table 6-3. NMED monitoring sites PM_{10} 24-hour average data distribution. Includes data flagged in AQS for exclusion due to high wind blowing dust events (RJ).

CCR Conclusion

On this day a high wind blowing dust event occurred, generating PM_{10} emissions that resulted in elevated concentrations at Anthony and Desert View monitoring sites. The monitored PM_{10} 24-Hour Averages of 219 & 212 µg/m^3, respectively, are above the 95th percentile of data monitored over the previous five years. Meteorological conditions were consistent with past event days and elevated PM_{10} concentrations. The comparisons and analyses provided in the CCR section of this demonstration support NMED's position that the event affected air quality in such a way that a clear causal relationship exists between the high wind blowing dust event and the monitored exceedances on this day, satisfying the CCR criterion.

Natural Event

The CCR and nRCP analyses show that this was a natural event caused by high wind and blowing dust. Based on the documentation provided in this demonstration, the event qualifies as a natural event. The exceedances associated with the event meets the regulatory definition of a natural event at 40 CFR 50.14(b)(8). This event transported windblown dust from natural and anthropogenic sources that have been reasonably controlled and accordingly, NMED has demonstrated that the event is a natural event and may be considered for treatment as an exceptional event.

7. HIGH WIND EXCEPTIONAL EVENT: April 15, 2016

Conceptual Model

A Pacific cold front caused high winds and blowing dust in Doña Ana County resulting in an exceedance of the PM_{10} NAAQS at the Desert View monitoring site on this date. In accordance with the EER, the AQB submitted this data to EPA's AQS database and flagged it (coded as RJ) as a high wind dust event (Table 7-1).

AQS Flag	AQS ID	Site Name	24-Hour Average Concentration	Max 1-Hour Wind Speed	Max Gust
RJ	35-013-0021	6ZM Desert View	237 µg/m³	8 m/s	16.9 m/s

Table 7-1. 2016 PM_{10} Data flagged by NMED for exclusion pursuant to the EER.

An upper low was located over Oregon and a trailing trough made its way down to central Baja. A strong upper low-level pressure system made its way along with the pacific cold front into Northern Arizona. As the storm system moved through the state, a pressure gradient formed over the Four Corner area (Figure 7-1). At the 1800 hour, an area of low pressure moved over the state of Colorado. Aloft, the low-pressure center of the storm system hovered in Idaho. As the day progressed this low pressure aloft traveled east and aligned itself with New Mexico and the surface wind direction (Figure 7-2). Diurnal heating of the surface allowed winds aloft to mix down, increasing the surface wind velocities and provided the turbulence required for vertical mixing and entrainment of dust.

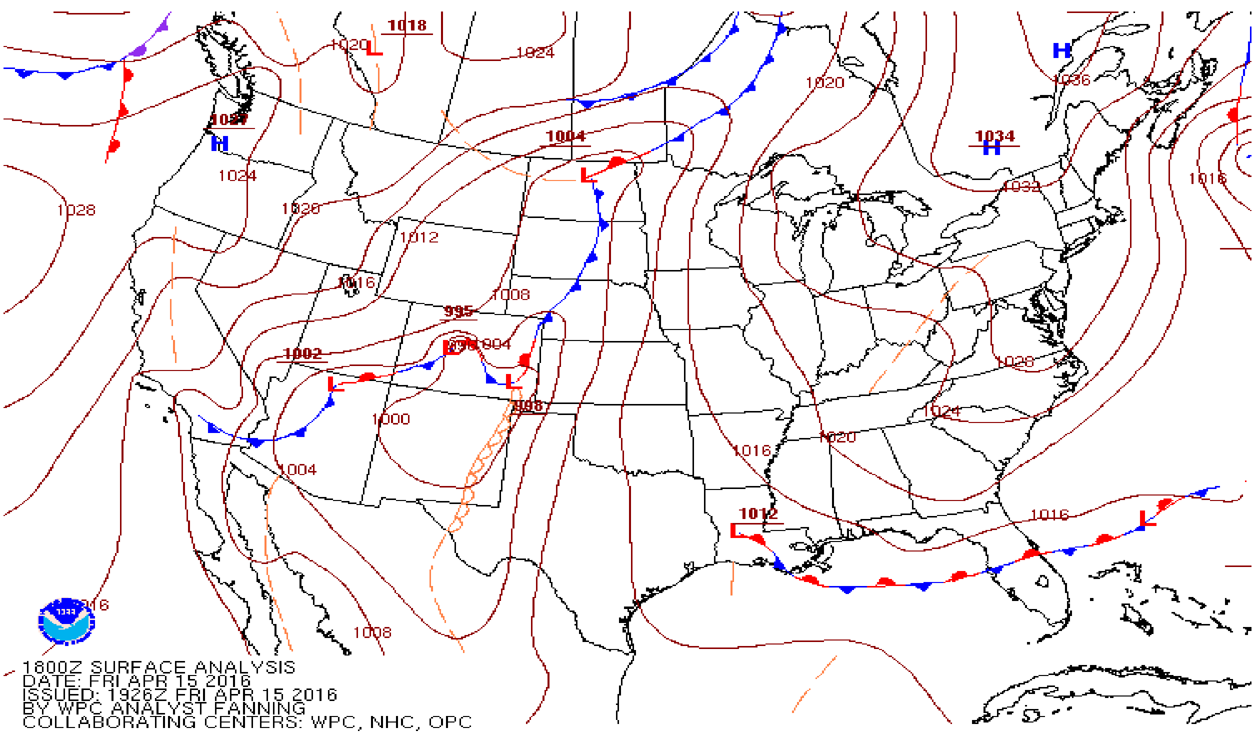

Figure 7-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

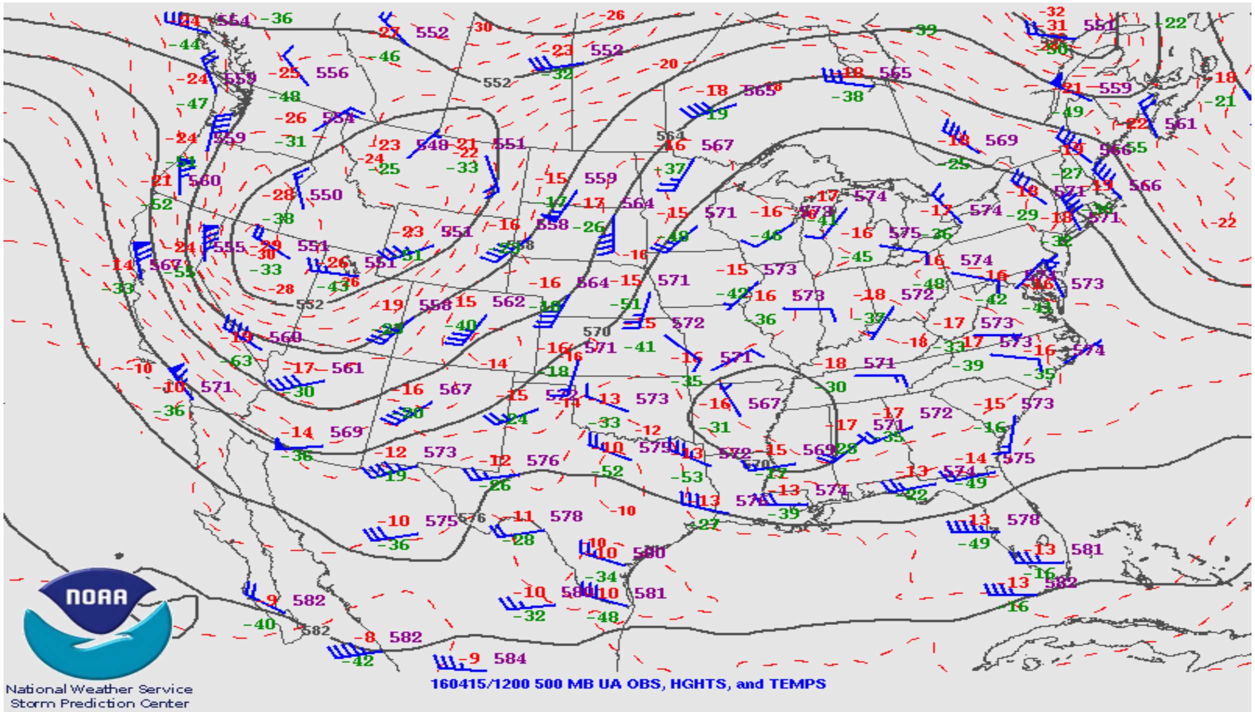

Figure 7-2. Upper air weather map for April 15, 2016 at the 1200 hour. Wind barbs depict wind speed (knots) and direction.

As the event unfolded, the wind blew from the southwest throughout the border region. These high velocity winds passed over large areas of desert within New Mexico and Mexico (Figure 7-3). Anthropogenic sources of dust near NMED's monitoring sites include: disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

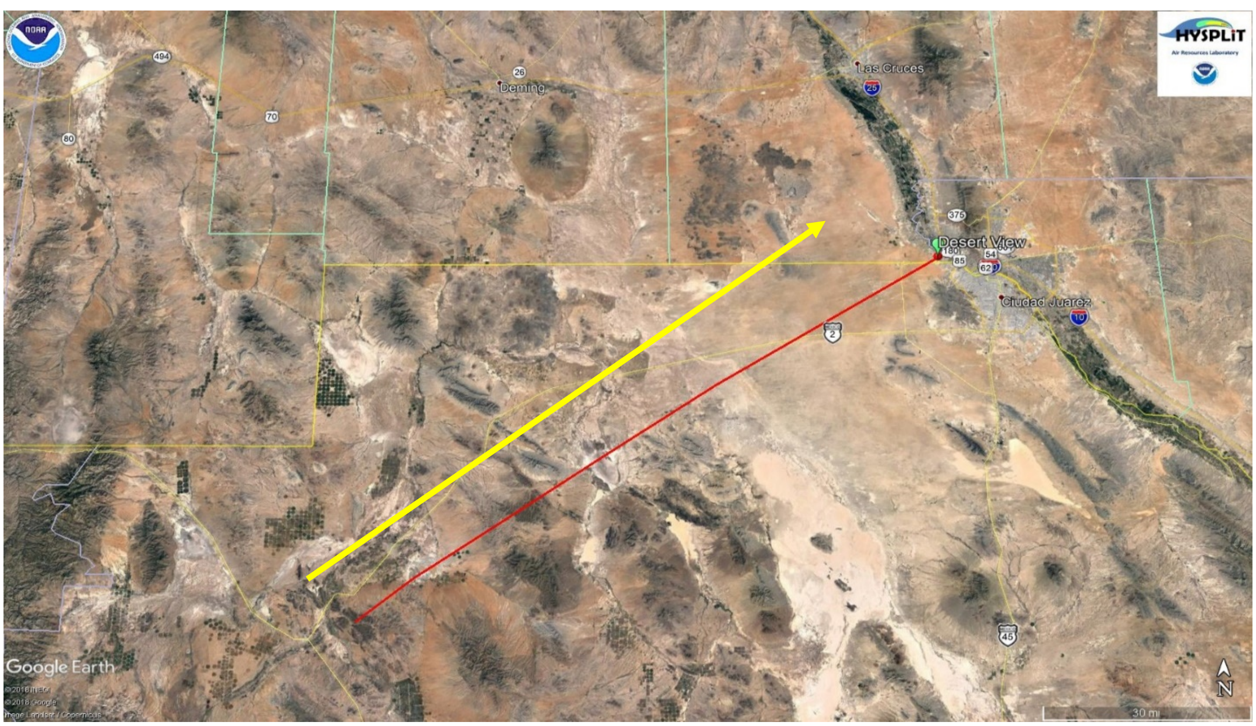

Figure 7-3. Map of NMED monitoring sites with a recorded exceedance of the NAAQS, predominant wind direction and suspected source locations for the high wind blowing dust event.

The co-occurrence of high winds and elevated levels of blowing dust, little to no point sources in the area, and the high hourly and daily PM_{10} concentrations support the assertion that this was a natural event, specifically a high wind dust event. Sustained hourly wind speeds exceeding 9 m/s (~20 mph) were recorded at Holman, West Mesa and Deming monitoring sites beginning at the 1200 hour and lasted through the 1900 hour. PM_{10} concentrations began to exceed the NAAQS at the Desert View monitoring sites beginning at the 1200 hour. Hourly concentrations remained elevated through the 2300 hour. Table 7-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event.

Hour	Desert View			Chaparral (POC #2)			Deming		
	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)
1200	486	6.3	15.1	122	7.3	12.9	39	9.3	15.8
1300	649	8	16.9	305	9.4	16.5	44	10.2	17.1
1400	500	7.2	14.6	202	8.1	14.8	197	11.4	20.3
1500	661	7.1	14.5	224	7.3	16.9	134	12.2	20.6
1600	720	7	13.9	237	8.9	16.1	171	12.7	19.2
1700	637	6.5	12.6	227	7.6	15.9	283	12.9	20.9
1800	234	4.9	10.7	239	7.7	15.9	110	10.9	17.1
1900	283	4.1	8.4	305	7.6	14.8	46	8.7	14.7
2000	486	4.6	9.4	132	8.9	15.1	46	8.7	14.2
2100	327	4.7	9	85	8.7	14.7	39	8.4	13.8
2200	158	3.9	7.9	58	8	14.4	70	8	13.4
2300	300	5	10.5	53	5.9	11.6	107	7.9	13.4

Table 7-2. Hourly PM_{10}, wind speed and wind gust data during the peak hours of the event.

Meteorologists forecasted the high wind blowing dust event to occur this day, as the spring windy season begins in March for most of the southwestern United States. Forecasts predicted strong winds as the storm approached the area with the area of low pressure tracking from west to east just south of the four corners in the morning and moving across New Mexico in the afternoon. The systems movement across the area timed well with daytime heating and mixing generating a deep trough to the east as stronger winds aloft moved into the area. Many outlets also forecasted a high probability of blowing and entrained dust throughout the area and haze in the afternoon, especially in the desert areas of southern New Mexico (Figure 7-4).

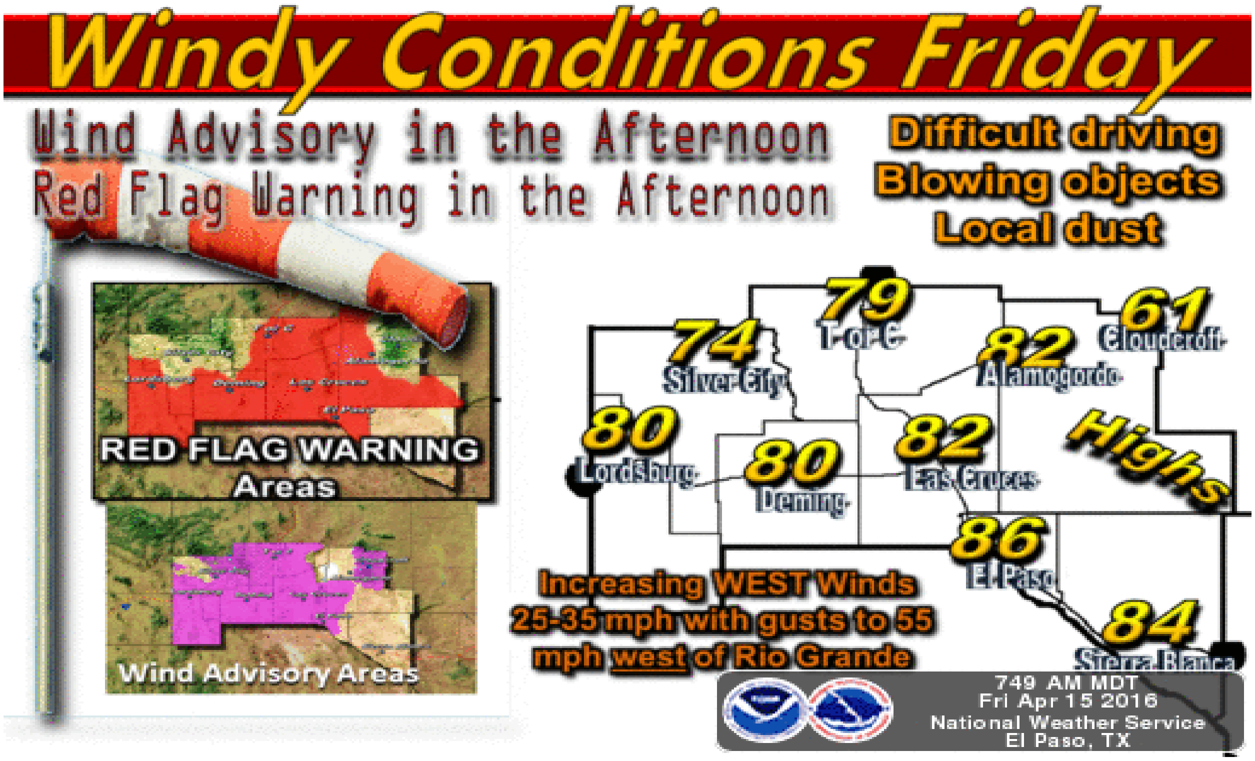

Figure 7-4. NWS Forecast Graphic for the event.

Not Reasonably Controllable or Preventable (nRCP)

Not Reasonably Preventable

This demonstration does not provide a showing of not reasonably preventable pursuant to 40 CFR 50.14(b)(5)(iv) that states, in part, "the State shall not be required to provide a case-specific justification for a high wind dust event."

Not Reasonably Controllable

The documentation provided in this section demonstrates that the wind speeds and other meteorological conditions overwhelmed the reasonable control measures in place for anthropogenic sources, causing emissions of dust that were transported to NMED's monitors.

Sustained Wind Speeds

EPA has indicated 11.2 m/s (25 mph) as the wind speed threshold at which natural or controlled anthropogenic sources will emit dust. The Deming monitoring site recorded wind speeds above this threshold for 3 hours from the 1400 to the 1700 hour (Figure 7-5).

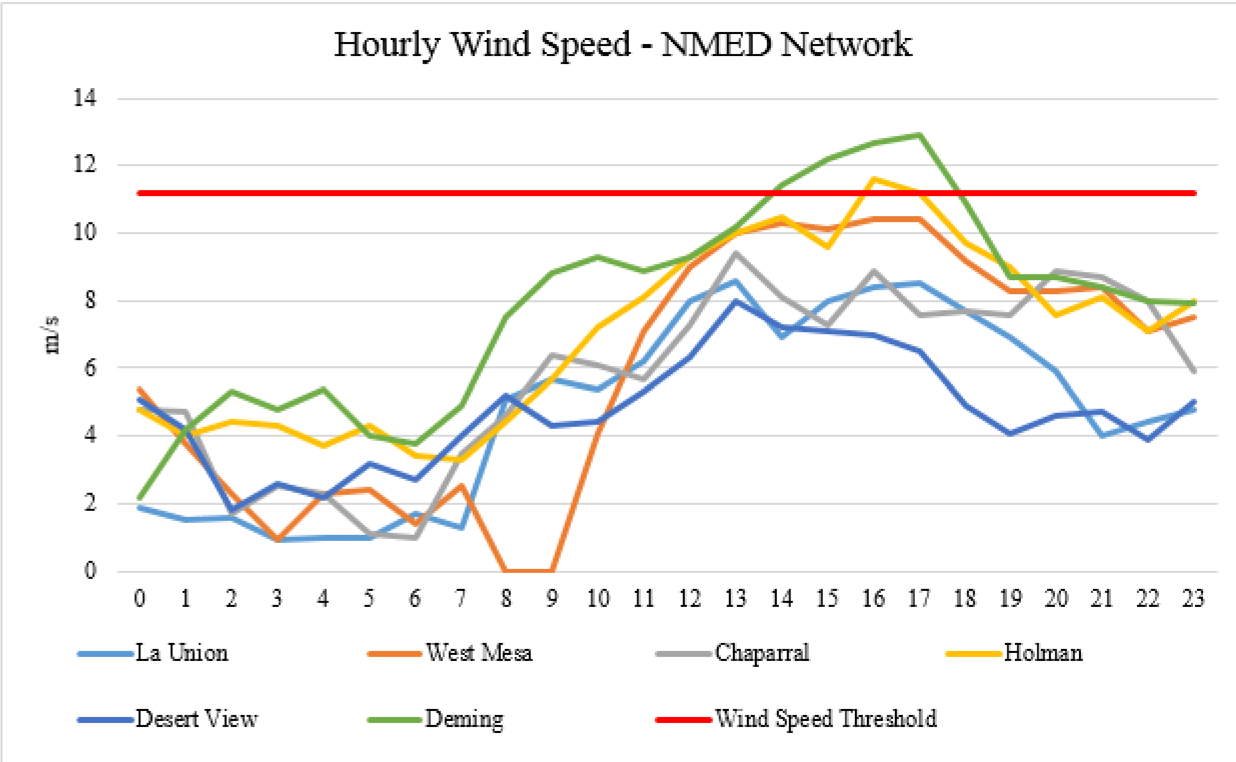

Figure 7-5. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

Level of Controls Analysis

Based on the sustained winds speeds monitored in the area during the event a basic controls analysis will be provided.

Basic Controls Analysis

Implementation and Enforcement of Control Measures

Reasonable controls for anthropogenic sources of dust are based on an area's attainment status for the PM_{10} NAAQS. It is not reasonable for areas designated as attainment, unclassifiable or maintenance to have the same level of controls as areas that are nonattainment for the standard. However, southern New Mexico has a long history of high wind blowing dust events with NMED developing a nonattainment SIP for the Anthony Area and NEAPs for the remaining portion of Doña Ana County and all of Luna County. As discussed in the Background section, NMED worked with local governments to help them develop and adopt dust control ordinances based on BACM. Based on the area's attainment status and SIP waiver, NMED believes these ordinances constitute reasonable controls.

The ordinances developed and adopted under the NEAPs are implemented and enforced at the local level with NMED playing a supporting role to ensure effective and enforceable implementation of control measures. Under the regulatory framework applicable to the two counties, NMED's purview does not include oversight of the extent of the effectiveness and enforcement of local ordinances. However, NMED believes that these ordinances are appropriately implemented at the local level.

Suspected Source Areas and Categories Contributing to the Event

Anthropogenic sources of dust in New Mexico include disturbed lands, construction and demolition activities, vacant parking lots and materials handling and transportation. Area sources account for a

much larger portion of overall PM_{10} emissions than point sources. On the day of the event, no unusual PM_{10} producing activities occurred and anthropogenic point source emissions remained constant before, during and after the event. Natural areas of the Chihuahuan Desert in Doña Ana, Luna, Hidalgo and Grant Counties are the most likely sources, under NMED's jurisdiction, contributing to the high wind blowing dust event. Other area sources located in Arizona and Chihuahua, MX likely contributed to the exceedance on this day. Controlling dust from the natural desert terrain is cost prohibitive and falls outside NMED's jurisdiction when it is transported from intrastate and international sources.

The documentation and analysis presented in this section demonstrates that all identified sources that may have caused or contributed to the exceedance were reasonably controlled, implemented and enforced at the time of the event, therefore emissions associated with the high wind dust event were not reasonably controllable or preventable.

Clear Causal Relationship (CCR)

Occurrence and Geographic Extent of the Event

Satellite Imagery

The event was captured on satellite imagery with dust plumes originating upwind of NMED's monitoring site near Ascension and Janos, Chih. This area is largely rural with the largest area sources of PM originating from agricultural activities as well as the vast desert areas and playas in northern Mexico (Figure 7-6). The dust plumes of interest appear to be limited to Mexico, orientated in a southwest to northeast fashion and traveling toward El Paso and NMED's monitoring site at the time of the satellite pass (1300 hour MDT) that captured the imagery.

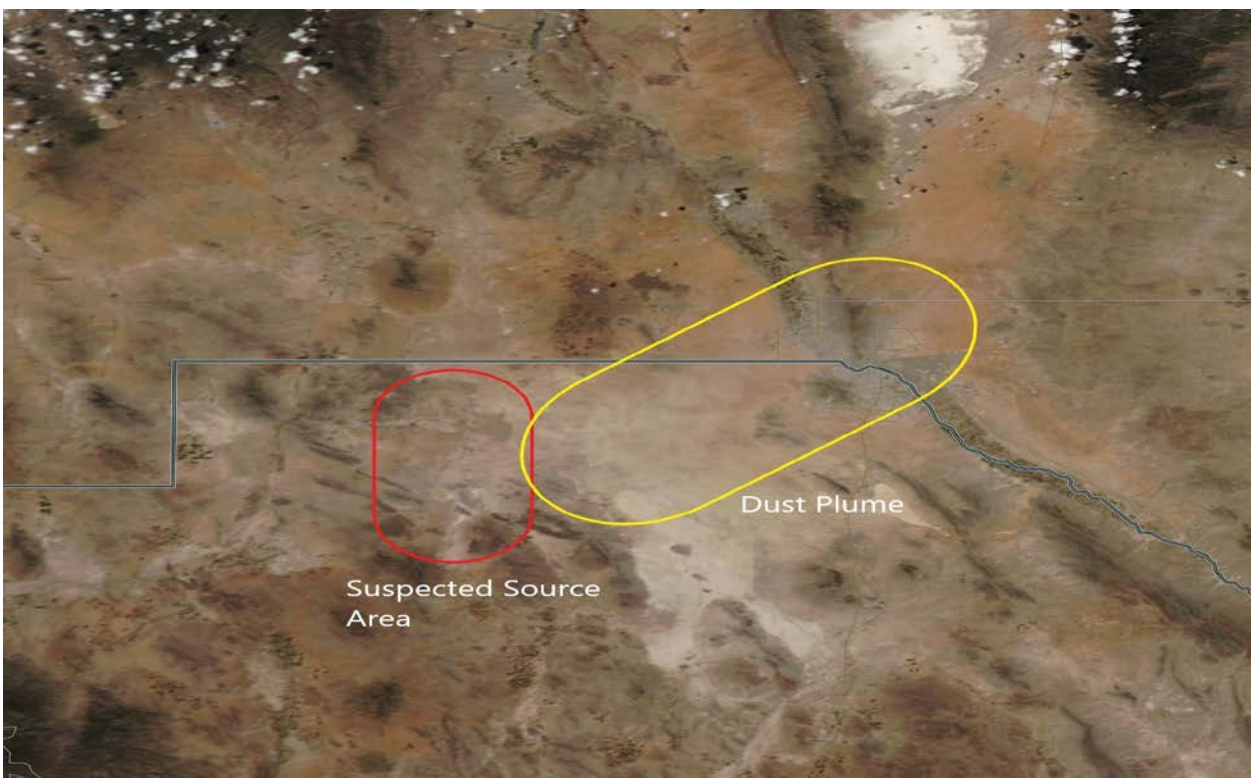

Figure 7-6. MODIS natural color imagery from the Aqua Satellite showing southwestern New Mexico, northern Chihuahua and western Texas. Imagery obtained from NASA's EOSDIS Worldview website.

Weather Statements, Advisories, News and Other Media Reports Covering the Event
The National Weather Service (NWS) issued a Wind Advisory and a Blowing Dust Advisory for this date. A Wind Advisory is issued by NWS when sustained winds of 30 to 39 mph are expected for 1 hour or longer. A Blowing Dust Advisory is issued when blowing dust is expected to reduce visibility to between ¼ to 1 mile, generally with winds of 25 mph or greater. These were in place for southwestern New Mexico and west Texas to warn the public of the high wind event. An excerpt from the NWS Wind Advisory can be found below:

```
WINDY THIS AFTERNOON AND THIS EVENING WITH WINDS GUSTING AROUND 50 MPH. THE
WINDS WILL PRODUCE BLOWING DUST WITH THE VISIBILITY LESS THAN A MILE OVER A
FEW AREAS.
```

Spatial and Transport Analysis

HYSPLiT Backtrajectory Analysis

A back-trajectory analysis using the NOAA Air Resources Laboratory HYSPLIT transport and dispersion model (Draxler et al., 2015; Rolph et al., 2017) shows that the air masses traveled from Chihuahua, MX into the southern New Mexico and El Paso, TX area and on to the NMED monitoring site. The model was run using GDAS meteorological data for the six hours preceding the start of elevated PM_{10} concentrations during the event (Figure 7-7). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

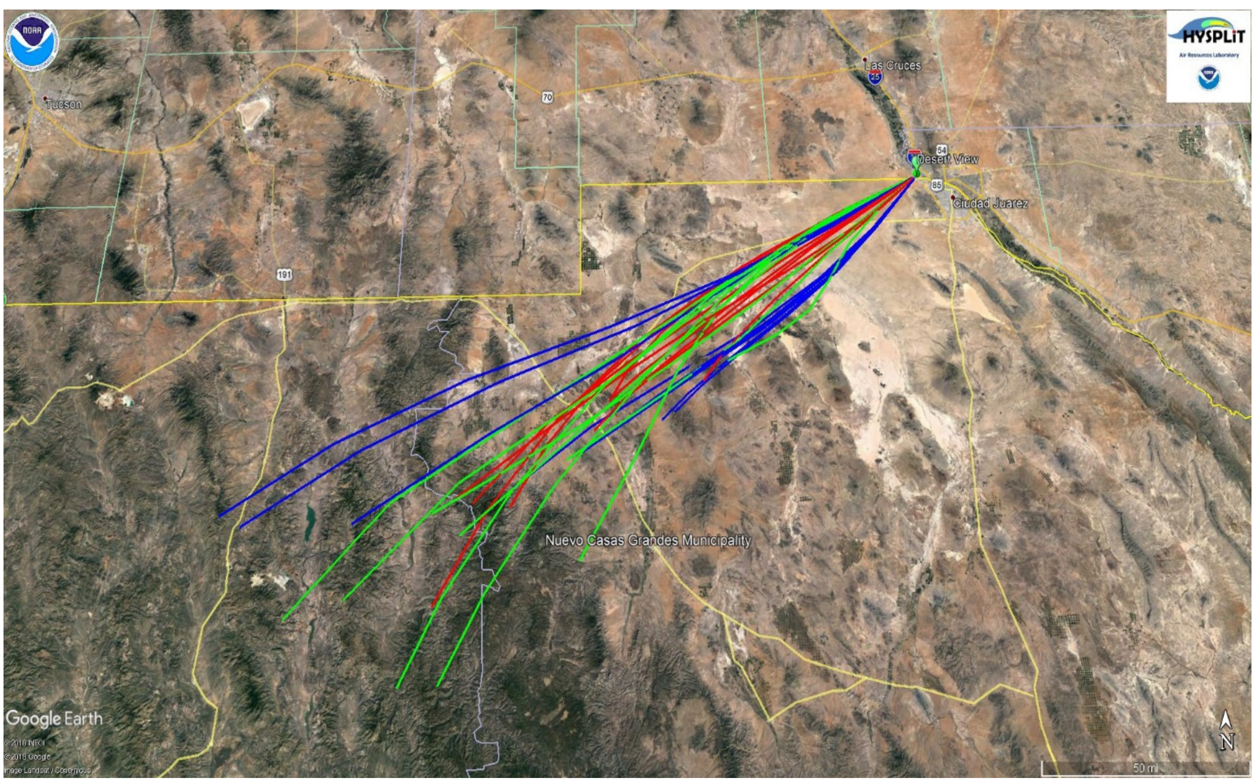

Figure 7-7. HYSPLiT back-trajectory analyses using the Ensemble mode.

Wind Direction and Elevated PM_{10} Concentrations

A pollution rose (Figure 7-8) was created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m^3 (1200 -2300 hour). During the event, winds blew from the west southwest approximately 80-100% of the time coinciding with peak PM_{10} concentrations.

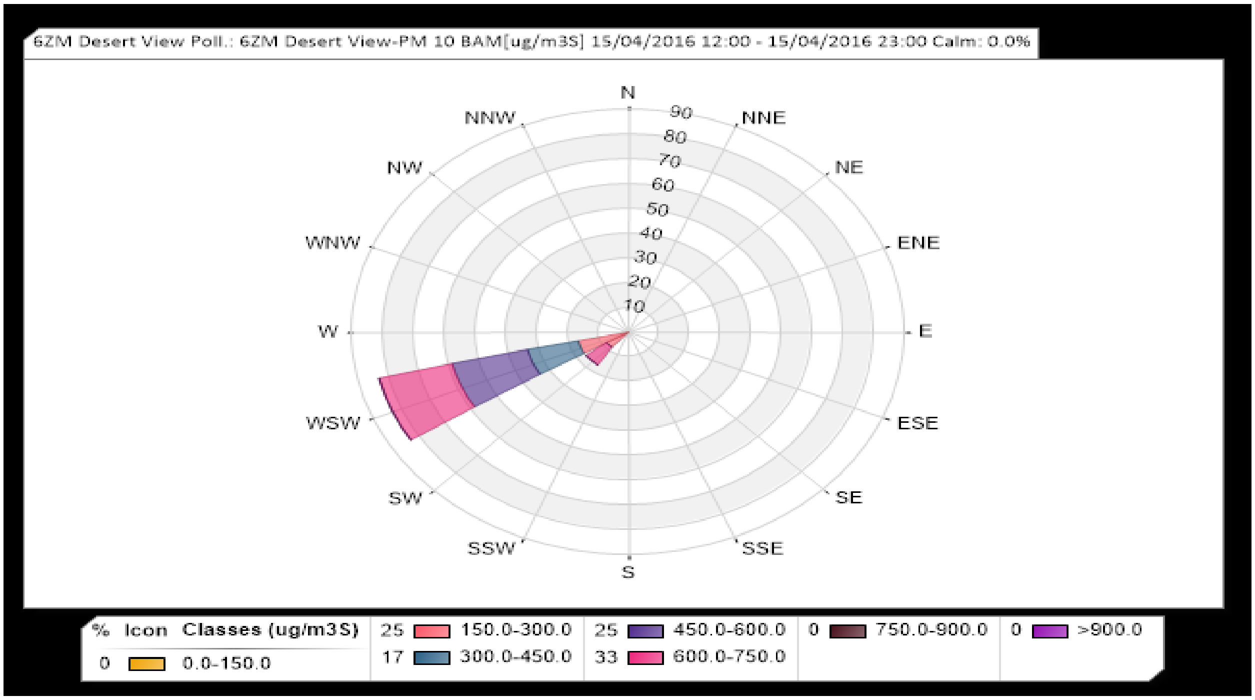

Figure 7-8. Pollution Rose for Desert View monitoring site

Temporal Relationship of High Wind and Elevated PM_{10} Concentrations

The high wind blowing dust event generated strong southwesterly winds beginning at the 1200 hour and lasting through the 1900 hour. During this time, peak hourly PM_{10} concentrations ranged from 241 to 720 µg/m^3 at NMED monitoring sites (Figure 7-9). Although not all NMED monitoring sites recorded an exceedance of the NAAQS, hourly PM_{10} data spiked at approximately the same time throughout the network. Sustained hourly average wind speeds of 12.9 m/s were recorded at the Deming monitoring site during the peak PM_{10} concentrations of the event. The time series plot in Figure 7-10 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

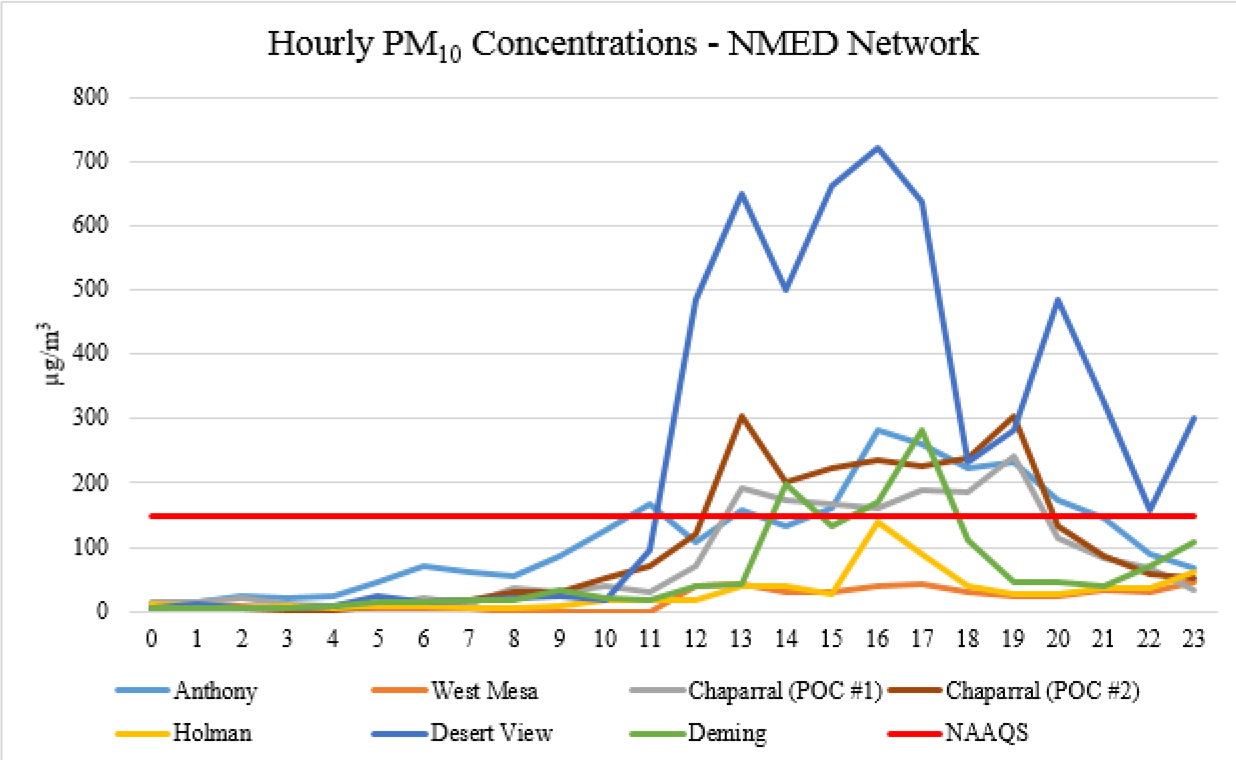

Figure 7-9. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

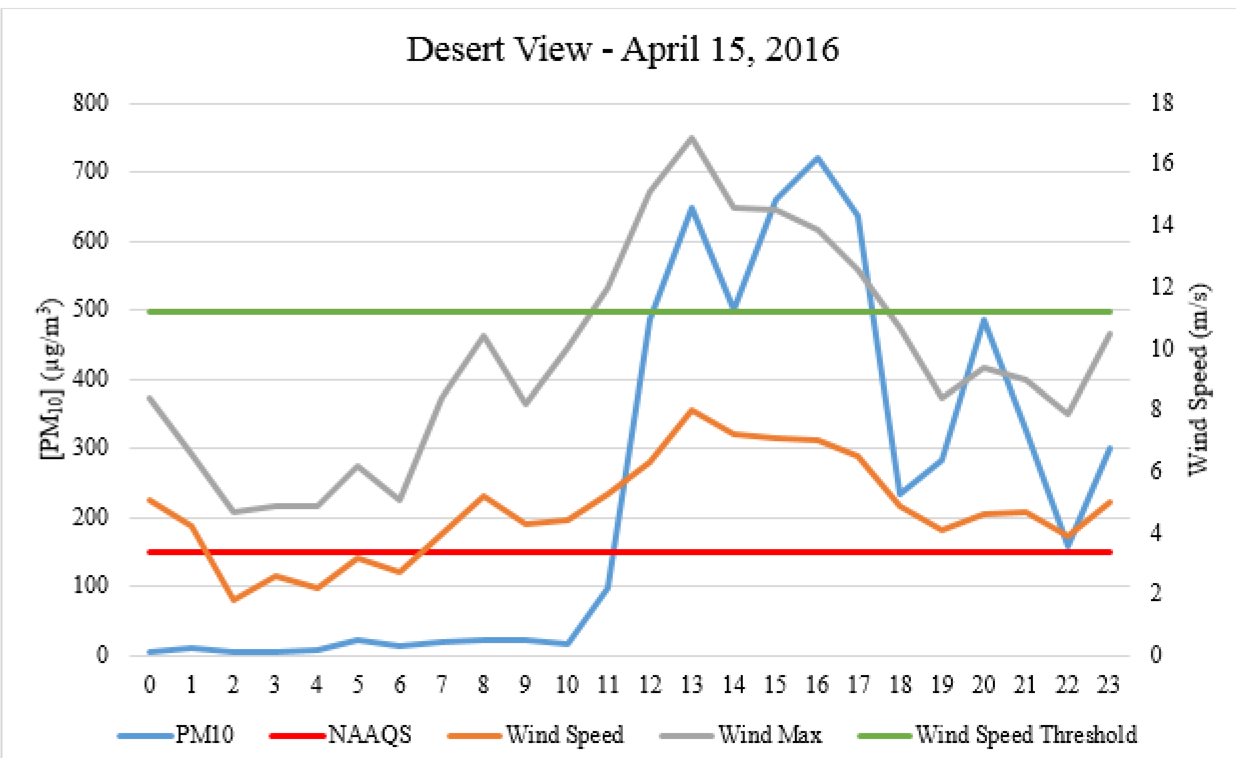

Figure 7-10. Desert View monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2011-2015, the Desert View monitoring site recorded 43 exceedances of the PM_{10} NAAQS (Figure 7-11). The maximum 24-hour average PM_{10} concentration at this site was 1691 µg/m³ recorded in 2012. High wind blowing dust events in southern New Mexico can occur at any time of the year, but the majority of these days occur during the spring windy season, from March through May. NMED has documented that all exceedances have been caused by high wind blowing dust events.

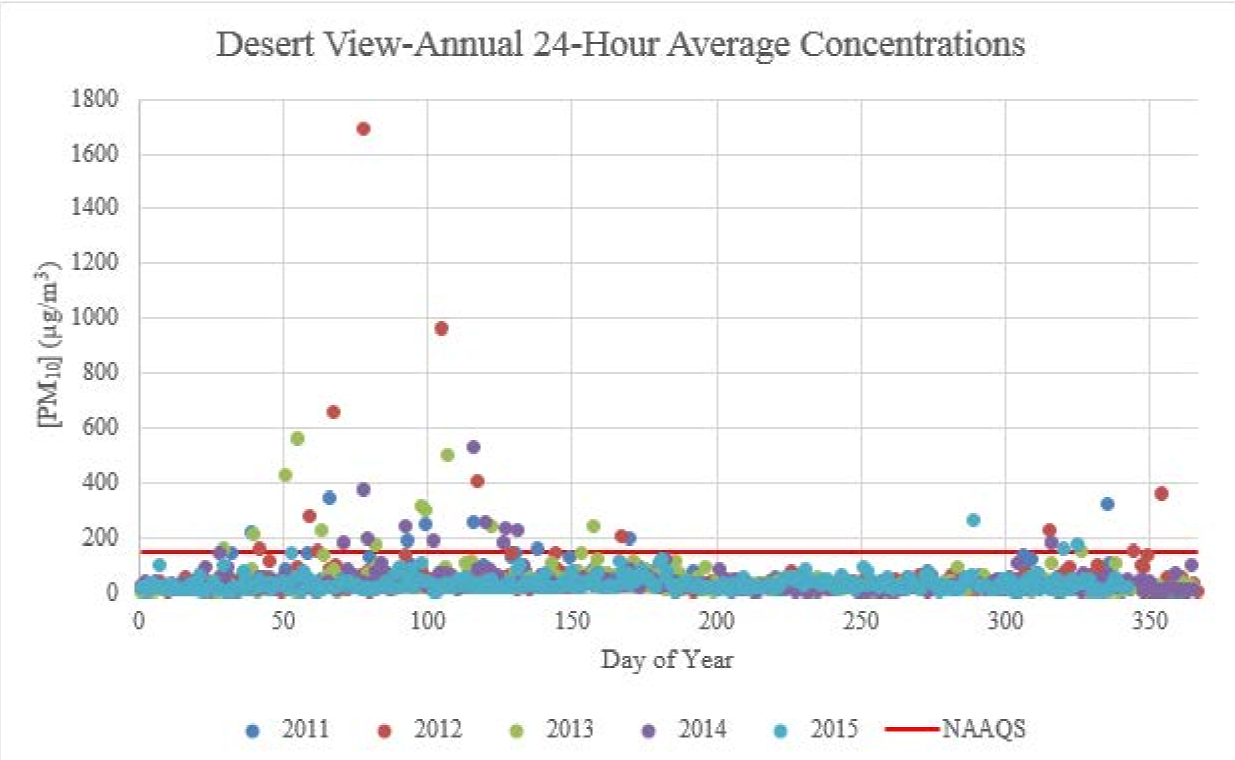

Figure 7-11. 24-hour averages by day of year from 2011-2015.

Spatial and Temporal Variability

As demonstrated in Figure 7-12, all NMED monitoring sites recorded elevated 24-Hour Average PM_{10} concentrations compared to the days preceding and following the event. Daily averages for the days surrounding the event did not surpass 50 µg/m³, demonstrating the influence high winds have on PM_{10} concentrations in the area.

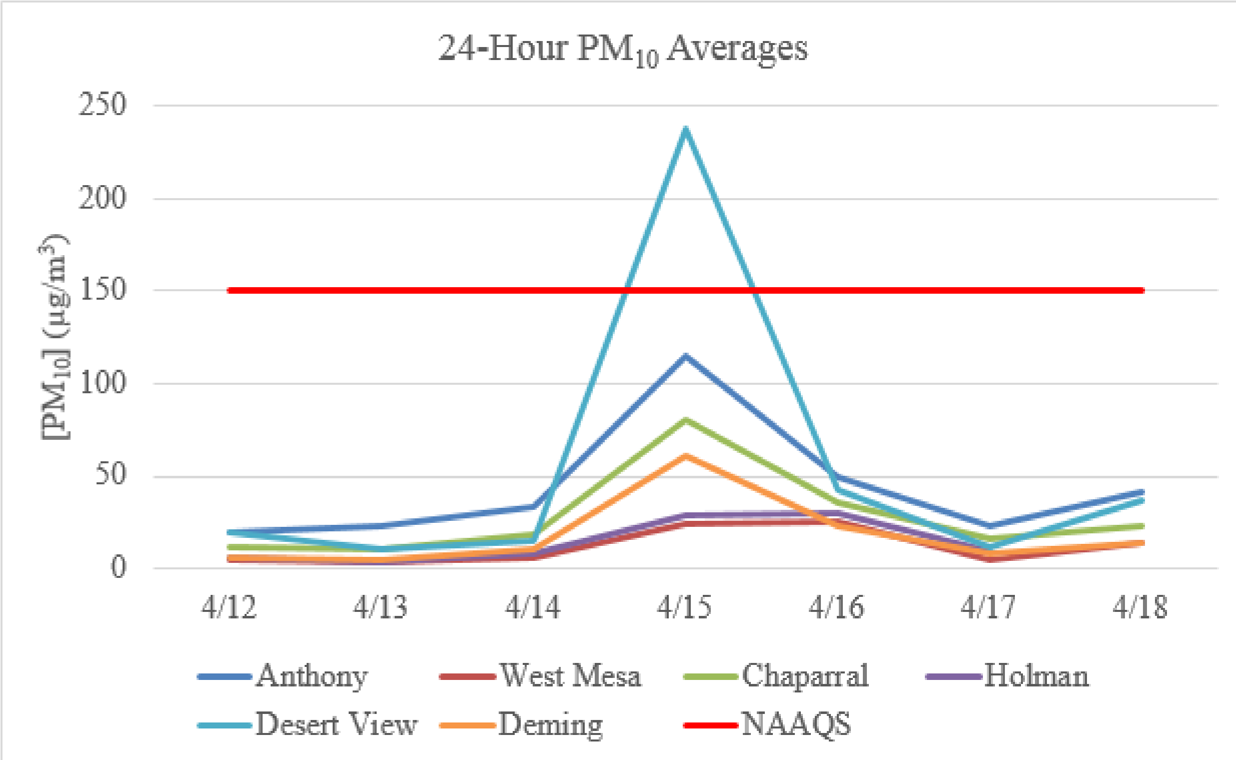

Figure 7-12. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

Percentile Ranking

Table 7-3 shows the 24-Hour Average PM_{10} data distribution recorded at NMED monitoring sites, including high wind blowing dust events flagged with a request to exclude data in the AQS database for exceedances of the standard from 2011-2015. The recorded value for this day (237 µg/m^3) is near the 99th percentile of historical data.

Statistic\Monitoring Site	Anthony	West Mesa	Chaparral	Holman	Desert View	Deming
Max	1739	487	1606	1449	1691	1098
99th Percentile	307	160	255	198	253	254
95th Percentile	99	59	91	68	99	68
75th Percentile	54	23	36	31	42	30
50th Percentile	38	16	24	21	28	20
25th Percentile	25	11	16	14	19	13
5th Percentile	13	5	6	6	9	6
Mean	49	23	36	30	40	30

Table 7-3. NMED monitoring sites PM_{10} 24-hour average data distribution. Includes data flagged in AQS for exclusion due to high wind blowing dust events (RJ).

CCR Conclusion

On this day a high wind blowing dust event occurred, generating PM_{10} emissions that resulted in elevated concentrations at the Desert View monitoring site. The monitored PM_{10} 24-Hour Average of 237 µg/m^3 is above the 95th percentile of data monitored over the previous five years. Meteorological conditions were consistent with past event days and elevated PM_{10} concentrations. The comparisons and analyses provided in the CCR section of this demonstration support NMED's position that the event affected air quality in such a way that a clear causal relationship exists between the high wind blowing dust event and the monitored exceedance on this day, satisfying the CCR criterion.

Natural Event

The CCR and nRCP analyses show that this was a natural event caused by high wind and blowing dust. Based on the documentation provided in this demonstration, the event qualifies as a natural event. The exceedance associated with the event meets the regulatory definition of a natural event at 40 CFR 50.14(b)(8). This event transported windblown dust from natural and anthropogenic sources that have been reasonably controlled and accordingly, NMED has demonstrated that the event is a natural event and may be considered for treatment as an exceptional event.

8. HIGH WIND EXCEPTIONAL EVENT: April 25, 2016

Conceptual Model

A Pacific cold front caused high winds and blowing dust in Doña Ana and Luna Counties resulting in an exceedance of the PM_{10} NAAQS at the Anthony, Desert View, and Chaparral monitoring sites on this date. In accordance with the EER, the AQB submitted this data to EPA's AQS database and flagged it (coded as RJ) as a high wind dust event (Table 8-1).

AQS Flag	AQS ID	Site Name	24-Hour Average Concentration	Max 1-Hour Wind Speed	Max Gust
RJ	35-013-0020	6ZK Chaparral	163 $\mu g/m^3$S (POC #1)	10.4 m/s	22.5 m/s
RJ	35-013-0020	6ZK Chaparral	225 $\mu g/m^3$ (POC #2)	10.4 m/s	22.5 m/s
RJ	35-013-0016	6CM Anthony	247 $\mu g/m^3$	10.9 m/s	20.7 m/s
RJ	35-013-0021	6ZM Desert View	221 $\mu g/m^3$	8.8 m/s	17.6 m/s

Table 8-1. 2016 PM_{10} Data flagged by NMED for exclusion pursuant to the EER.

An upper level trough over southern Nevada brings a band of strong winds across the region by mixing with a surface low from the northeast. As the storm system moved through the state, a pressure gradient formed over southeastern Arizona, southwestern New Mexico and northern Mexico (Figure 8-1). At the 1800 hour, an area of low pressure moved over the state of Utah. Aloft, the low-pressure center of the storm system hovered in Southern California. As the day progressed this low pressure aloft traveled east and aligned itself with New Mexico and the surface wind direction (Figure 8-2). Diurnal heating of the surface allowed winds aloft to mix down, increasing the surface wind velocities and provided the turbulence required for vertical mixing and entrainment of dust.

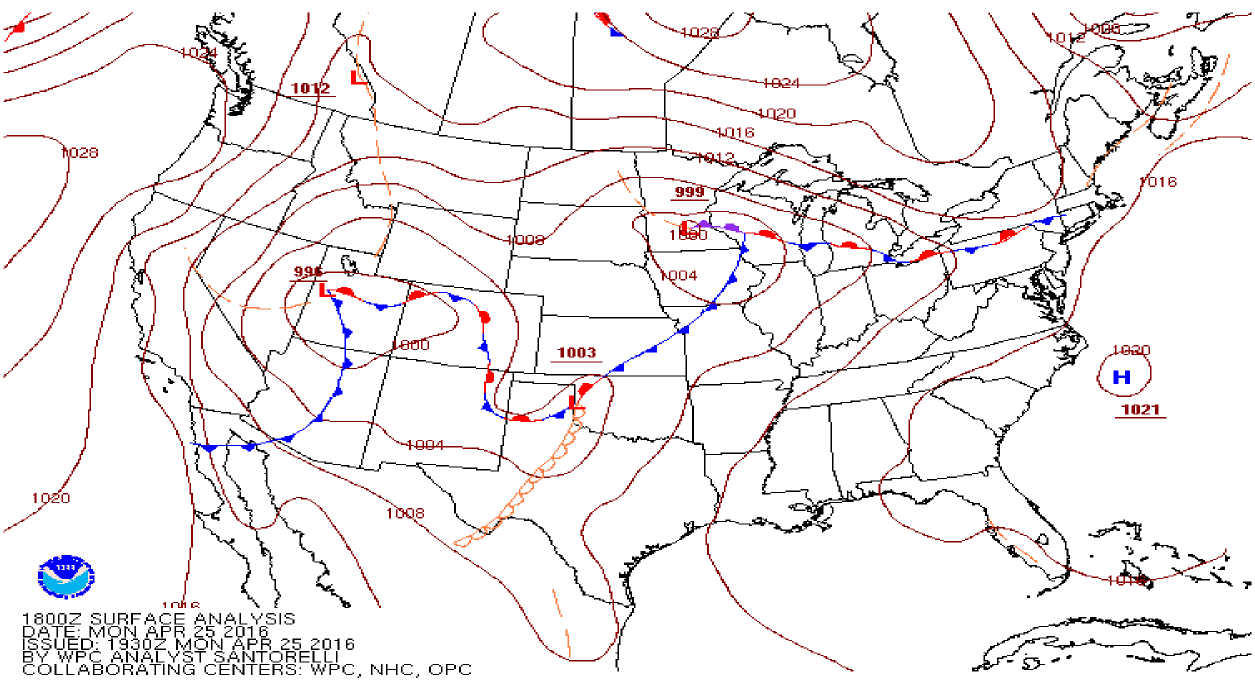

Figure 8-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

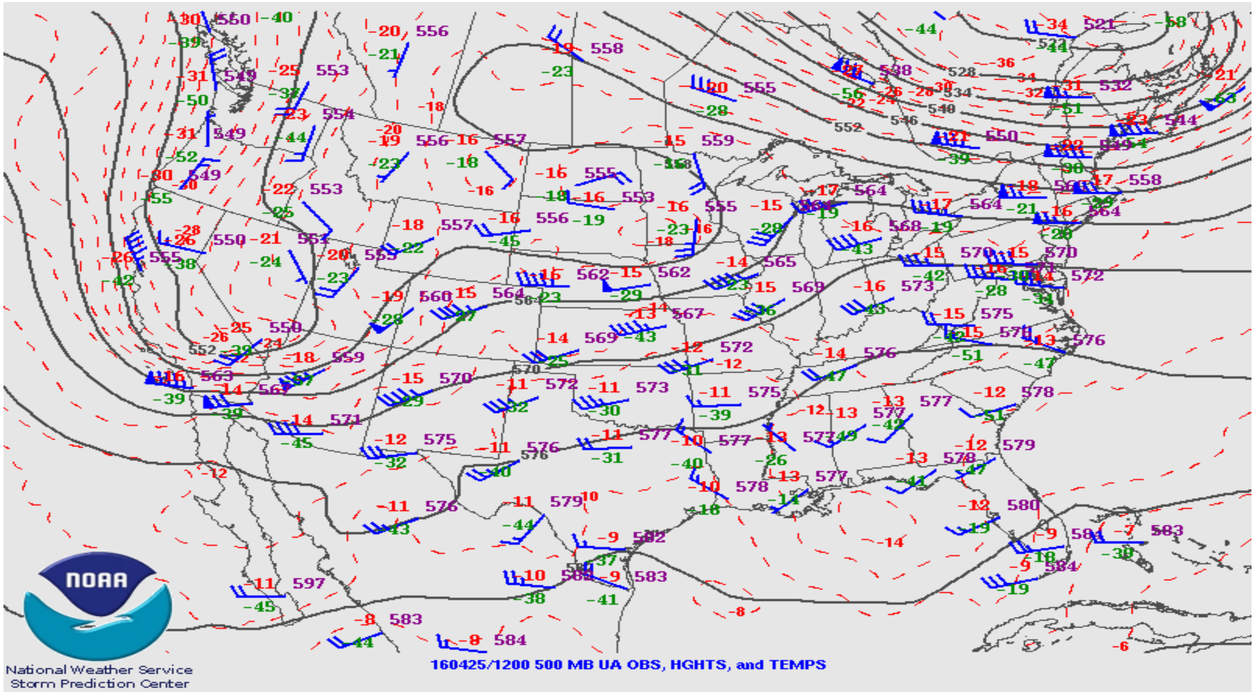

Figure 8-2. Upper air weather map for April 25, 2016 at the 1200 hour. Wind barbs depict wind speed (knots) and direction.

As the event unfolded, the wind blew from the southwest throughout the border region. These high velocity winds passed over large areas of desert within New Mexico and Mexico (Figure 8-3). Anthropogenic sources of dust near NMED's monitoring sites include: disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

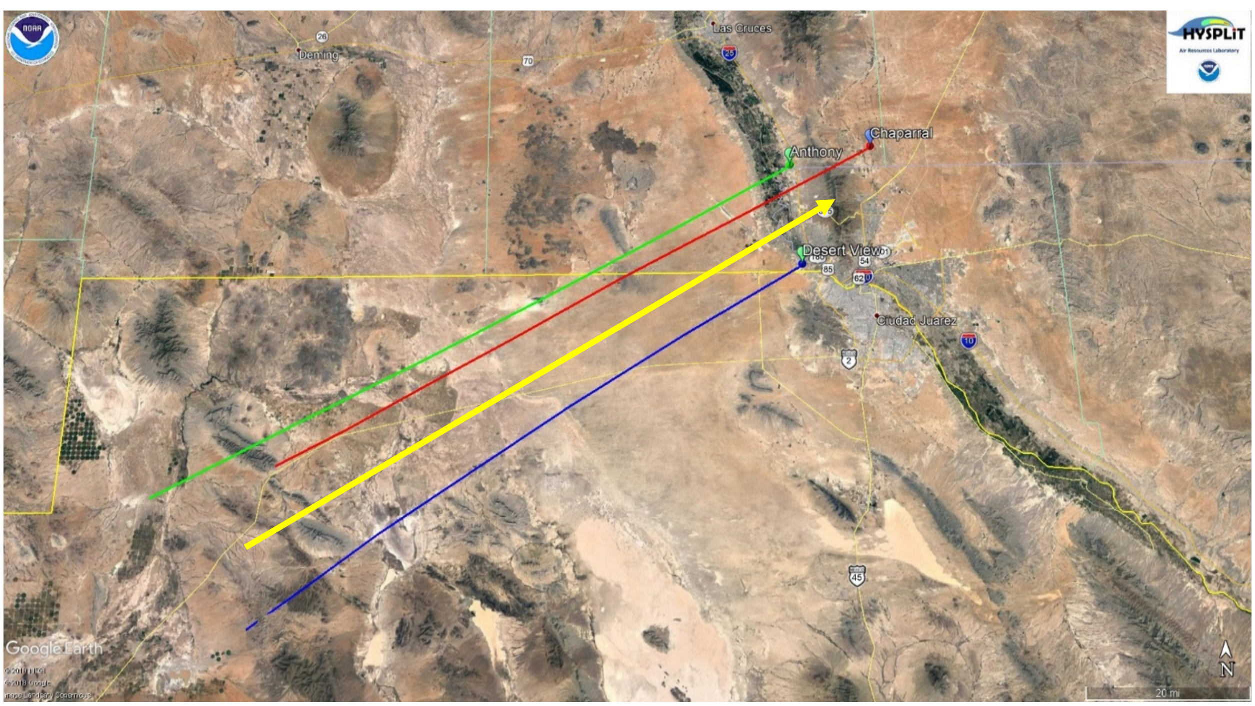

Figure 8-3. Map of NMED monitoring sites with a recorded exceedance of the NAAQS, predominant wind direction and suspected source locations for the high wind blowing dust event.

The co-occurrence of high winds and elevated levels of blowing dust, little to no point sources in the area, and the high hourly and daily PM_{10} concentrations support the assertion that this was a natural event, specifically a high wind dust event. Sustained hourly wind speeds exceeding 9 m/s (~20 mph) were recorded at Holman and West Mesa monitoring sites beginning at the 1200 hour and lasted through the 1900 hour. PM_{10} concentrations began to exceed the NAAQS at the Anthony, Chaparral, Desert View, Holman, and Deming monitoring sites beginning at the 2100 hour. Hourly concentrations remained elevated through the 2100 hour. Table 8-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event.

Hour	Anthony			Chaparral			Desert View			Holman		
	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)
1100	165	6.9	12.2	114	6.5	14.8	75	5.2	12	19	8.9	14.9
1200	352	7.5	13.7	163	7.1	14.2	166	5.6	12.3	29	10	16
1300	640	8.9	16.8	376	8.3	16.5	412	6.8	12.8	44	9.5	16.3
1400	571	10.4	19	823	10.3	18.3	644	7.1	14.5	66	11	21.9
1500	1070	10.9	20.7	679	9.4	20.4	1050	8.2	17.6	117	11.7	19.2
1600	814	10.2	16.9	1077	9	22.5	674	8.8	15.9	107	11.4	18
1700	602	8.9	16.9	659	10.4	20.8	744	8.2	14.1	205	11.7	17.9
1800	460	7.5	11.7	447	9.2	17.7	759	7.1	16	68	9.7	16.4
1900	248	6.3	10.9	320	9.4	15.9	342	6.2	11.9	66	6.9	10.8
2000	208	6.2	12.2	217	8.7	15	112	6	12	73	6.3	10.4
2100	151	3.7	7.9	112	9.1	14.2	39	6.2	10.7	44	4.5	8.2

Table 8-2. Hourly PM10, wind speed and wind gust data during the peak hours of the event.

Meteorologists forecasted the high wind blowing dust event to occur this day, as the spring windy season begins in March for most of the southwestern United States. Forecasts predicted strong winds as the storm approached the area with the area of low pressure tracking from west to east just south of the California in the morning and moving across New Mexico in the afternoon. The systems movement across the area timed well with daytime heating and mixing generating a deep trough to the west as stronger winds aloft moved into the area. Many outlets also forecasted a high probability of blowing and entrained dust throughout the area and haze in the afternoon, especially in the desert areas of southern New Mexico.

Not Reasonably Controllable or Preventable (nRCP)

Not Reasonably Preventable

This demonstration does not provide a showing of not reasonably preventable pursuant to 40 CFR 50.14(b)(5)(iv) that states, in part, "the State shall not be required to provide a case-specific justification for a high wind dust event."

Not Reasonably Controllable

The documentation provided in this section demonstrates that the wind speeds and other meteorological conditions overwhelmed the reasonable control measures in place for anthropogenic sources, causing emissions of dust that were transported to NMED's monitors.

Sustained Wind Speeds

EPA has indicated 11.2 m/s (25 mph) as the wind speed threshold at which natural or controlled anthropogenic sources will emit dust. The Holman monitoring site recorded wind speeds above this threshold for 2 hours from the 15:00 to the 17:00 hour (Figure 8-4). The Wind speeds at the upwind Deming monitoring site also reached the high wind threshold.

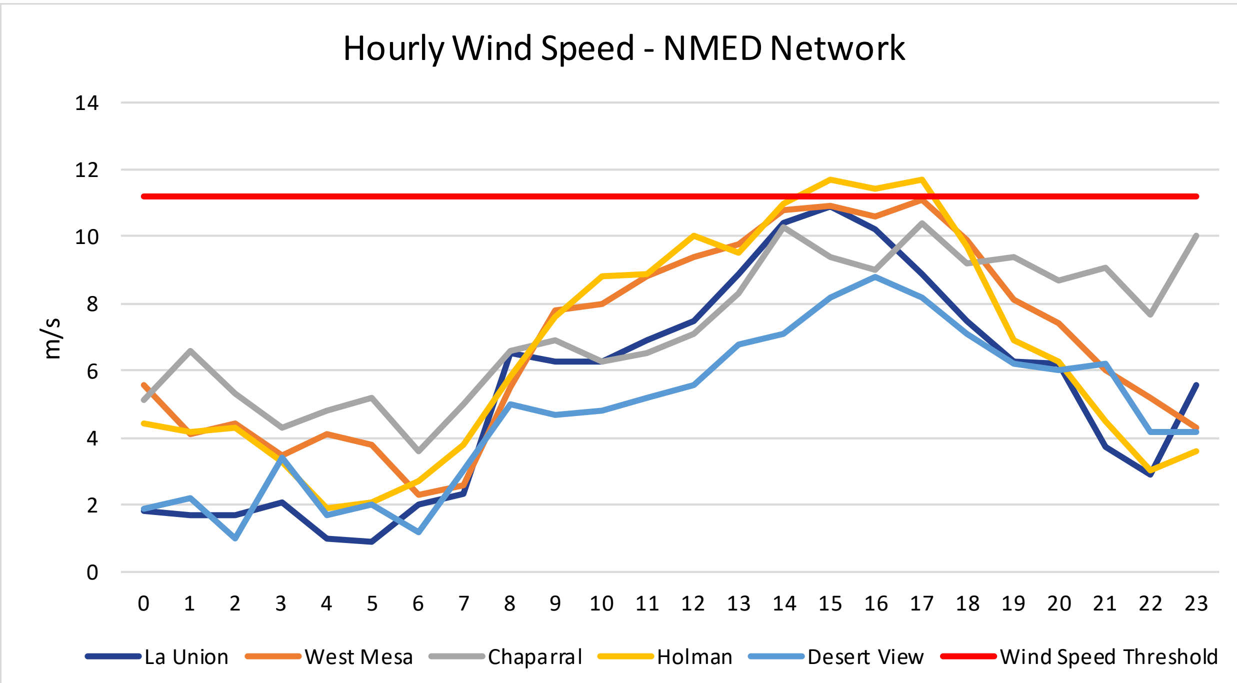

Figure 8-4. Wind speeds at NMED monitoring sites in Doña Ana County.

Level of Controls Analysis

Based on the sustained winds speeds monitored in the area during the event a basic controls analysis will be provided.

Basic Controls Analysis

Implementation and Enforcement of Control Measures

Reasonable controls for anthropogenic sources of dust are based on an area's attainment status for the PM_{10} NAAQS. It is not reasonable for areas designated as attainment, unclassifiable or maintenance to have the same level of controls as areas that are nonattainment for the standard. However, southern New Mexico has a long history of high wind blowing dust events with NMED developing a nonattainment SIP for the Anthony Area and NEAPs for the remaining portion of Doña Ana County and all of Luna County. As discussed in the Background section, NMED worked with local governments to help them develop and adopt dust control ordinances based on BACM. Based on the area's attainment status and SIP waiver, NMED believes these ordinances constitute reasonable controls.

The ordinances developed and adopted under the NEAPs are implemented and enforced at the local level with NMED playing a supporting role to ensure effective and enforceable implementation of control measures. Under the regulatory framework applicable to the two counties, NMED's purview does not include oversight of the extent of the effectiveness and enforcement of local ordinances. However, NMED believes that these ordinances are appropriately implemented at the local level.

Suspected Source Areas and Categories Contributing to the Event
Anthropogenic sources of dust in New Mexico include disturbed lands, construction and demolition activities, vacant parking lots and materials handling and transportation. Area sources account for a much larger portion of overall PM_{10} emissions than point sources. On the day of the event, no unusual PM_{10} producing activities occurred and anthropogenic point source emissions remained constant before, during and after the event. Natural areas of the Chihuahuan Desert in Doña Ana, Luna, Hidalgo and Grant Counties are the most likely sources, under NMED's jurisdiction, contributing to the high wind blowing dust event. Other area sources located in Arizona and Chihuahua, MX likely contributed to the exceedances on this day. Controlling dust from the natural desert terrain is cost prohibitive and falls outside NMED's jurisdiction when it is transported from intrastate and international sources.

The documentation and analysis presented in this section demonstrates that all identified sources that may have caused or contributed to the exceedance were reasonably controlled, implemented and enforced at the time of the event, therefore emissions associated with the high wind dust event were not reasonably controllable or preventable.

Clear Causal Relationship (CCR)

Occurrence and Geographic Extent of the Event

Satellite Imagery
The event was captured on satellite imagery with dust plumes shown as a pink band originating upwind of NMED's monitoring sites near Ascension and Janos, Chih. This area is largely rural with the largest area sources of PM originating from agricultural activities as well as the vast desert areas and playas in northern Mexico (Figure 8-5). The dust plumes of interest appear to be limited to Mexico, orientated in a southwest to northeast fashion and traveling toward El Paso and NMED's monitoring sites at the time of the satellite pass (1400 hour MDT) that captured the imagery.

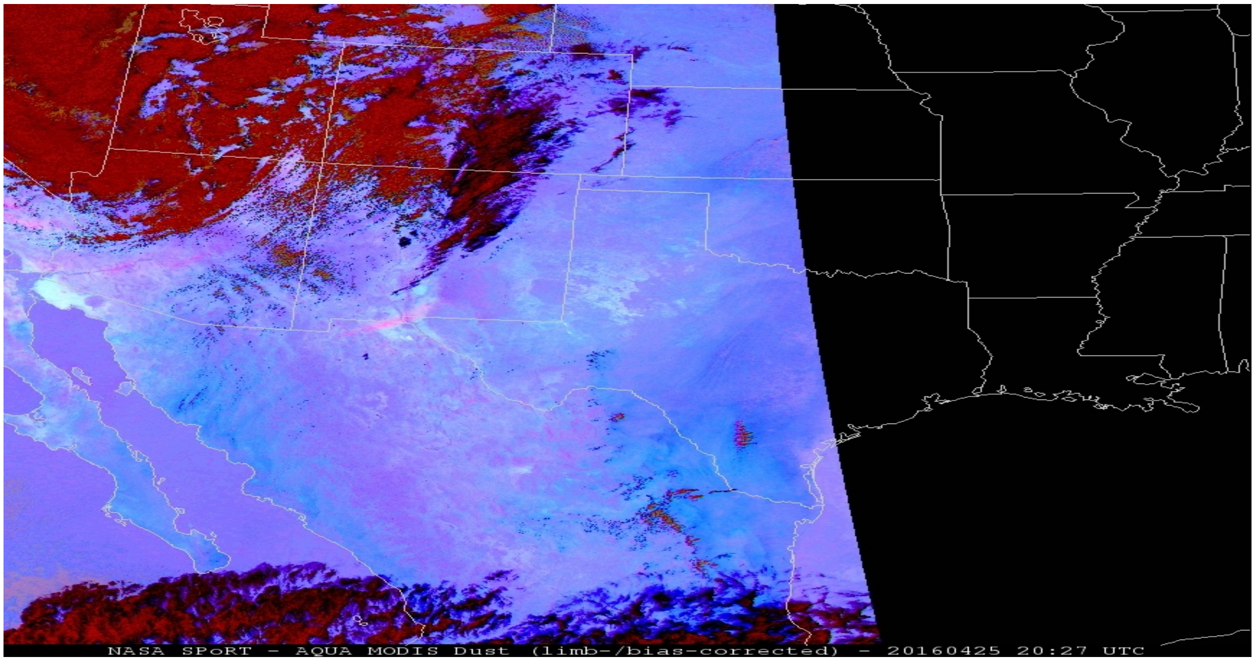

Figure 8-5. MODIS RGB product imagery from the Aqua Satellite showing southwestern New Mexico, northern Chihuahua and western Texas. Imagery obtained from NASA's SPoRT website.

Weather Statements, Advisories, News and Other Media Reports Covering the Event

The National Weather Service (NWS) issued a Wind Advisory and a Blowing Dust Advisory for this date. A Wind Advisory is issued by NWS when sustained winds of 30 to 39 mph are expected for 1 hour or longer. A Blowing Dust Advisory is issued when blowing dust is expected to reduce visibility to between ¼ to 1 mile, generally with winds of 25 mph or greater. These were in place for southwestern New Mexico and west Texas to warn the public of the high wind event. An excerpt from the NWS Wind Advisory can be found below:

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BLOWING DUST WILL REDUCE THE VISIBILITY TO UNDER A MILE OVER A FEW LOWLAND
LOCATIONS INCLUDING ACROSS PORTIONS OF INTERSTATE 10 AROUND
LORDSBURG...DEMING...LAS CRUCES AND EL PASO.
```

Spatial and Transport Analysis

HYSPLiT Backtrajectory Analysis

A back-trajectory analysis using the NOAA Air Resources Laboratory HYSPLIT transport and dispersion model (Draxler et al., 2015; Rolph et al., 2017) shows that the air masses traveled from Chihuahua, MX into the southern New Mexico and El Paso, TX area and on to the NMED monitoring sites. The model was run using GDAS meteorological data for the six hours preceding the start of elevated PM_{10} concentrations during the event (Figures 8-6 through 8-8). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

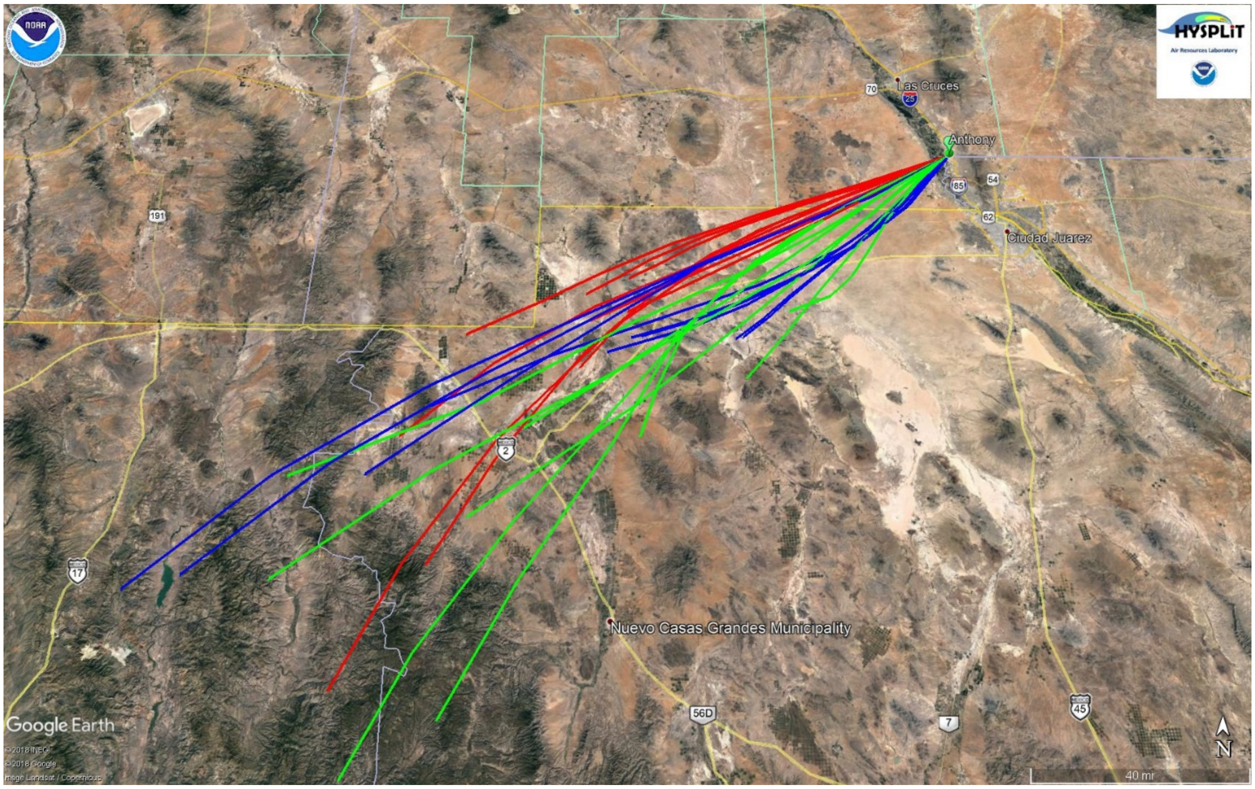

Figure 8-6. HYSPLiT back-trajectory analyses using the Ensemble mode for the Anthony monitoring site.

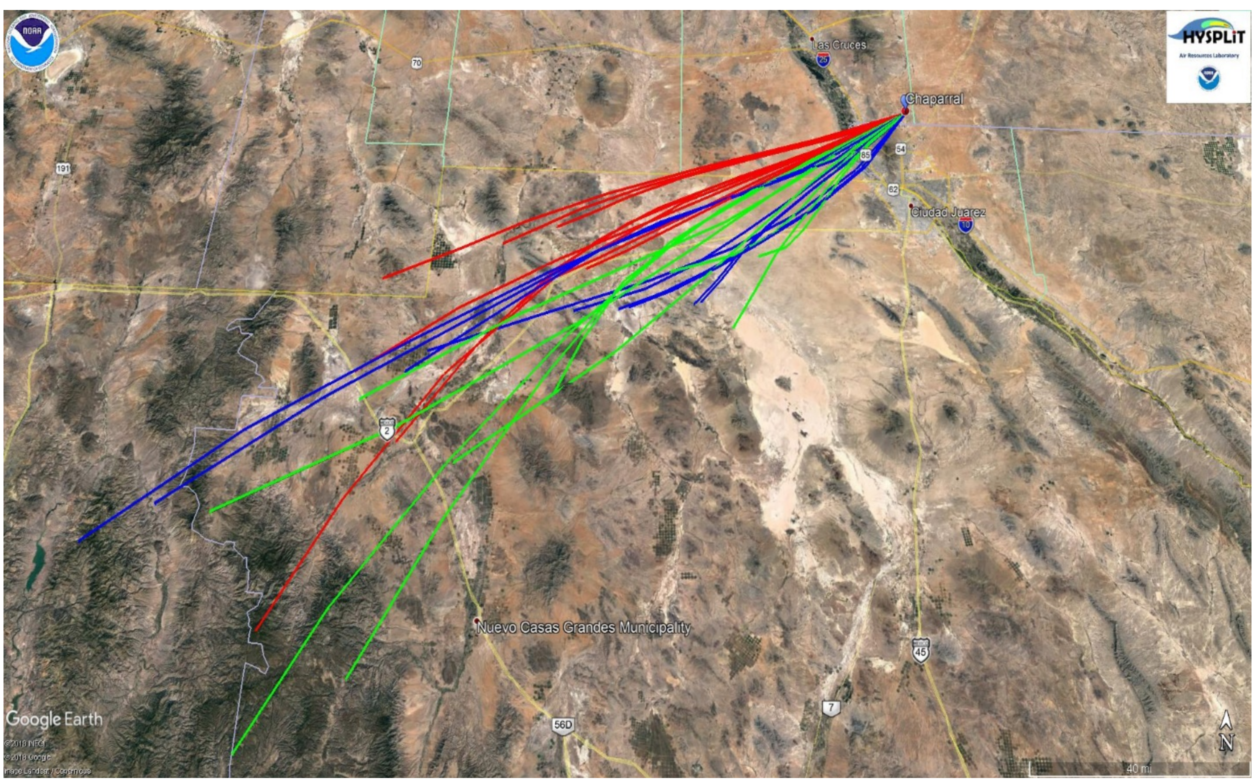

Figure 8-7. HYSPLiT back-trajectory analyses using the Ensemble mode for the Chaparral monitoring site.

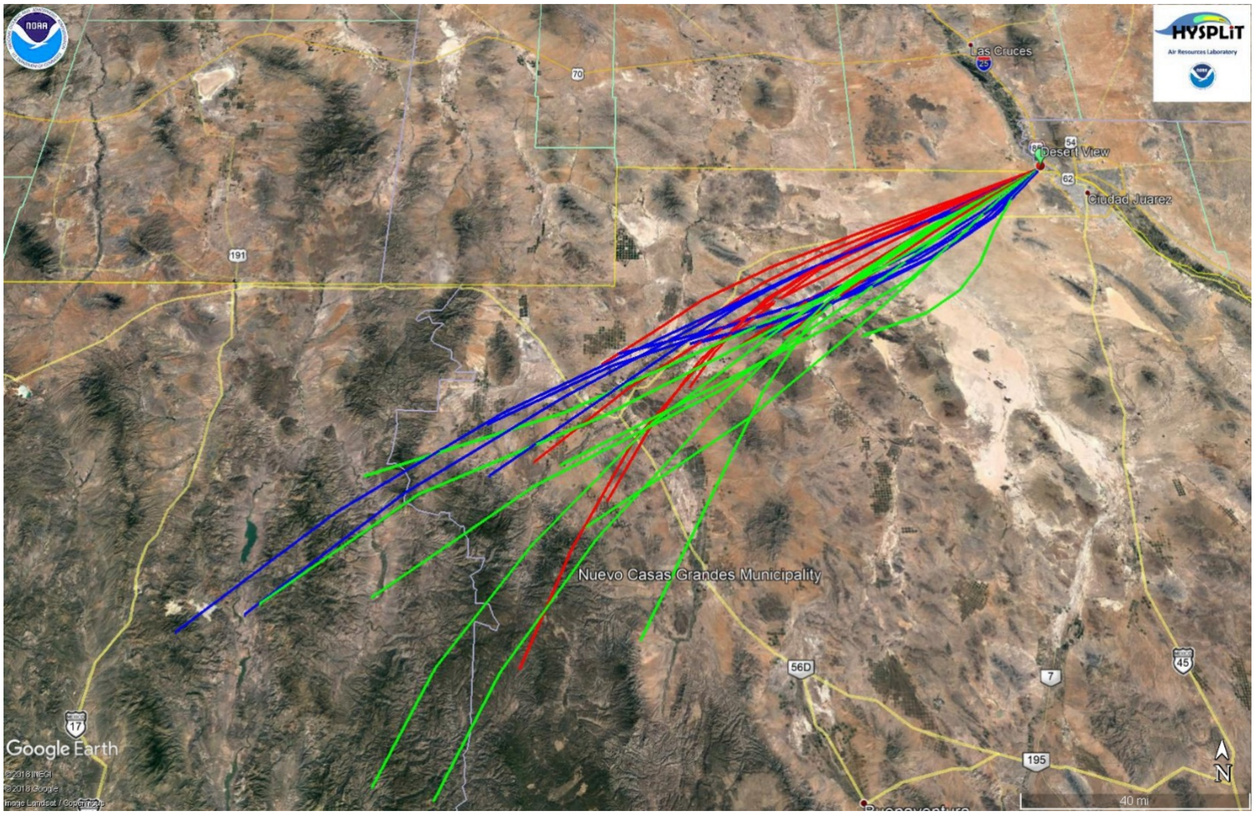

Figure 8-8. HYSPLiT back-trajectory analyses using the Ensemble mode for the Desert View monitoring site.

Wind Direction and Elevated PM_{10} Concentrations

Pollution roses (Figures 8-9 through 8-11) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m^3 (1100-2100 hour). During the event, winds blew from the west southwest approximately 80-100% of the time coinciding with peak PM_{10} concentrations.

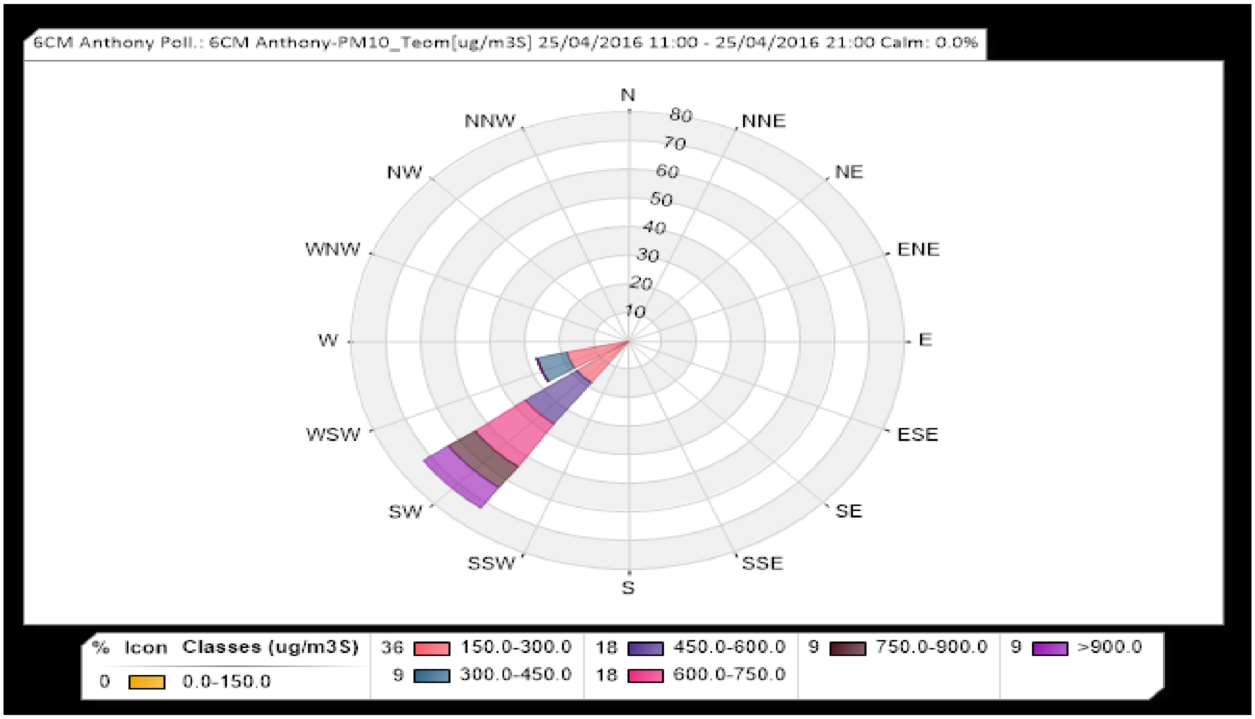

Figure 8-9. Pollution rose for the Anthony monitoring site

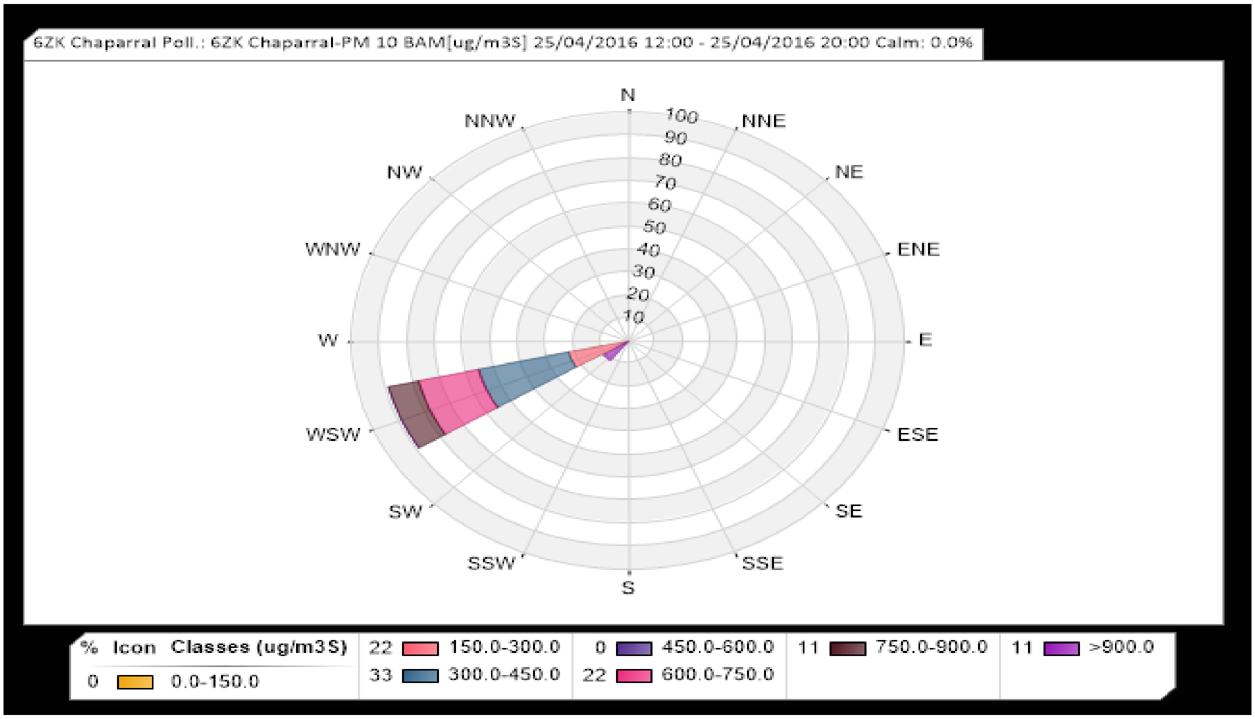

Figure 8-10. Pollution rose for the Chaparral monitoring site.

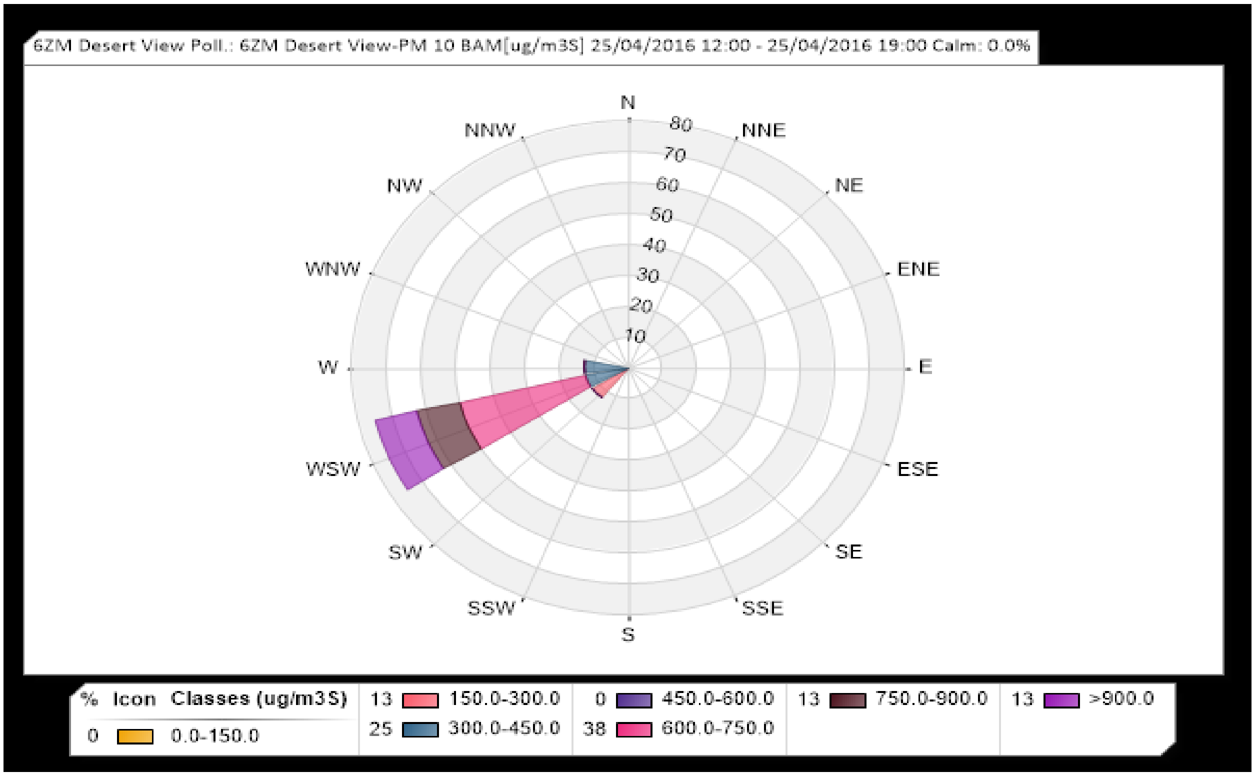

Figure 8-11. Pollution rose for the Desert View monitoring site.

Temporal Relationship of High Wind and Elevated PM_{10} Concentrations

The high wind blowing dust event generated strong southwesterly winds beginning at the 1200 hour and lasting through the 1900 hour. During this time, peak hourly PM_{10} concentrations ranged from 290 to 1077 µg/m^3 at NMED monitoring sites (Figure 8-12). Although not all NMED monitoring sites recorded an exceedance of the NAAQS, hourly PM_{10} data spiked at approximately the same time throughout the network. Sustained hourly average wind speeds of 11.7 m/s were recorded at the Holman monitoring site during the peak PM_{10} concentrations of the event. The time series plot in Figures 8-13 through 8-15 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

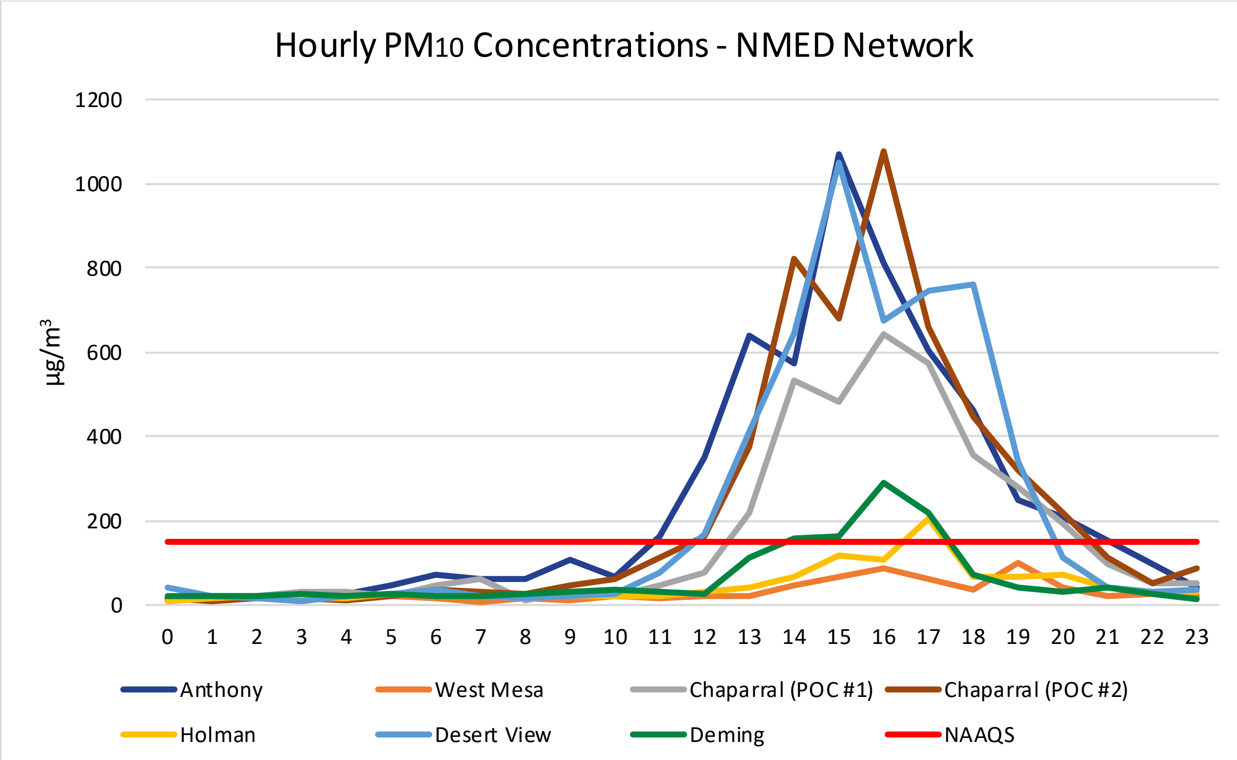

Figure 8-12. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

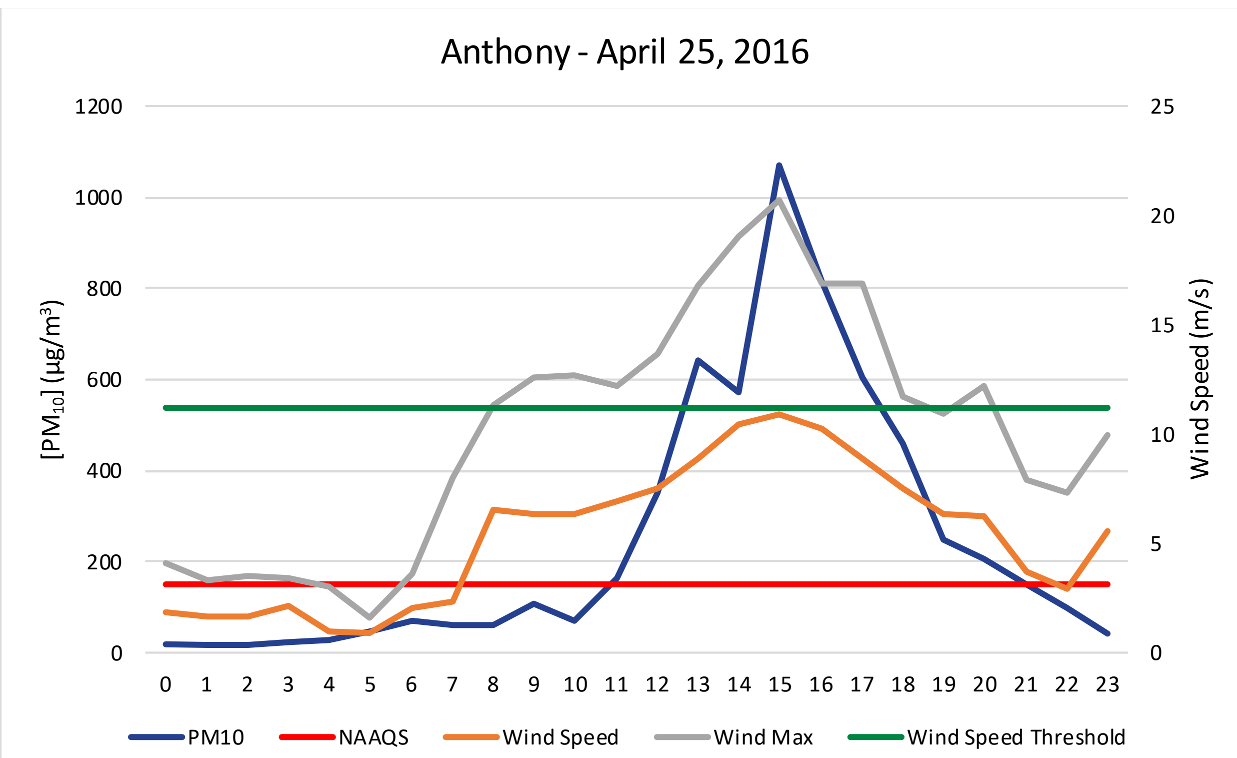

Figure 8-13. Anthony monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

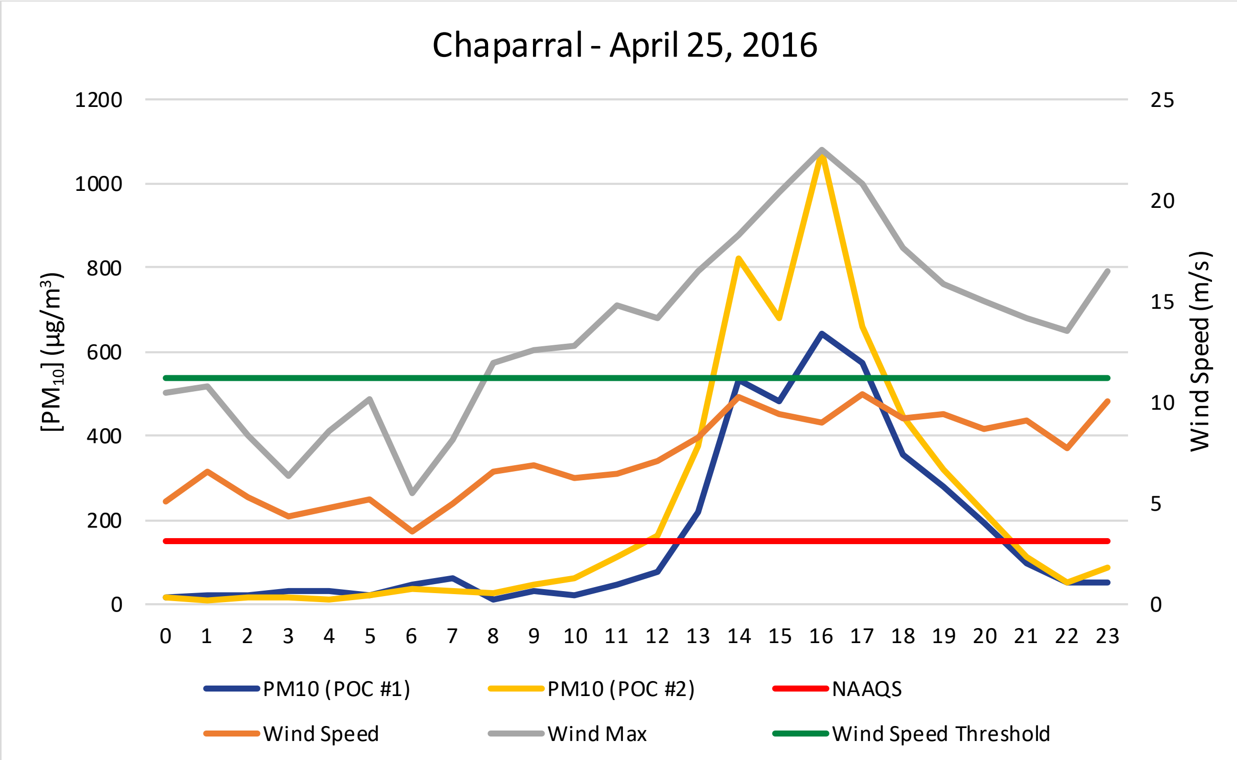

Figure 8-14. Chaparral monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

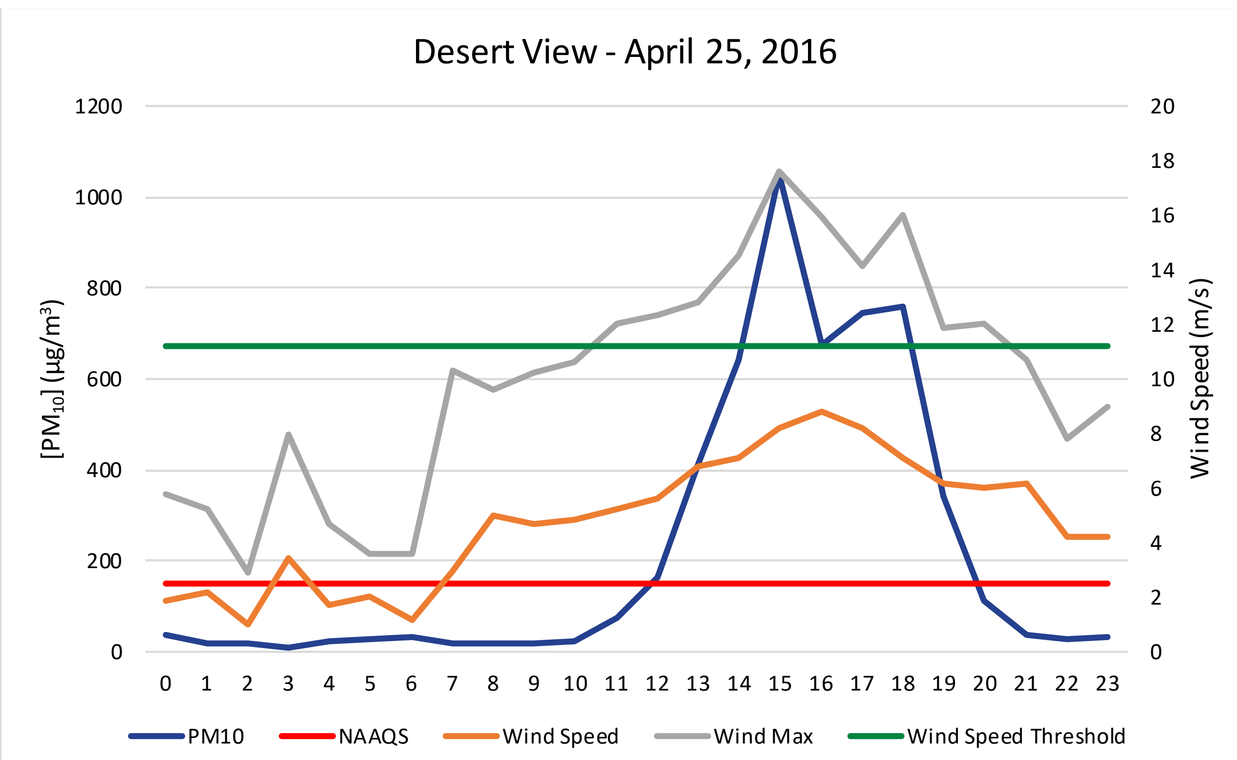

Figure 8-15. Desert View monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2011-2015, the Anthony, Chaparral, and Desert View monitoring sites recorded 54 exceedances for Anthony and 43 exceedances each for both Chaparral and Desert View of the PM_{10} NAAQS (Figures 8-16 through 8-18). The maximum 24-hour average PM_{10} concentration at these sites were 1739 (Anthony), 1606 (Chaparral), & 1691 (Desert View) μg/m³ recorded in 2012. High wind blowing dust events in southern New Mexico can occur at any time of the year, but the majority of these days occur during the spring windy season, from March through May. NMED has documented that all exceedances have been caused by high wind blowing dust events.

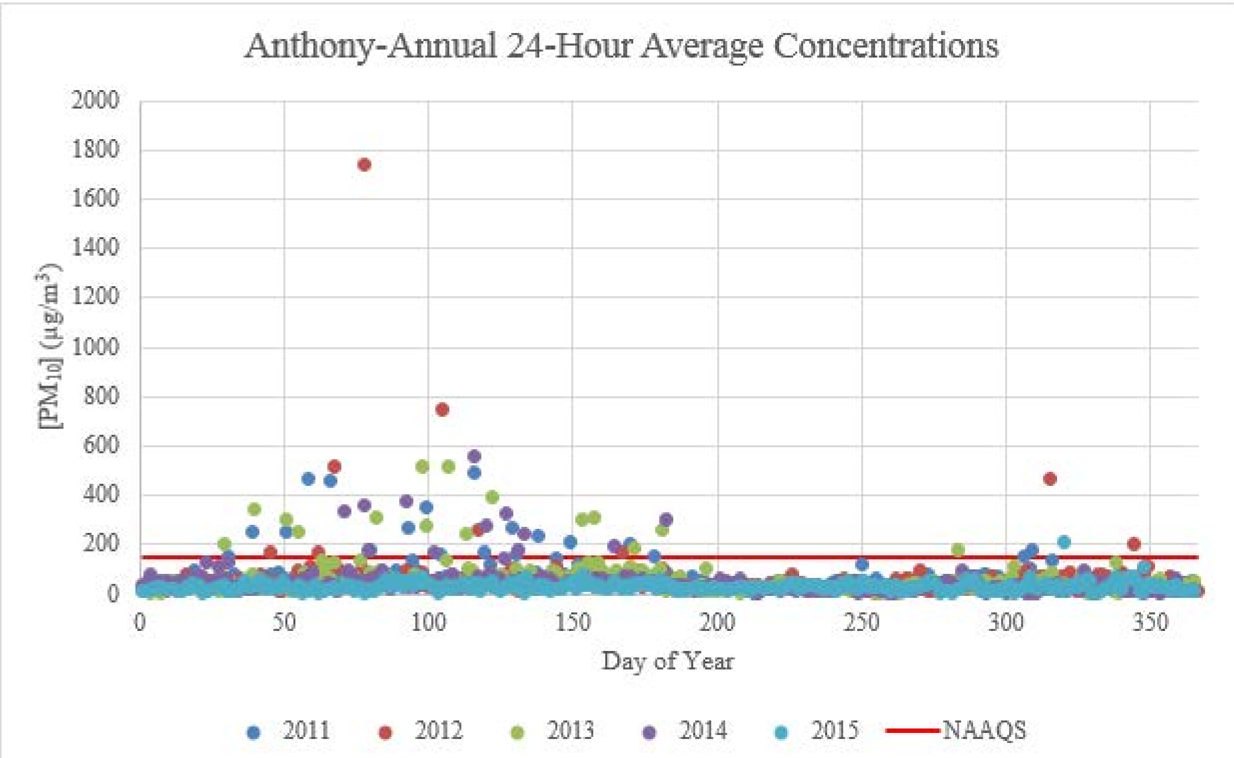

Figure 8-16. Anthony monitoring site 24-hour averages by day of year from 2011-2015.

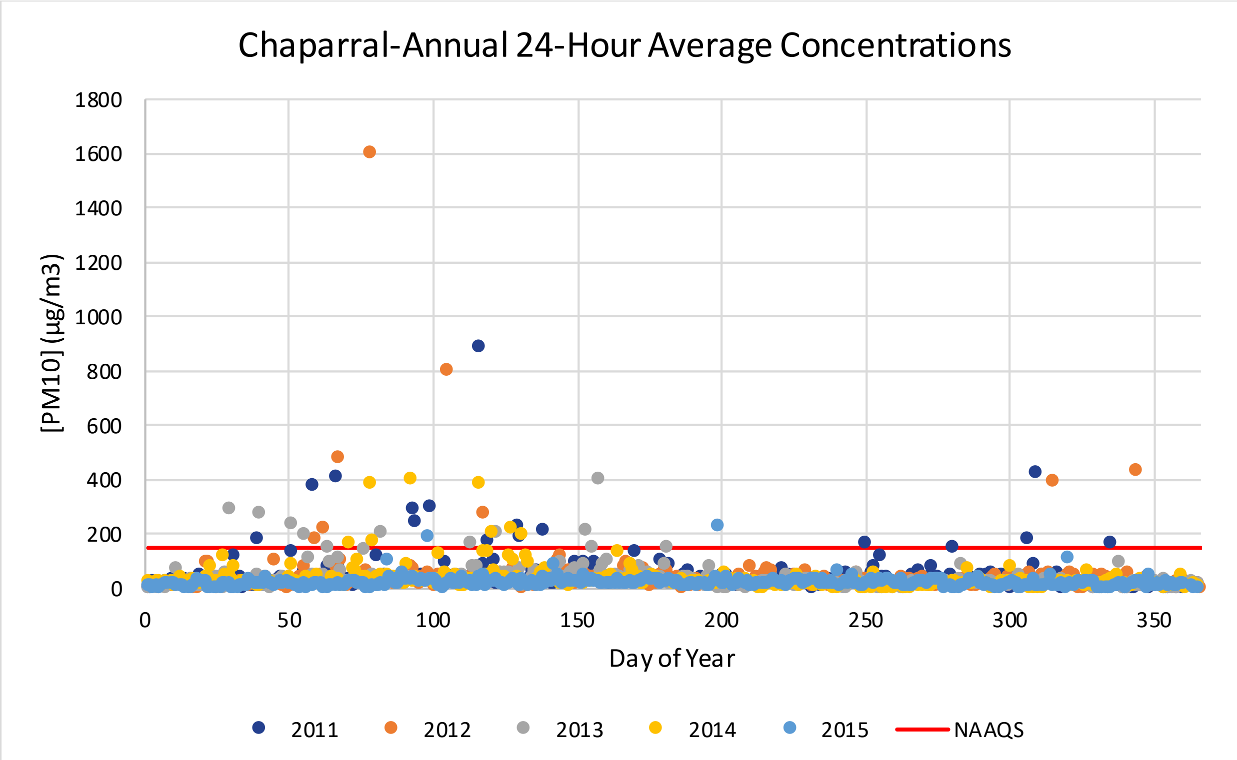

Figure 8-17. Chaparral monitoring site 24-hour averages by day of year from 2011-2015.

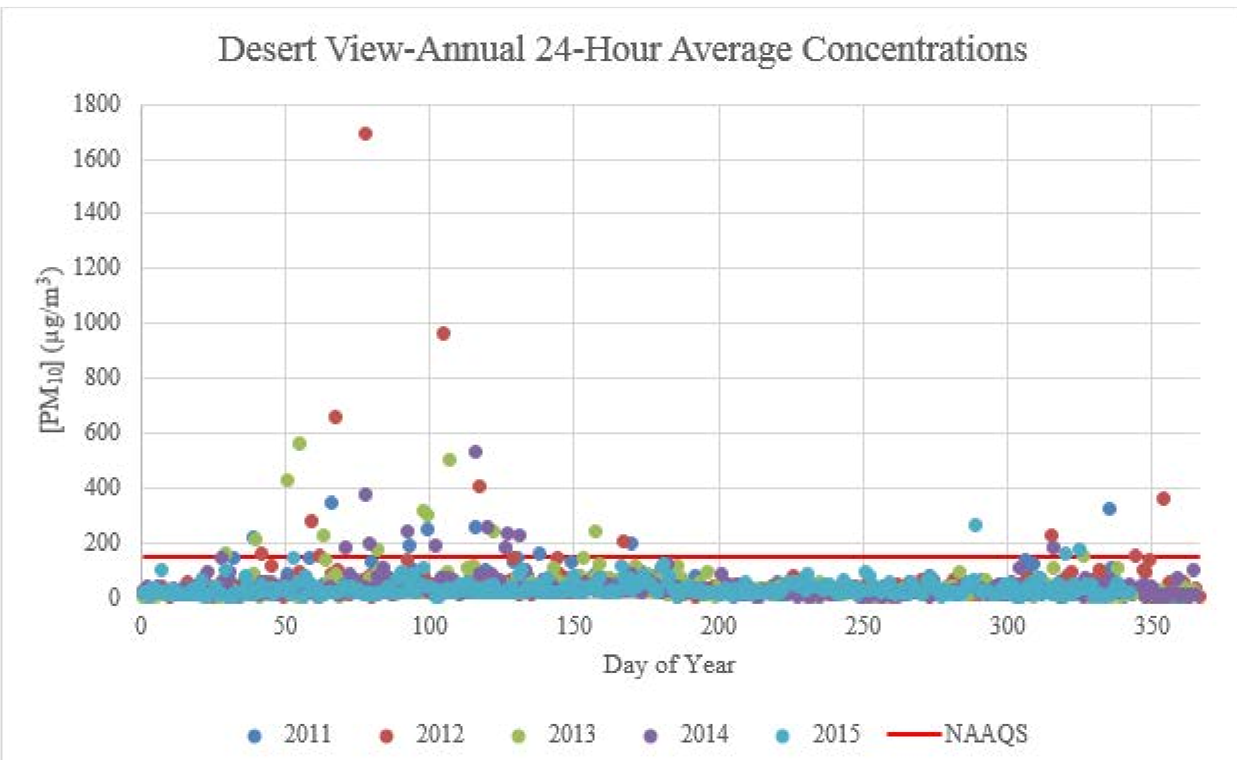

Figure 8-18. Desert view monitoring site 24-hour averages by day of year from 2011-2015.

Spatial and Temporal Variability

As demonstrated in Figure 8-19, all NMED monitoring sites recorded elevated 24-Hour Average PM_{10} concentrations compared to the days preceding and following the event. Daily averages for the days surrounding the event did not surpass 40 µg/m^3, demonstrating the influence high winds have on PM_{10} concentrations in the area.

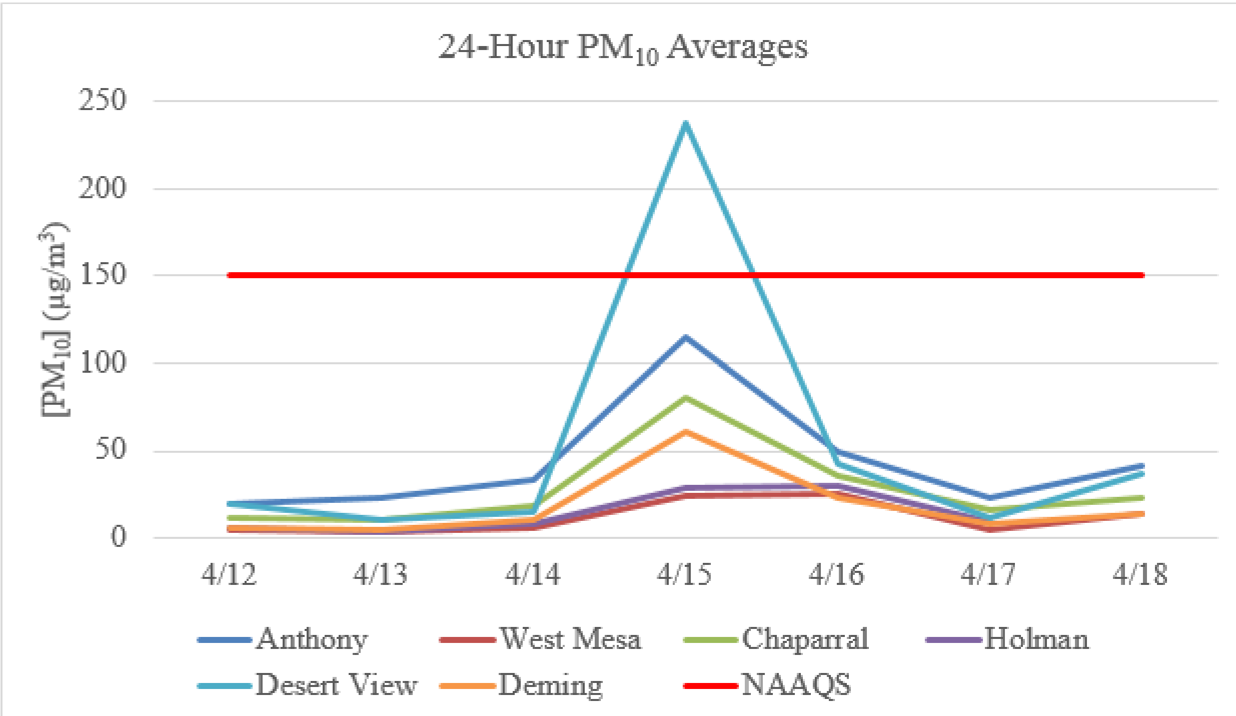

Figure 8-19. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

Percentile Ranking

Table 8-3 shows the 24-Hour Average PM_{10} data distribution recorded at NMED monitoring sites, including high wind blowing dust events flagged with a request to exclude data in the AQS database for exceedances of the standard from 2011-2015. The recorded values for this day 247 (Anthony), 163 (Chaparral POC #1), 225 (Chaparral POC #2), & 221 (Desert View) µg/m^3) are above the 95th percentile of historical data.

Statistic\Monitoring Site	Anthony	West Mesa	Chaparral	Holman	Desert View	Deming
Max	1739	487	1606	1449	1691	1098
99th Percentile	307	160	255	198	253	254
95th Percentile	99	59	91	68	99	68
75th Percentile	54	23	36	31	42	30
50th Percentile	38	16	24	21	28	20
25th Percentile	25	11	16	14	19	13
5th Percentile	13	5	6	6	9	6
Mean	49	23	36	30	40	30

Table 8-3. NMED monitoring sites PM_{10} 24-hour average data distribution. Includes data flagged in AQS for exclusion due to high wind blowing dust events (RJ).

CCR Conclusion

On this day a high wind blowing dust event occurred, generating PM_{10} emissions that resulted in elevated concentrations at Anthony, Chaparral, and Desert View monitoring sites. The monitored PM_{10} 24-Hour Averages of 247 (Anthony), 163 (Chaparral POC #1), 225 (Chaparral POC#2), & 221 (Desert View) µg/m^3 are above the 95th percentile of data monitored over the previous five years. Meteorological conditions were consistent with past event days and elevated PM_{10} concentrations. The comparisons and analyses provided in the CCR section of this demonstration support NMED's position that the event affected air quality in such a way that a clear causal relationship exists between the high wind blowing dust event and the monitored exceedances on this day, satisfying the CCR criterion.

Natural Event

The CCR and nRCP analyses show that this was a natural event caused by high wind and blowing dust. Based on the documentation provided in this demonstration, the event qualifies as a natural event. The exceedances associated with the event meets the regulatory definition of a natural event at 40 CFR 50.14(b)(8). This event transported windblown dust from natural and anthropogenic sources that have been reasonably controlled and accordingly, NMED has demonstrated that the event is a natural event and may be considered for treatment as an exceptional event.

9. HIGH WIND EXCEPTIONAL EVENT: May 6, 2016

Conceptual Model

A Pacific cold front caused high winds and blowing dust in Doña Ana County resulting in an exceedance of the PM_{10} NAAQS at the Anthony, Chaparral, and Desert View monitoring sites on this date. In accordance with the EER, the AQB submitted this data to EPA's AQS database and flagged it (coded as RJ) as a high wind dust event (Table 9-1).

AQS Flag	AQS ID	Site Name	24-Hour Average Concentration	Max 1-Hour Wind Speed	Max Gust
RJ	35-013-0016	6CM Anthony	252 $\mu g/m^3$ (POC #1)	9.8 m/s	17.3 m/s
RJ	35-013-0020	6ZK Chaparral	230 $\mu g/m^3$ (POC #1)	9.2 m/s	19.3 m/s
RJ	35-013-0020	6ZK Chaparral	269 $\mu g/m^3$ (POC #2)	9.2 m/s	19.3 m/s
RJ	35-013-0021	6ZM Desert View	184 $\mu g/m^3$	7.3m/s	15.1 m/s

Table 9-1. 2016 PM_{10} Data flagged by NMED for exclusion pursuant to the EER.

A large upper level low pressure system approached the state which strengthened the southwest flow over the area. As the storm system moved through the state, a pressure gradient formed over southeastern Arizona, southwestern New Mexico and northern Mexico (Figure 9-1). At the 1800 hour, an area of low pressure moved over the Great Basin. Aloft, the low-pressure center of the storm system hovered along the coast of California and central Baja. As the day progressed this low pressure aloft traveled east and aligned itself with New Mexico and the surface wind direction (Figure 9-2). Diurnal heating of the surface allowed winds aloft to mix down, increasing the surface wind velocities and provided the turbulence required for vertical mixing and entrainment of dust.

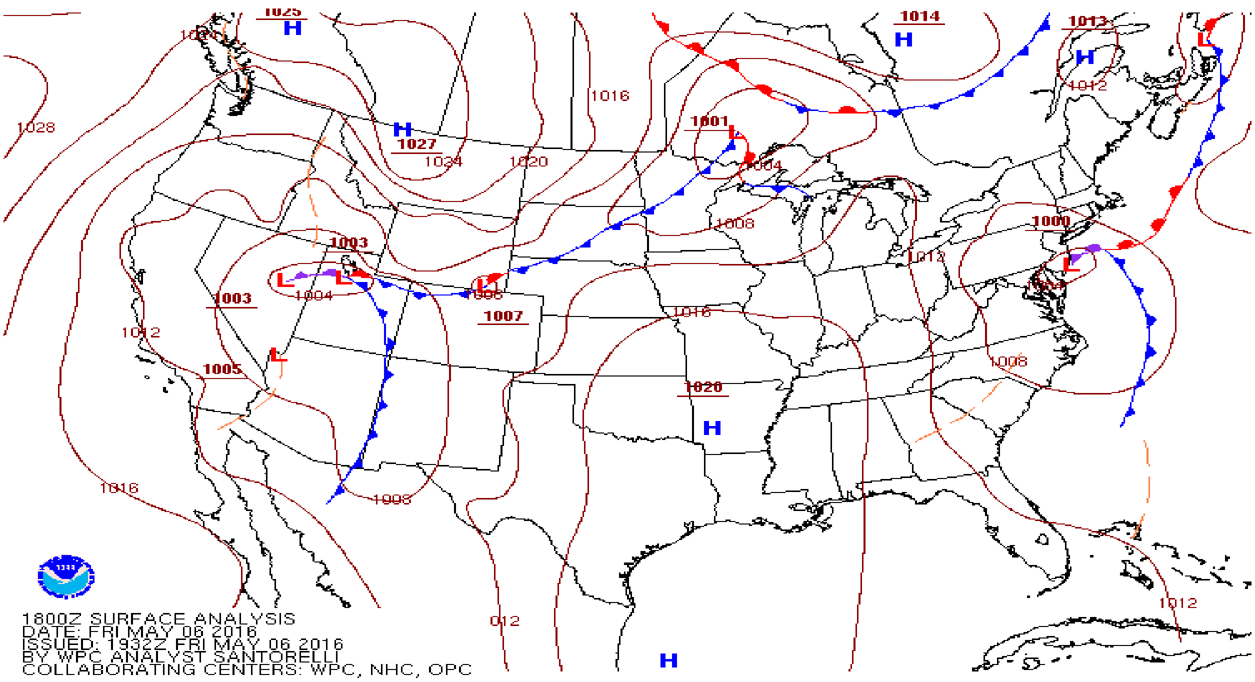

Figure 9-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

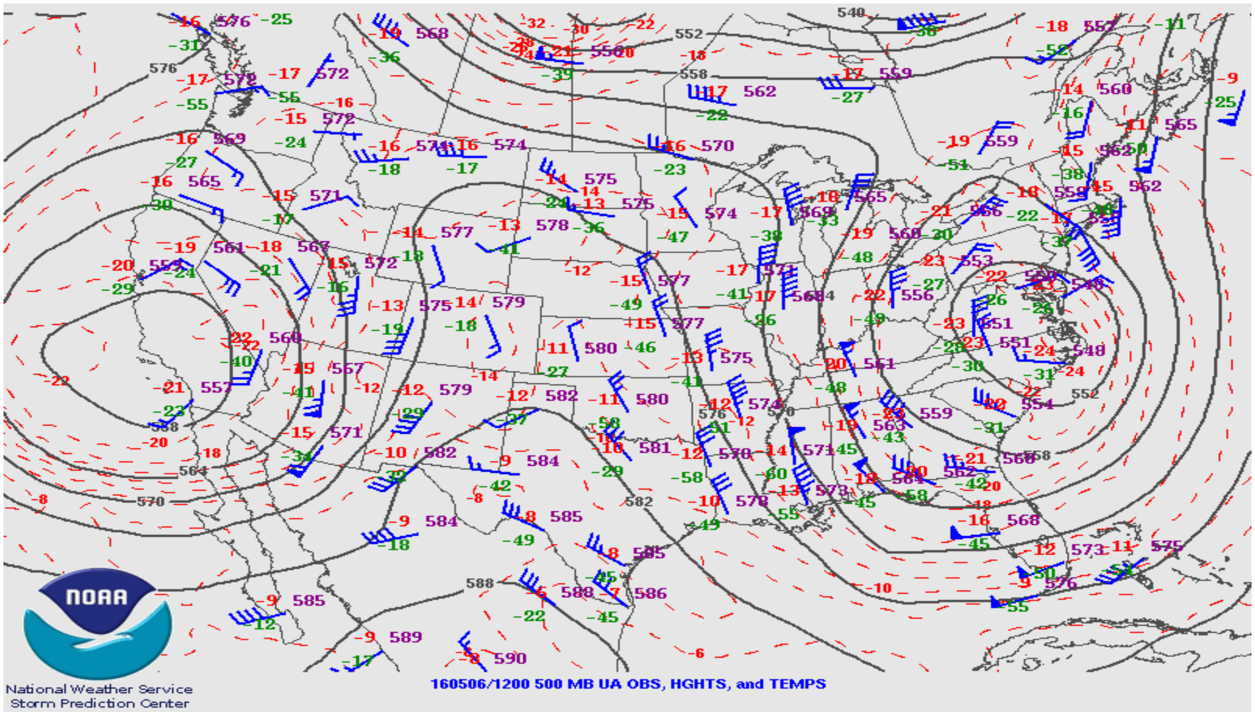

Figure 9-2. Upper air weather map for May 6, 2016 at the 1200 hour. Wind barbs depict wind speed (knots) and direction.

As the event unfolded, the wind blew from the southwest throughout the border region. These high velocity winds passed over large areas of desert within New Mexico and Mexico (Figure 9-3). Anthropogenic sources of dust near NMED's monitoring sites include: disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

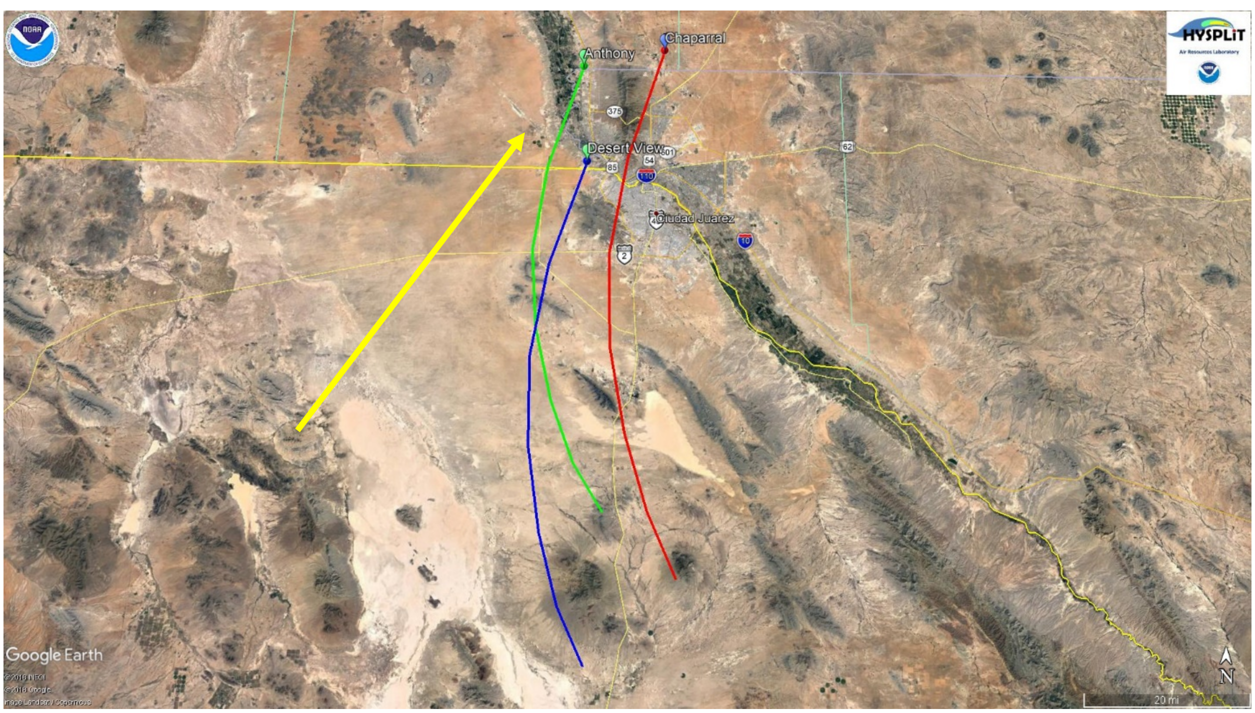

Figure 9-3. Map of NMED monitoring sites with a recorded exceedance of the NAAQS, predominant wind direction and suspected source locations for the high wind blowing dust event.

The co-occurrence of high winds and elevated levels of blowing dust, little to no point sources in the area, and the high hourly and daily PM_{10} concentrations support the assertion that this was a natural event, specifically a high wind dust event. Sustained hourly wind speeds exceeding 9 m/s (~20 mph) were recorded at Chaparral, Holman, La Union and Deming monitoring sites beginning at the 1200 hour and lasted through the 1700 hour. PM_{10} concentrations began to exceed the NAAQS at the Anthony, Desert View, Chaparral, Holman, West Mesa and Deming monitoring sites beginning at the 1100 hour. Hourly concentrations remained elevated through the 2300 hour. Table 9-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event.

Hour	Anthony			Chaparral (POC #2)			Desert View		
	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)
1100	197	7.1	14.8	44	5.6	11.4	95	6.5	12.6
1200	143	6.5	13	237	6.4	14	136	6.7	13
1300	149	6.4	14.9	158	5.7	131	151	6.4	13.7
1400	249	7.5	15.2	302	6.7	19.3	346	6.5	14.7
1500	873	8.6	17.3	502	7.4	14.8	385	7.3	14.7
1600	993	9.3	15.4	1113	8.7	14.8	508	6.6	15.1
1700	843	9.8	16	1025	9.2	15.1	1067	7.2	12.9
1800	513	6.8	13.7	698	7.8	15.6	420	6.2	14.7
1900	441	4.9	8.1	500	6.3	10.9	193	3.6	8.4
2000	386	3.5	6.9	539	6.9	11.3	124	1.4	4.3
2100	474	1.4	4.8	537	7.1	11.6	285	1.1	2.9
2200	279	1.3	2.5	312	4.9	8.6	249	2.4	3.9
2300	83	1	2.4	190	3.7	8	58	2.1	3.7

Table 9-2. Hourly PM_{10}, wind speed and wind gust data during the peak hours of the event.

Meteorologists forecasted the high wind blowing dust event to occur this day, as the spring windy season begins in March for most of the southwestern United States. Forecasts predicted strong winds as the storm approached the area with the area of low pressure tracking from west to east along the borders of Arizona, Utah, and Nevada in the morning and moving across New Mexico in the afternoon. The systems movement across the area timed well with daytime heating and mixing generating a deep trough to the east as stronger winds aloft moved into the area. Many outlets also forecasted a high probability of blowing and entrained dust throughout the area and haze in the afternoon, especially in the desert areas of southern New Mexico.

Not Reasonably Controllable or Preventable (nRCP)

Not Reasonably Preventable

This demonstration does not provide a showing of not reasonably preventable pursuant to 40 CFR 50.14(b)(5)(iv) that states, in part, “the State shall not be required to provide a case-specific justification for a high wind dust event.”

Not Reasonably Controllable

The documentation provided in this section demonstrates that the wind speeds and other meteorological conditions overwhelmed the reasonable control measures in place for anthropogenic sources, causing emissions of dust that were transported to NMED's monitors.

Sustained Wind Speeds

EPA has indicated 11.2 m/s (25 mph) as the wind speed threshold at which natural or controlled anthropogenic sources will emit dust. The Deming monitoring site recorded wind speeds above this threshold for 1 hour at the 1400 hour (Figure 9-4).

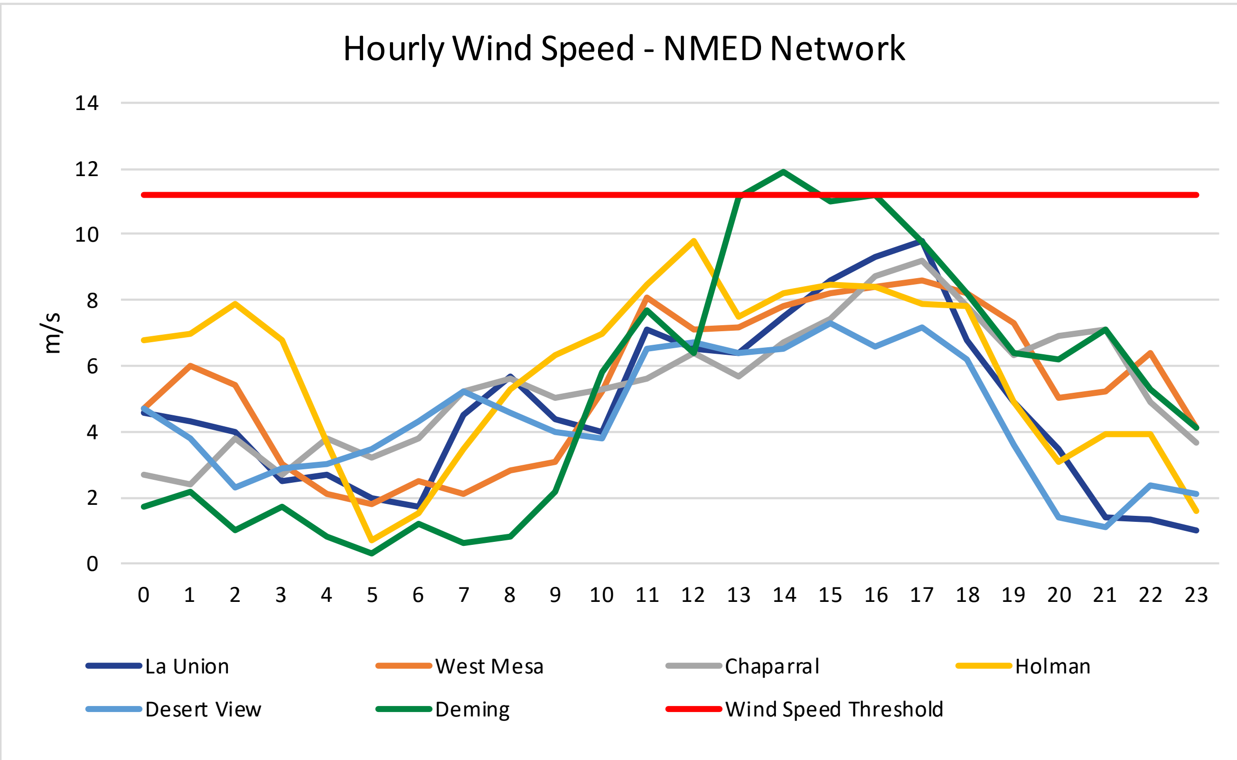

Figure 9-4. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

Level of Controls Analysis

Based on the sustained winds speeds monitored in the area during the event a basic controls analysis will be provided.

Basic Controls Analysis

Implementation and Enforcement of Control Measures

Reasonable controls for anthropogenic sources of dust are based on an area's attainment status for the PM_{10} NAAQS. It is not reasonable for areas designated as attainment, unclassifiable or maintenance to have the same level of controls as areas that are nonattainment for the standard. However, southern New Mexico has a long history of high wind blowing dust events with NMED developing a nonattainment SIP for the Anthony Area and NEAPs for the remaining portion of Doña Ana County and all of Luna County. As discussed in the Background section, NMED worked with local governments to help them develop and adopt dust control ordinances based on BACM. Based on the area's attainment status and SIP waiver, NMED believes these ordinances constitute reasonable controls.

The ordinances developed and adopted under the NEAPs are implemented and enforced at the local level with NMED playing a supporting role to ensure effective and enforceable implementation of control measures. Under the regulatory framework applicable to the two counties, NMED's purview does not include oversight of the extent of the effectiveness and enforcement of local ordinances. However, NMED believes that these ordinances are appropriately implemented at the local level.

Suspected Source Areas and Categories Contributing to the Event
Anthropogenic sources of dust in New Mexico include disturbed lands, construction and demolition activities, vacant parking lots and materials handling and transportation. Area sources account for a much larger portion of overall PM_{10} emissions than point sources. On the day of the event, no unusual PM_{10} producing activities occurred and anthropogenic point source emissions remained constant before, during and after the event. Natural areas of the Chihuahuan Desert in Doña Ana and Luna Counties are the most likely sources, under NMED's jurisdiction, contributing to the high wind blowing dust event. Other area sources located in Texas and Chihuahua, MX likely contributed to the exceedances on this day. Controlling dust from the natural desert terrain is cost prohibitive and falls outside NMED's jurisdiction when it is transported from intrastate and international sources.

The documentation and analysis presented in this section demonstrates that all identified sources that may have caused or contributed to the exceedance were reasonably controlled, implemented and enforced at the time of the event, therefore emissions associated with the high wind dust event were not reasonably controllable or preventable.

Clear Causal Relationship (CCR)

Occurrence and Geographic Extent of the Event

Weather Statements, Advisories, News and Other Media Reports Covering the Event
The National Weather Service (NWS) issued a Wind Advisory and a Blowing Dust Advisory for this date. A Wind Advisory is issued by NWS when sustained winds of 30 to 39 mph are expected for 1 hour or longer. A Blowing Dust Advisory is issued when blowing dust is expected to reduce visibility to between ¼ to 1 mile, generally with winds of 25 mph or greater. These were in place for southwestern New Mexico and west Texas to warn the public of the high wind event. An excerpt from the NWS Wind Advisory can be found below:

STRONG SOUTHWEST WINDS WILL OCCUR THIS AFTERNOON FOR AREAS WEST OF AND NORTH OF LAS CRUCES. WIND SPEEDS OF 25 TO 35 MPH WITH GUSTS UP TO 45 MPH WILL BE POSSIBLE. ALSO AREAS OF BLOWING DUST WILL REDUCE VISIBILITIES TO LESS THAN A MILE IN DUST PRONE AREAS THIS AFTERNOON.

Spatial and Transport Analysis

HYSPLiT Backtrajectory Analysis
A back-trajectory analysis using the NOAA Air Resources Laboratory HYSPLIT transport and dispersion model (Draxler et al., 2015; Rolph et al., 2017) shows that the air masses traveled from Chihuahua, MX into the southern New Mexico and El Paso, TX area and on to the NMED monitoring sites. The model was run using GDAS meteorological data for the six hours preceding the start of elevated PM_{10} concentrations during the event (Figures 9-5 through 9-7). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

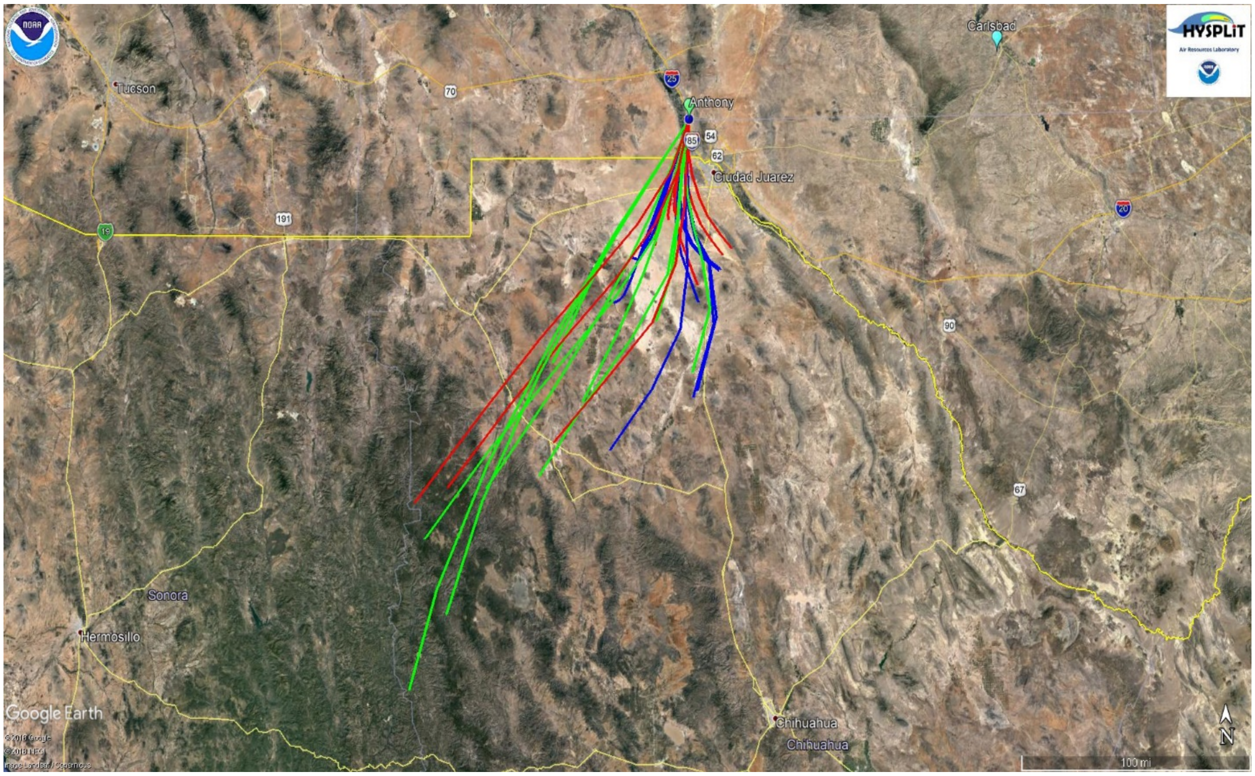

Figure 9-5. HYSPLiT back-trajectory analyses using the Ensemble mode for Anthony monitoring site

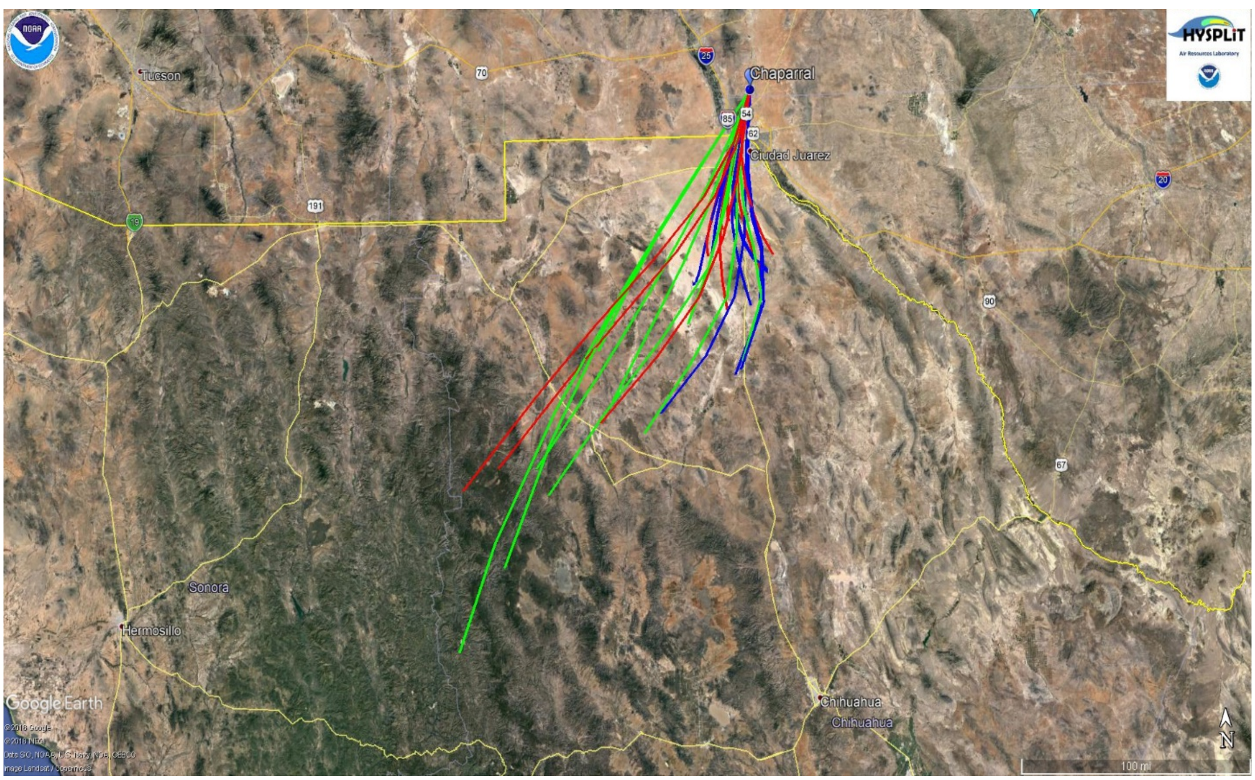

Figure 9-6. HYSPLiT back-trajectory analyses using the Ensemble mode for Chaparral monitoring site

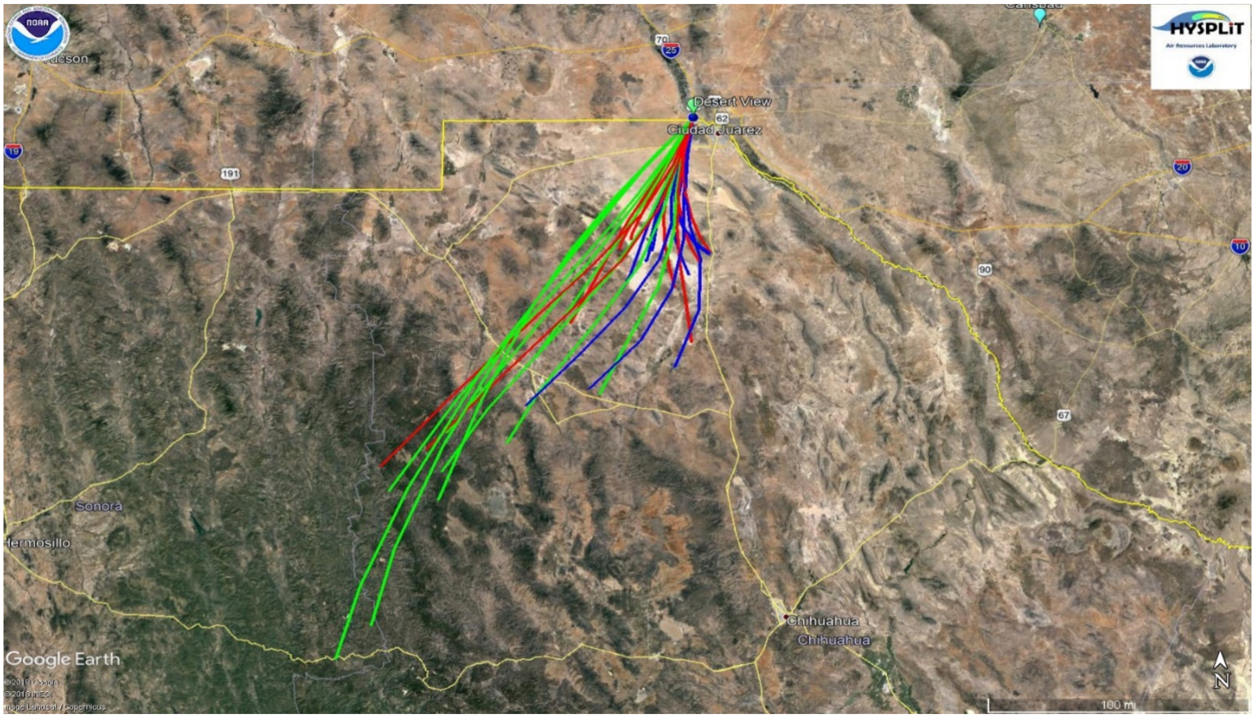

Figure 9-7. HYSPLiT back-trajectory analyses using the Ensemble mode for Desert View monitoring site

Wind Direction and Elevated PM_{10} Concentrations
Pollution roses (Figures 9-8 through 9-10) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m³ (1100 -2300 hour). During the event, winds blew from the west southwest approximately 60-100% of the time coinciding with peak PM_{10} concentrations.

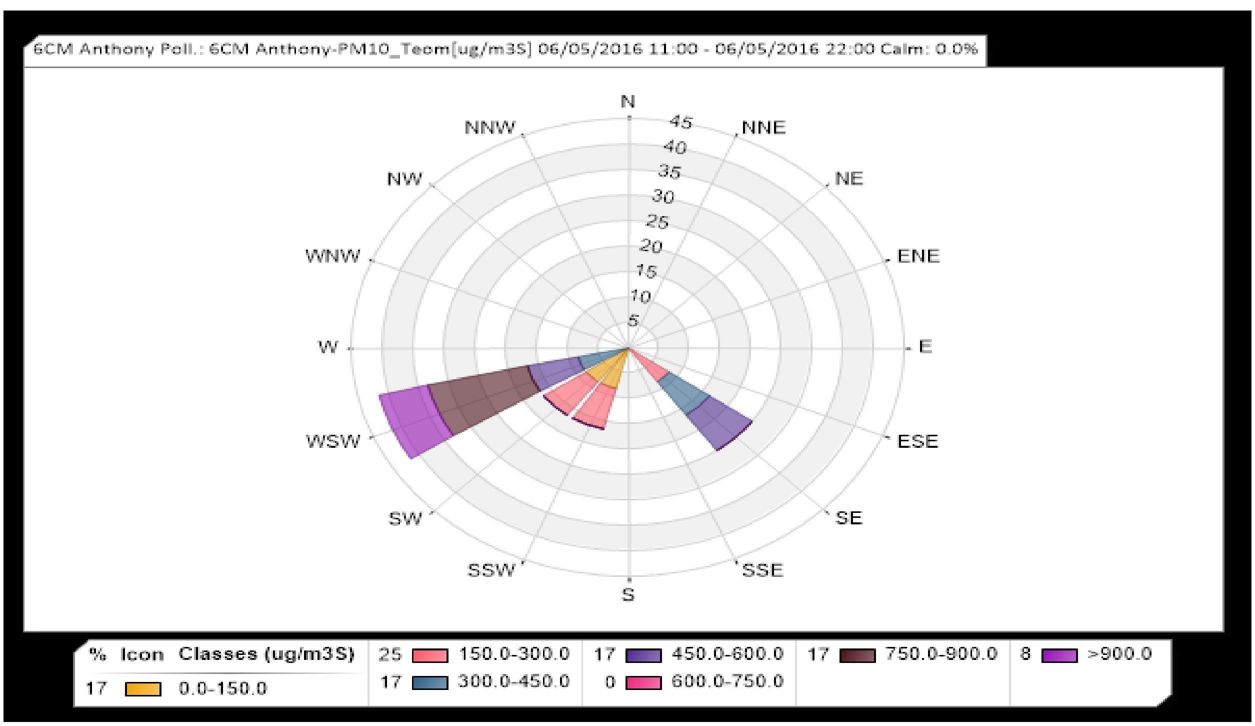

Figure 9-8. Pollution rose for the Anthony monitoring site.

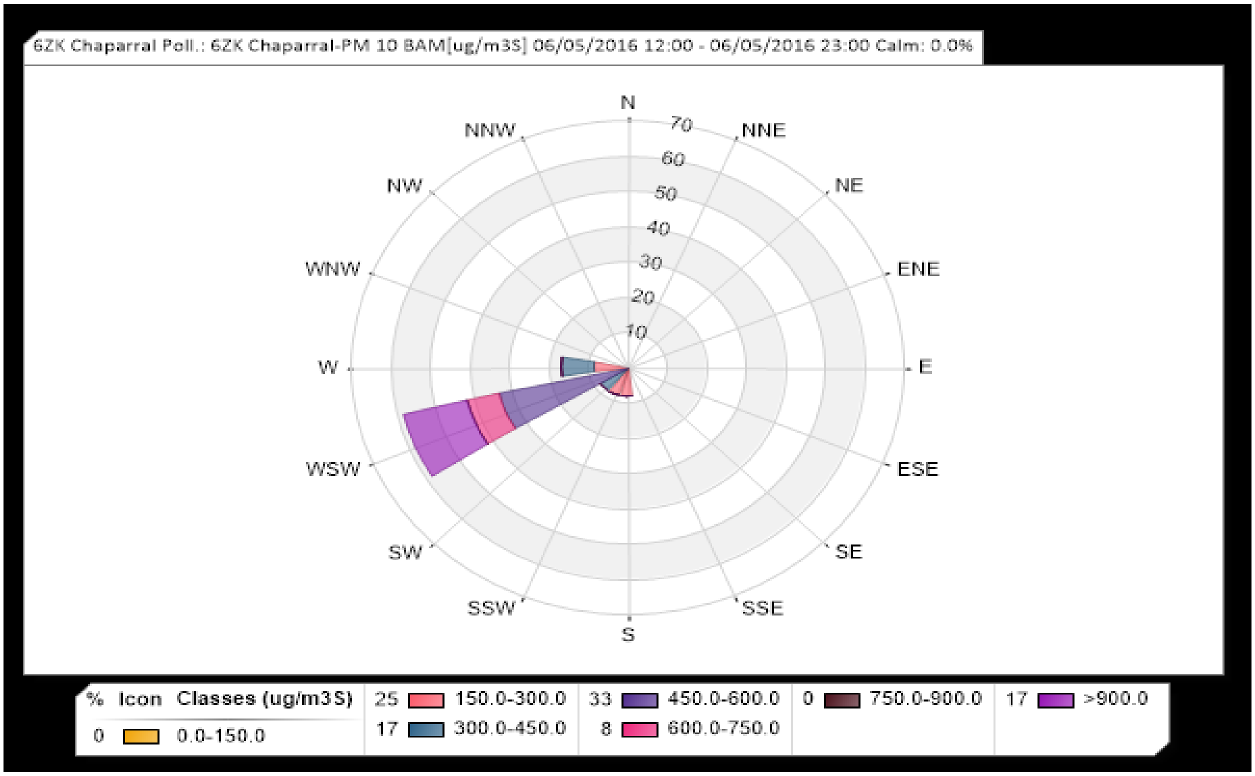

Figure 9-9. Pollution rose for the Chaparral monitoring site.

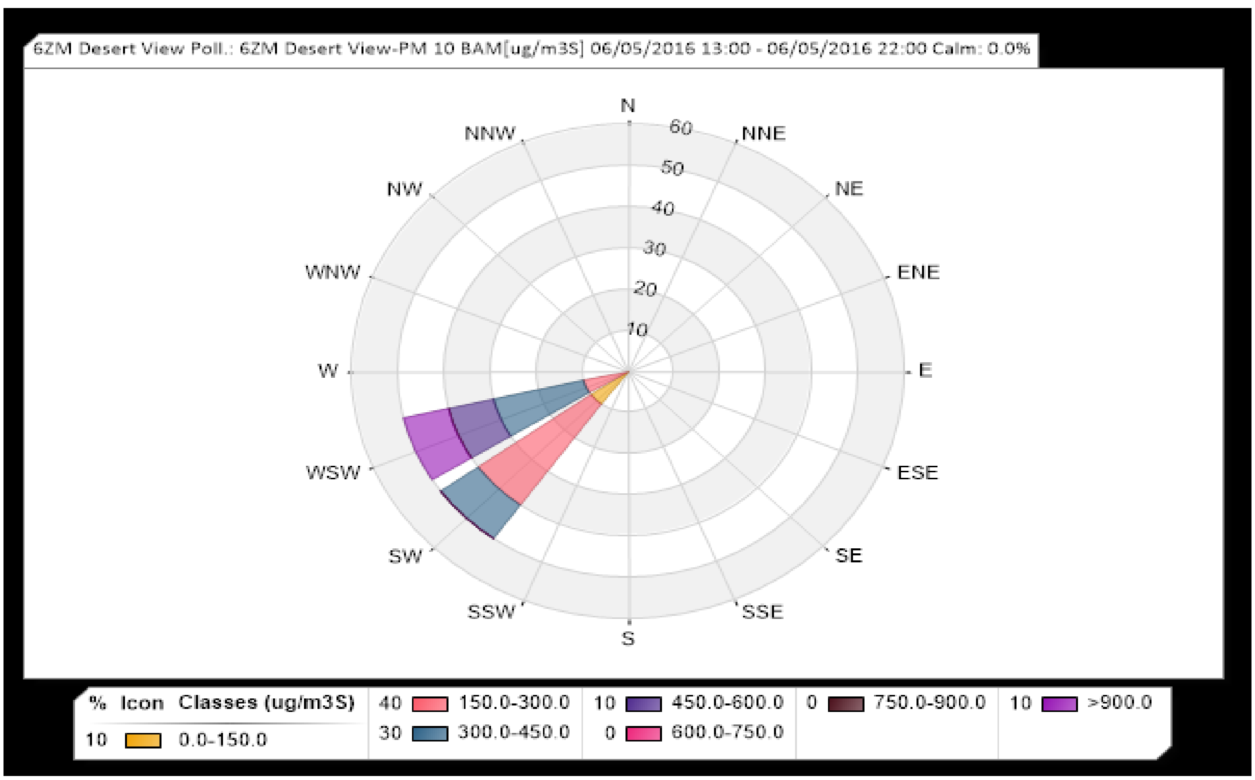

Figure 9-10. Pollution rose for the Desert View monitoring site

Temporal Relationship of High Wind and Elevated PM_{10} Concentrations

The high wind blowing dust event generated strong southwesterly winds beginning at the 1200 hour and lasting through the 1700 hour. During this time, peak hourly PM_{10} concentrations ranged from 320 to 1113 µg/m³ at NMED monitoring sites (Figure 9-11). Although not all NMED monitoring sites recorded an exceedance of the NAAQS, hourly PM_{10} data spiked at approximately the same time throughout the network. Sustained hourly average wind speeds of 11.9 m/s were recorded at the Deming monitoring site during the peak PM_{10} concentrations of the event. The time series plot in Figures 9-12 through 9-14 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

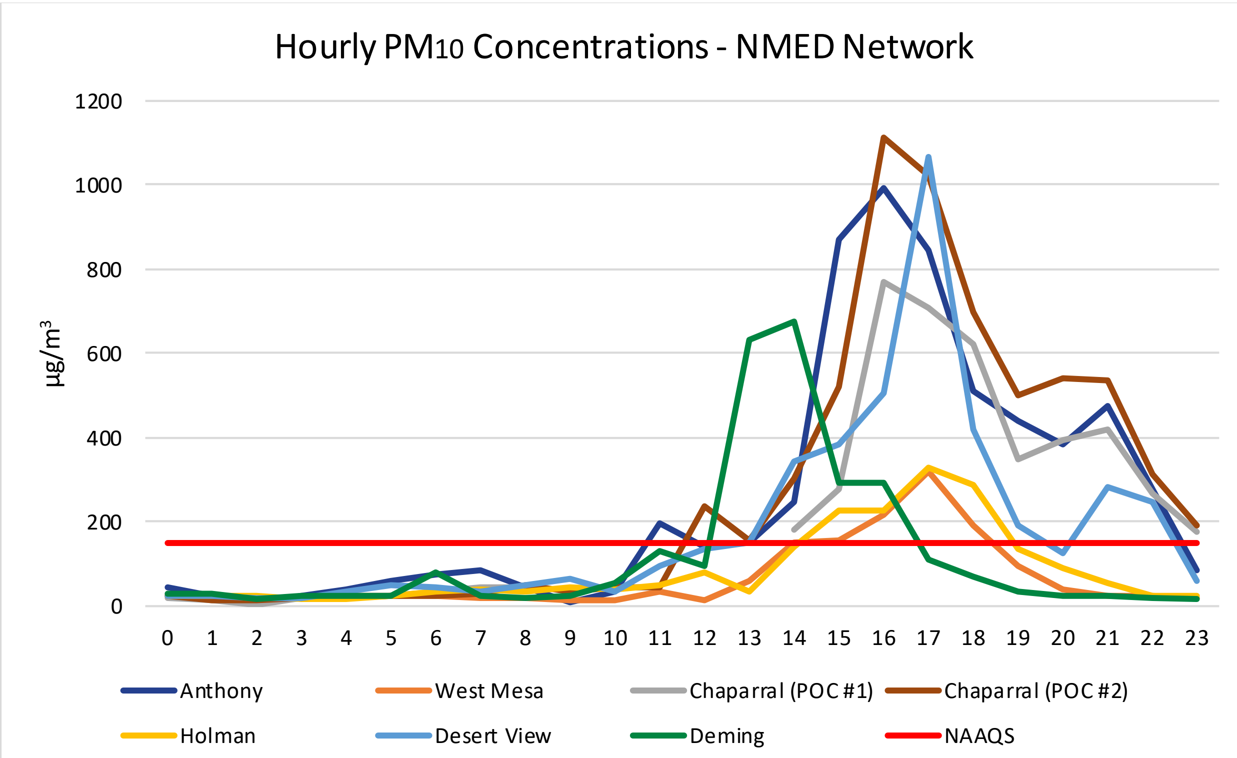

Figure 9-11. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

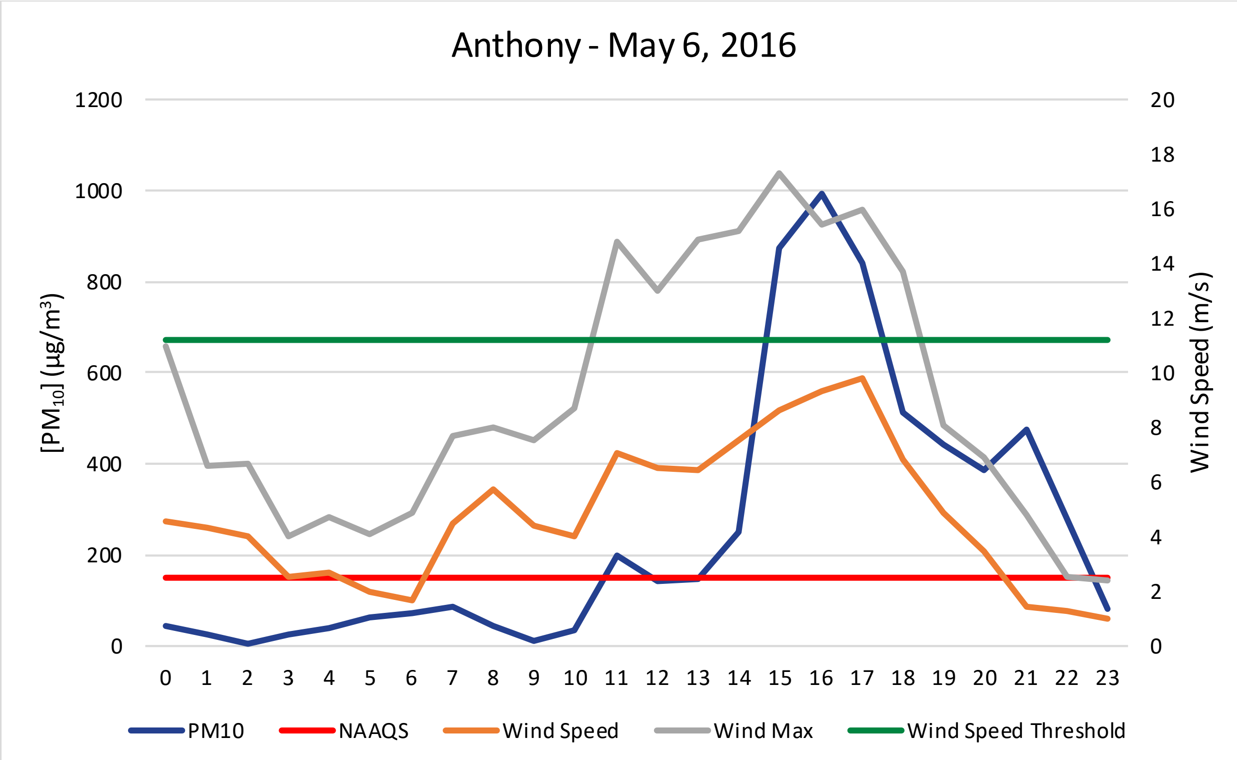

Figure 9-12. Anthony monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

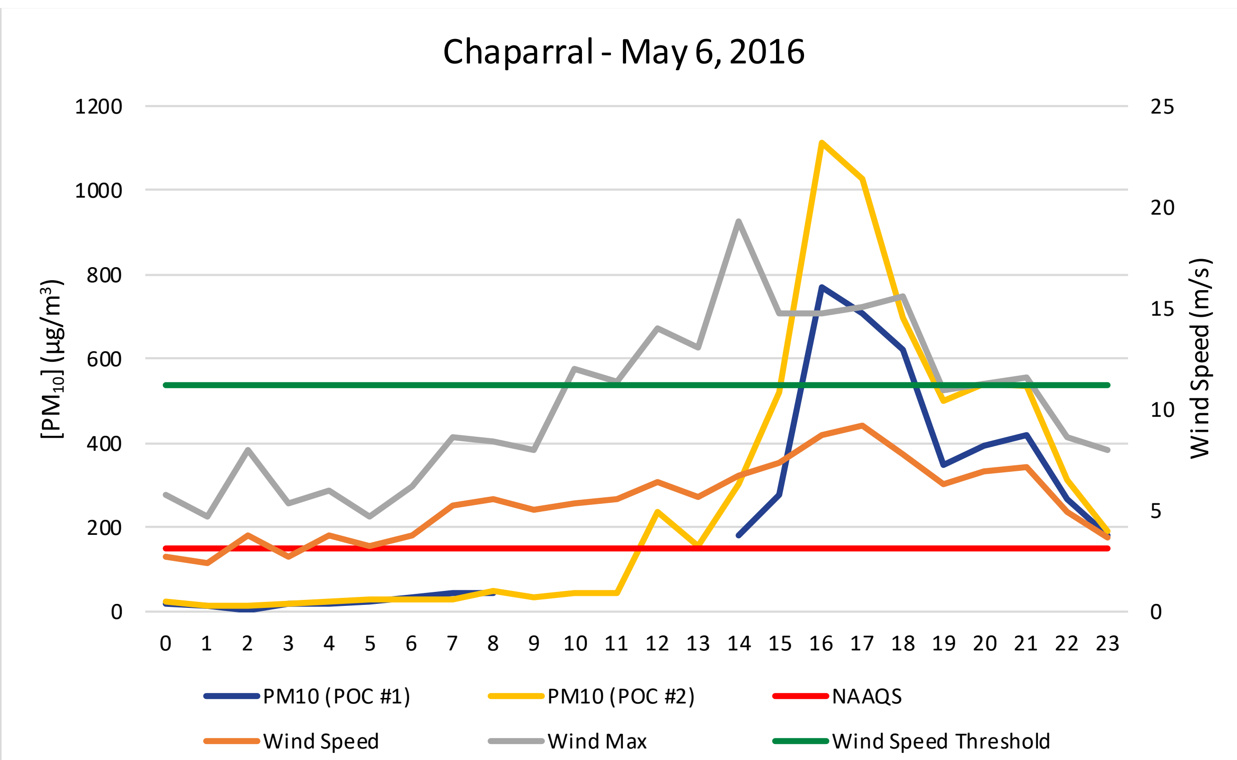

Figure 9-13. Chaparral monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

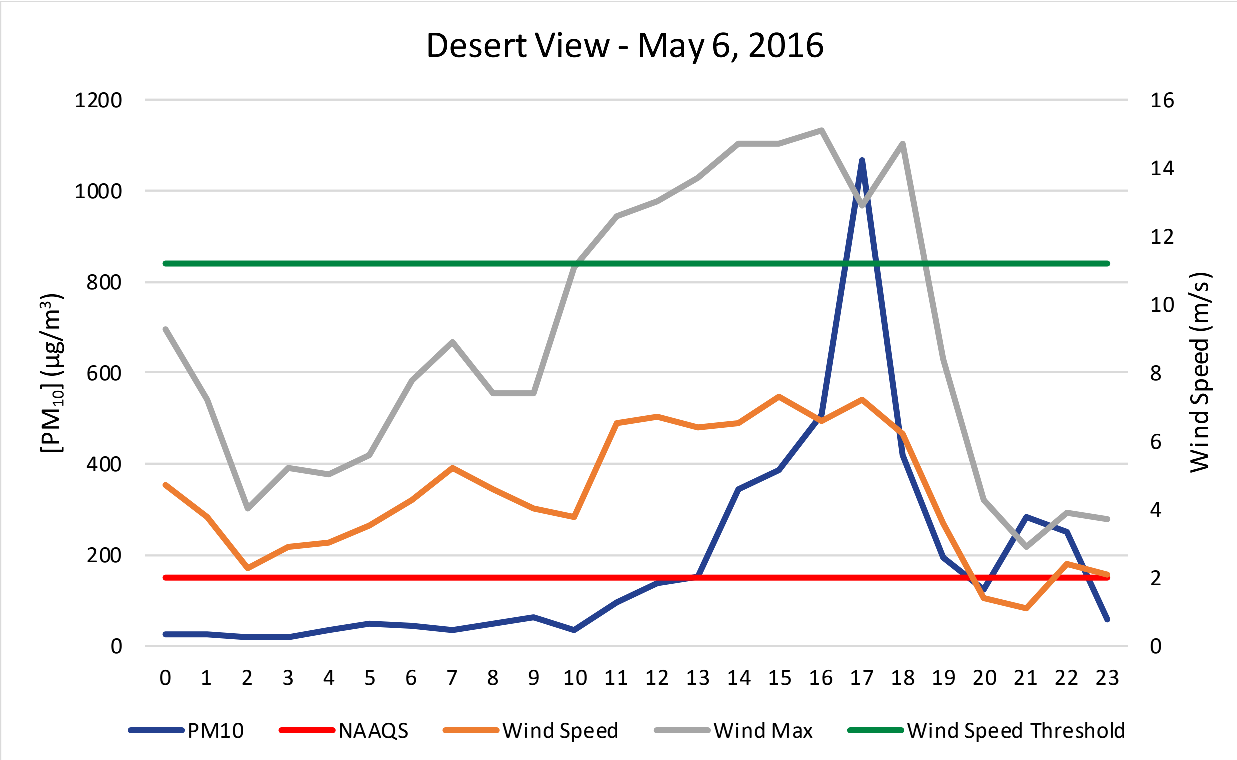

Figure 9-14. Desert view monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2011-2015, the Anthony monitoring site recorded 54 exceedances; while both the Chaparral and Desert View monitoring sites each recorded 43 exceedances of the PM_{10} NAAQS (Figures 9-15 through 9-17). The maximum 24-hour average PM_{10} concentration at these sites were 1739 (Anthony), 1606 (Chaparral), & 1691 (Desert View)µg/m^3 recorded in 2012. High wind blowing dust events in southern New Mexico can occur at any time of the year, but the majority of these days occur during the spring windy season, from March through May. NMED has documented that all exceedances have been caused by high wind blowing dust events.

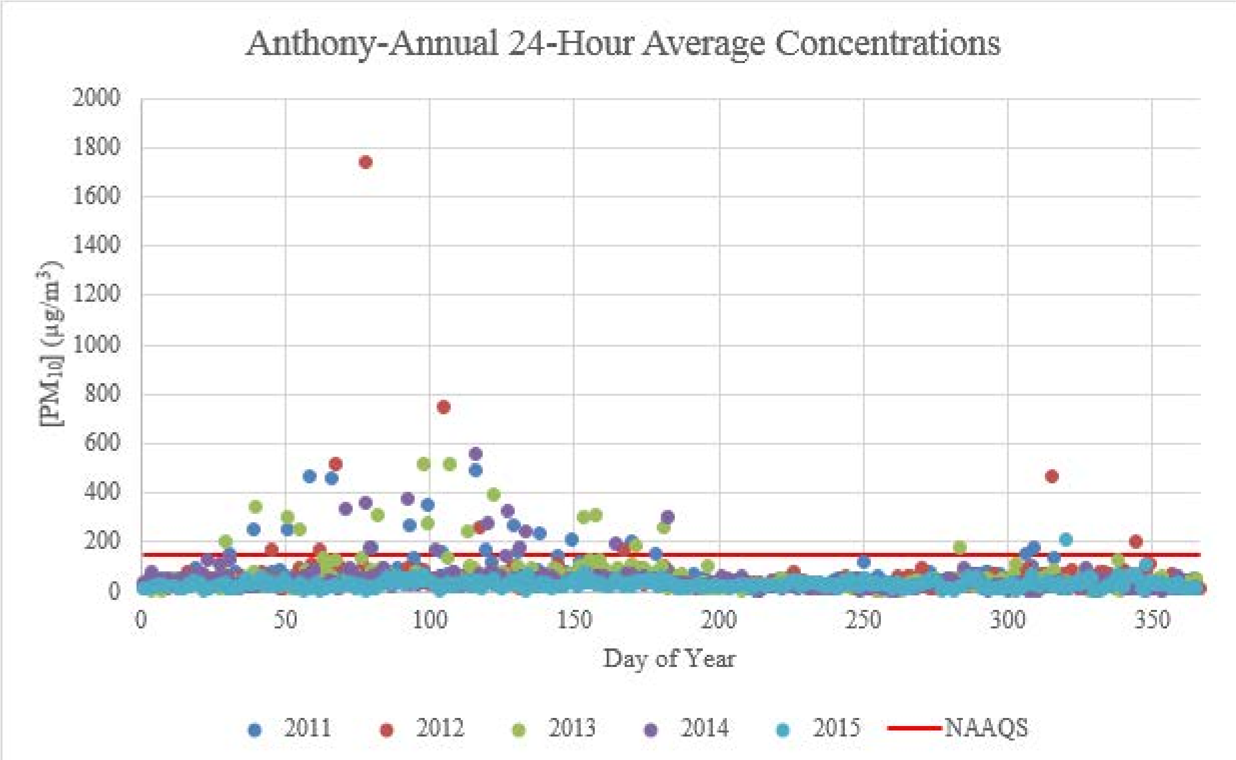

Figure 9-15. 24-hour averages by day of year from 2011-2015 for Anthony monitoring site.

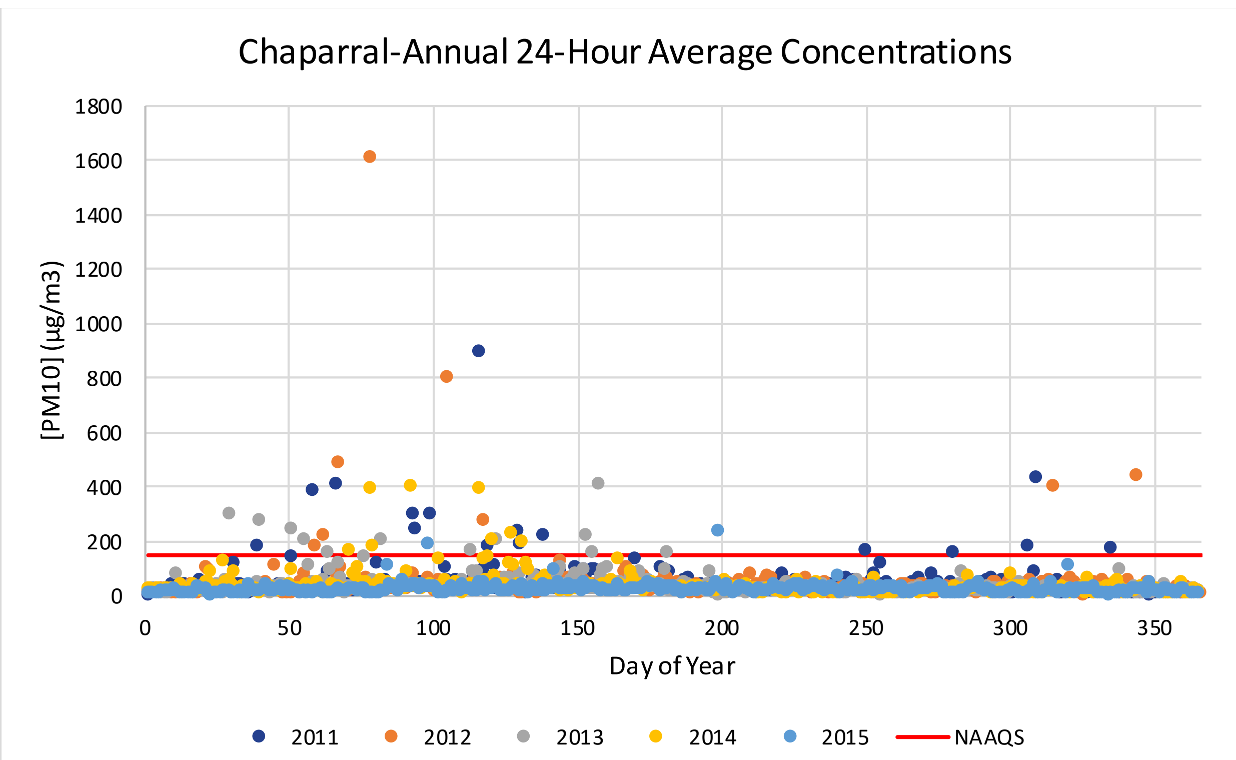

Figure 9-16. 24-hour averages by day of year from 2011-2015 for Chaparral monitoring site.

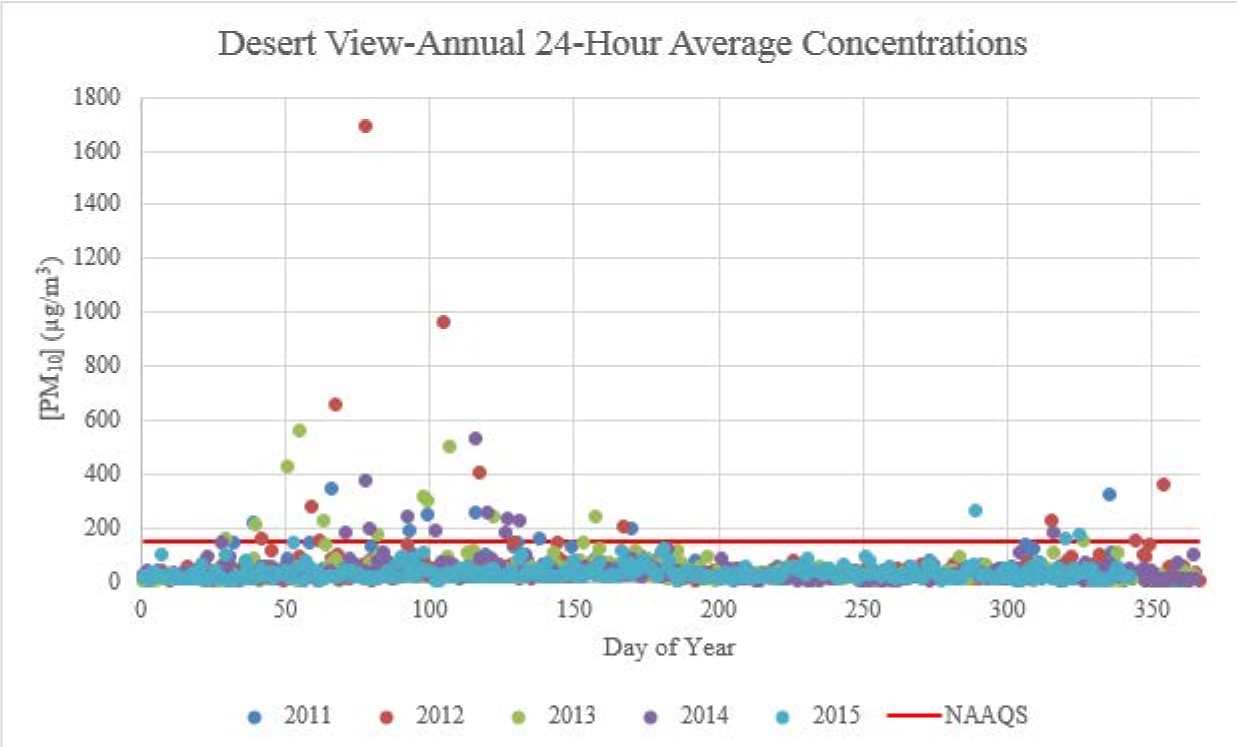

Figure 9-17. 24-hour averages by day of year from 2011-2015 for Desert View monitoring site.

Spatial and Temporal Variability

As demonstrated in Figure 9-18, all NMED monitoring sites recorded elevated 24-Hour Average PM_{10} concentrations compared to the days preceding and following the event. Daily averages for the days surrounding the event did not surpass 60 µg/m^3, demonstrating the influence high winds have on PM_{10} concentrations in the area.

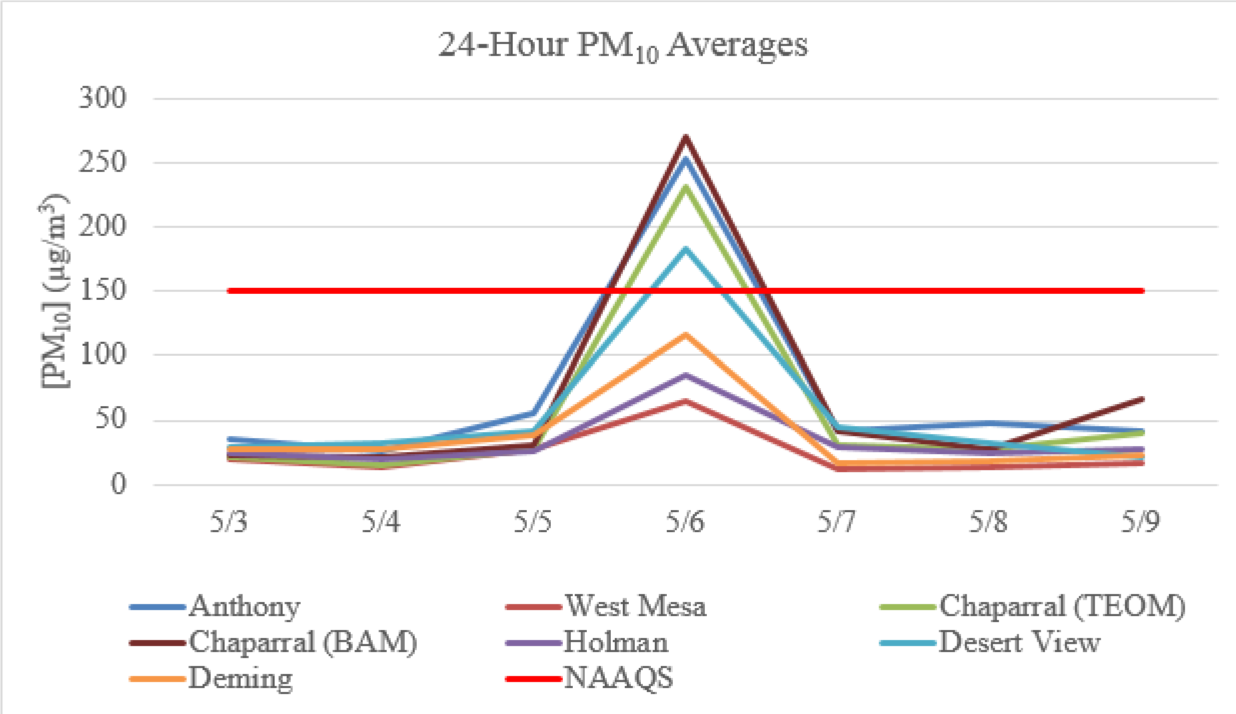

Figure 9-18. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

Percentile Ranking

Table 9-3 shows the 24-Hour Average PM_{10} data distribution recorded at NMED monitoring sites, including high wind blowing dust events flagged with a request to exclude data in the AQS database for exceedances of the standard from 2011-2015. The recorded values for this day (252 (Anthony), 230 (Chaparral POC#1), 269 (Chaparral POC#2), & 184 (Desert View)µg/m^3) are above the 95th percentile of historical data.

Statistic\Monitoring Site	Anthony	West Mesa	Chaparral	Holman	Desert View	Deming
Max	1739	487	1606	1449	1691	1098
99th Percentile	307	160	255	198	253	254
95th Percentile	99	59	91	68	99	68
75th Percentile	54	23	36	31	42	30
50th Percentile	38	16	24	21	28	20
25th Percentile	25	11	16	14	19	13
5th Percentile	13	5	6	6	9	6
Mean	49	23	36	30	40	30

Table 9-3. NMED monitoring sites PM_{10} 24-hour average data distribution. Includes data flagged in AQS for exclusion due to high wind blowing dust events (RJ).

CCR Conclusion

On this day a high wind blowing dust event occurred, generating PM_{10} emissions that resulted in elevated concentrations at Anthony, Chaparral, and Desert View monitoring sites. The monitored PM_{10} 24-Hour Averages of 252 (Anthony), 230 (Chaparral POC#1), 269 (Chaparral POC #2), & 184 (Desert View)µg/m^3 are above the 95th percentile of data monitored over the previous five years. Meteorological conditions were consistent with past event days and elevated PM_{10} concentrations. The comparisons and analyses provided in the CCR section of this demonstration support NMED's position that the event affected air quality in such a way that a clear causal relationship exists between the high wind blowing dust event and the monitored exceedances on this day, satisfying the CCR criterion.

Natural Event

The CCR and nRCP analyses show that this was a natural event caused by high wind and blowing dust. Based on the documentation provided in this demonstration, the event qualifies as a natural event. The exceedances associated with the event meets the regulatory definition of a natural event at 40 CFR 50.14(b)(8). This event transported windblown dust from natural and anthropogenic sources that have been reasonably controlled and accordingly, NMED has demonstrated that the event is a natural event and may be considered for treatment as an exceptional event.

10. HIGH WIND EXCEPTIONAL EVENT: July 15, 2016

Conceptual Model

Thunderstorm outflow caused high winds and blowing dust in Doña Ana and Luna Counties resulting in an exceedance of the PM_{10} NAAQS at the Anthony, Chaparral, and Deming monitoring sites on this date. In accordance with the EER, the AQB submitted this data to EPA's AQS database and flagged it (coded as RJ) as a high wind dust event (Table 10-1).

AQS Flag	AQS ID	Site Name	24-Hour Average Concentration	Max 1-Hour Wind Speed	Max Gust
RJ	35-013-0020	6ZK Chaparral	214 $\mu g/m^3$ (POC #2)	11.3 m/s	23.6 m/s
RJ	35-013-0016	6CM Anthony	289 $\mu g/m^3$	6.4 m/s	17.9 m/s
RJ	35-029-0003	7E Deming	278 $\mu g/m^3$	10.5 m/s	20.9 m/s

Table 10-1. 2016 PM_{10} Data flagged by NMED for exclusion pursuant to the EER.

An upper high-pressure system over northern Baja and a mid-level high pressure system over southern Arizona and New Mexico will allow thunderstorm outflows to take place. As the storm system moved through the state, a pressure gradient formed over southeastern Arizona, southwestern New Mexico and northern Mexico (Figure 10-1). At the 1400 hour, an area of low pressure moved over the Great Plains. The low-pressure center of the storm system hovered the eastern side of New Mexico along the Rio Grande Valley and the Franklin Mountains of El Paso, TX. As the day progressed this low-pressure system traveled east and the outflow boundary aligned itself along the border of New Mexico and Texas (Figure 10-2). Thunderstorm outflows created winds aloft to mix down, increasing the surface wind velocities and provided the turbulence required for vertical mixing and entrainment of dust.

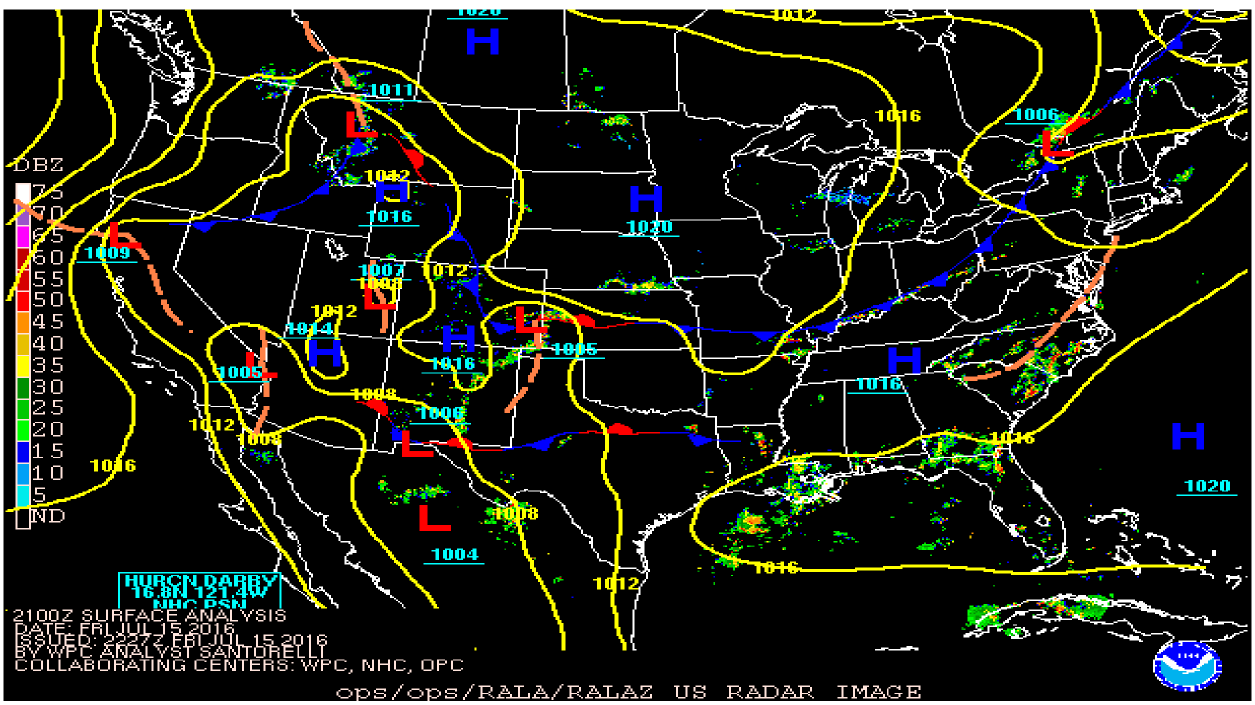

Figure 10-1. Surface weather radar map at the 1400 hour (MST) showing storm (surface low), cold fronts and isobars of constant pressure (yellow lines).

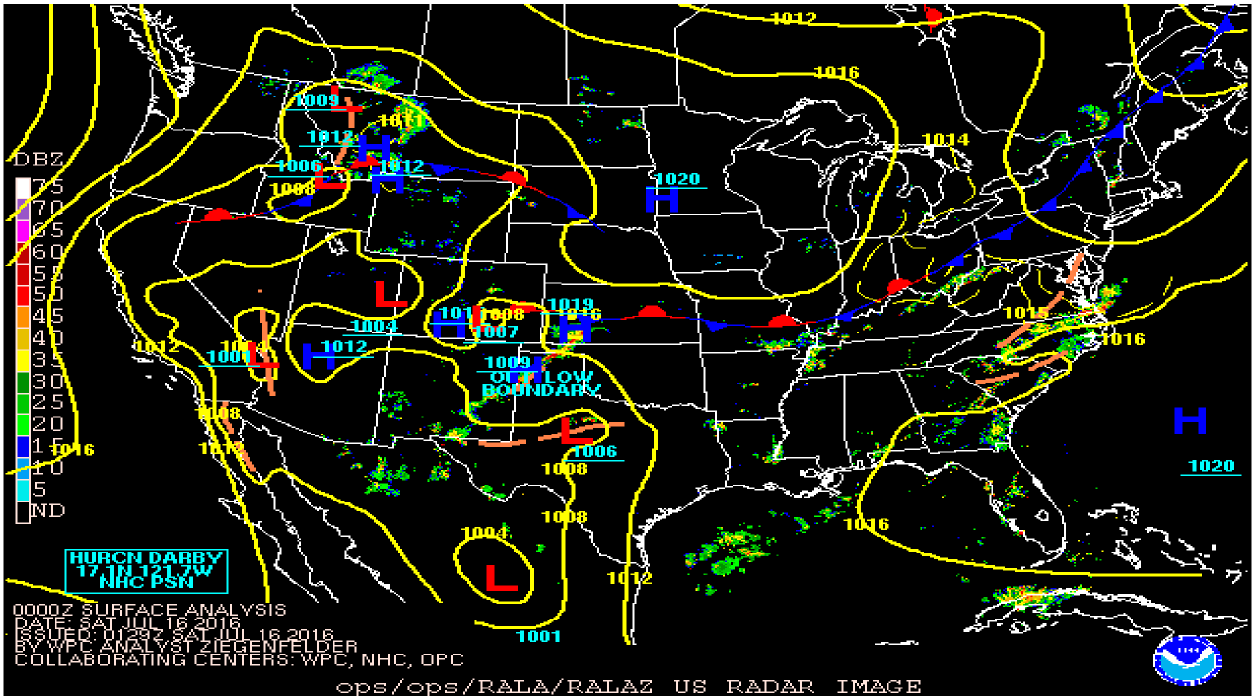

Figure 10-2. Surface weather radar map at the 1900 hour (MST) showing storm (surface low), cold fronts and isobars of constant pressure (yellow lines), and outflow boundary.

As the event unfolded, the wind blew from multiple-directions throughout the border region. These high velocity winds passed over large areas of desert within New Mexico(Figures 10-3 & 10-4). Anthropogenic sources of dust near NMED's monitoring sites include: disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

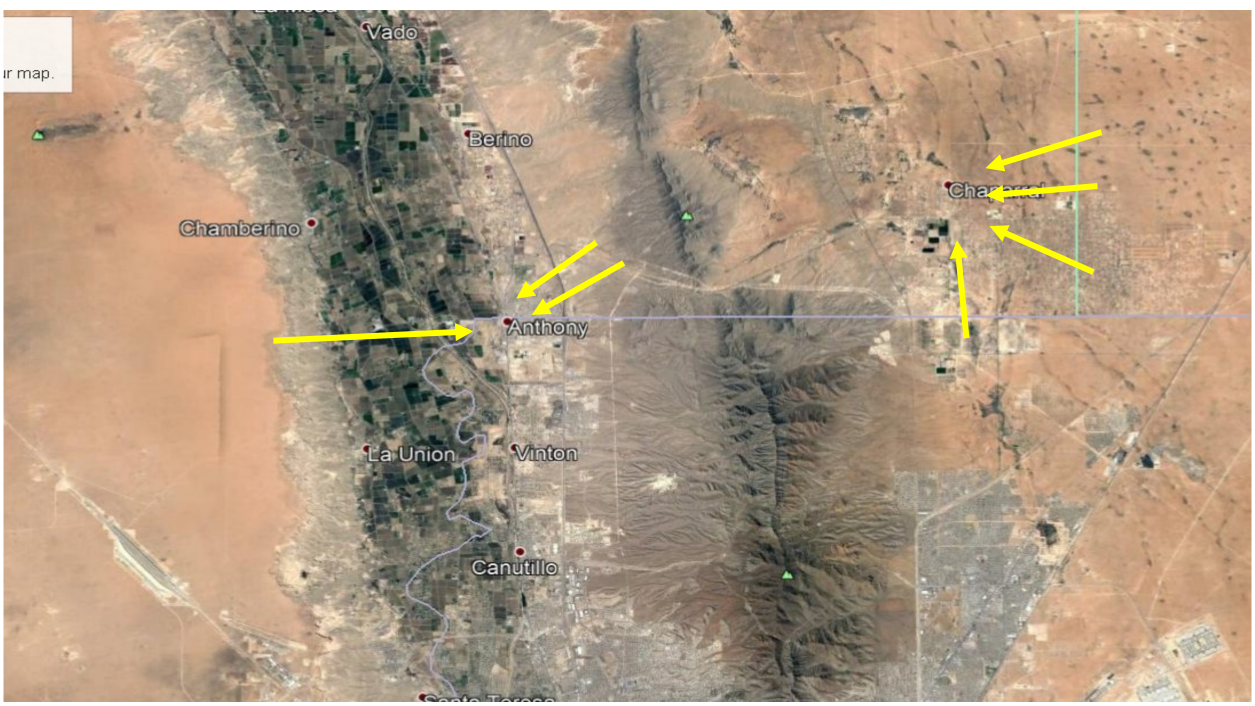

Figure 10-3. Map of Anthony and Chaparral monitoring sites with a recorded exceedance of the NAAQS, predominant wind direction and suspected source locations for the high wind blowing dust event.

Figure 10-4. Map of Deming monitoring site with a recorded exceedance of the NAAQS, predominant wind direction and suspected source locations for the high wind blowing dust event.

The co-occurrence of high winds and elevated levels of blowing dust, little to no point sources in the area, and the high hourly and daily PM_{10} concentrations support the assertion that this was a natural event, specifically a high wind dust event. Sustained hourly wind speeds exceeding 9 m/s (~20 mph) were recorded at Chaparral, Holman, and Deming monitoring sites beginning at the 1600 hour and lasted through the 1800 hour. PM_{10} concentrations began to exceed the NAAQS at the Anthony, Desert View, Chaparral, Holman, West Mesa and Deming monitoring sites beginning at the 1500 hour. Hourly concentrations remained elevated through the 2000 hour. Table 10-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event.

Hour	Anthony			Chaparral			Desert View			Deming		
	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)
1500	45	2	4.8	31	3	7.7	27	1.6	4.9	1592	6.1	19.9
1600	298	1.3	3.6	1155	9.1	17.9	27	1.7	5.2	2229	10.5	20.9
1700	1215	6.2	13.7	219	11	22.2	300	5.3	13.8	46	7.9	13.7
1800	4001	6.4	17.9	1553	11.3	23.6	1042	7.3	15.2	19	4.5	10.2
1900	44	4.6	11.6	715	5.2	19.5	742	4.7	15.9	27	2.8	7
2000	56	5.4	10.2	202	4.5	8.2	136	4.7	11.8	70	3.9	8.1

Table 10-2. Hourly PM_{10}, wind speed and wind gust data during the peak hours of the event.

Meteorologists forecasted the high wind blowing dust event to occur this day, as the spring windy season begins in March for most of the southwestern United States. Forecasts predicted strong winds as the storm approached the area with the area of low pressure tracking moving northeast from southern Arizona in the morning and moving across New Mexico in the afternoon. The systems movement across the area timed well with daytime heating and mixing generating a deep trough to the east as stronger winds aloft moved into the area. Many outlets also forecasted a high probability of blowing and entrained dust throughout the area and haze in the afternoon, especially in the desert areas of southern New Mexico.

Not Reasonably Controllable or Preventable (nRCP)

Not Reasonably Preventable

This demonstration does not provide a showing of not reasonably preventable pursuant to 40 CFR 50.14(b)(5)(iv) that states, in part, "the State shall not be required to provide a case-specific justification for a high wind dust event."

Not Reasonably Controllable

The documentation provided in this section demonstrates that the wind speeds and other meteorological conditions overwhelmed the reasonable control measures in place for anthropogenic sources, causing emissions of dust that were transported to NMED's monitors.

Sustained Wind Speeds

EPA has indicated 11.2 m/s (25 mph) as the wind speed threshold at which natural or controlled anthropogenic sources will emit dust. The Chaparral and Holman monitoring sites recorded wind speeds above this threshold for 1 hour from the 1700 to the 1800 hour (Figure 10-4).

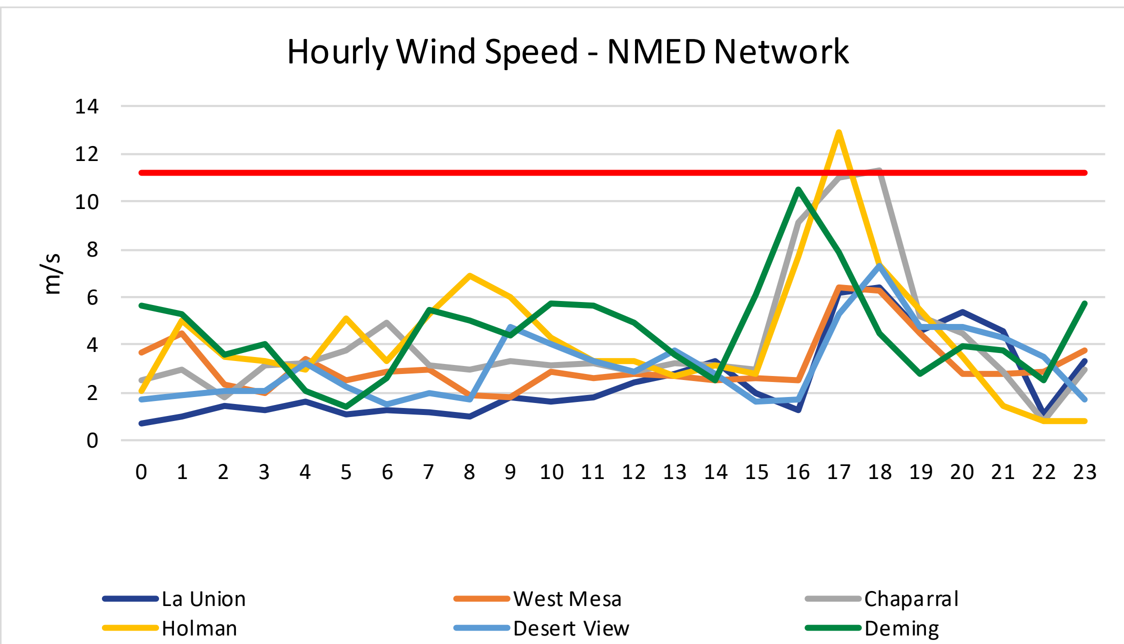

Figure 10-5. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

Level of Controls Analysis

Based on the sustained winds speeds monitored in the area during the event a basic controls analysis will be provided.

Basic Controls Analysis

Implementation and Enforcement of Control Measures

Reasonable controls for anthropogenic sources of dust are based on an area's attainment status for the PM_{10} NAAQS. It is not reasonable for areas designated as attainment, unclassifiable or maintenance to have the same level of controls as areas that are nonattainment for the standard. However, southern New Mexico has a long history of high wind blowing dust events with NMED developing a nonattainment SIP for the Anthony Area and NEAPs for the remaining portion of Doña Ana County and all of Luna County. As discussed in the Background section, NMED worked with local governments to help them develop and adopt dust control ordinances based on BACM. Based on the area's attainment status and SIP waiver, NMED believes these ordinances constitute reasonable controls.

The ordinances developed and adopted under the NEAPs are implemented and enforced at the local level with NMED playing a supporting role to ensure effective and enforceable implementation of control measures. Under the regulatory framework applicable to the two counties, NMED's purview does not include oversight of the extent of the effectiveness and enforcement of local ordinances. However, NMED believes that these ordinances are appropriately implemented at the local level.

Suspected Source Areas and Categories Contributing to the Event

Anthropogenic sources of dust in New Mexico include disturbed lands, construction and demolition activities, vacant parking lots and materials handling and transportation. Area sources account for a much larger portion of overall PM_{10} emissions than point sources. On the day of the event, no unusual PM_{10} producing activities occurred and anthropogenic point source emissions remained constant before, during and after the event. Natural areas of the Chihuahuan Desert in Doña Ana, Luna, Hidalgo and Grant Counties are the most likely sources, under NMED's jurisdiction, contributing to the high wind blowing dust event. Other area sources located in Arizona, Texas and Chihuahua, MX likely contributed to the exceedances on this day. Controlling dust from the natural desert terrain is cost prohibitive and falls outside NMED's jurisdiction when it is transported from intrastate and international sources.

The documentation and analysis presented in this section demonstrates that all identified sources that may have caused or contributed to the exceedance were reasonably controlled, implemented and enforced at the time of the event, therefore emissions associated with the high wind dust event were not reasonably controllable or preventable.

Clear Causal Relationship (CCR)

Occurrence and Geographic Extent of the Event

The National Weather Service (NWS) issued a Wind Advisory and a Blowing Dust Advisory for this date (Figure 10-6). A Wind Advisory is issued by NWS when sustained winds of 30 to 39 mph are expected for 1 hour or longer. A Blowing Dust Advisory is issued when blowing dust is expected to reduce visibility to between ¼ to 1 mile, generally with winds of 25 mph or greater. These were in place for southwestern New Mexico and west Texas to warn the public of the high wind event. An excerpt from the NWS Wind Advisory and the Climate Report for this day can be found below:

```
RECORD HIGH HEAT AND HOT TEMPERATURES TODAY…ISOLATED SHOWER AND THUNDERSTORM
POTENTIAL THIS AFTERNOON AND EARLY EVENING. MAIN THREAT WILL BE DAMAGING
OUTFLOW WINDS AND BLOWING DUST.
```

CLIMATE REPORT
NATIONAL WEATHER SERVICE EL PASO, TX
326 AM MDT SAT JUL 16 2016

....

...THE EL PASO CLIMATE SUMMARY FOR JULY 15 2016...

CLIMATE NORMAL PERIOD 1981 TO 2010
CLIMATE RECORD PERIOD 1879 TO 2016

WEATHER ITEM	OBSERVED VALUE	TIME (LST)	RECORD VALUE	YEAR	NORMAL VALUE	DEPARTURE FROM NORMAL	LAST YEAR
TEMPERATURE (F)							
YESTERDAY							
MAXIMUM	104	416 PM	106	1963	95	9	94
MINIMUM	76	728 PM	60	1987 1973	71	5	75
AVERAGE	90				83	7	85
PRECIPITATION (IN)							
YESTERDAY	0.05		1.51	1976	0.04	0.01	T
MONTH TO DATE	0.05				0.65	-0.60	1.27
SINCE JUN 1	0.38				1.59	-1.21	1.45
SINCE JAN 1	1.02				3.41	-2.39	3.99
SNOWFALL (IN)							
YESTERDAY	0.0						0.0
MONTH TO DATE	0.0						0.0
SINCE JUN 1	0.0						0.0
SINCE JUL 1	0.0						0.0
SNOW DEPTH	0						
DEGREE DAYS							
HEATING							
YESTERDAY	0				0	0	0
MONTH TO DATE	0				0	0	0
SINCE JUN 1	0				0	0	0
SINCE JUL 1	0				0	0	0
COOLING							
YESTERDAY	25				18	7	20
MONTH TO DATE	371				273	98	283
SINCE JUN 1	963				775	188	875
SINCE JAN 1	1359				1152	207	1246

....

WIND (MPH)

HIGHEST WIND SPEED	44	HIGHEST WIND DIRECTION	NE (40)
HIGHEST GUST SPEED	56	HIGHEST GUST DIRECTION	NE (40)
AVERAGE WIND SPEED	10.9		

```
SKY COVER
  POSSIBLE SUNSHINE  MM
  AVERAGE SKY COVER 0.5


WEATHER CONDITIONS
 THE FOLLOWING WEATHER WAS RECORDED YESTERDAY.
  THUNDERSTORM
  RAIN
  LIGHT RAIN
  HAZE
  SANDSTORM


RELATIVE HUMIDITY (PERCENT)
 HIGHEST    34          700 AM
 LOWEST     11          400 PM
 AVERAGE    23

..........................................................


THE EL PASO CLIMATE NORMALS FOR TODAY
                         NORMAL    RECORD    YEAR
 MAXIMUM TEMPERATURE (F)   95       104      1980
 MINIMUM TEMPERATURE (F)   71        61      1985


SUNRISE AND SUNSET
JULY 16 2016..........SUNRISE   612 AM MDT   SUNSET   812 PM MDT
JULY 17 2016..........SUNRISE   612 AM MDT   SUNSET   811 PM MDT


-  INDICATES NEGATIVE NUMBERS.
R  INDICATES RECORD WAS SET OR TIED.
MM INDICATES DATA IS MISSING.
T  INDICATES TRACE AMOUNT.
```

Figure 10-6. Hazardous Weather Statement and Climate Report for the El Paso Area indicating haze and sandstorm conditions.

Spatial and Transport Analysis

Wind Direction and Elevated PM_{10} Concentrations

Pollution rose (Figures 10-7) was created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m^3 (1600 -1800 hour). During the event, winds blew from the east northeast approximately 66% and from the west 33% of the time coinciding with peak PM_{10} concentrations.

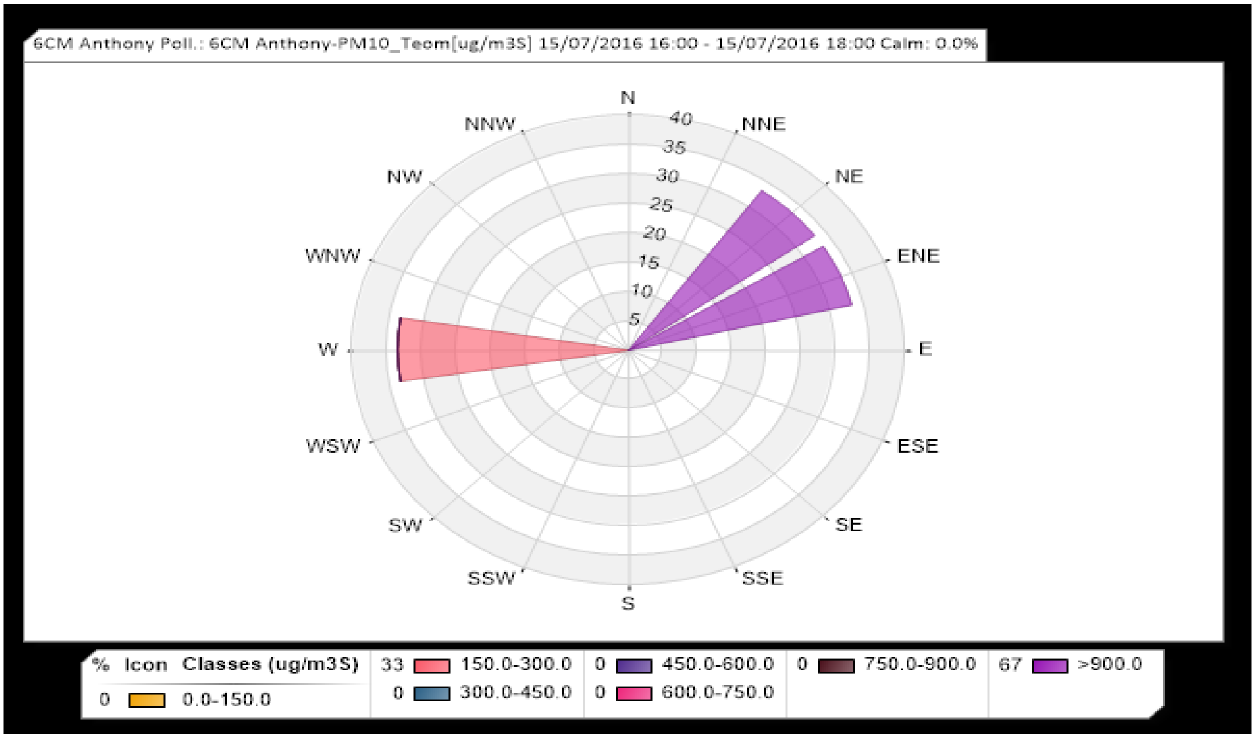

Figure 10-7. Pollution rose for Anthony monitoring site.

Pollution rose (Figures 10-8) was created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m^3 (1600 -2000 hour). During the event, winds blew from the east approximately 80% and from the south 20% of the time coinciding with peak PM_{10} concentrations.

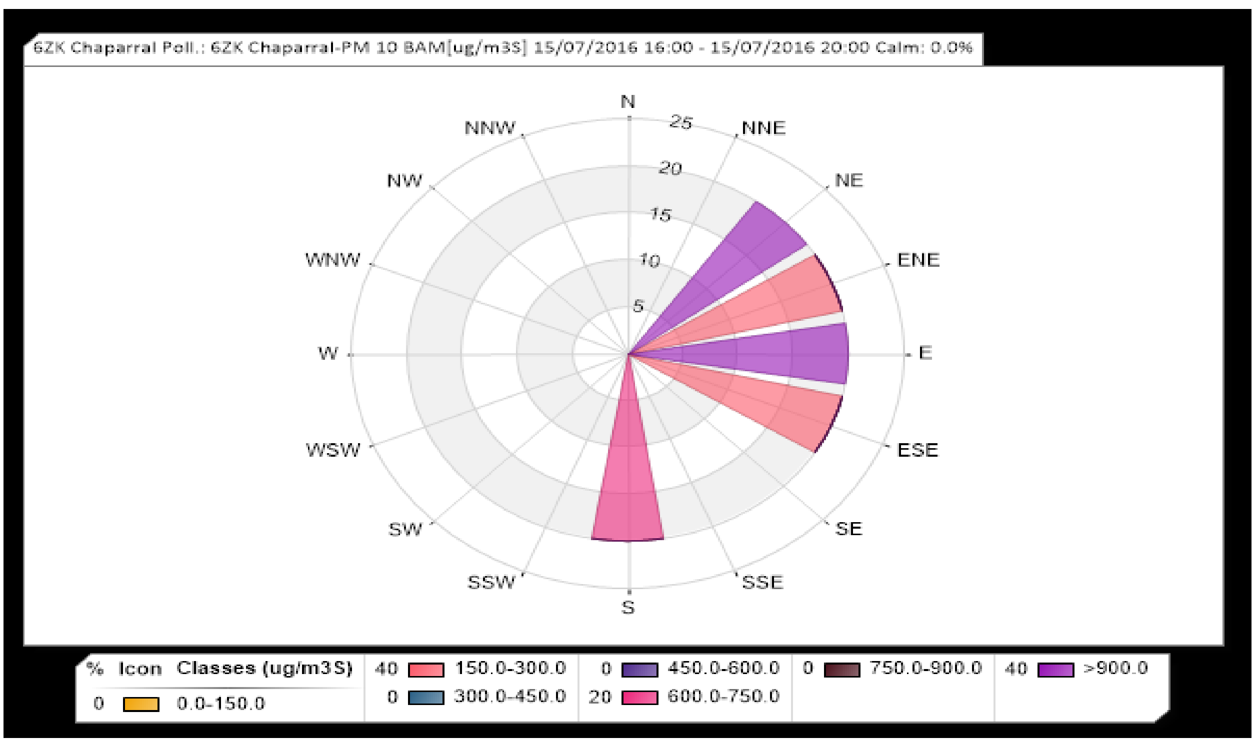

Figure 10-8. Pollution rose for Chaparral monitoring site.

Pollution rose (Figure 10-9) was created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m^3 (1500 -1600 hour). During the event, winds blew from the west northwest approximately 100% of the time coinciding with peak PM_{10} concentrations.

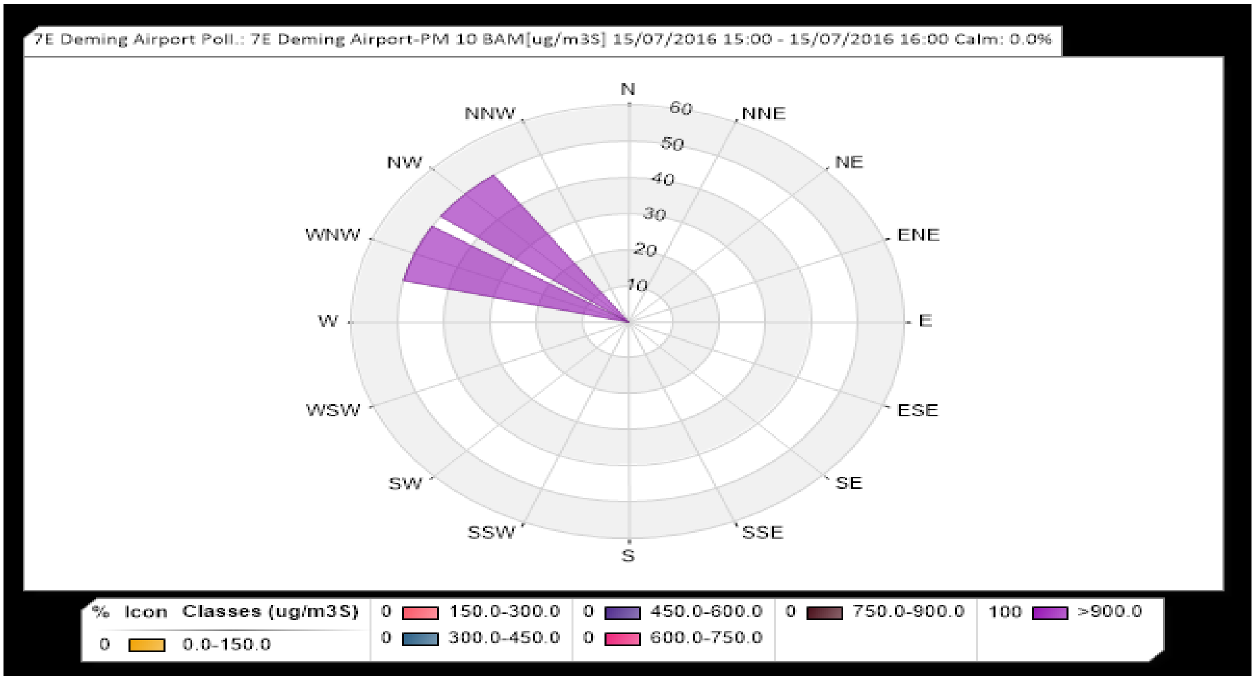

Figure 10-9. Pollution roses for Deming monitoring site

Pollution rose (Figure 10-10) was created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m^3 (2300 hour). During the event, winds blew from the south 100% of the time coinciding with peak PM_{10} concentrations.

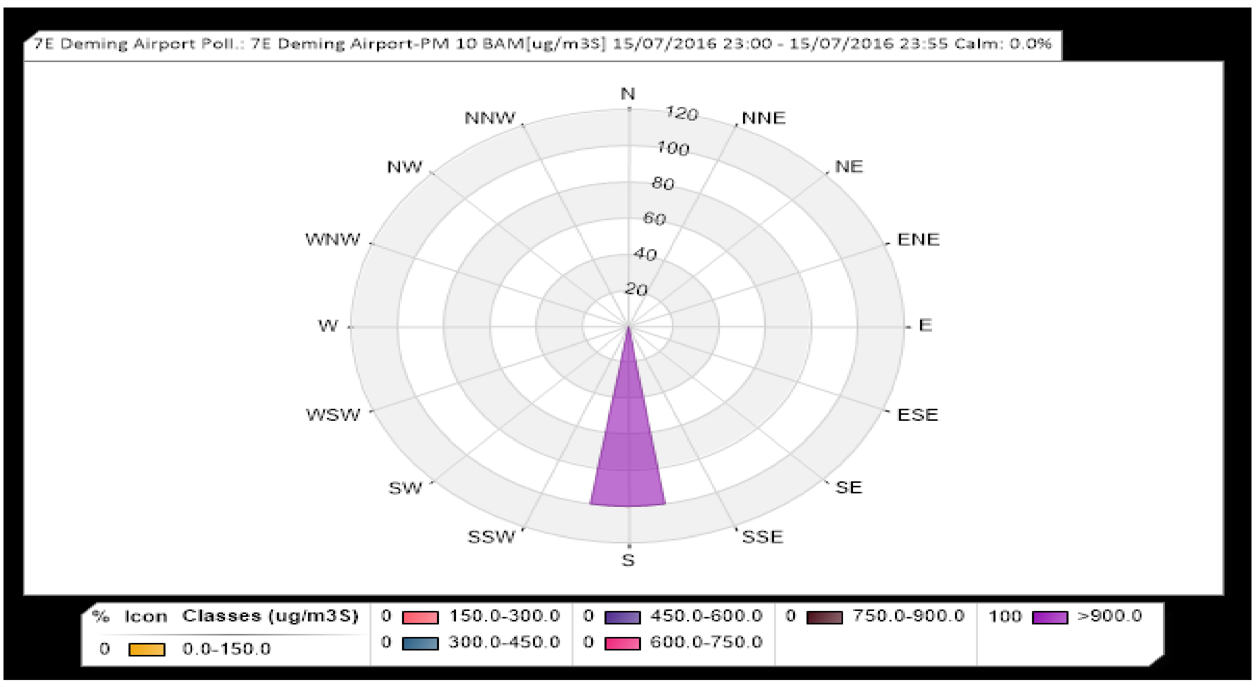

Figure 10-10. Pollution roses for Deming monitoring site

Temporal Relationship of High Wind and Elevated PM_{10} Concentrations

The high wind blowing dust event generated strong multi-directional winds beginning at the 1600 hour and lasting through the 1800 hour. During this time, peak hourly PM_{10} concentrations ranged from 342 to 4001 µg/m³ at NMED monitoring sites (Figure 10-11). Although not all NMED monitoring sites recorded an exceedance of the NAAQS, hourly PM_{10} data spiked at approximately the same time throughout the network. Sustained hourly average wind speeds of 12.9 m/s were recorded at the Holman monitoring site during the peak PM_{10} concentrations of the event. The time series plot in Figures 10-12 through 10-14 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

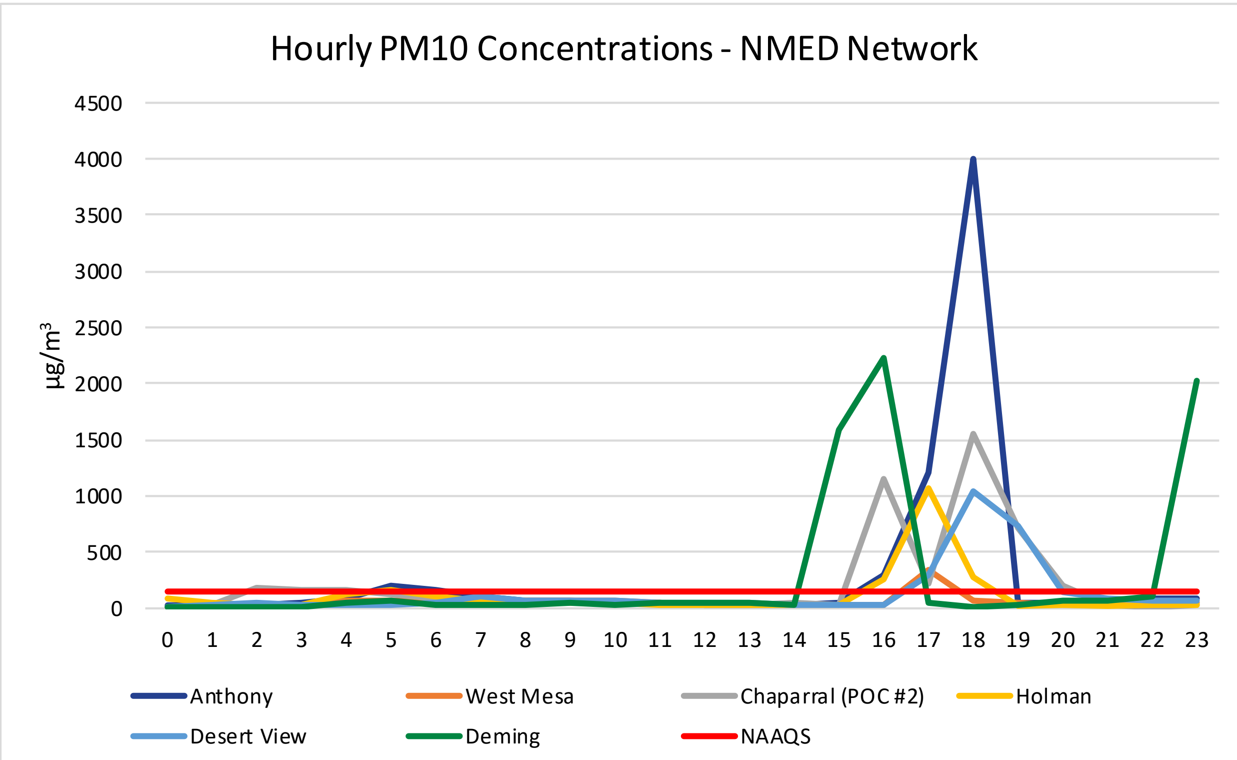

Figure 10-11. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

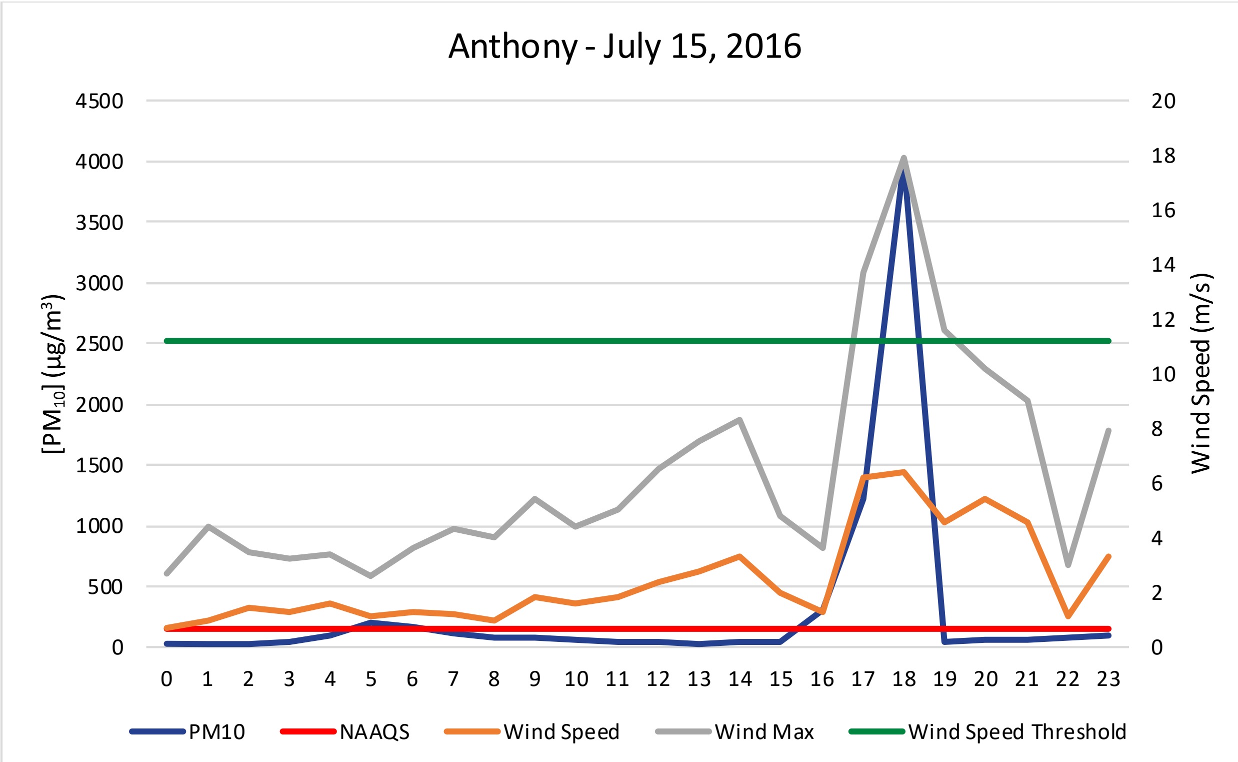

Figure 10-12. NMED monitoring network hourly PM_{10} and wind speed data for the high wind blowing dust event.

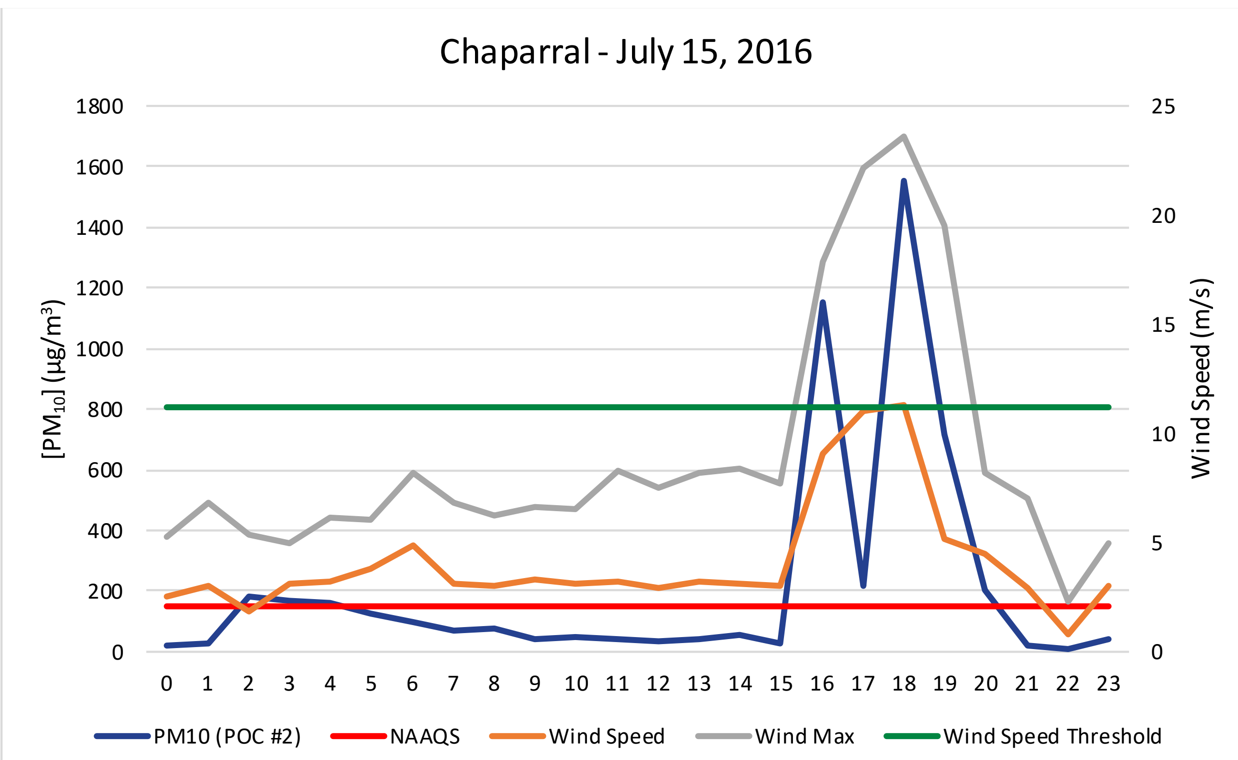

Figure 10-13. NMED monitoring network hourly PM_{10} and wind speed data for the high wind blowing dust event.

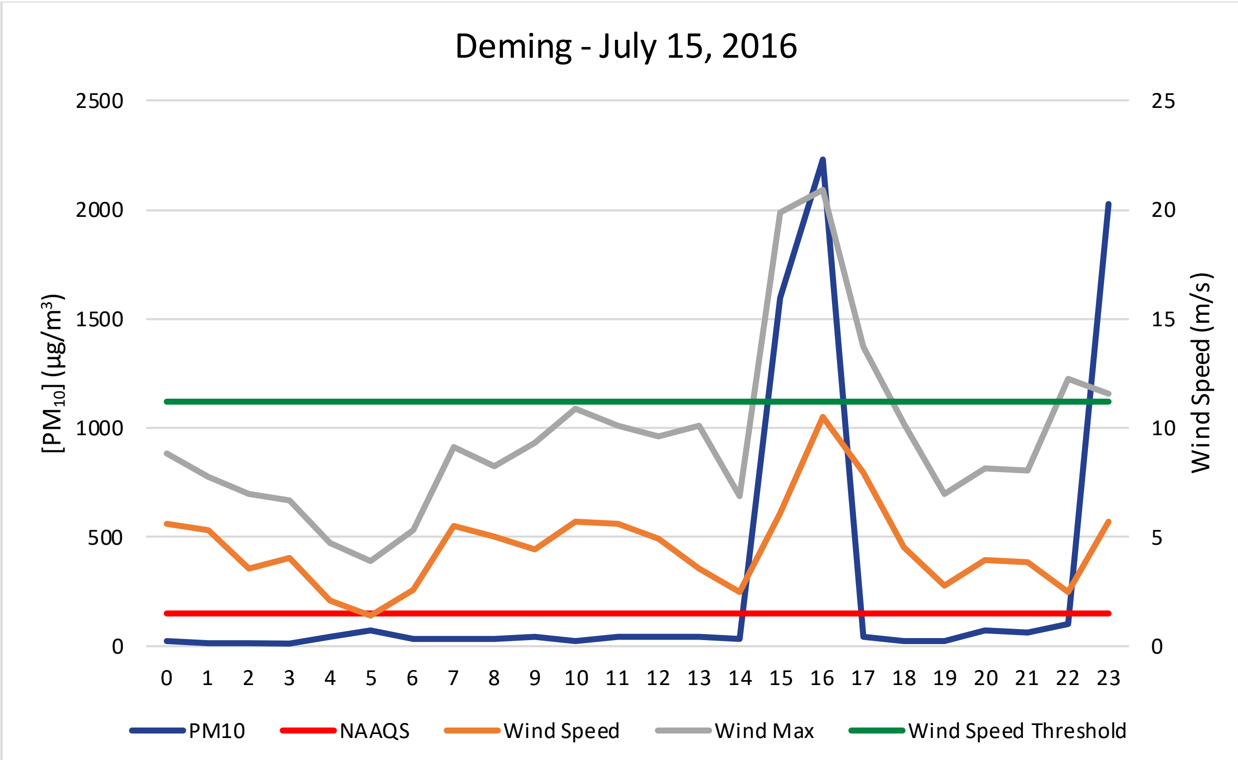

Figure 10-14. NMED monitoring network hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2011-2015, the Anthony, Chaparral, and Deming monitoring sites recorded 54, 43, & 31 exceedances of the PM_{10} NAAQS (Figures 10-15 through 10-17). The maximum 24-hour average PM_{10} concentrations at these sites were 1739, 1606, & 1098 µg/m^3, respectively, all recorded in 2012. High wind blowing dust events in southern New Mexico can occur at any time of the year, but the majority of these days occur during the spring windy season, from March through May. NMED has documented that all exceedances have been caused by high wind blowing dust events.

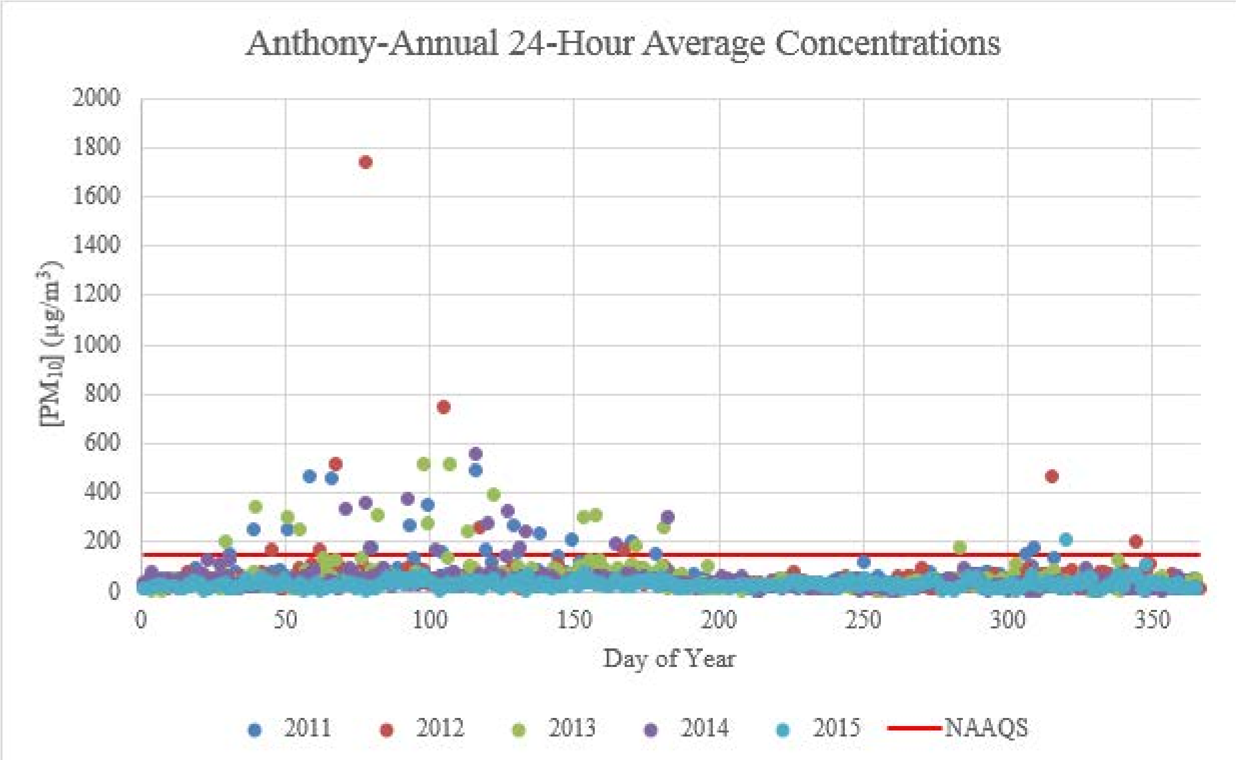

Figure 10-15. 24-hour averages by day of year from 2011-2015 for Anthony monitoring site

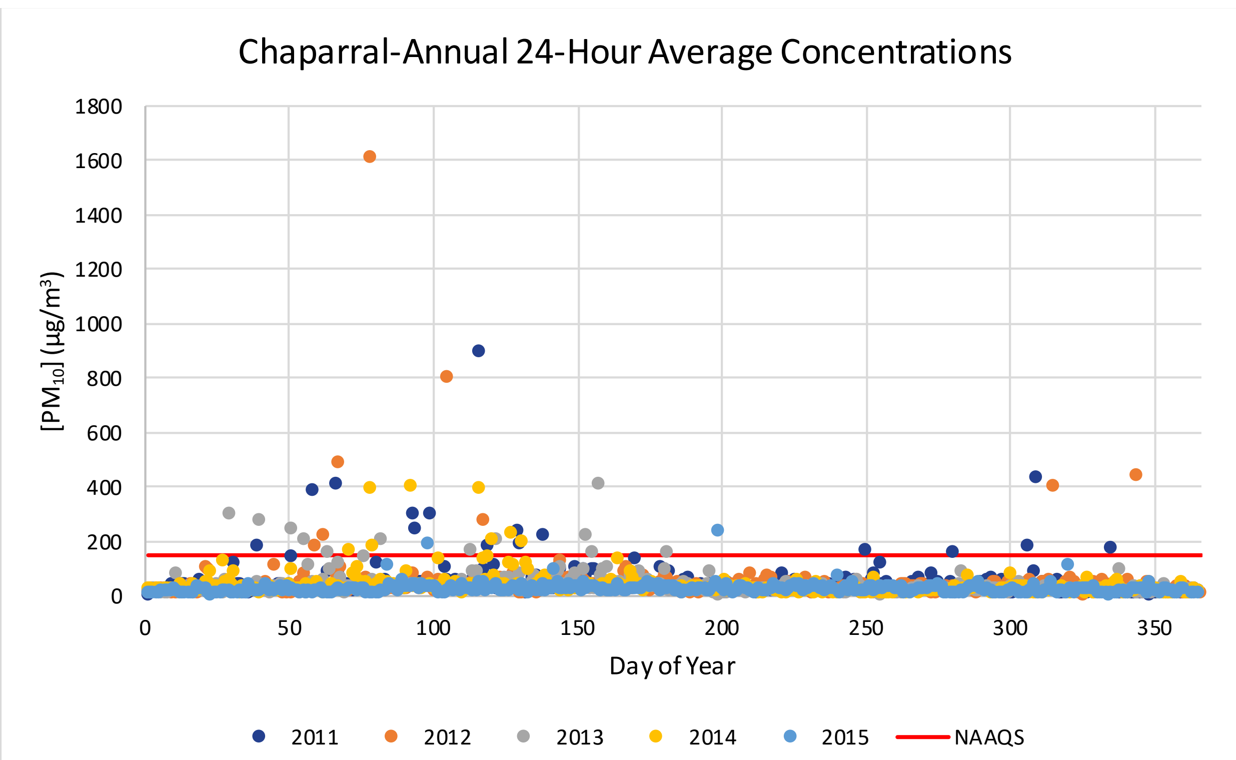

Figure 10-16. 24-hour averages by day of year from 2011-2015 for Chaparral monitoring site

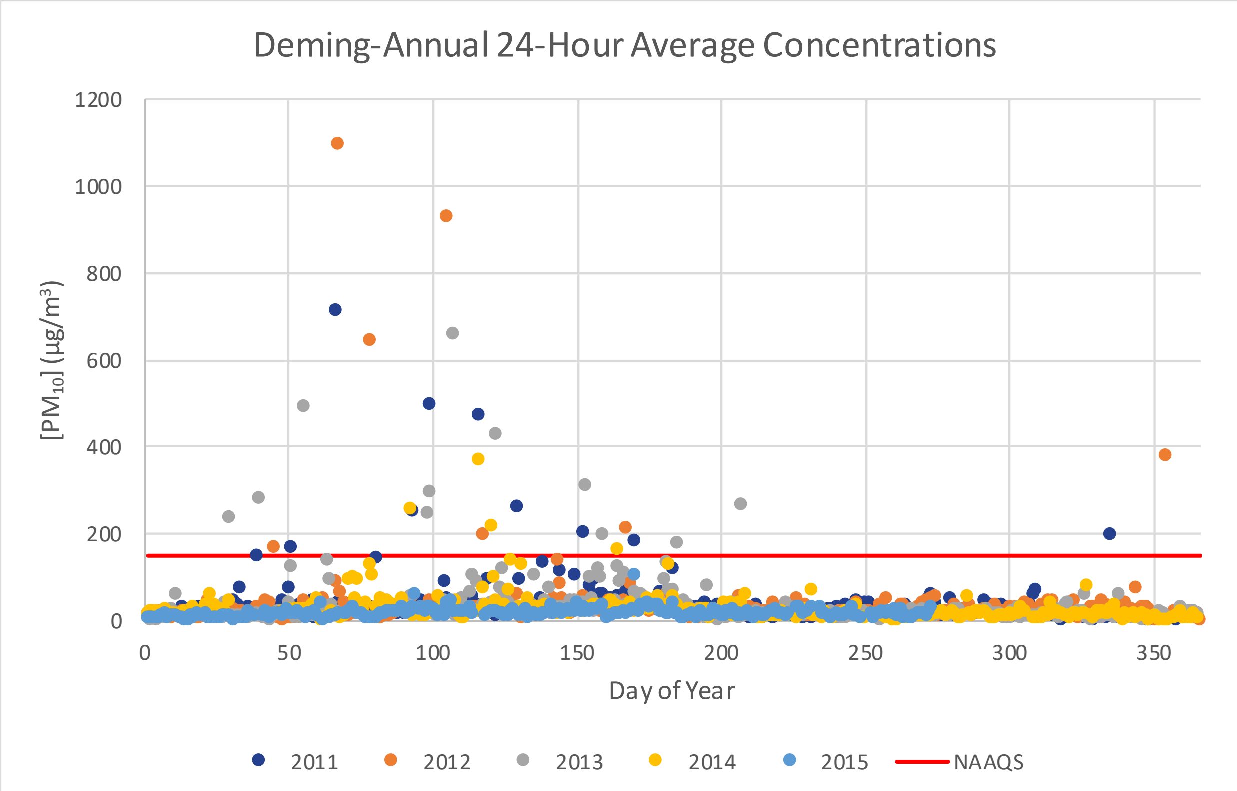

Figure 10-17. 24-hour averages by day of year from 2011-2015 for Deming monitoring site.

Spatial and Temporal Variability

As demonstrated in Figure 10-18, all NMED monitoring sites recorded elevated 24-Hour Average PM_{10} concentrations compared to the days preceding and following the event. Daily averages for the days surrounding the event did not surpass 50 µg/m^3, demonstrating the influence high winds have on PM_{10} concentrations in the area.

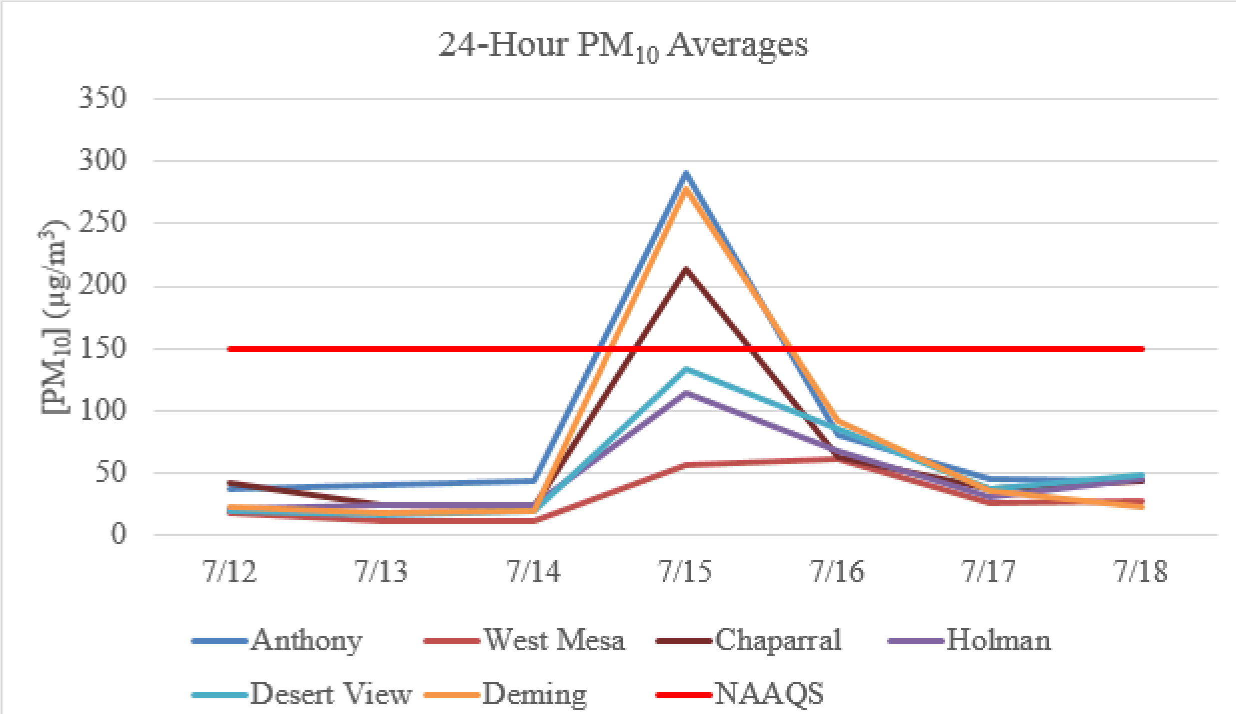

Figure 10-18. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

Percentile Ranking

Table 10-3 shows the 24-Hour Average PM_{10} data distribution recorded at NMED monitoring sites, including high wind blowing dust events flagged with a request to exclude data in the AQS database for exceedances of the standard from 2011-2015. The recorded value for this day (289 (Anthony), 214 (Chaparral), & 278 (Deming)µg/m^3) is above, the 95th percentile of historical data.

Statistic\Monitoring Site	Anthony	West Mesa	Chaparral	Holman	Desert View	Deming
Max	1739	487	1606	1449	1691	1098
99th Percentile	307	160	255	198	253	254
95th Percentile	99	59	91	68	99	68
75th Percentile	54	23	36	31	42	30
50th Percentile	38	16	24	21	28	20
25th Percentile	25	11	16	14	19	13
5th Percentile	13	5	6	6	9	6
Mean	49	23	36	30	40	30

Table 10-3. NMED monitoring sites PM_{10} 24-hour average data distribution. Includes data flagged in AQS for exclusion due to high wind blowing dust events (RJ).

CCR Conclusion

On this day a high wind blowing dust event occurred, generating PM_{10} emissions that resulted in elevated concentrations at NMED monitoring sites. The monitored PM_{10} 24-Hour Averages of 289 (Anthony), 214 (Chaparral), & 278 (Deming)µg/m^3 are above the 95th percentile of data monitored over the previous five years. Meteorological conditions were consistent with past event days and elevated PM_{10} concentrations. The comparisons and analyses provided in the CCR section of this demonstration support NMED's position that the event affected air quality in such a way that a clear causal relationship exists between the high wind blowing dust event and the monitored exceedances on this day, satisfying the CCR criterion.

Natural Event

The CCR and nRCP analyses show that this was a natural event caused by high wind and blowing dust. Based on the documentation provided in this demonstration, the event qualifies as a natural event. The exceedances associated with the event meets the regulatory definition of a natural event at 40 CFR 50.14(b)(8). This event transported windblown dust from natural and anthropogenic sources that have been reasonably controlled and accordingly, NMED has demonstrated that the event is a natural event and may be considered for treatment as an exceptional event.

11. HIGH WIND EXCEPTIONAL EVENT: July 24, 2016

Conceptual Model

Thunderstorm outflow caused high winds and blowing dust in Doña Ana County resulting in an exceedance of the PM_{10} NAAQS at the Desert View monitoring site on this date. In accordance with the EER, the AQB submitted this data to EPA's AQS database and flagged it (coded as RJ) as a high wind dust event (Table 11-1).

AQS Flag	AQS ID	Site Name	24-Hour Average Concentration	Max 1-Hour Wind Speed	Max Gust
RJ	35-013-0021	6ZM Desert View	195 µg/m³	6.6 m/s	17.8 m/s

Table 11-1. 2016 PM_{10} Data flagged by NMED for exclusion pursuant to the EER.

A high-pressure system aloft kept the temperatures high in the area with moisture over the region located over Arizona and made its way west towards New Mexico and Texas. Isolated storm development favored the area mountains where upslope flow and heating complement the added lift where the better chances for storm development. Areas west of mountains say strong storm outflow winds and blowing dust. As the storm system moved through the state, a pressure gradient formed over southeastern Arizona, southwestern New Mexico and northern Mexico (Figure 11-1). At the 2000 hour, an area of low pressure moved over the state of Colorado. Aloft, the low-pressure center of the storm system hovered in Canada. As the day progressed this low-pressure aloft traveled east and aligned itself with New Mexico and the surface wind direction (Figure 11-2). Thunderstorm outflows created winds aloft to mix down, increasing the surface wind velocities and provided the turbulence required for vertical mixing and entrainment of dust.

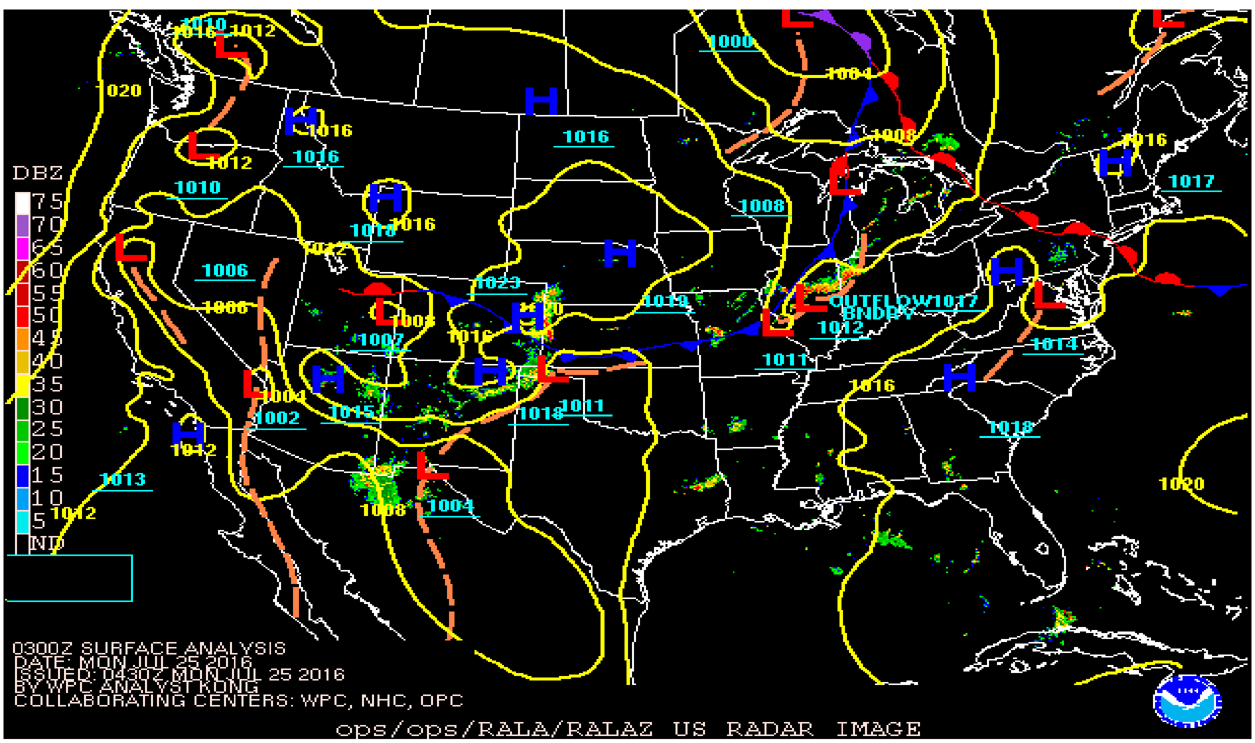

Figure 11-1. Radar weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

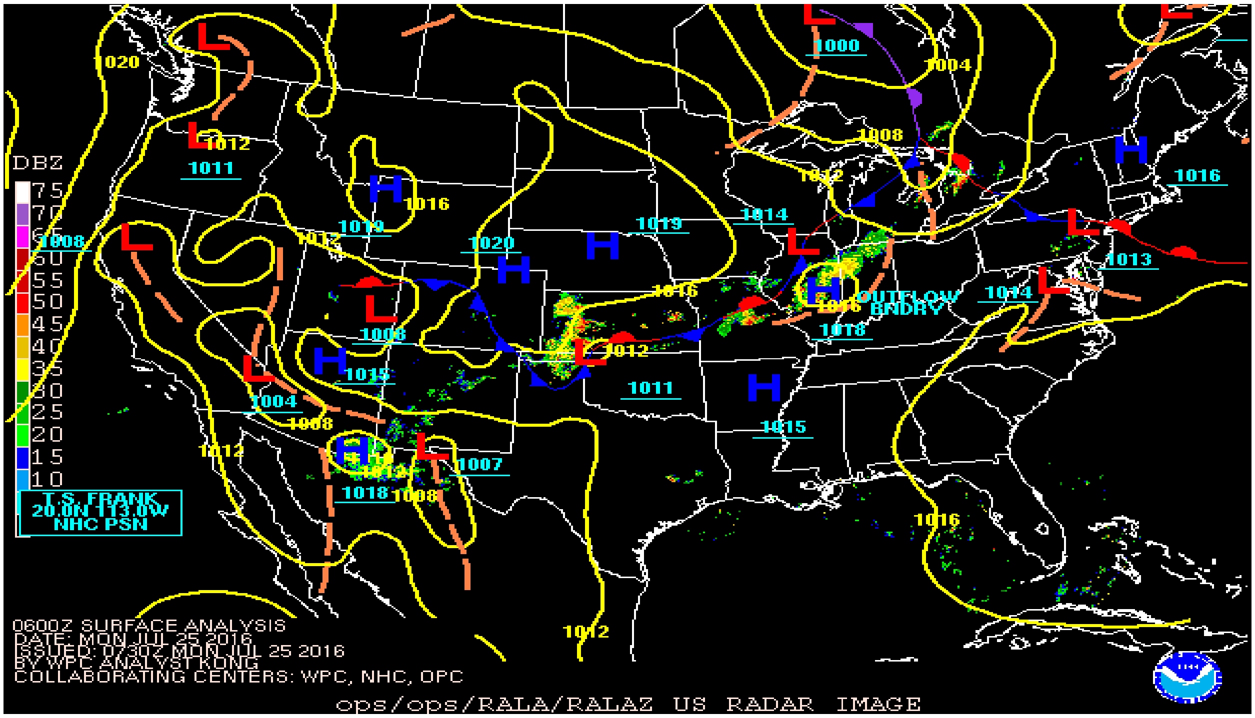

Figure 11-2. Surface weather map for July 24, 2016 at the 1800 hour. Wind barbs depict wind speed (knots) and direction.

As the event unfolded, the wind blew from multiple directions throughout the border region. These high velocity winds passed over large areas of desert within New Mexico and Mexico (Figure 11-3). Anthropogenic sources of dust near NMED's monitoring sites include: disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

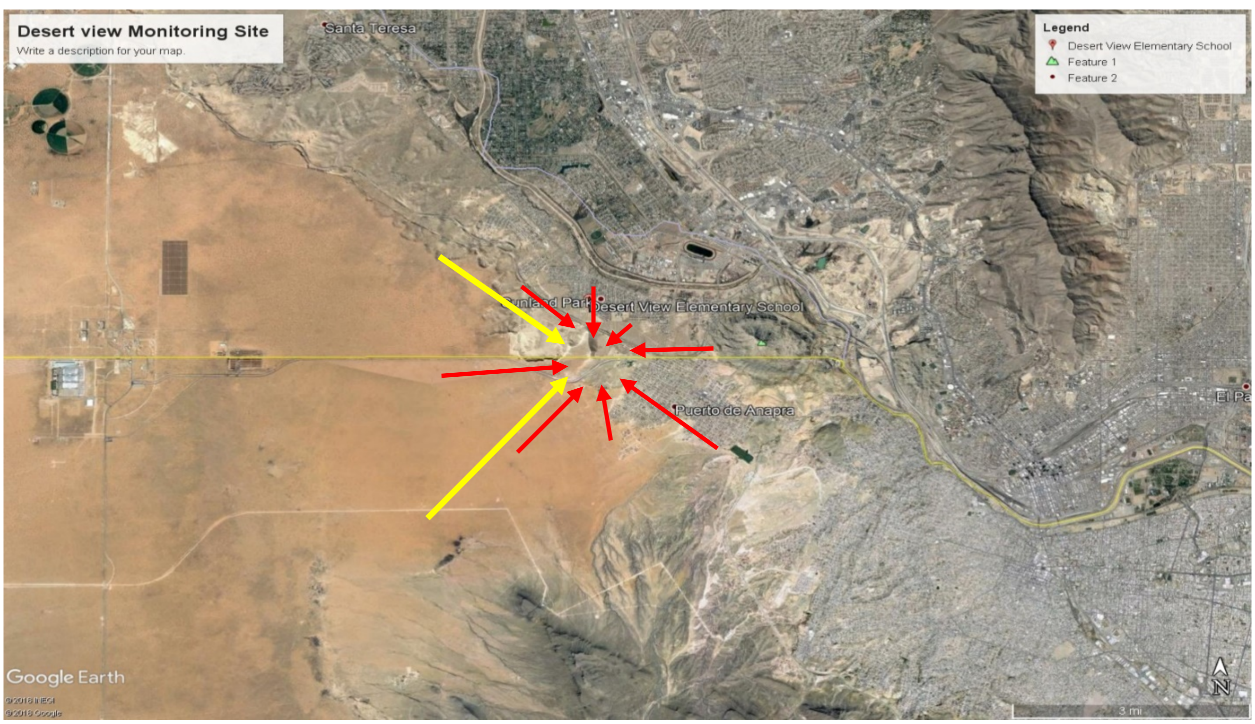

Figure 11-3. Map of NMED monitoring sites with predominant wind direction and suspected source locations for the high wind blowing dust event. Yellow vectors indicate direction of PM_{10} sources; red vectors indicate wind directions.

The co-occurrence of high winds and elevated levels of blowing dust, little to no point sources in the area, and the high hourly and daily PM_{10} concentrations support the assertion that this was a natural event, specifically a high wind dust event. Sustained 5-minute wind speeds exceeding 9 m/s (~20 mph) were recorded at the Santa Teresa monitoring site beginning at the 1955 hour and lasted through the 2140 hour (Table 11-3). PM_{10} concentrations began to exceed the NAAQS at the Desert View monitoring site beginning at the 2200 hour. Hourly concentrations remained elevated through the 2300 hour. Table 11-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event.

Hour	West Mesa			Desert View			Deming		
	PM_{10} (µg/m^3)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m^3)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m^3)	Wind Speed (m/s)	Wind Gust (m/s)
1900	51	6.6	16.8	92	4.7	14.2	173	5.3	14.2
2000	12	3.6	11.6	136	6.6	17.8	22	5	10.8
2100	14	3.2	8.2	19	4.3	11.1	17	3.7	8.2
2200	7	2.2	4.3	1741	5.2	11.2	22	4.6	10.2
2300	9	5.9	10.6	2280	1.2	3.9	29	3.6	8.3

Table 11-2. Hourly PM_{10}, wind speed and wind gust data during the peak hours of the event.

Hour	Santa Teresa	Desert View
	Wind Speed (m/s)	Wind Speed (m/s)
1950	6.6	8.8
1955	7.3	9.5
2000	11.4	10.6
2005	10.8	10.3
2010	11.1	11.5
2015	11.6	11
2020	10.7	5.9
2025	10.8	2.2
2030	10.5	1.8
2035	10.4	4.6
2040	7.9	5.2
2045	9	7.5
2050	9.8	4.9
2055	12.2	4.1
2100	12.1	6.2
2105	13.1	6.9
2110	10.8	5.3
2115	8.9	4.6
2120	11.8	4.5
2125	12	3.9
2130	1.6	4.5
2135	11.9	5.9
2140	9.9	4.9

Table 11-3. 5-minute wind speeds for the Desert View and Santa Teresa monitoring sites

Meteorologists forecasted the high wind blowing dust event to occur this day. Forecasts predicted strong winds as the storm approached the area with the area of low pressure tracking from west to east just south of the great plains in the morning and moving across Arizona and New Mexico in the afternoon. The systems movement across the area timed well with the outflow boundary along eastern New Mexico. The high to low pressure gradient along southeastern Arizona and southwestern New Mexico strengthened the outflow boundary to the east; thus, increasing wind speeds, with winds coming from many directions because of the short duration it takes for formation of the storm system.

Not Reasonably Controllable or Preventable (nRCP)

Not Reasonably Preventable

This demonstration does not provide a showing of not reasonably preventable pursuant to 40 CFR 50.14(b)(5)(iv) that states, in part, "the State shall not be required to provide a case-specific justification for a high wind dust event."

Not Reasonably Controllable

The documentation provided in this section demonstrates that the wind speeds and other meteorological conditions overwhelmed the reasonable control measures in place for anthropogenic sources, causing emissions of dust that were transported to NMED's monitors.

Sustained Wind Speeds

EPA has indicated 11.2 m/s (25 mph) as the wind speed threshold at which natural or controlled anthropogenic sources will emit dust. The Santa Teresa monitoring site recorded wind speeds above this threshold for 9 different 5-minute wind intervals for a total of 45 minutes intermittently between the hours of 2000 and 2140 at the Santa Teresa and Desert View monitoring sites (Figure 11-4 & Table 11-3).

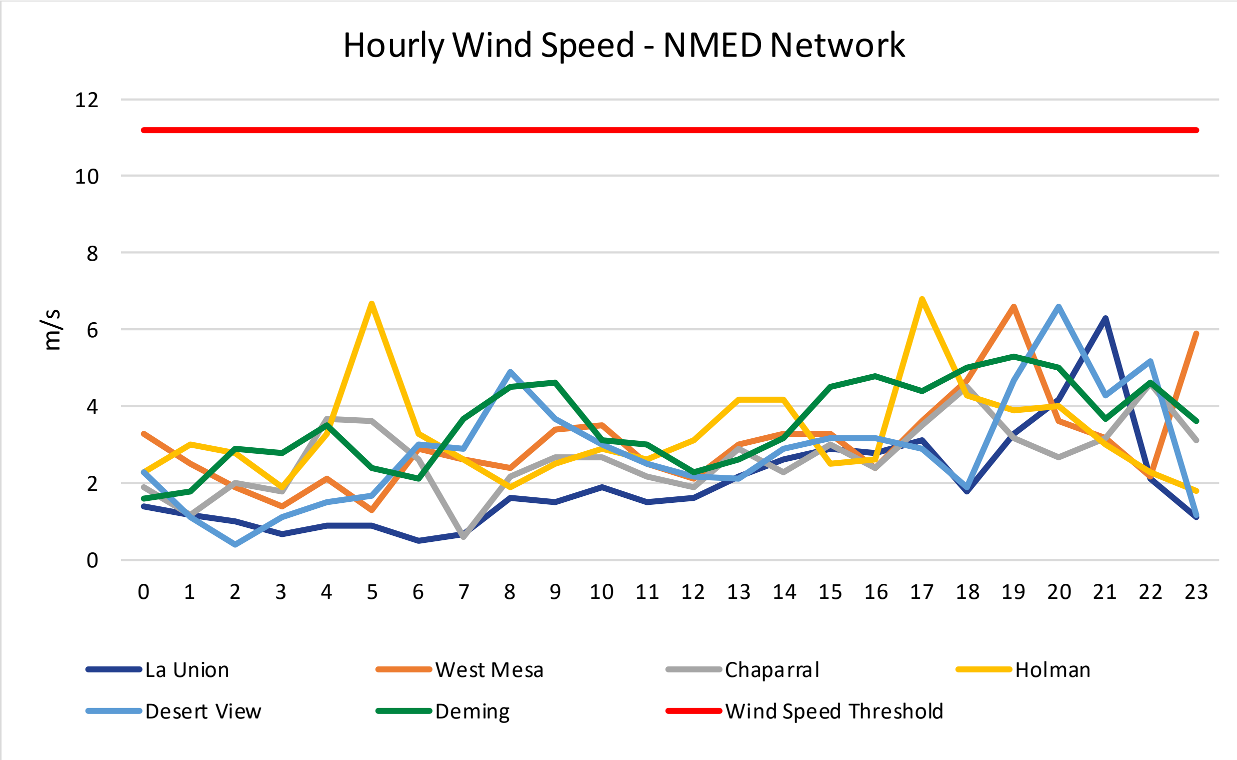

Figure 11-4. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

Level of Controls Analysis

Based on the sustained winds speeds monitored in the area during the event a basic controls analysis will be provided.

Basic Controls Analysis

Implementation and Enforcement of Control Measures

Reasonable controls for anthropogenic sources of dust are based on an area's attainment status for the PM_{10} NAAQS. It is not reasonable for areas designated as attainment, unclassifiable or maintenance to have the same level of controls as areas that are nonattainment for the standard. However, southern New Mexico has a long history of high wind blowing dust events with NMED developing a nonattainment SIP for the Anthony Area and NEAPs for the remaining portion of Doña Ana County and all of Luna County. As discussed in the Background section, NMED worked with local governments to help them develop and adopt dust control ordinances based on BACM. Based on the area's attainment status and SIP waiver, NMED believes these ordinances constitute reasonable controls.

The ordinances developed and adopted under the NEAPs are implemented and enforced at the local level with NMED playing a supporting role to ensure effective and enforceable implementation of control measures. Under the regulatory framework applicable to the two counties, NMED's purview does not include oversight of the extent of the effectiveness and enforcement of local ordinances. However, NMED believes that these ordinances are appropriately implemented at the local level.

Suspected Source Areas and Categories Contributing to the Event

Anthropogenic sources of dust in New Mexico include disturbed lands, construction and demolition activities, vacant parking lots and materials handling and transportation. Area sources account for a

much larger portion of overall PM_{10} emissions than point sources. On the day of the event, no unusual PM_{10} producing activities occurred and anthropogenic point source emissions remained constant before, during and after the event. Natural areas of the Chihuahuan Desert in Doña Ana, Luna, Hidalgo and Grant Counties are the most likely sources, under NMED's jurisdiction, contributing to the high wind blowing dust event. Other area sources located in Arizona, Texas and Chihuahua, MX likely contributed to the exceedances on this day. Controlling dust from the natural desert terrain is cost prohibitive and falls outside NMED's jurisdiction when it is transported from intrastate and international sources.

The documentation and analysis presented in this section demonstrates that all identified sources that may have caused or contributed to the exceedance were reasonably controlled, implemented and enforced at the time of the event, therefore emissions associated with the high wind dust event were not reasonably controllable or preventable.

Clear Causal Relationship (CCR)

Occurrence and Geographic Extent of the Event

No satellite imagery illustrating the exceptional event's blowing dust was available due to cloud cover with strong localized meteorological patterns consistent with outflow winds.

Spatial and Transport Analysis

Wind Direction and Elevated PM_{10} Concentrations

Wind and pollution rose (Figures 11-5 & 11-6) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m^3 (2200 - 2300 hour). During the event PM_{10} blew from the northwest approximately 50% and south southwest the other 50% of the time coinciding with peak PM_{10} concentrations; even though, winds were coming from six different directions accounting for approximately 70% of the wind during the 2000 – 2300 hours. Such representations are consistent with strong outflow winds.

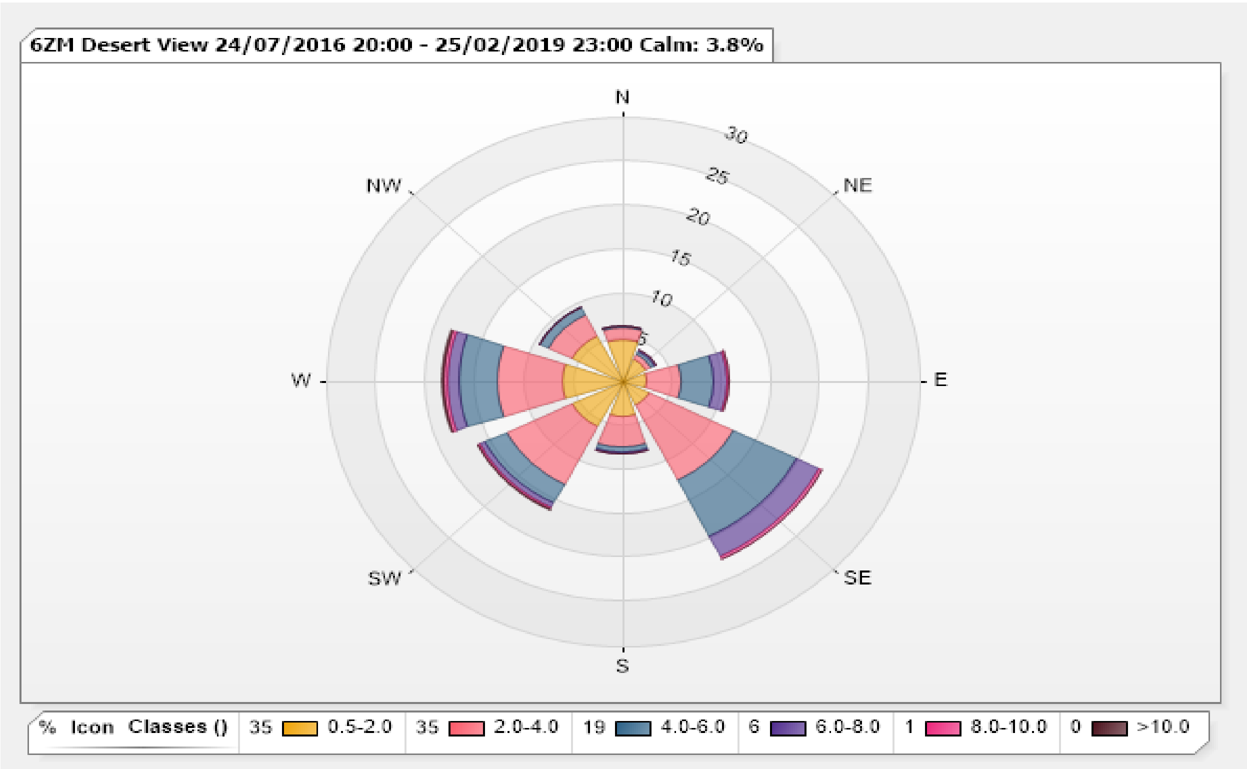

Figure 11-5. Wind Rose for Desert View monitoring site.

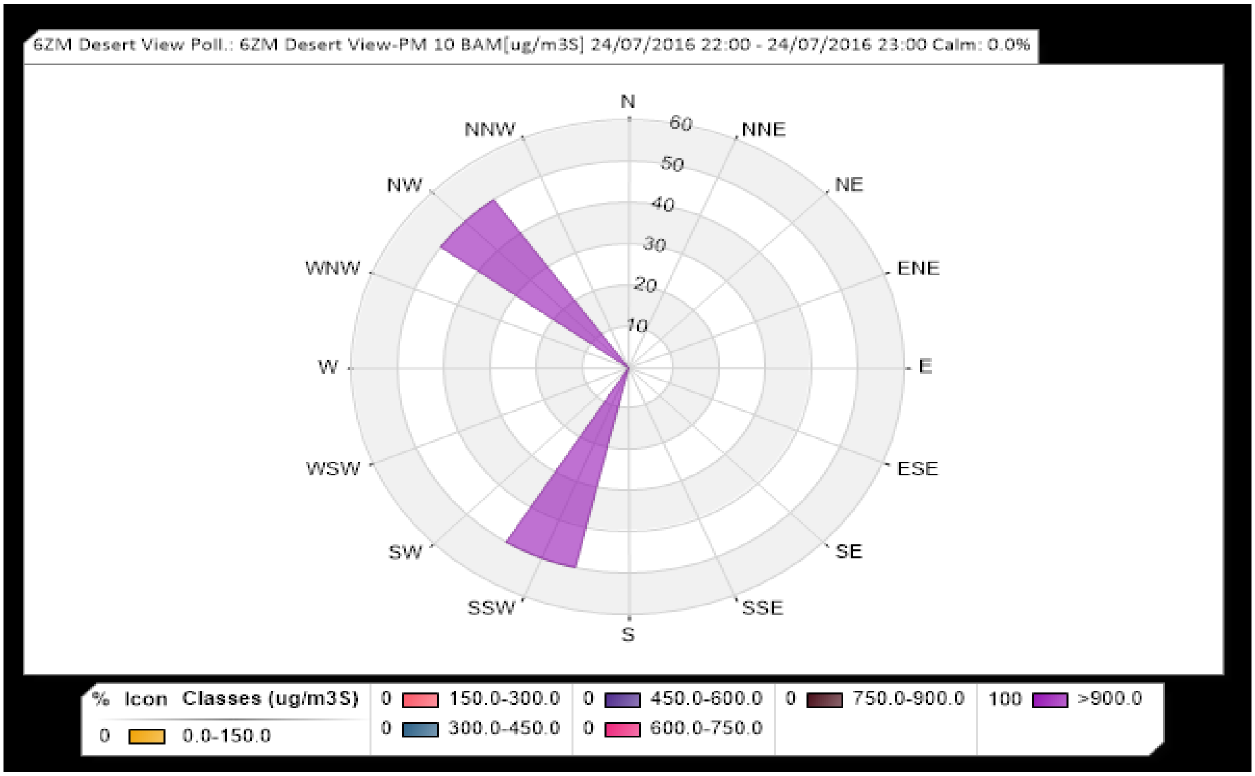

Figure 11-6. Pollution Rose for Desert View monitoring site at 10:00-11:00

Temporal Relationship of High Wind and Elevated PM_{10} Concentrations

The high wind blowing dust event generated strong winds beginning at the 1955 hour and lasting through the 2140 hour. During this time, peak hourly PM_{10} concentrations ranged from 173 to 1741 µg/m^3 at NMED monitoring sites (Figure 11-7). Although not all NMED monitoring sites recorded an exceedance of the NAAQS, hourly PM_{10} data spiked at approximately the same time throughout the network. Sustained five-minute average wind speeds of 13.1 m/s were recorded at the Santa Teresa monitoring site during the peak PM_{10} concentrations of the event. The time series plot in Figure 11-8 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

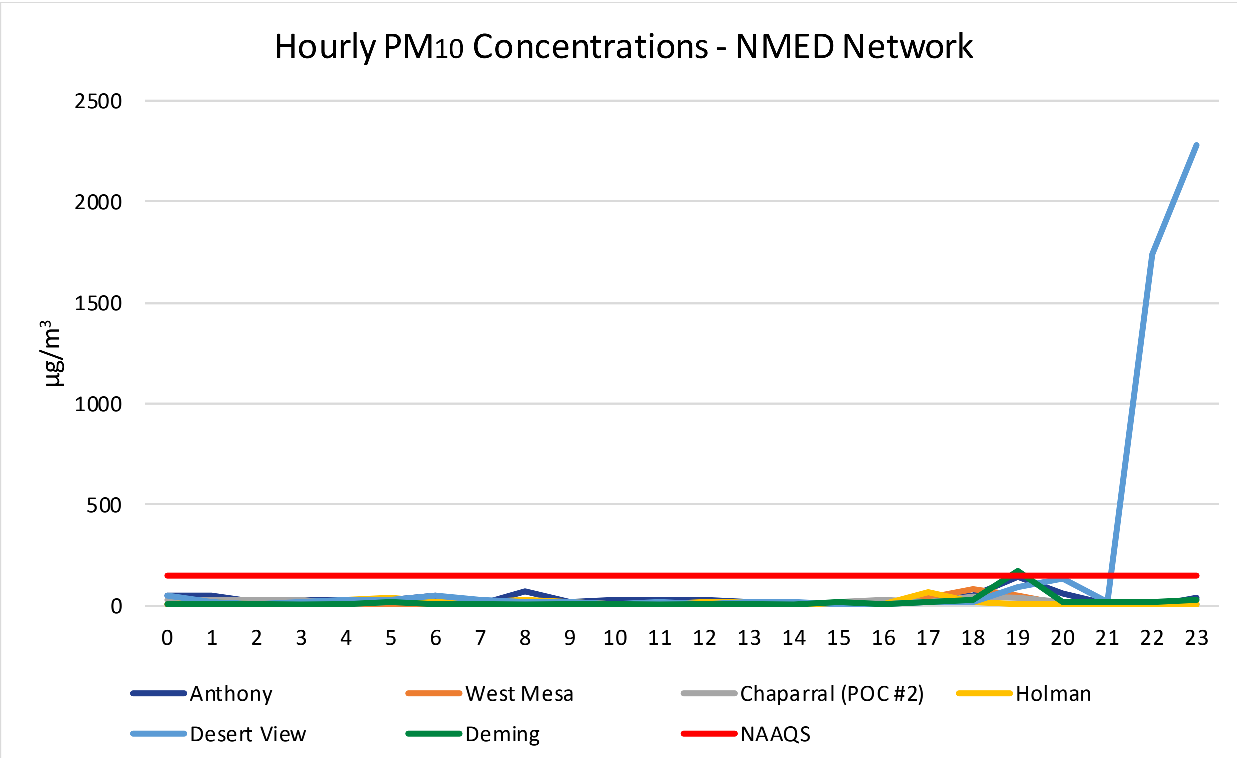

Figure 11-7. NMED monitoring network hourly PM10 data for the high wind blowing dust event.

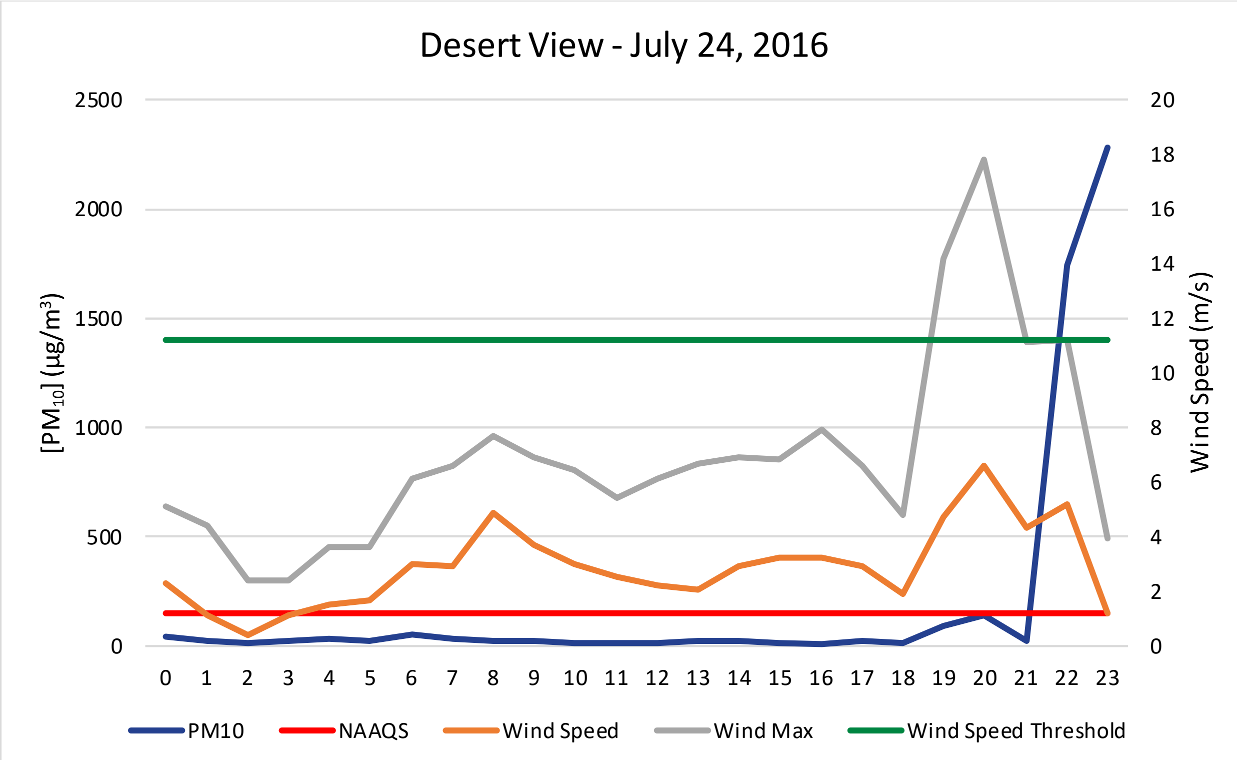

Figure 11-8. NMED monitoring network hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2011-2015, the Desert View monitoring site recorded 43 exceedances of the PM_{10} NAAQS (Figure 11-9). The maximum 24-hour average PM_{10} concentration at this site was 1691 µg/m^3 recorded in 2012. High wind blowing dust events in southern New Mexico can occur at any time of the year, but the majority of these days occur during the spring windy season, from March through May. NMED has documented that all exceedances have been caused by high wind blowing dust events.

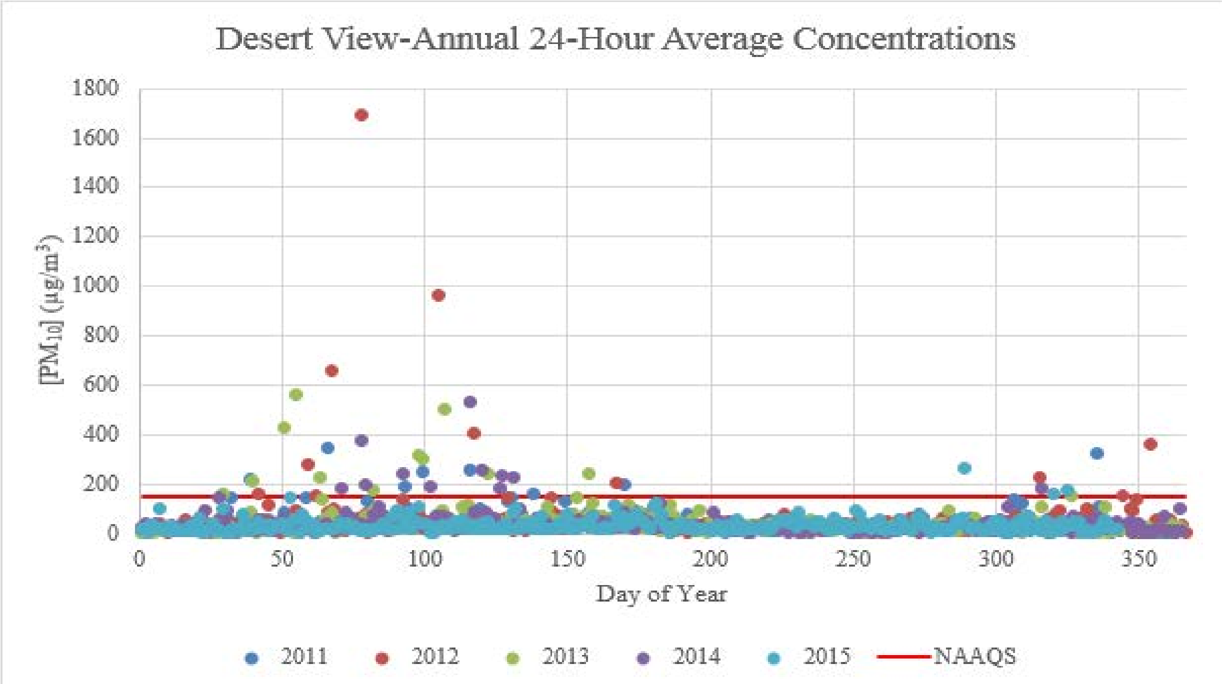

Figure 11-9. 24-hour averages by day of year from 2011-2015.

Spatial and Temporal Variability

As demonstrated in Figure 11-10, all NMED monitoring sites recorded elevated 24-Hour Average PM_{10} concentrations compared to the days preceding and following the event. Daily averages for the days surrounding the event did not surpass 50 µg/m^3, demonstrating the influence high winds have on PM_{10} concentrations in the area.

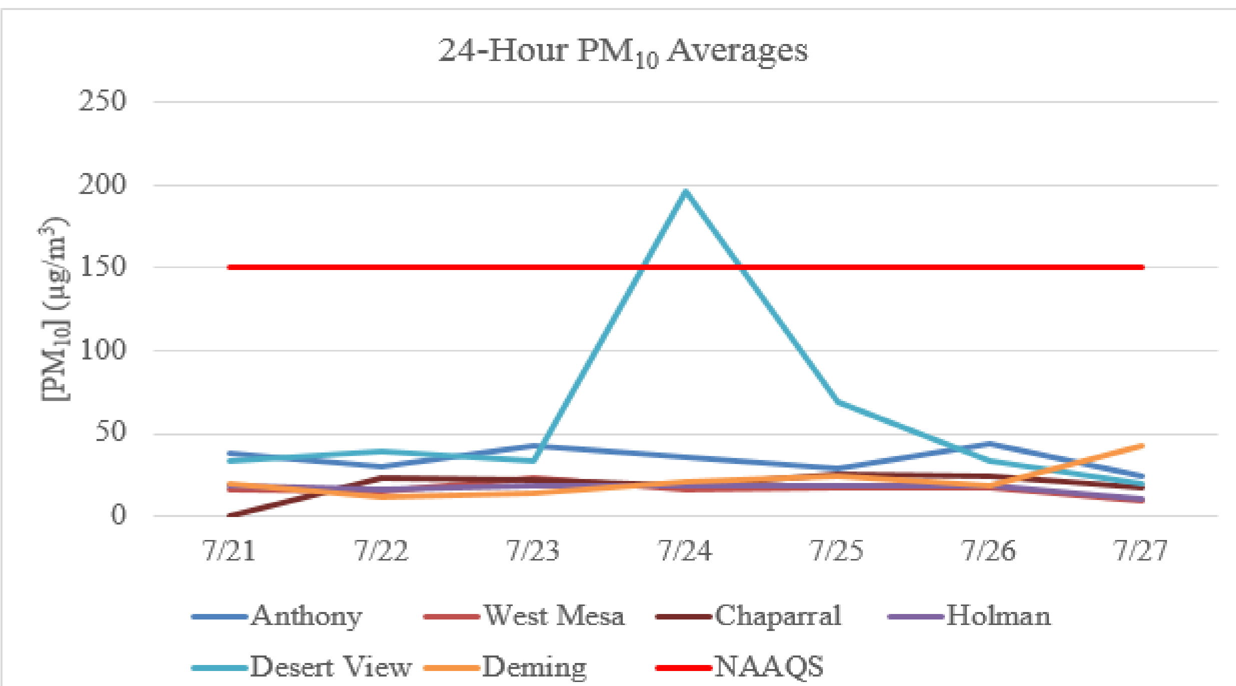

Figure 11-10. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

Percentile Ranking

Table 11-4 shows the 24-Hour Average PM_{10} data distribution recorded at NMED monitoring sites, including high wind blowing dust events flagged with a request to exclude data in the AQS database for exceedances of the standard from 2011-2015. The recorded value for this day (195 µg/m^3) is above the 95^{th} percentile of historical data.

Statistic\MonitoringSite	Anthony	West Mesa	Chaparral	Holman	Desert View	Deming
Max	1739	487	1606	1449	1691	1098
99th Percentile	307	160	255	198	253	254
95th Percentile	99	59	91	68	99	68
75th Percentile	54	23	36	31	42	30
50th Percentile	38	16	24	21	28	20
25th Percentile	25	11	16	14	19	13
5th Percentile	13	5	6	6	9	6
Mean	49	23	36	30	40	30

Table 11-4. NMED monitoring sites PM_{10} 24-hour average data distribution. Includes data flagged in AQS for exclusion due to high wind blowing dust events (RJ).

CCR Conclusion

On this day a high wind blowing dust event occurred, generating PM_{10} emissions that resulted in elevated concentrations at the Desert View monitoring site. The monitored PM_{10} 24-Hour Average of 195 µg/m^3 is above the 95th percentile of data monitored over the previous five years. Meteorological conditions were consistent with past event days and elevated PM_{10} concentrations. The comparisons and analyses provided in the CCR section of this demonstration support NMED's position that the event affected air quality in such a way that a clear causal relationship exists between the high wind blowing dust event and the monitored exceedance on this day, satisfying the CCR criterion.

Natural Event

The CCR and nRCP analyses show that this was a natural event caused by high wind and blowing dust. Based on the documentation provided in this demonstration, the event qualifies as a natural event. The exceedance associated with the event meets the regulatory definition of a natural event at 40 CFR 50.14(b)(8). This event transported windblown dust from natural and anthropogenic sources that have been reasonably controlled and accordingly, NMED has demonstrated that the event is a natural event and may be considered for treatment as an exceptional event.

12. HIGH WIND EXCEPTIONAL EVENT: December 16, 2016

Conceptual Model

A Pacific cold front caused high winds and blowing dust in Doña Ana County resulting in an exceedance of the PM_{10} NAAQS at the Chaparral monitoring site on this date. In accordance with the EER, the AQB submitted this data to EPA's AQS database and flagged it (coded as RJ) as a high wind dust event (Table 12-1).

AQS Flag	AQS ID	Site Name	24-Hour Average Concentration	Max 1-Hour Wind Speed	Max Gust
RJ	35-013-0020	6ZK Chaparral	172 µg/m³ (POC #2)	12.3 m/s	21 m/s

Table 12-1. 2016 PM_{10} Data flagged by NMED for exclusion pursuant to the EER.

An upper ridging storm system moved through the state originating from the Pacific northwest, a cold pressure gradient formed over southeastern Arizona, southwestern New Mexico and northern Mexico (Figure 12-1). At the 2100 hour, an area of low pressure moved over the states of northern Utah and northern Colorado. Aloft, the low-pressure center of the storm system hovered over northern California. As the day progressed this low pressure aloft traveled east and aligned itself with New Mexico and the surface wind direction (Figure 12-2). Diurnal heating of the surface allowed winds aloft to mix down, increasing the surface wind velocities and provided the turbulence required for vertical mixing and entrainment of dust.

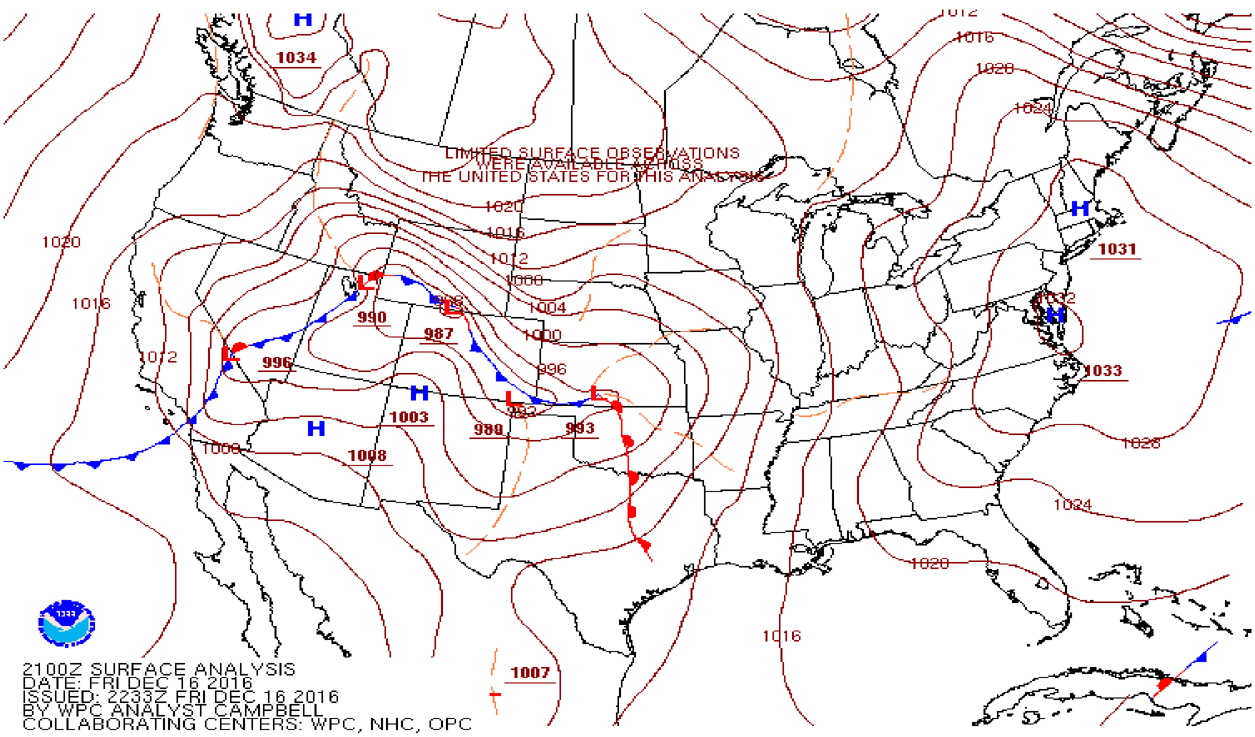

Figure 12-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

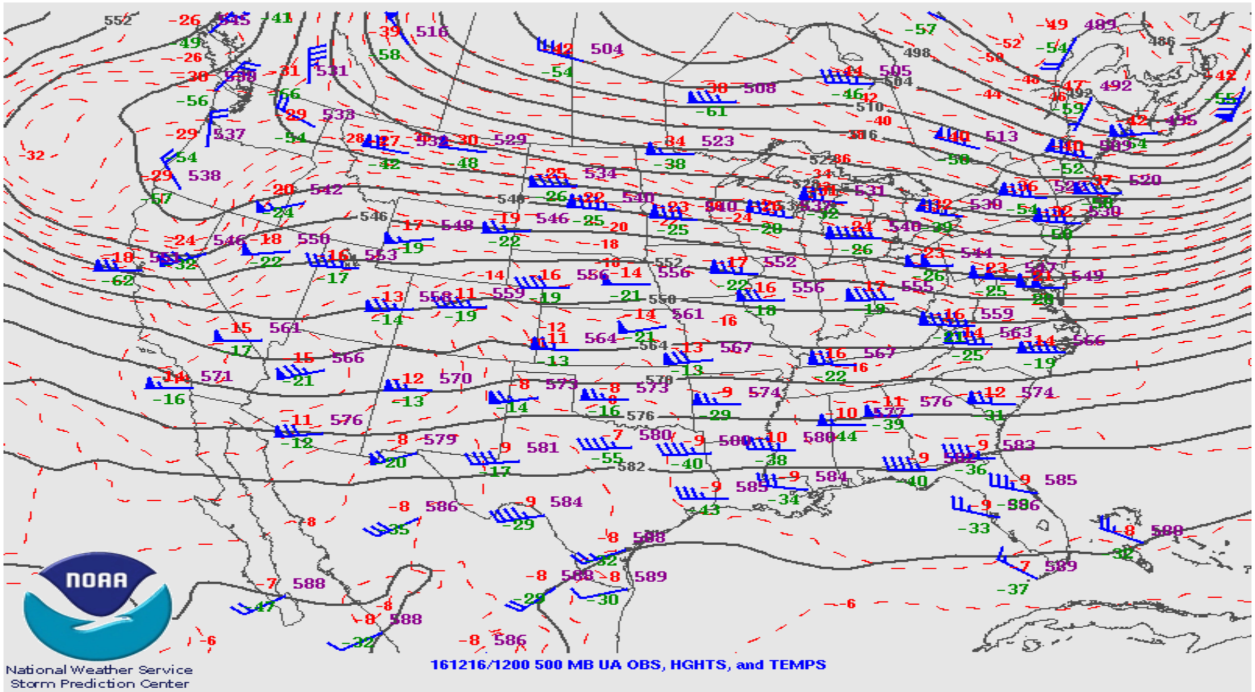

Figure 12-2. Upper air weather map for December 16, 2016 at the 1200 hour. Wind barbs depict wind speed (knots) and direction.

As the event unfolded, the wind blew from the southwest throughout the border region. These high velocity winds passed over large areas of desert within New Mexico and Mexico (Figure 12-3). Anthropogenic sources of dust near NMED's monitoring sites include: disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

Figure 12-3. Map of NMED monitoring sites with a recorded exceedance of the NAAQS, predominant wind direction and suspected source locations for the high wind blowing dust event.

The co-occurrence of high winds and elevated levels of blowing dust, little to no point sources in the area, and the high hourly and daily PM_{10} concentrations support the assertion that this was a natural event, specifically a high wind dust event. Sustained hourly wind speeds exceeding 9 m/s (~20 mph) were recorded at Anthony, Chaparral, Holman, West Mesa and Deming monitoring sites beginning at the 1200 hour and lasted through the 2300 hour. PM_{10} concentrations began to exceed the NAAQS at the Anthony, Chaparral, Desert View, and Deming monitoring sites beginning at the 1300 hour. Hourly concentrations remained elevated through the 1700 hour. Table 12-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event.

Hour	Anthony Monitoring Site			Chaparral (POC #2) Monitoring Site			Deming Monitoring Site		
	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)
1200	128	9.2	15.7	110	8.8	15.3	92	9.2	15.4
1300	462	8.2	13.4	539	10.3	17.3	171	10.3	16.7
1400	674	10.4	19.3	1018	12.3	21	217	11.1	17.8
1500	549	10.1	16.1	554	12.1	20.7	190	10.6	16.7
1600	139	9.2	16.8	178	10.7	18	70	9.1	15.8
1700	123	6.7	13	210	11.1	17.5	36	7.9	11.9
1800	53	2.6	7.4	78	10.2	17.6	31	6.3	11.2
1900	69	2.9	5.6	63	9	14.6	24	5.7	9.8
2000	45	4.1	8.6	329	10.8	20.5	22	8.5	13.6
2100	36	4.6	8.7	427	11.4	20.5	14	8.2	14.6
2200	33	3.3	6.3	107	11	18.6	19	9.2	14.7
2300	36	3.7	5.7	156	10.8	19.4	17	7.3	11.5

Table 12-2. Hourly PM_{10}, wind speed and wind gust data during the peak hours of the event.

Meteorologists forecasted the high wind blowing dust event to occur this day along with a drop in temperatures from the ensuing cold front. Forecasts predicted strong winds as the storm approached the area with the area of low pressure tracking from west to east just north of the four corners in the morning and moving across New Mexico in the afternoon. The systems movement across the area timed well with daytime heating and mixing generating a deep trough to the east as stronger winds aloft moved into the area. Many outlets also forecasted a high probability of blowing and entrained dust throughout the area and haze in the afternoon, especially in the desert areas of southern New Mexico.

Not Reasonably Controllable or Preventable (nRCP)

Not Reasonably Preventable

This demonstration does not provide a showing of not reasonably preventable pursuant to 40 CFR 50.14(b)(5)(iv) that states, in part, "the State shall not be required to provide a case-specific justification for a high wind dust event."

Not Reasonably Controllable

The documentation provided in this section demonstrates that the wind speeds and other meteorological conditions overwhelmed the reasonable control measures in place for anthropogenic sources, causing emissions of dust that were transported to NMED's monitors.

Sustained Wind Speeds

EPA has indicated 11.2 m/s (25 mph) as the wind speed threshold at which natural or controlled anthropogenic sources will emit dust. The West Mesa monitoring site recorded wind speeds above this threshold for 1 hour from the 1400 to the 1500 hour (Figure 12-4). The Wind speeds at the upwind Deming monitoring site also reached near the high wind threshold.

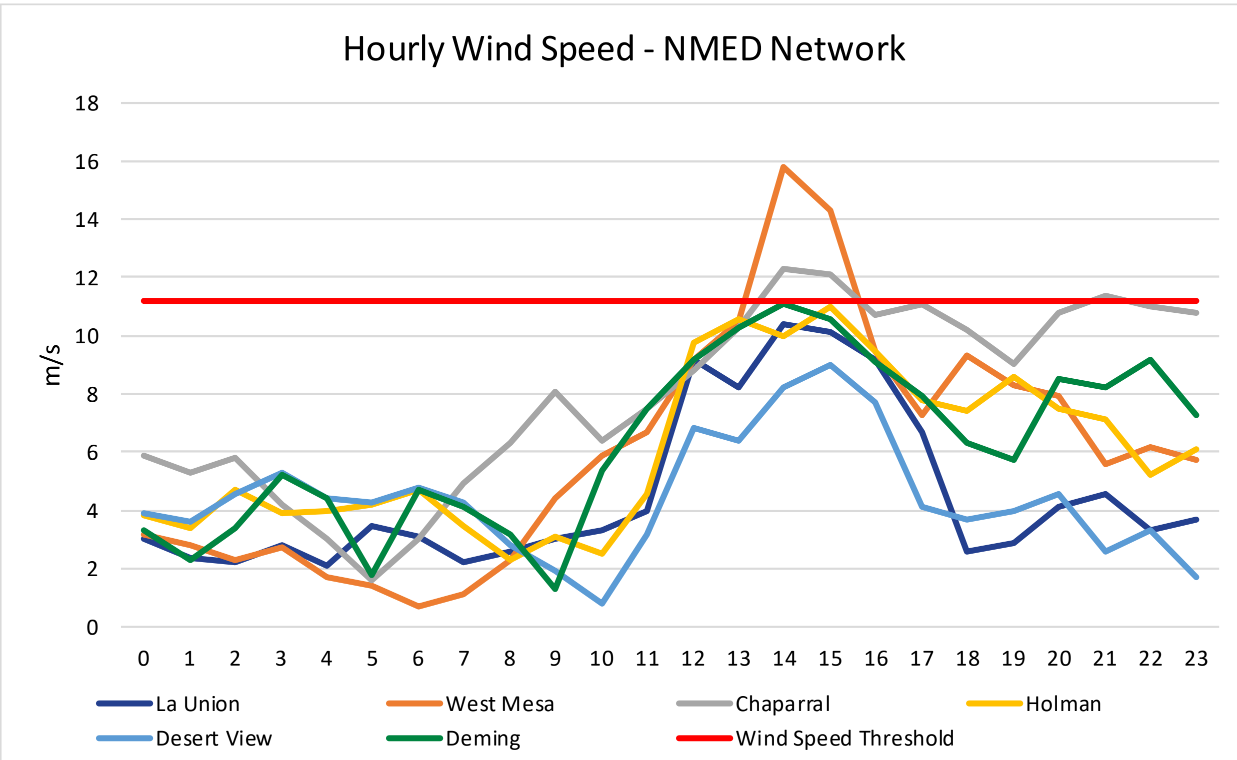

Figure 12-4. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

Level of Controls Analysis

Based on the sustained winds speeds monitored in the area during the event, a basic controls analysis will be provided.

Basic Controls Analysis

Implementation and Enforcement of Control Measures

Reasonable controls for anthropogenic sources of dust are based on an area's attainment status for the PM_{10} NAAQS. It is not reasonable for areas designated as attainment, unclassifiable or maintenance to have the same level of controls as areas that are nonattainment for the standard. However, southern New Mexico has a long history of high wind blowing dust events with NMED developing a nonattainment SIP for the Anthony Area and NEAPs for the remaining portion of Doña Ana County and all of Luna County. As discussed in the Background section, NMED worked with local governments to help them develop and adopt dust control ordinances based on BACM. Based on the area's attainment status and SIP waiver, NMED believes these ordinances constitute reasonable controls.

The ordinances developed and adopted under the NEAPs are implemented and enforced at the local level with NMED playing a supporting role to ensure effective and enforceable implementation of control measures. Under the regulatory framework applicable to the two counties, NMED's purview does not include oversight of the extent of the effectiveness and enforcement of local ordinances. However, NMED believes that these ordinances are appropriately implemented at the local level.

Suspected Source Areas and Categories Contributing to the Event
Anthropogenic sources of dust in New Mexico include disturbed lands, construction and demolition activities, vacant parking lots and materials handling and transportation. Area sources account for a much larger portion of overall PM_{10} emissions than point sources. On the day of the event, no unusual PM_{10} producing activities occurred and anthropogenic point source emissions remained constant before, during and after the event. Natural areas of the Chihuahuan Desert in Doña Ana, Luna, Hidalgo and Grant Counties are the most likely sources, under NMED's jurisdiction, contributing to the high wind blowing dust event. Other area sources located in Arizona, Texas and Chihuahua, MX likely contributed to the exceedance on this day. Controlling dust from the natural desert terrain is cost prohibitive and falls outside NMED's jurisdiction when it is transported from intrastate and international sources.

The documentation and analysis presented in this section demonstrates that all identified sources that may have caused or contributed to the exceedance were reasonably controlled, implemented and enforced at the time of the event, therefore emissions associated with the high wind dust event were not reasonably controllable or preventable.

Clear Causal Relationship (CCR)

Occurrence and Geographic Extent of the Event

Satellite Imagery
The event was captured on satellite imagery with dust plumes originating upwind of NMED's monitoring site near Ascension and Janos, Chih. This area is largely rural with the largest area sources of PM originating from agricultural activities as well as the vast desert areas and playas in northern Mexico (Figure 12-5). The dust plumes of interest appear to be limited to Mexico, orientated in a southwest to northeast fashion and traveling toward El Paso and NMED's monitoring site at the time of the satellite pass (1100 hour MDT) that captured the imagery.

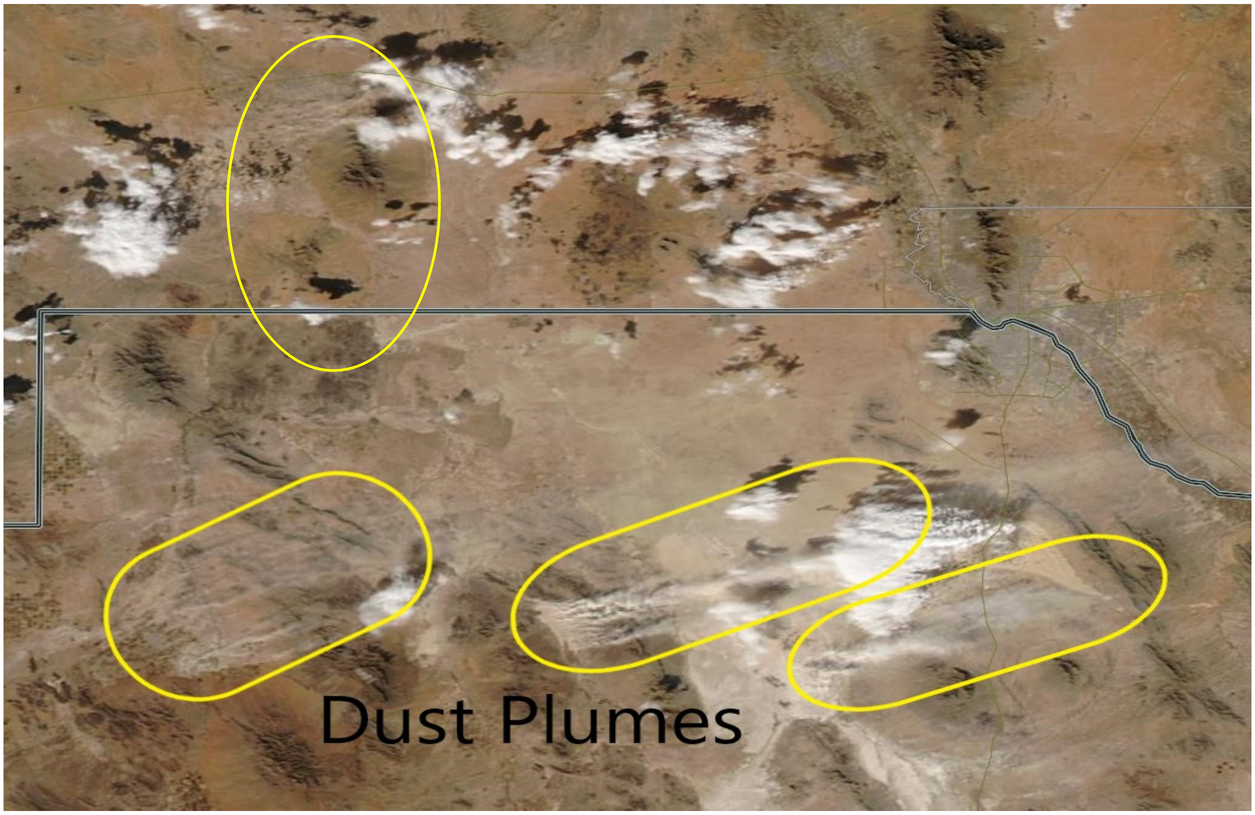

Figure 12-5. MODIS natural color imagery from the Aqua Satellite showing southwestern New Mexico, northern Chihuahua and western Texas. Imagery obtained from NASA's EOSDIS Worldview website.

Weather Statements, Advisories, News and Other Media Reports Covering the Event

The National Weather Service (NWS) issued a Wind Advisory and a Blowing Dust Advisory for this date. A Wind Advisory is issued by NWS when sustained winds of 30 to 39 mph are expected for 1 hour or longer. A Blowing Dust Advisory is issued when blowing dust is expected to reduce visibility to between ¼ to 1 mile, generally with winds of 25 mph or greater. These were in place for southwestern New Mexico and west Texas to warn the public of the high wind event. An excerpt from the NWS Wind Advisory can be found below:

```
WEST TO SOUTHWEST WINDS TO 25 TO 35 MPH WITH GUSTS UP TO 50 MPH. BLOWING DUST
ACROSS THE SOUTHWEST DESERTS MAY CAUSE SIGNIFICANT DRIVING
HAZARDS...ESPECIALLY ALONG I-10...DUE TO LOW VISIBILITY
```

Spatial and Transport Analysis

HYSPLiT Backtrajectory Analysis

A back-trajectory analysis using the NOAA Air Resources Laboratory HYSPLIT transport and dispersion model (Draxler et al., 2015; Rolph et al., 2017) shows that the air masses traveled from Chihuahua, MX and the playas of southwestern New Mexico into the southern New Mexico Chaparral and El Paso, TX area and on to the NMED monitoring site. The model was run using GDAS meteorological data for the six hours preceding the start of elevated PM_{10} concentrations during the event (Figure 12-6). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

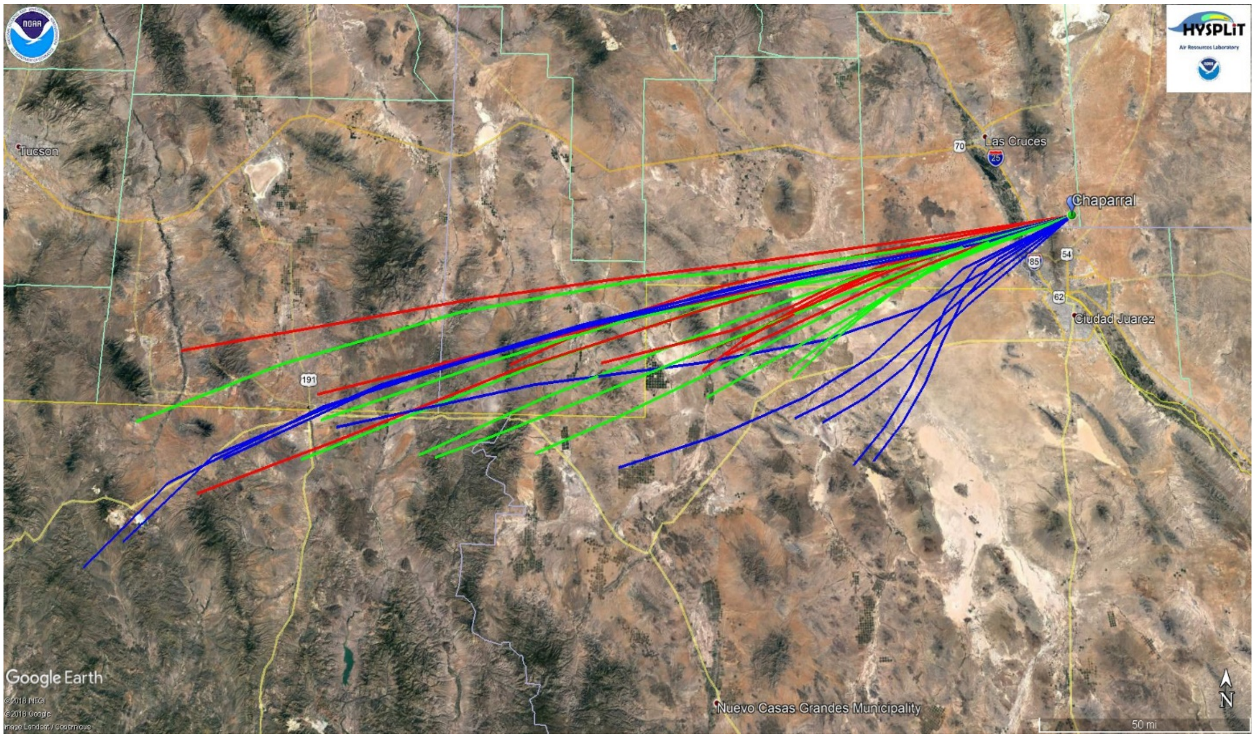

Figure 12-6. HYSPLiT back-trajectory analyses using the Ensemble mode.

Wind Direction and Elevated PM_{10} Concentrations
Pollution rose (Figure 12-7) was created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m³ (1300 -2100 hour). During the event, winds blew from the west southwest approximately 66-100% of the time coinciding with peak PM_{10} concentrations.

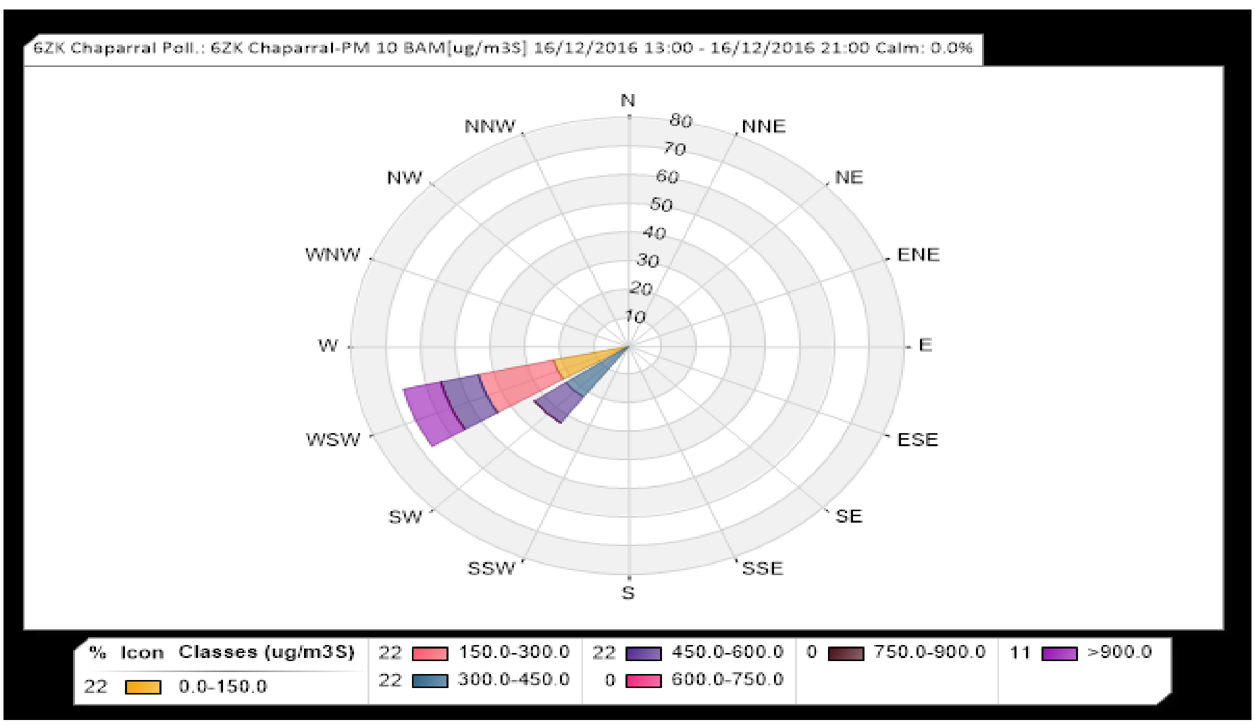

Figure 12-7. Pollution rose for Chaparral monitoring site.

Temporal Relationship of High Wind and Elevated PM_{10} Concentrations

The high wind blowing dust event generated strong west southwesterly winds beginning at the 1200 hour and lasting through the 2300 hour. During this time, peak hourly PM_{10} concentrations ranged from 217 to 1018 µg/m³ at NMED monitoring sites (Figure 12-8). Although not all NMED monitoring sites recorded an exceedance of the NAAQS, hourly PM_{10} data spiked at approximately the same time throughout the network. Sustained hourly average wind speeds of 12.3 to 15.8 m/s were recorded at Chaparral and West Mesa monitoring sites during the peak PM_{10} concentrations of the event. The time series plot in Figure 12-9 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

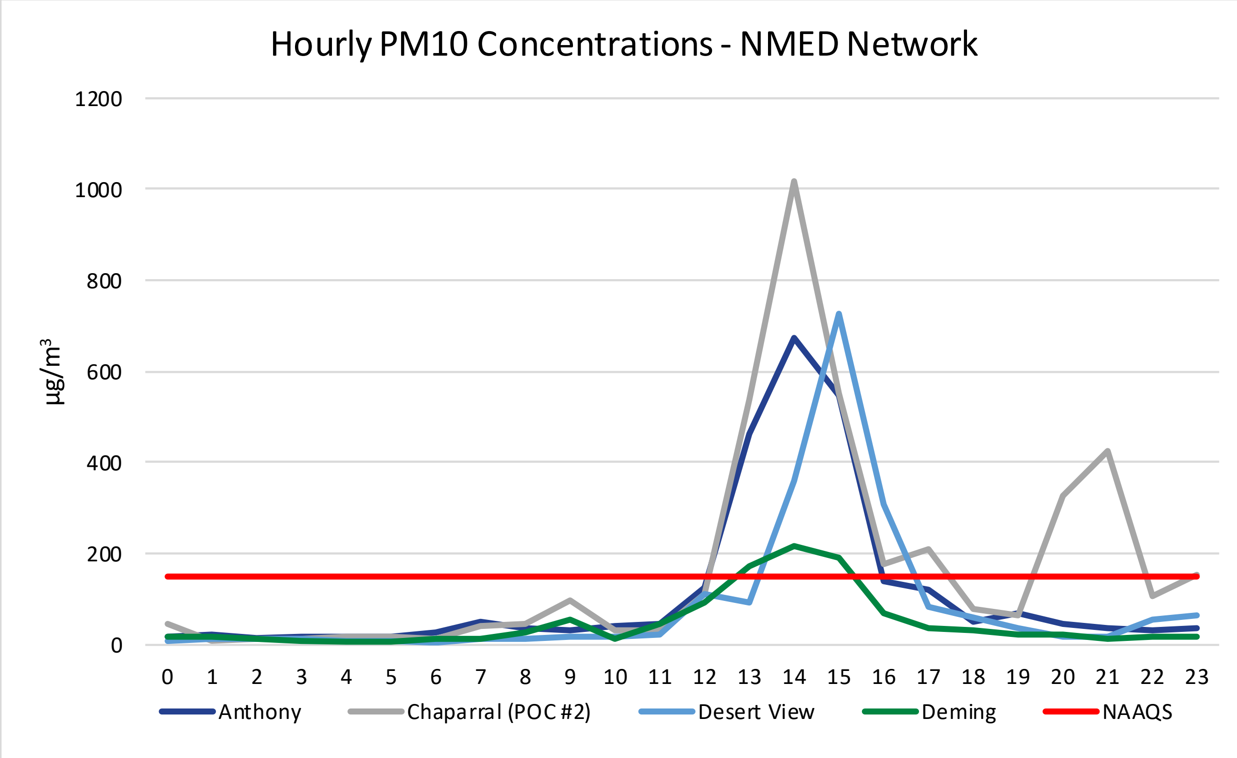

Figure 12-8. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

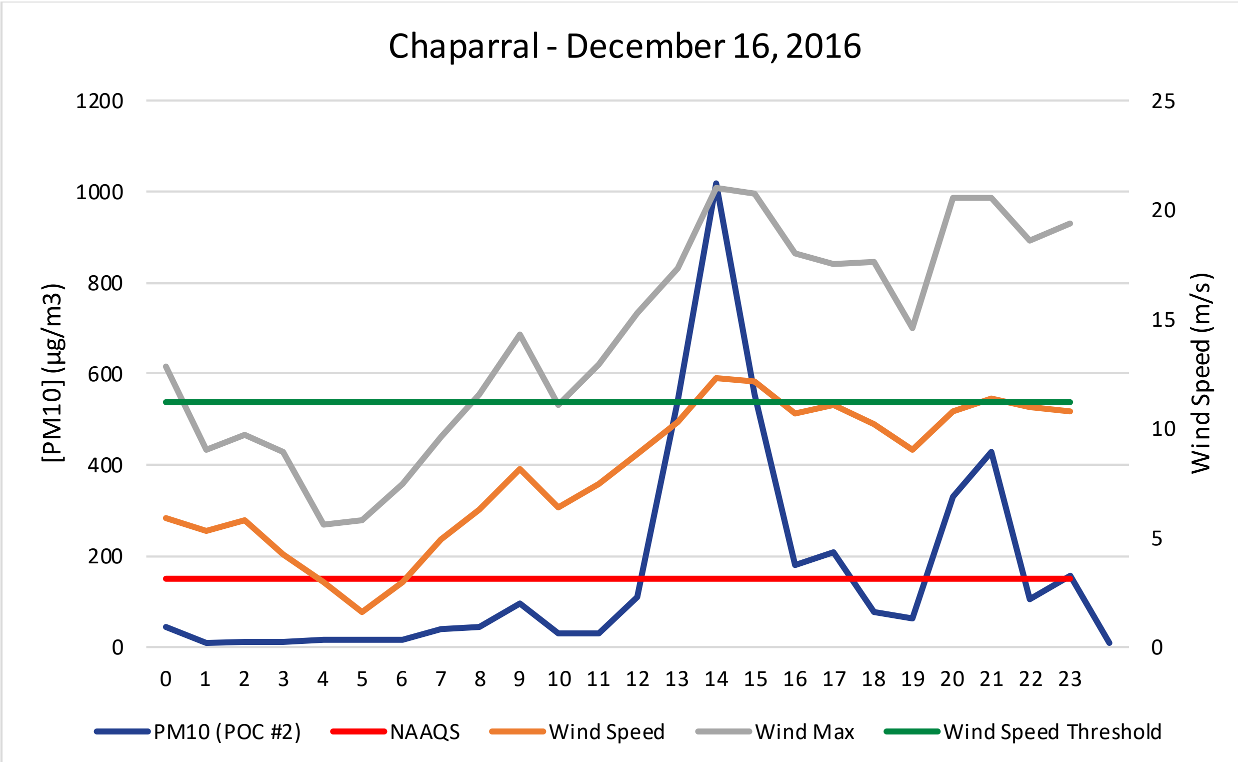

Figure 12-9. NMED monitoring network hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2011-2015, the Chaparral monitoring site recorded 43 exceedances of the PM_{10} NAAQS (Figure 12-10). The maximum 24-hour average PM_{10} concentration at this site was 1606 µg/m^3 recorded in 2012. High wind blowing dust events in southern New Mexico can occur at any time of the year, but the majority of these days occur during the spring windy season, from March through May. NMED has documented that all exceedances have been caused by high wind blowing dust events.

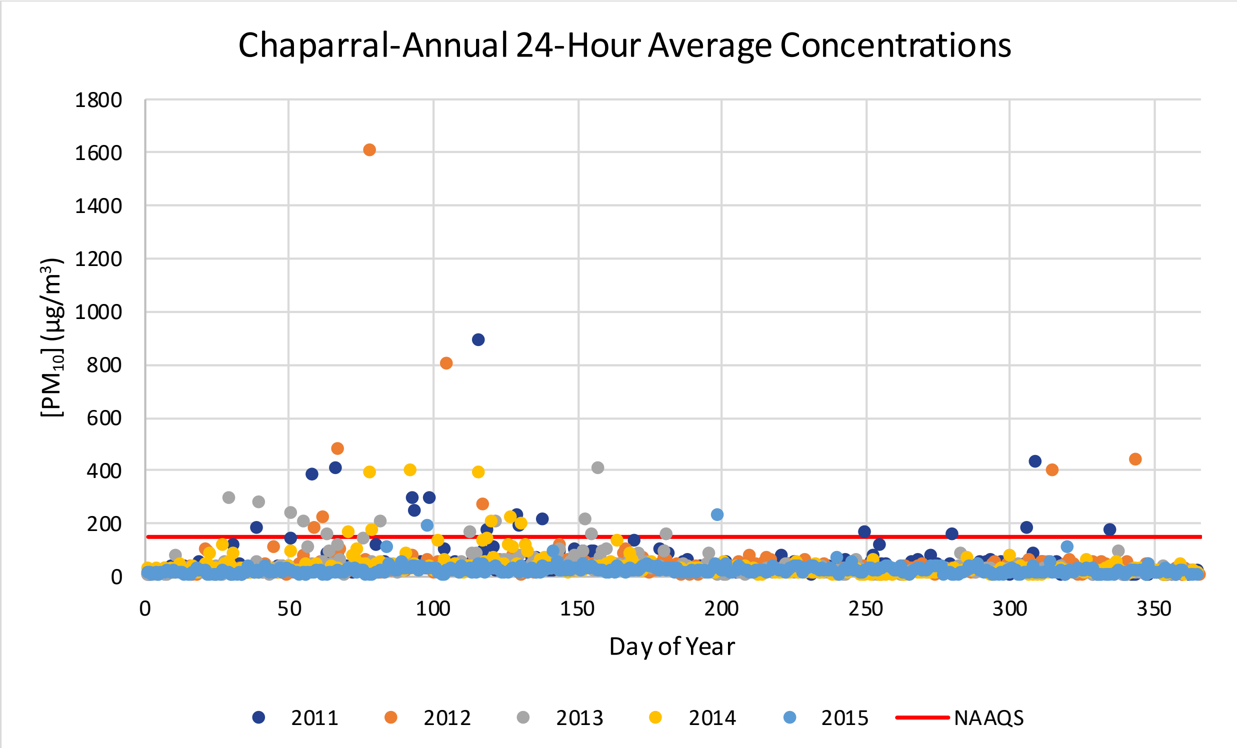

Figure 12-10. 24-hour averages by day of year from 2011-2015.

Spatial and Temporal Variability

As demonstrated in Figure 12-11, all NMED monitoring sites recorded elevated 24-Hour Average PM_{10} concentrations compared to the days preceding and following the event. Daily averages for the days surrounding the event did not surpass 60 µg/m^3, demonstrating the influence high winds have on PM_{10} concentrations in the area.

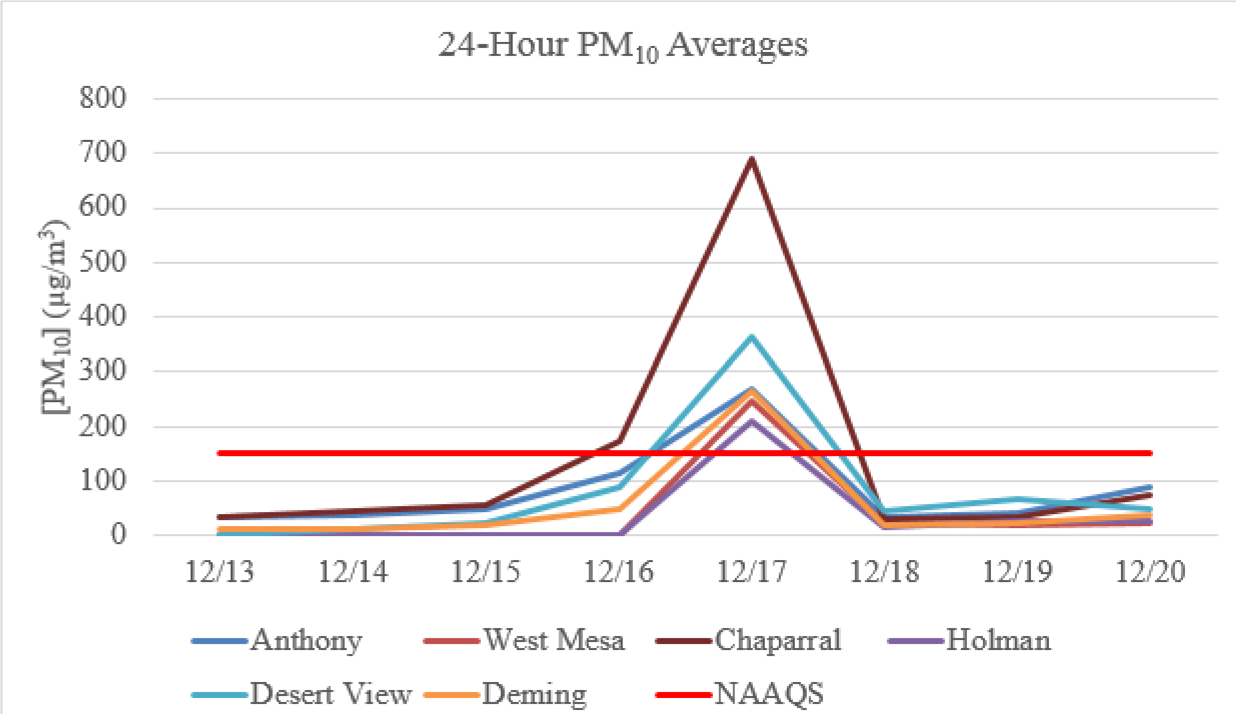

Figure 12-11. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

Percentile Ranking

Table 12-3 shows the 24-Hour Average PM_{10} data distribution recorded at NMED monitoring sites, including high wind blowing dust events flagged with a request to exclude data in the AQS database for exceedances of the standard from 2011-2015. The recorded value for this day (172 µg/m^3) is above the 95th percentile of historical data.

Statistic\Monitoring Site	Anthony	West Mesa	Chaparral	Holman	Desert View	Deming
Max	1739	487	1606	1449	1691	1098
99th Percentile	307	160	255	198	253	254
95th Percentile	99	59	91	68	99	68
75th Percentile	54	23	36	31	42	30
50th Percentile	38	16	24	21	28	20
25th Percentile	25	11	16	14	19	13
5th Percentile	13	5	6	6	9	6
Mean	49	23	36	30	40	30

Table 12-3. NMED monitoring sites PM_{10} 24-hour average data distribution. Includes data flagged in AQS for exclusion due to high wind blowing dust events (RJ).

CCR Conclusion

On this day a high wind blowing dust event occurred, generating PM_{10} emissions that resulted in elevated concentrations at the Chaparral monitoring site. The monitored PM_{10} 24-Hour Average of 172 µg/m^3 is above the 95th percentile of data monitored over the previous five years. Meteorological conditions were consistent with past event days and elevated PM_{10} concentrations. The comparisons and analyses provided in the CCR section of this demonstration support NMED's position that the event affected air quality in such a way that a clear causal relationship exists between the high wind blowing dust event and the monitored exceedance on this day, satisfying the CCR criterion.

Natural Event

The CCR and nRCP analyses show that this was a natural event caused by high wind and blowing dust. Based on the documentation provided in this demonstration, the event qualifies as a natural event. The exceedance associated with the event meets the regulatory definition of a natural event at 40 CFR 50.14(b)(8). This event transported windblown dust from natural and anthropogenic sources that have been reasonably controlled and accordingly, NMED has demonstrated that the event is a natural event and may be considered for treatment as an exceptional event.

13. HIGH WIND EXCEPTIONAL EVENT: December 17, 2016

Conceptual Model

A Pacific cold front caused high winds and blowing dust in Doña Ana and Luna Counties resulting in an exceedance of the PM_{10} NAAQS at the Anthony, Desert View, Chaparral, Holman, West Mesa and Deming monitoring sites on this date. In accordance with the EER, the AQB submitted this data to EPA's AQS database and flagged it (coded as RJ) as a high wind dust event (Table 13-1).

AQS Flag	AQS ID	Site Name	24-Hour Average Concentration	Max 1-Hour Wind Speed	Max Gust
RJ	35-013-0020	6ZK Chaparral	689 µg/m^3 (POC #2)	15.9 m/s	23.6 m/s
RJ	35-013-0016	6CM Anthony	268 µg/m^3	12.7 m/s	23 m/s
RJ	35-013-0021	6ZM Desert View	363 µg/m^3	10.4 m/s	20.9 m/s
RJ	35-029-0003	7E Deming	266 µg/m^3	14 m/s	22.8 m/s
RJ	35-013-0019	6ZL Holman	209 µg/m^3	14.5 m/s	25.3 m/s
RJ	35-013-0024	6WM West Mesa	246 µg/m^3	17.6 m/s	26.5 m/s

Table 13-1. 2016 PM_{10} Data flagged by NMED for exclusion pursuant to the EER.

As the storm system moved through the state, a pressure gradient formed over southeastern Arizona, southwestern New Mexico and northern Mexico (Figure 13-1). At the 1800 hour, an area of low pressure moved over the state of Colorado and descending south over Northern New Mexico along with the cold front. Aloft, the low-pressure center of the storm system hovered over the Great Basin. As the day progressed this low-pressure aloft traveled east and aligned itself with New Mexico and the surface wind direction (Figure 13-2). Diurnal heating of the surface allowed winds aloft to mix down, increasing the surface wind velocities and provided the turbulence required for vertical mixing and entrainment of dust.

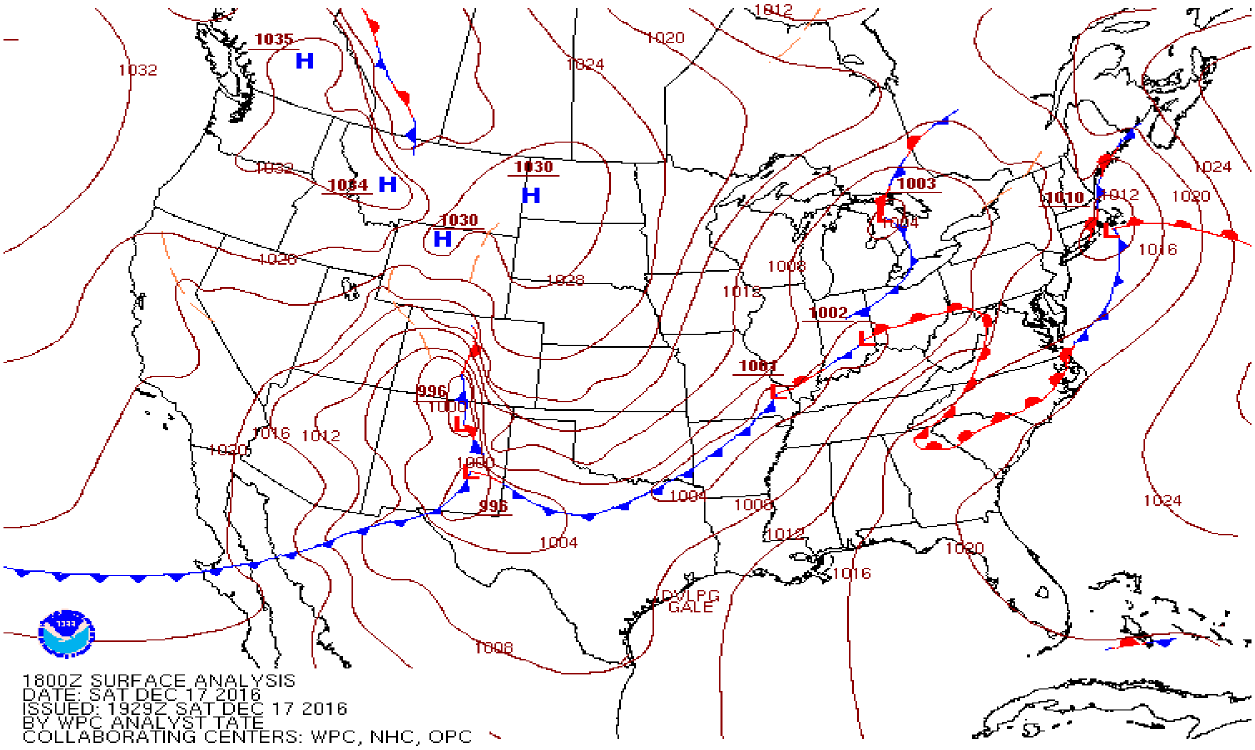

Figure 13-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

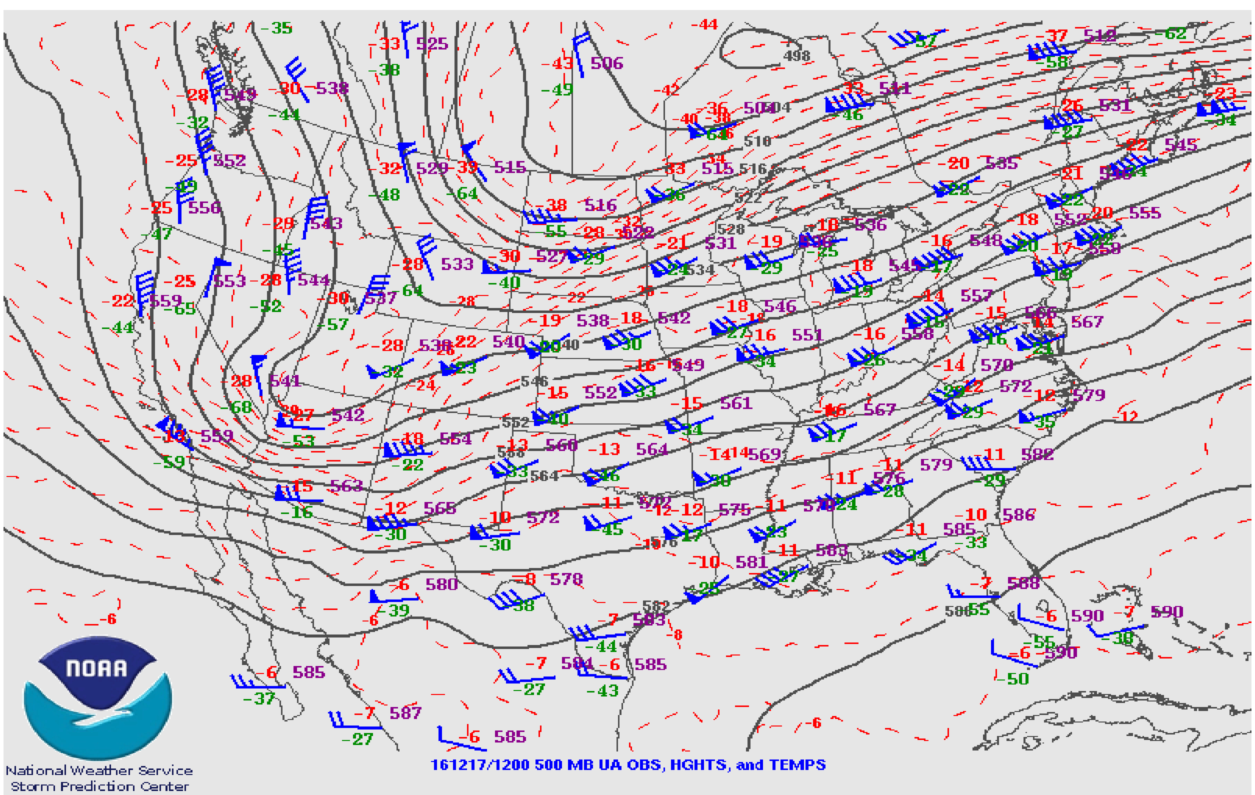

Figure 13-2. Upper air weather map for December 17, 2016 at the 1200 hour. Wind barbs depict wind speed (knots) and direction.

As the event unfolded, the wind blew from the southwest throughout the border region. These high velocity winds passed over large areas of desert within New Mexico and Mexico (Figure 13-3). Anthropogenic sources of dust near NMED's monitoring sites include: disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

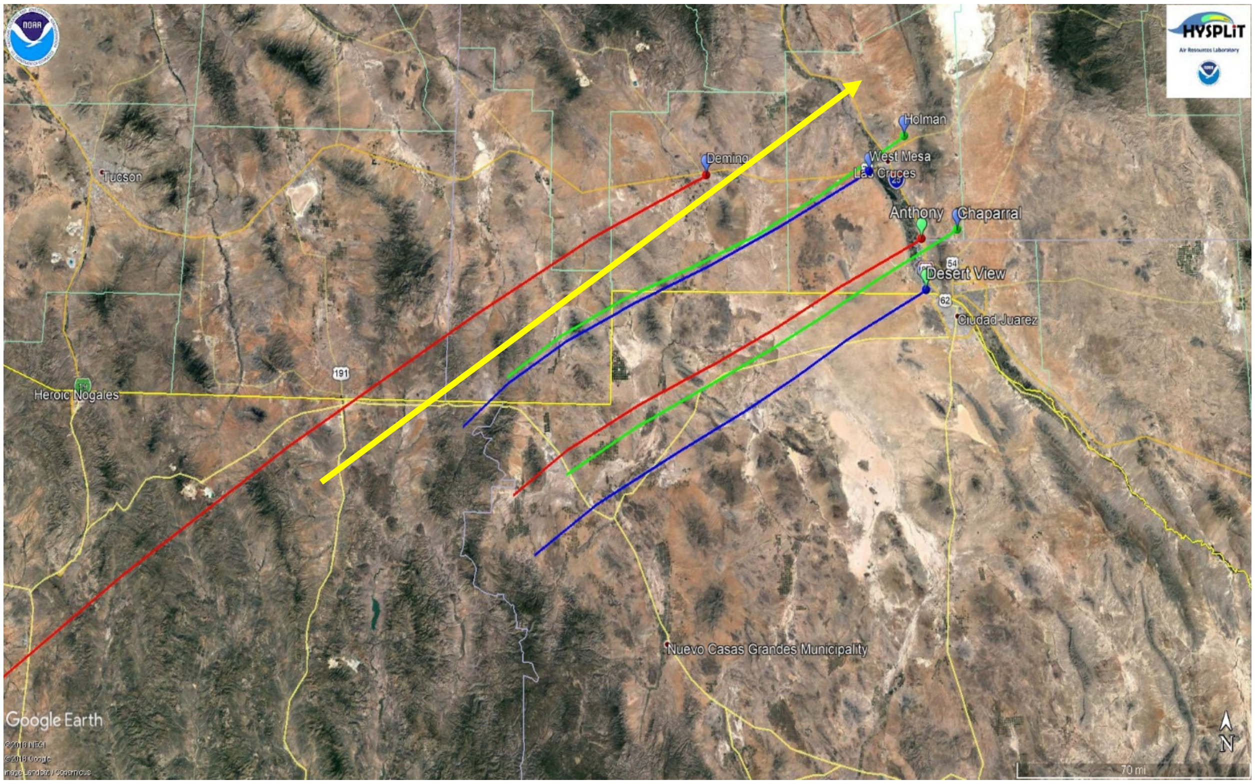

Figure 13-3. Map of NMED monitoring sites with a recorded exceedance of the NAAQS, predominant wind direction and suspected source locations for the high wind blowing dust event.

The co-occurrence of high winds and elevated levels of blowing dust, little to no point sources in the area, and the high hourly and daily PM_{10} concentrations support the assertion that this was a natural event, specifically a high wind dust event. Sustained hourly wind speeds exceeding 9 m/s (~20 mph) were recorded at the Chaparral and Deming monitoring sites beginning at the 0200 hour and lasted through the 1700 hour. PM_{10} concentrations began to exceed the NAAQS at the Anthony, Desert View, Chaparral, Holman, West Mesa and Deming monitoring sites beginning at the 0400 hour. Hourly concentrations remained elevated through the 1500 hour. Table 13-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event.

Hour	Chaparral Monitoring Site			Deming Monitoring Site			West Mesa Monitoring Site		
	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} (µg/m³)	Wind Speed (m/s)	Wind Gust (m/s)
0200	239	10.9	18.3	19	9.3	14.3	14	5.2	9.3
0300	85	8.8	15.5	39	9.7	17.1	9	3.7	5
0400	339	9.4	19.9	97	10.4	16.4	12	4.5	8.3
0500	527	10	20.1	588	11.8	18.2	102	6.2	11
0600	591	10.1	22.6	1274	12.1	20.9	92	6	10.8
0700	1755	12.1	27.6	2493	14	22.8	68	8.7	14.1
0800	--------	13.7	32	17	12.5	20.3	342	11.5	26.5
0900	2224	14.2	25.4	29	11.9	19.6	510	16	23.1
1000	962	14.2	21.9	58	12	19	222	15.1	23.7
1100	762	13.5	20.7	168	12.4	19.1	110	12.8	19.9
1200	1323	14.1	23.3	693	14	20.8	1763	17.6	26.4
1300	2525	14.9	26.9	434	12.9	20.7	2000	16.4	24.6
1400	2984	15.5	25.8	70	9.9	16.6	266	12.9	21.4
1500	520	12	19.6	53	7.7	13.2	102	13	20.5
1600	146	9.3	15.6	48	6.6	10	68	13.3	19.8
1700	85	7.9	12.6	51	6.6	10.3	39	11.6	17.5

Table 13-2. Hourly PM_{10}, wind speed and wind gust data during the peak hours of the event.

Meteorologists forecasted the high wind blowing dust event to occur this day with a wind advisory set in place. Forecasts predicted strong winds as the storm approached the area with the area of low pressure tracking from west to east just south of the Great basin in the morning and moving across New Mexico in the afternoon. The systems movement across the area timed well with daytime heating and mixing generating a deep trough to the east as stronger winds aloft moved into the area. Many outlets also forecasted a high probability of blowing and entrained dust throughout the area and haze in the afternoon, especially in the desert areas of southern New Mexico.

Not Reasonably Controllable or Preventable (nRCP)

Not Reasonably Preventable

This demonstration does not provide a showing of not reasonably preventable pursuant to 40 CFR 50.14(b)(5)(iv) that states, in part, “the State shall not be required to provide a case-specific justification for a high wind dust event.”

Not Reasonably Controllable

The documentation provided in this section demonstrates that the wind speeds and other meteorological conditions overwhelmed the reasonable control measures in place for anthropogenic sources, causing emissions of dust that were transported to NMED’s monitors.

Sustained Wind Speeds

EPA has indicated 11.2 m/s (25 mph) as the wind speed threshold at which natural or controlled anthropogenic sources will emit dust. The Chaparral, Deming, Holman, and West Mesa monitoring sites recorded wind speeds above this threshold for 12 hours from the 0500 to the 1700 hour (Figure 13-4). The Wind speeds at the upwind La Union monitoring site also reached the high wind threshold.

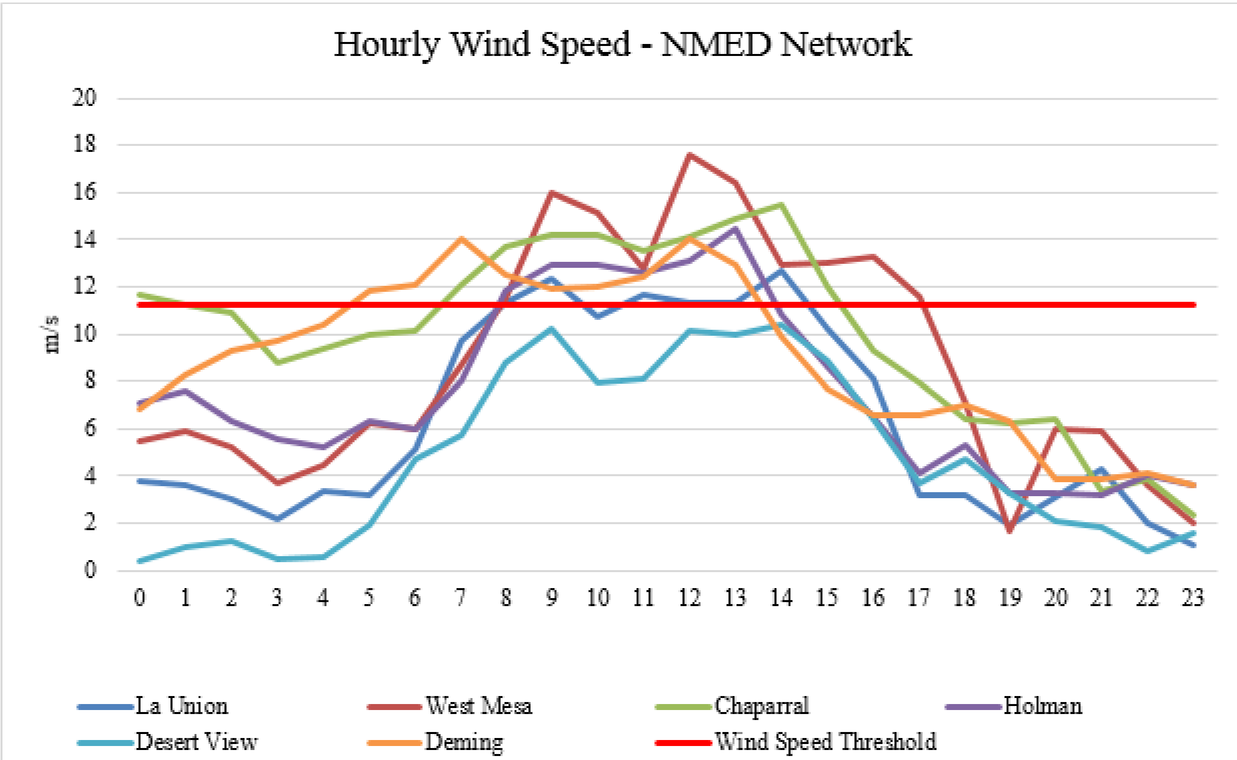

Figure 13-4. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

Level of Controls Analysis

Based on the sustained winds speeds monitored in the area during the event a basic controls analysis will be provided.

Basic Controls Analysis

Implementation and Enforcement of Control Measures

Reasonable controls for anthropogenic sources of dust are based on an area's attainment status for the PM_{10} NAAQS. It is not reasonable for areas designated as attainment, unclassifiable or maintenance to have the same level of controls as areas that are nonattainment for the standard. However, southern New Mexico has a long history of high wind blowing dust events with NMED developing a nonattainment SIP for the Anthony Area and NEAPs for the remaining portion of Doña Ana County and all of Luna County. As discussed in the Background section, NMED worked with local governments to help them develop and adopt dust control ordinances based on BACM. Based on the area's attainment status and SIP waiver, NMED believes these ordinances constitute reasonable controls.

The ordinances developed and adopted under the NEAPs are implemented and enforced at the local level with NMED playing a supporting role to ensure effective and enforceable implementation of control measures. Under the regulatory framework applicable to the two counties, NMED's purview does not include oversight of the extent of the effectiveness and enforcement of local ordinances. However, NMED believes that these ordinances are appropriately implemented at the local level.

Suspected Source Areas and Categories Contributing to the Event
Anthropogenic sources of dust in New Mexico include disturbed lands, construction and demolition activities, vacant parking lots and materials handling and transportation. Area sources account for a much larger portion of overall PM_{10} emissions than point sources. On the day of the event, no unusual PM_{10} producing activities occurred and anthropogenic point source emissions remained constant before, during and after the event. Natural areas of the Chihuahuan Desert in Doña Ana, Luna, Hidalgo and Grant Counties are the most likely sources, under NMED's jurisdiction, contributing to the high wind blowing dust event. Other area sources located in Arizona, Texas and Chihuahua, MX likely contributed to the exceedances on this day. Controlling dust from the natural desert terrain is cost prohibitive and falls outside NMED's jurisdiction when it is transported from intrastate and international sources.

The documentation and analysis presented in this section demonstrates that all identified sources that may have caused or contributed to the exceedance were reasonably controlled, implemented and enforced at the time of the event, therefore emissions associated with the high wind dust event were not reasonably controllable or preventable.

Clear Causal Relationship (CCR)

Occurrence and Geographic Extent of the Event

Satellite Imagery
The event was captured on satellite imagery with dust plumes originating upwind of NMED's monitoring sites near Ascension and Janos, Chih. This area is largely rural with the largest area sources of PM originating from agricultural activities as well as the vast desert areas and playas in northern Mexico (Figure 13-5). Another large plume that did not contribute to this event, can be seen coming off of White Sands National Monument and carrying over the Sacramento Mountains. The dust plumes of interest appear to be limited to Mexico, orientated in a southwest to northeast fashion and traveling toward El Paso and NMED's monitoring sites at the time of the satellite pass (0925 hour MDT) that captured the imagery.

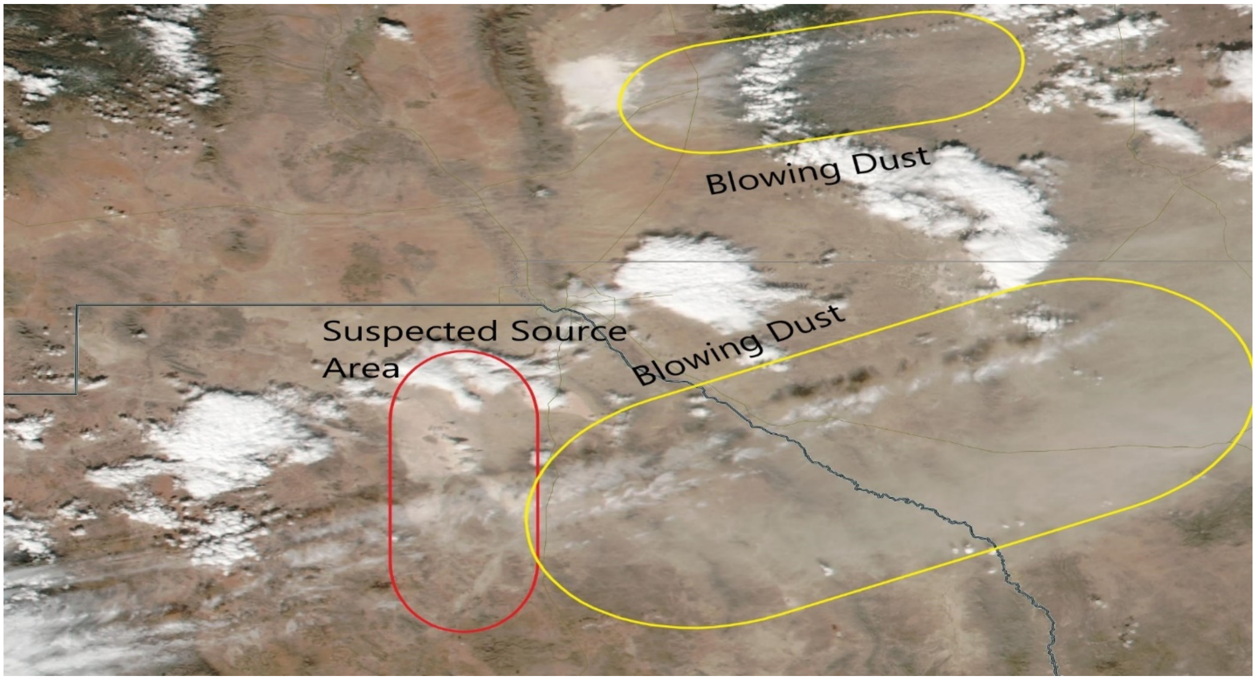

Figure 13-5. VIIRS natural color imagery from the Suomi Satellite showing southwestern New Mexico, northern Chihuahua and western Texas. Imagery obtained from NASA's EOSDIS Worldview website.

Weather Statements, Advisories, News and Other Media Reports Covering the Event
The National Weather Service (NWS) issued a Wind Advisory and a Blowing Dust Advisory for this date. A Wind Advisory is issued by NWS when sustained winds of 30 to 39 mph are expected for 1 hour or longer. A Blowing Dust Advisory is issued when blowing dust is expected to reduce visibility to between ¼ to 1 mile, generally with winds of 25 mph or greater. These were in place for southwestern New Mexico and west Texas to warn the public of the high wind event. An excerpt from the NWS Wind Advisory can be found below:

```
WIND ADVISORY REMAINS IN EFFECT UNTIL 8 PM MST THIS EVENING STRONG WESTERLY
SOUTHWESTERLY WINDS TODAY IN THE 25 TO 35 MPH RANGE WITH GUSTS TO 50 MPH
EXPECTED. DRIVING COULD BE HAZARDOUS. LOOSE OBJECTS WILL BE BLOWN ABOUT.
```

Spatial and Transport Analysis

HYSPLiT Backtrajectory Analysis
A back-trajectory analysis using the NOAA Air Resources Laboratory HYSPLIT transport and dispersion model (Draxler et al., 2015; Rolph et al., 2017) shows that the air masses traveled from Chihuahua, MX into the southern New Mexico and El Paso, TX area and on to the NMED monitoring sites. The model was run using GDAS meteorological data for the six hours preceding the start of elevated PM_{10} concentrations during the event (Figures 13-6 through 13-11). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

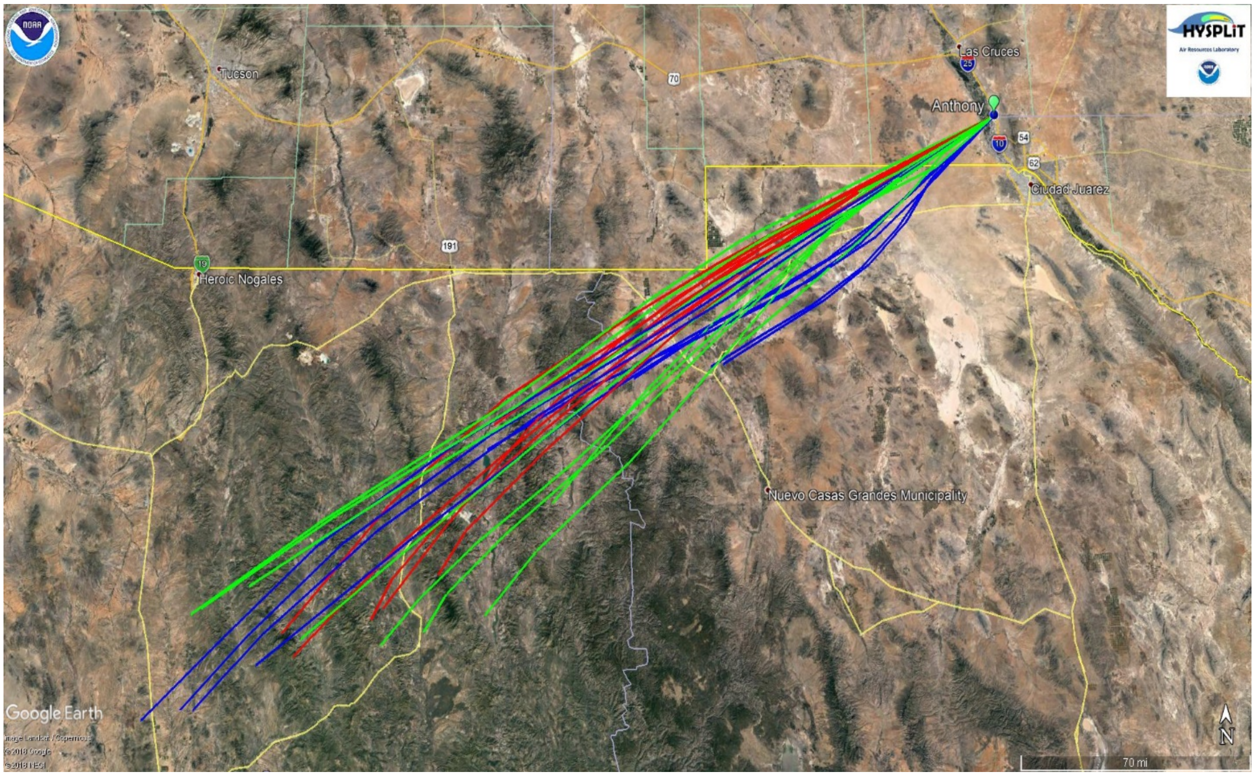

Figure 13-6. HYSPLiT back-trajectory analyses using the Ensemble mode for the Anthony monitoring site.

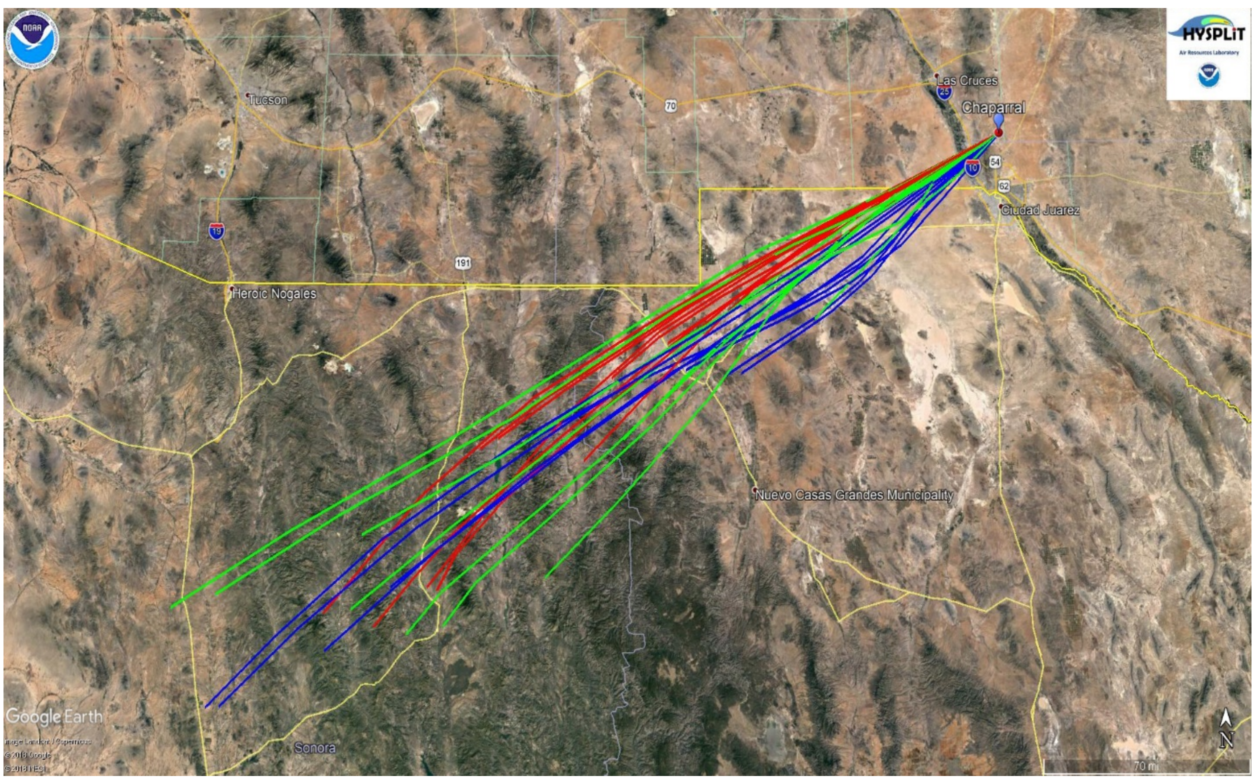

Figure 13-7. HYSPLiT back-trajectory analyses using the Ensemble mode for the Chaparral monitoring site.

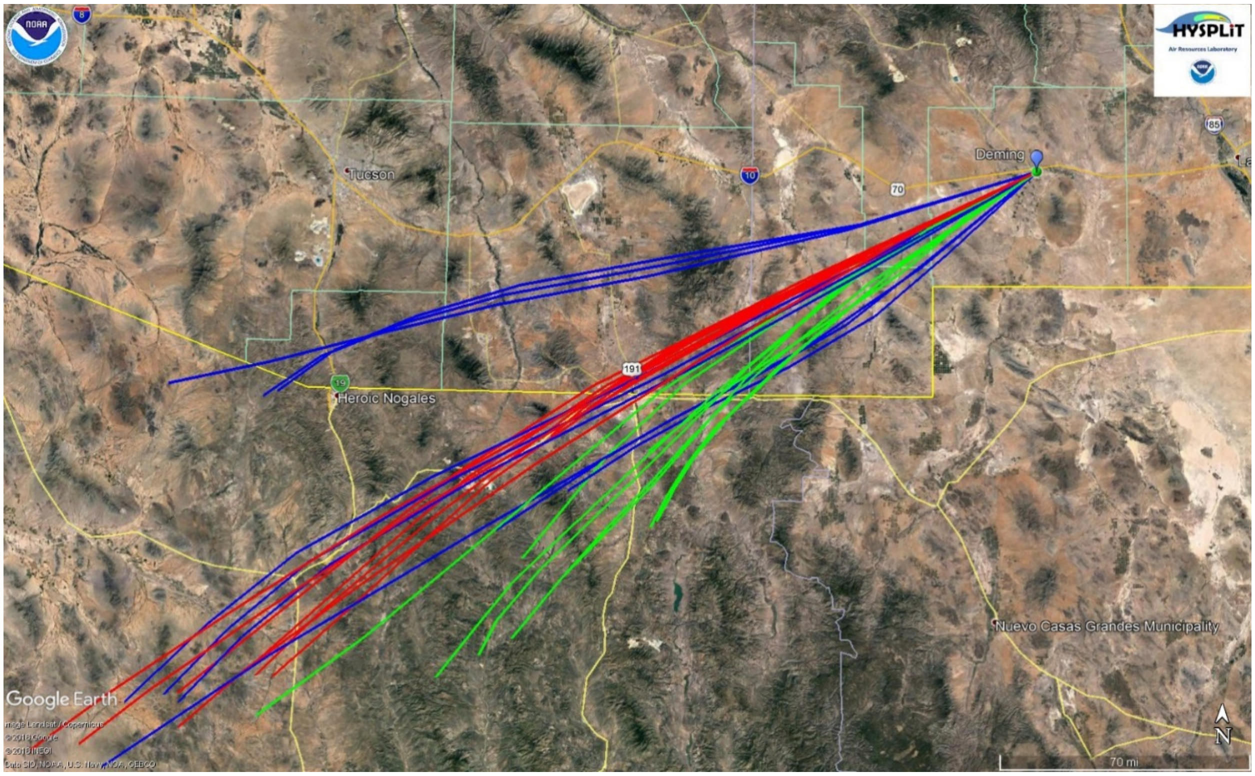

Figure 13-8. HYSPLiT back-trajectory analyses using the Ensemble mode for the Deming monitoring site.

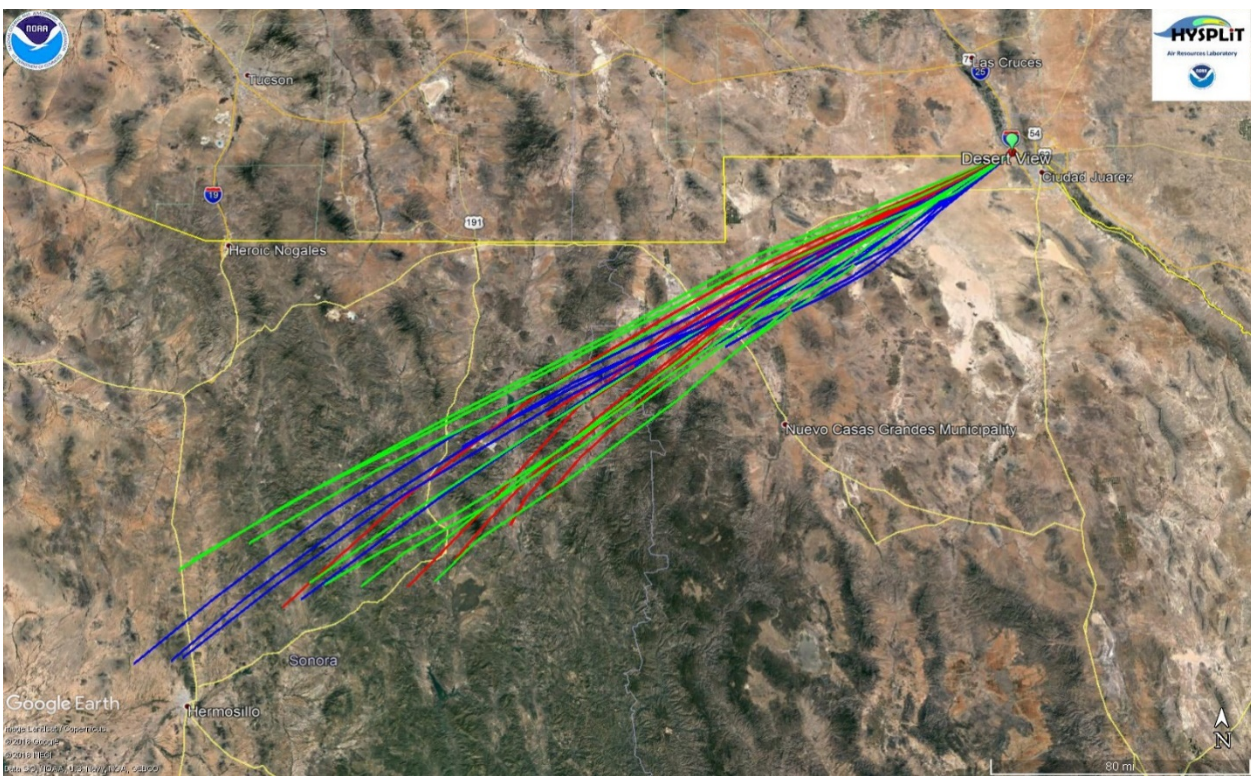

Figure 13-9. HYSPLiT back-trajectory analyses using the Ensemble mode for the Desert View monitoring site.

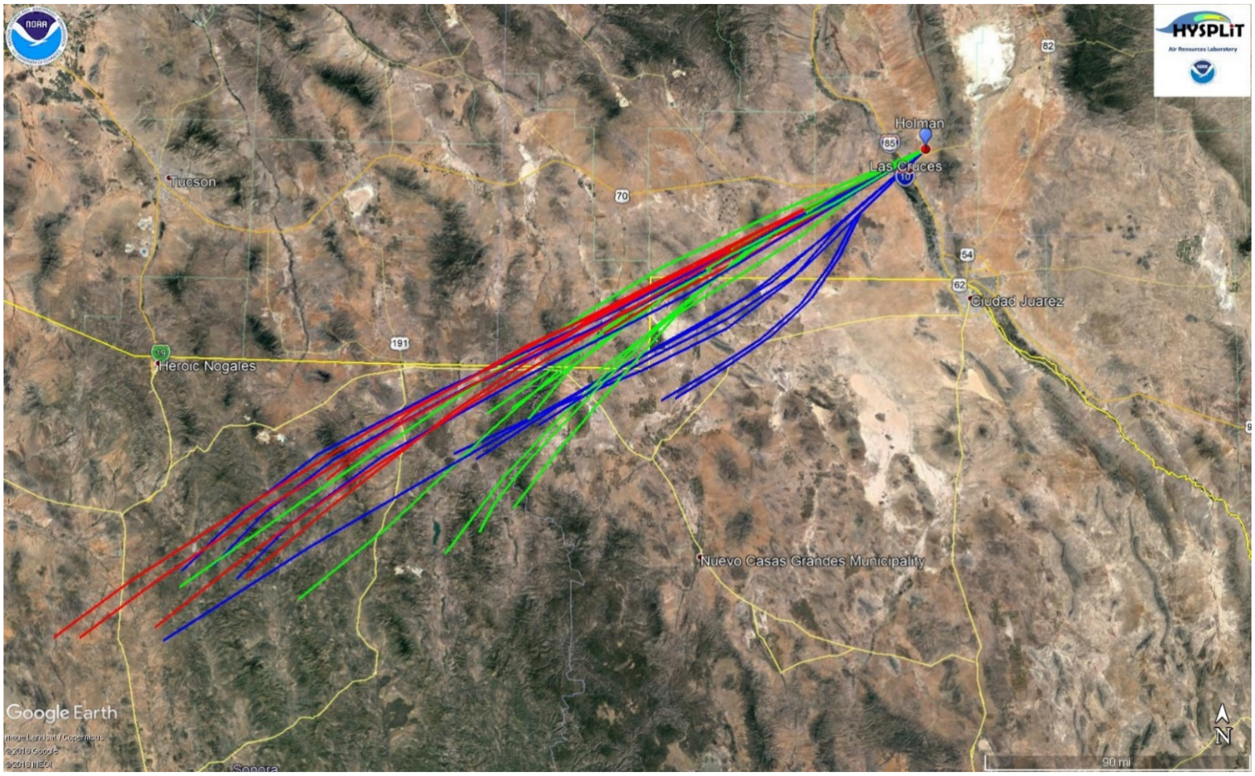

Figure 13-10. HYSPLiT back-trajectory analyses using the Ensemble mode for the Holman monitoring site.

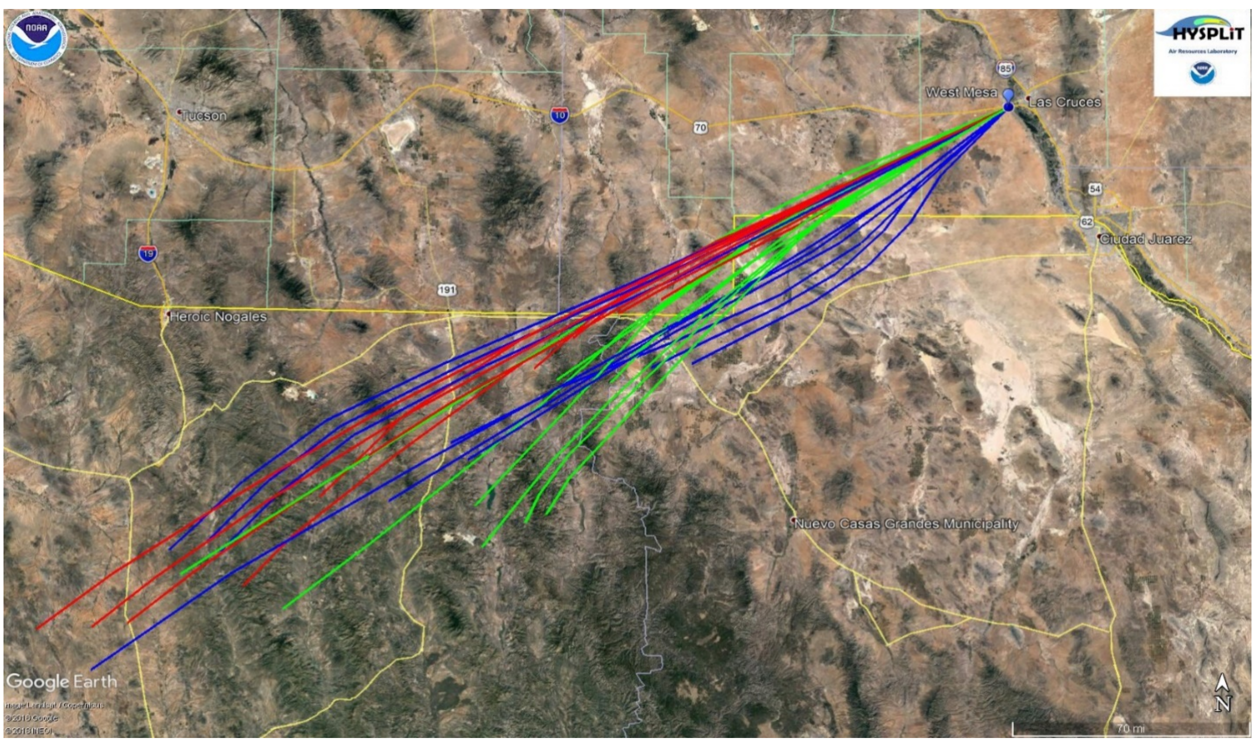

Figure 13-11. HYSPLiT back-trajectory analyses using the Ensemble mode for the West Mesa monitoring site.

Wind Direction and Elevated PM_{10} Concentrations

Pollution roses (Figure 13-12) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m³ (0600 -1500 hour). During the event, winds blew from the west northwest approximately 100% of the time coinciding with peak PM_{10} concentrations.

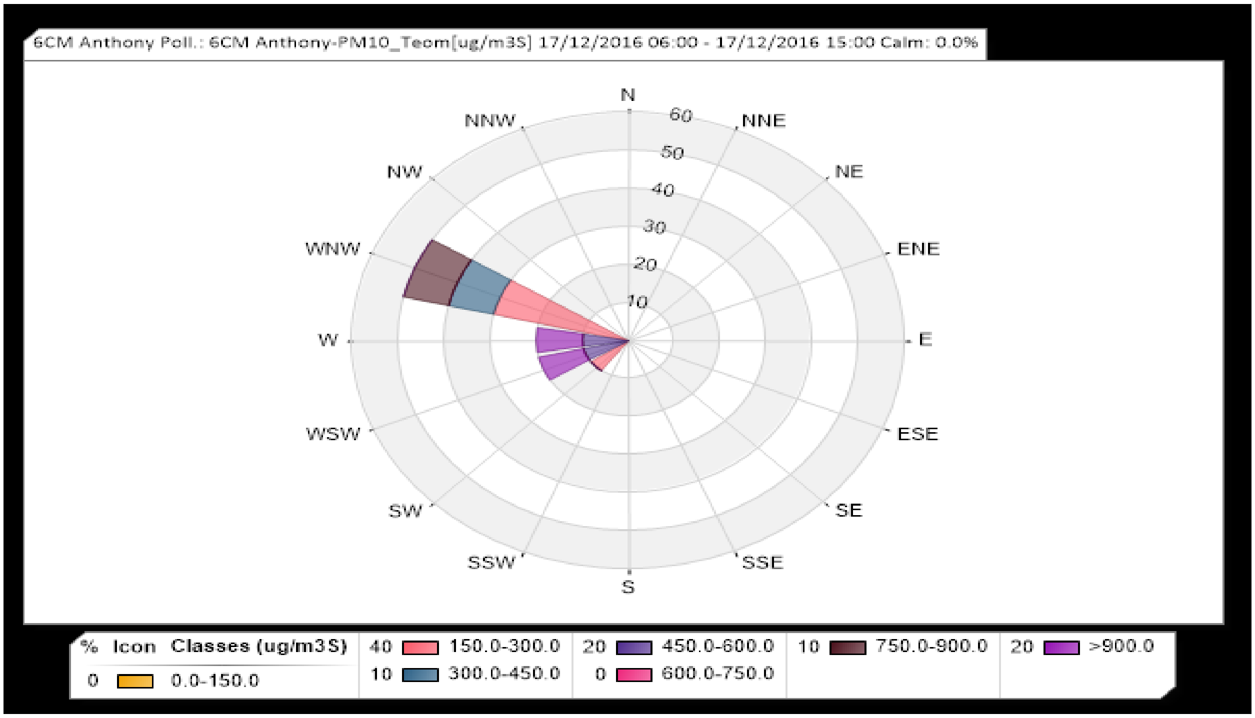

Figure 13-12. Pollution Rose for Anthony Monitoring Site

Pollution roses (Figure 13-13) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m³ (0000 -1500 hour). During the event, winds blew from the west southwest approximately 100% of the time coinciding with peak PM_{10} concentrations.

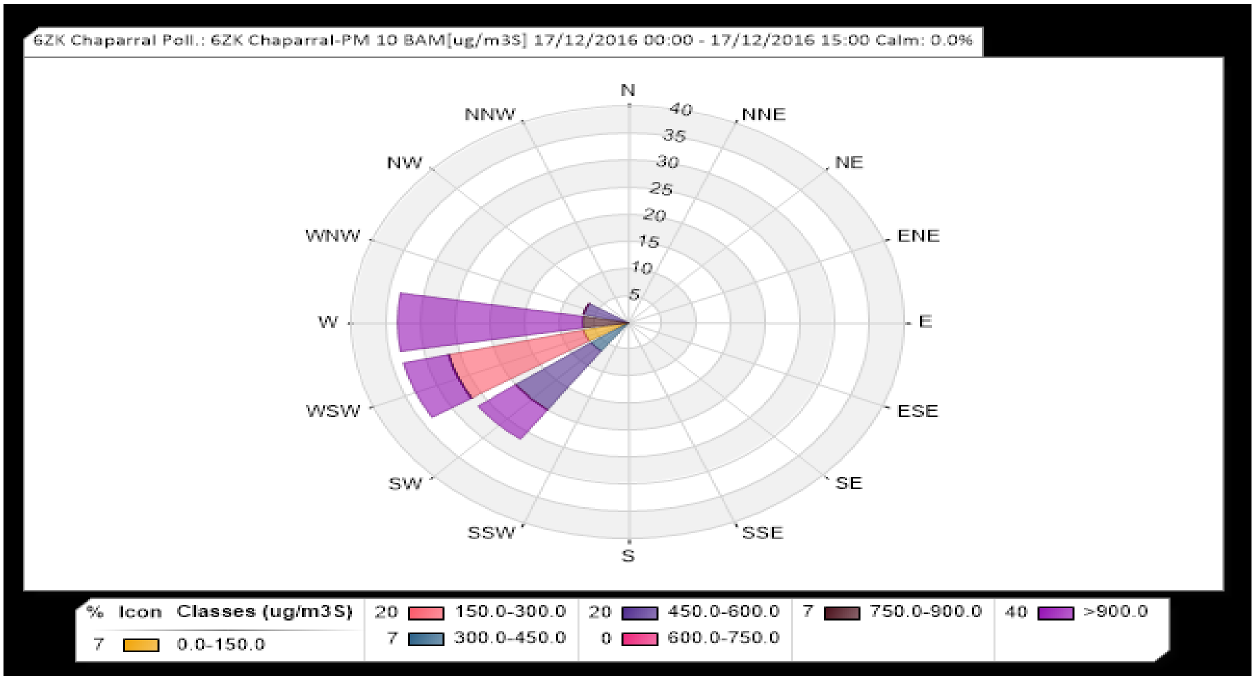

Figure 13-13. Pollution Rose for Chaparral Monitoring Site

Pollution roses (Figure 13-14) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m^3 (0500 -0700 hour). During the event, winds blew from the west southwest approximately 100% of the time coinciding with peak PM_{10} concentrations.

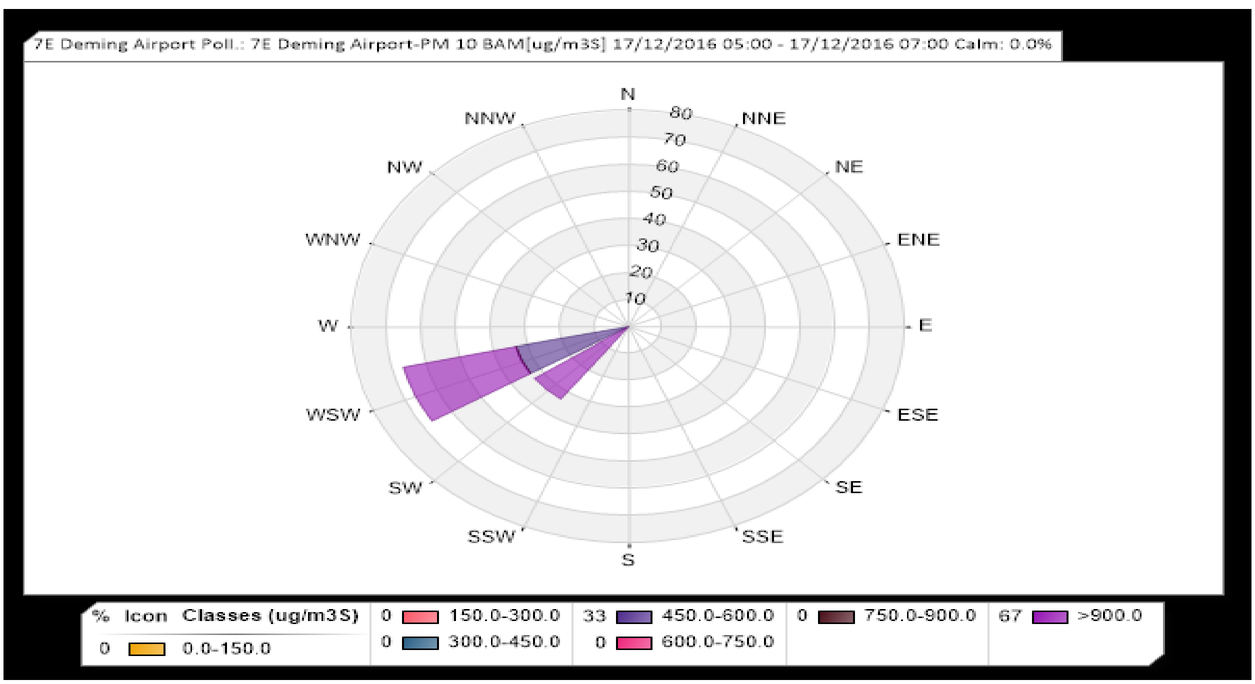

Figure 13-14. Pollution Rose for Deming Monitoring Site

Pollution roses (Figure 13-15) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m^3 (1100 -1300 hour). During the event, winds blew from the west northwest approximately 100% of the time coinciding with peak PM_{10} concentrations.

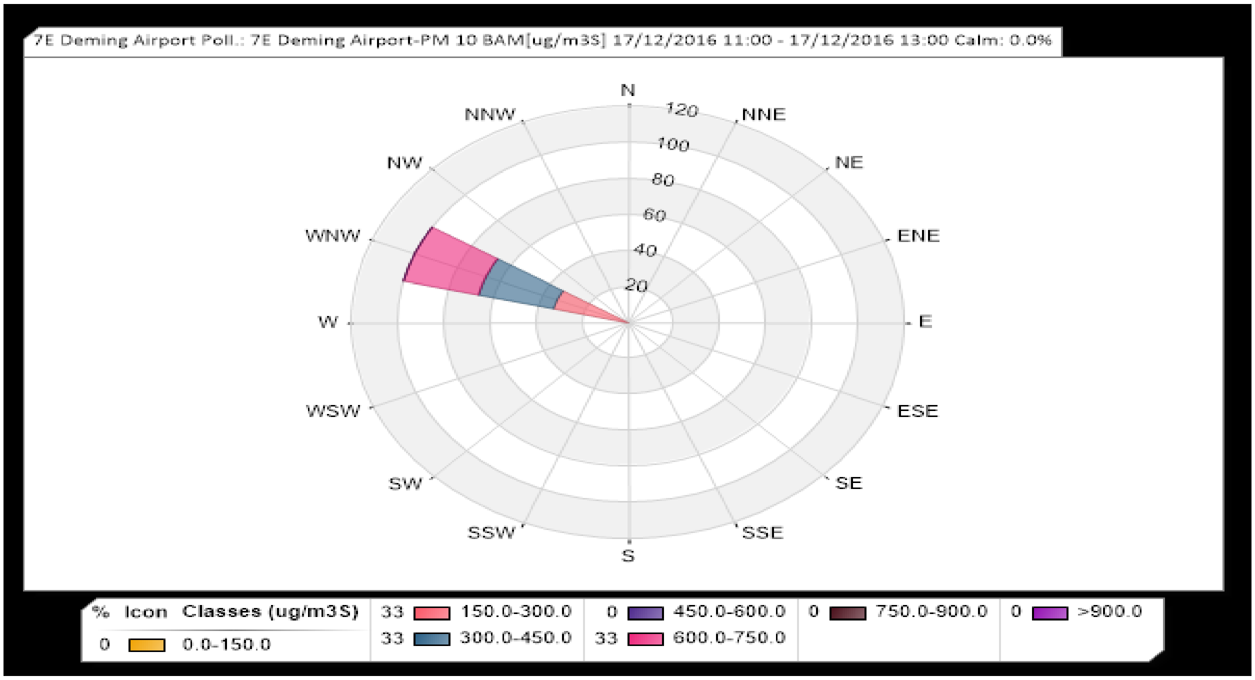

Figure 13-15. Pollution Rose for Deming Monitoring Site

Pollution roses (Figure 13-16) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m^3 (0600 -1500 hour). During the event, winds blew from the west northwest approximately 100% of the time coinciding with peak PM_{10} concentrations.

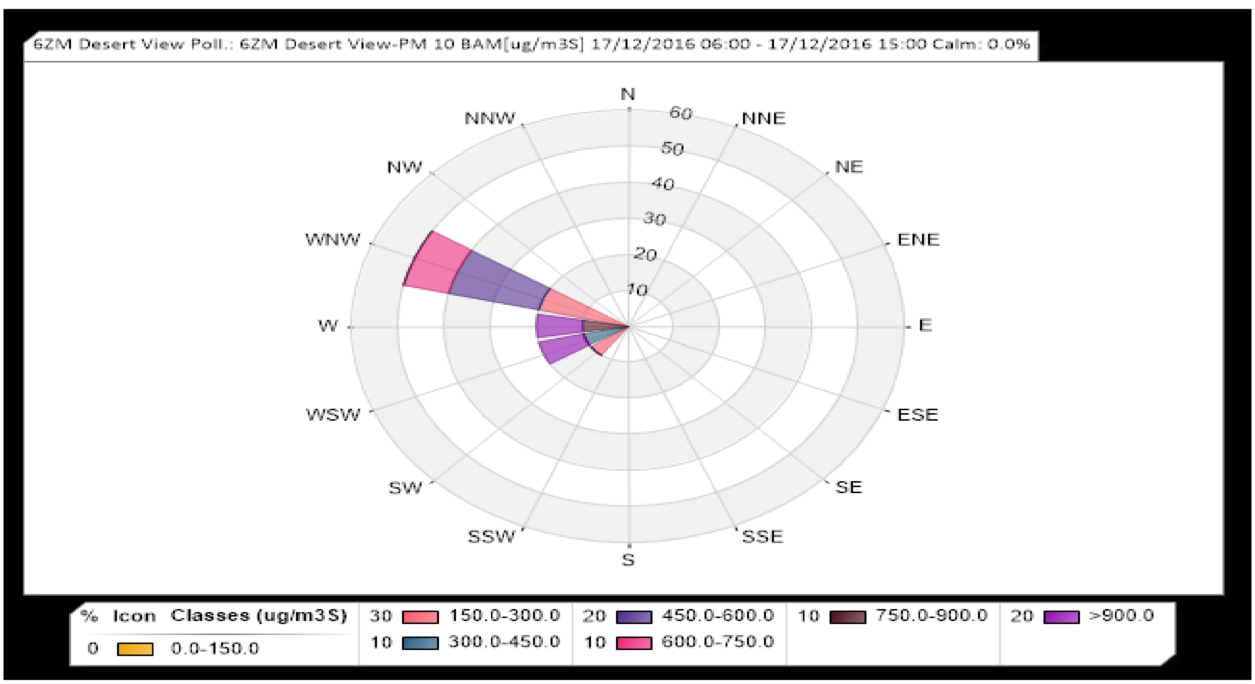

Figure 13-16. Pollution Rose for Desert View Monitoring Site

Pollution roses (Figure 13-17) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m^3 (0800 -1400 hour). During the event, winds blew from the west southwest approximately 100% of the time coinciding with peak PM_{10} concentrations.

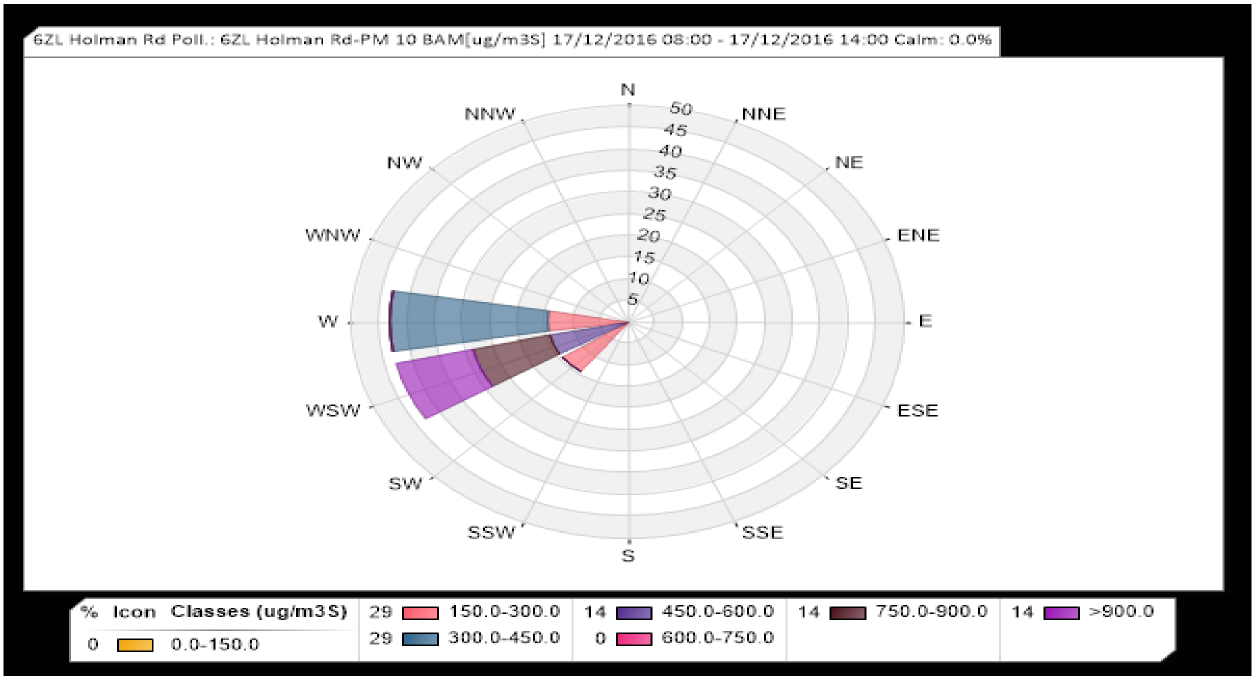

Figure 13-17. Pollution Rose for Holman Monitoring Site

Pollution roses (Figure 13-18) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m^3 (0800 -1400 hour). During the event, winds blew from the west northwest approximately 100% of the time coinciding with peak PM_{10} concentrations.

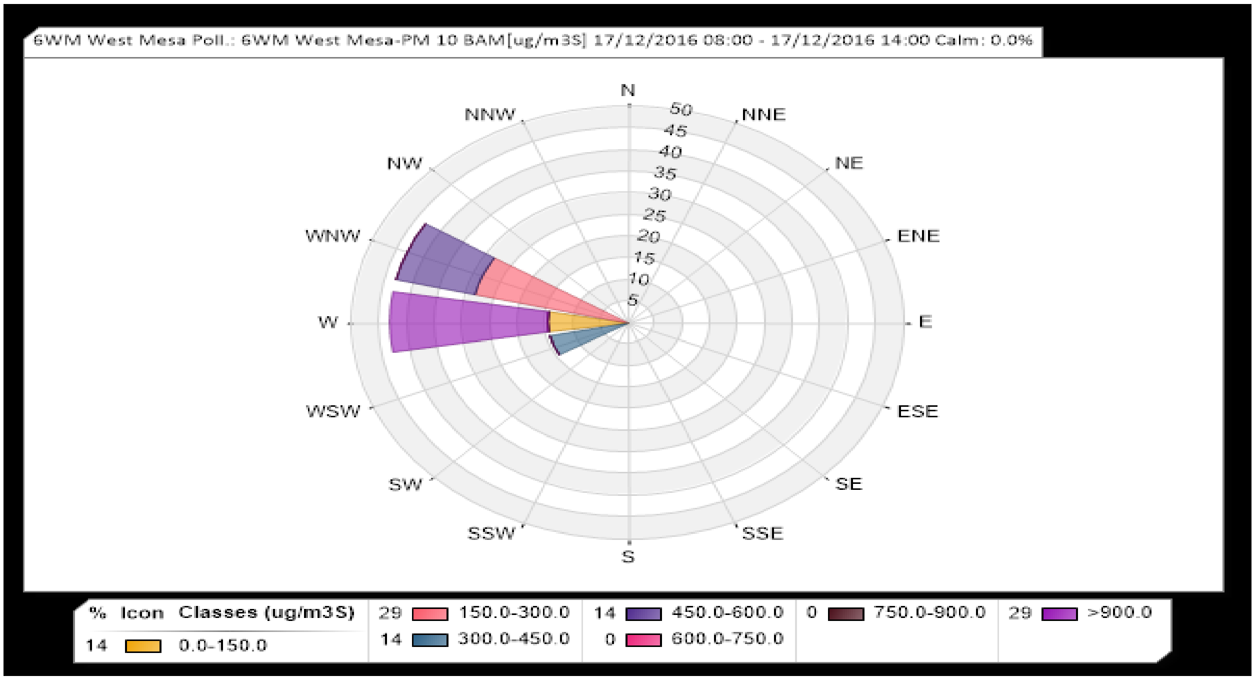

Figure 13-18. Pollution Rose for West Mesa Monitoring Site

Temporal Relationship of High Wind and Elevated PM_{10} Concentrations

The high wind blowing dust event generated strong southwesterly winds beginning at the 0500 hour and lasting through the 1700 hour. During this time, peak hourly PM_{10} concentrations ranged from 510 to 2984 µg/m³ at NMED monitoring sites (Figure 13-19). Although not all NMED monitoring sites recorded an exceedance of the NAAQS, hourly PM_{10} data spiked at approximately the same time throughout the network. Sustained hourly average wind speeds of 12.3 to 17.6 m/s were recorded at the La Union and West Mesa monitoring sites during the peak PM_{10} concentrations of the event. The time series plot in Figures 13-20 through 13-25 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

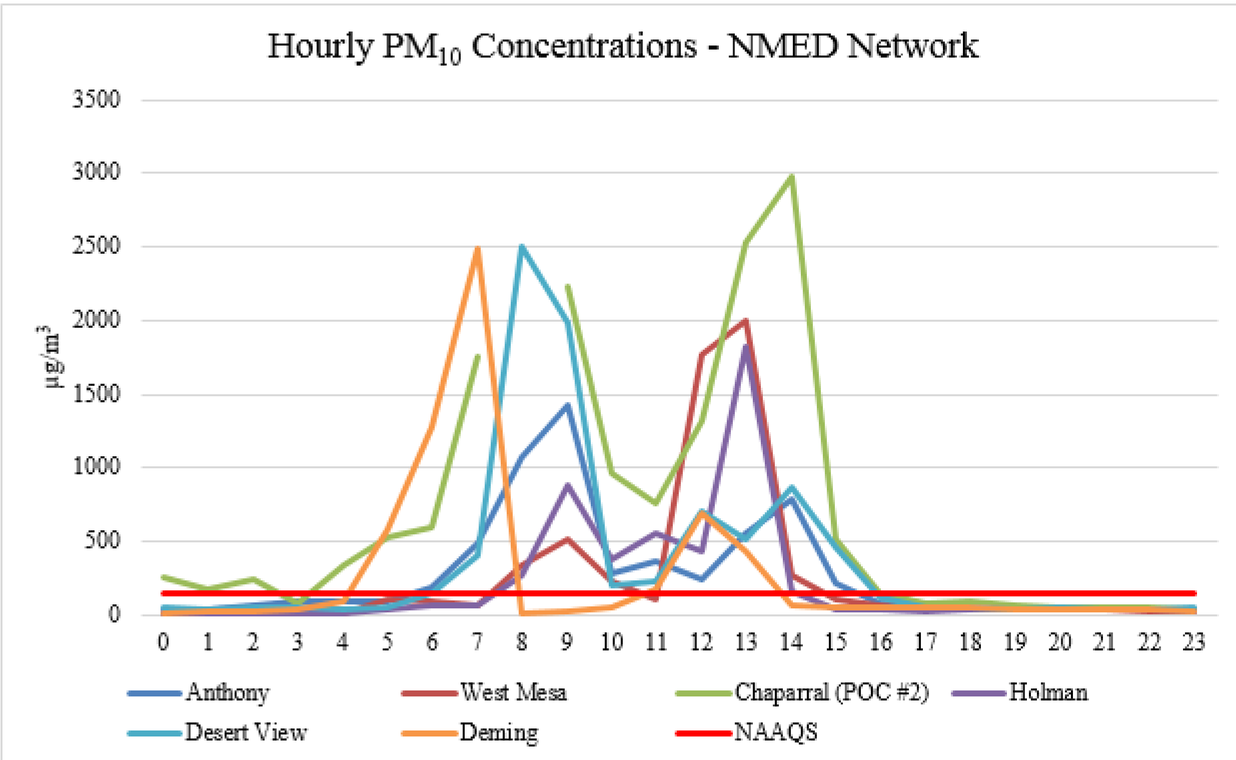

Figure 13-19. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

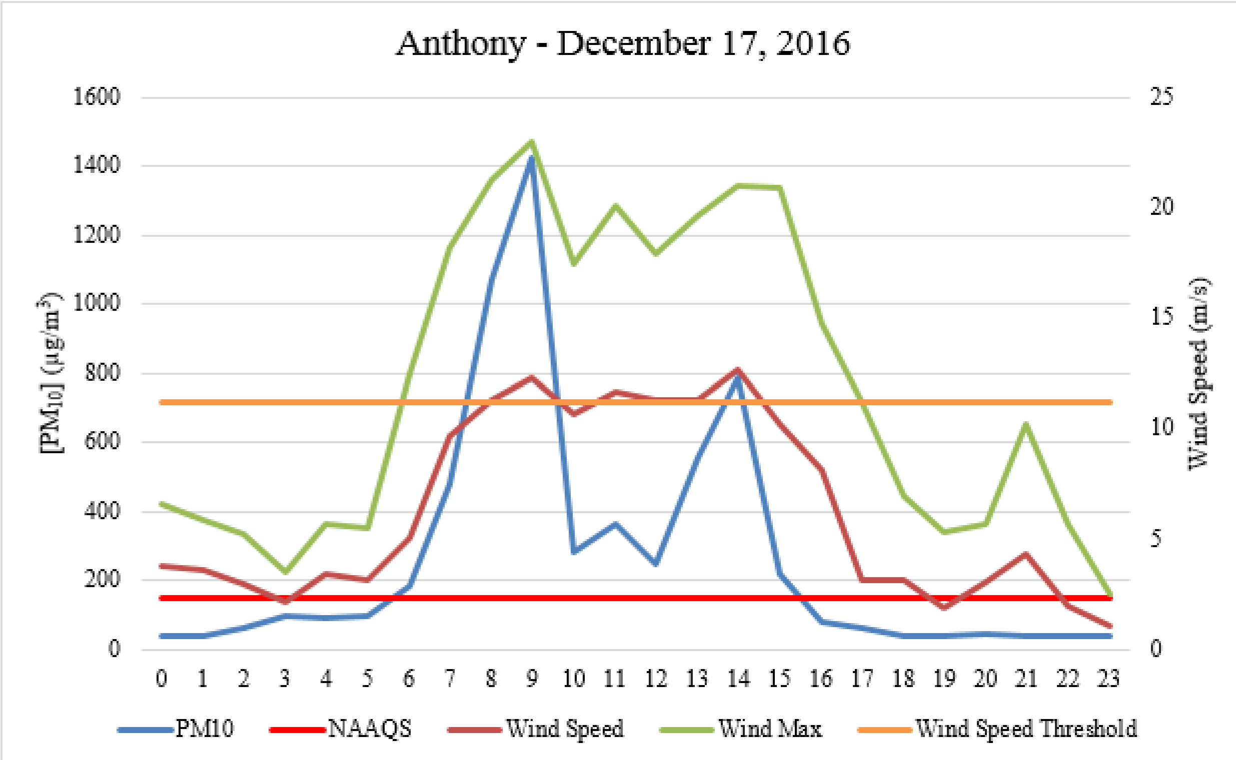

Figure 13-20. Anthony monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

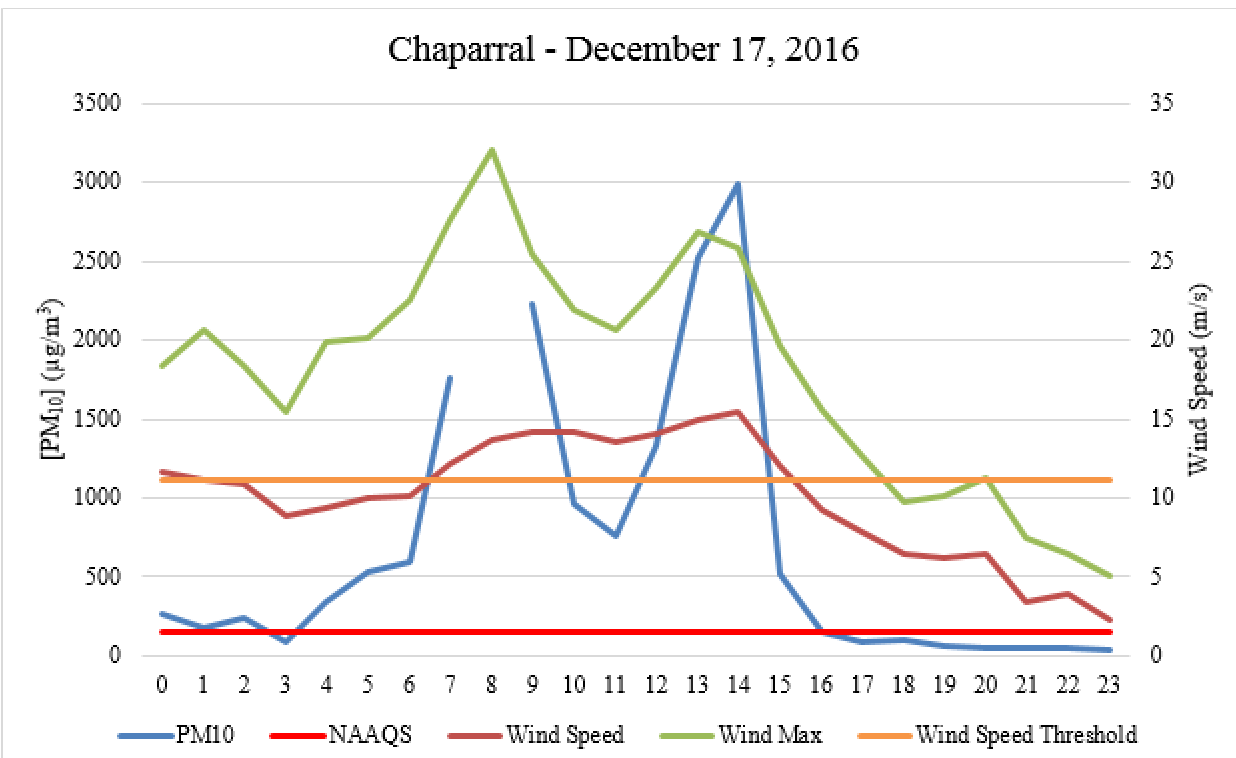

Figure 13-21. Chaparral monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

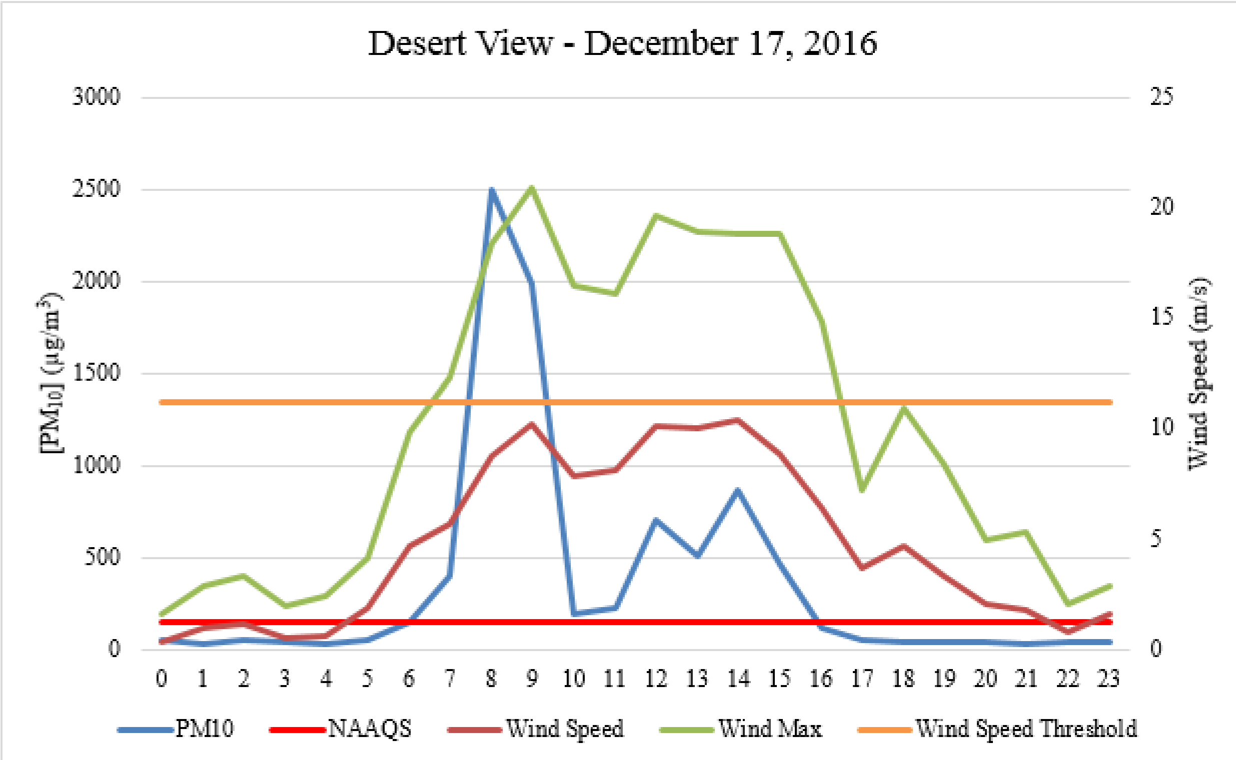

Figure 13-22. Desert View monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

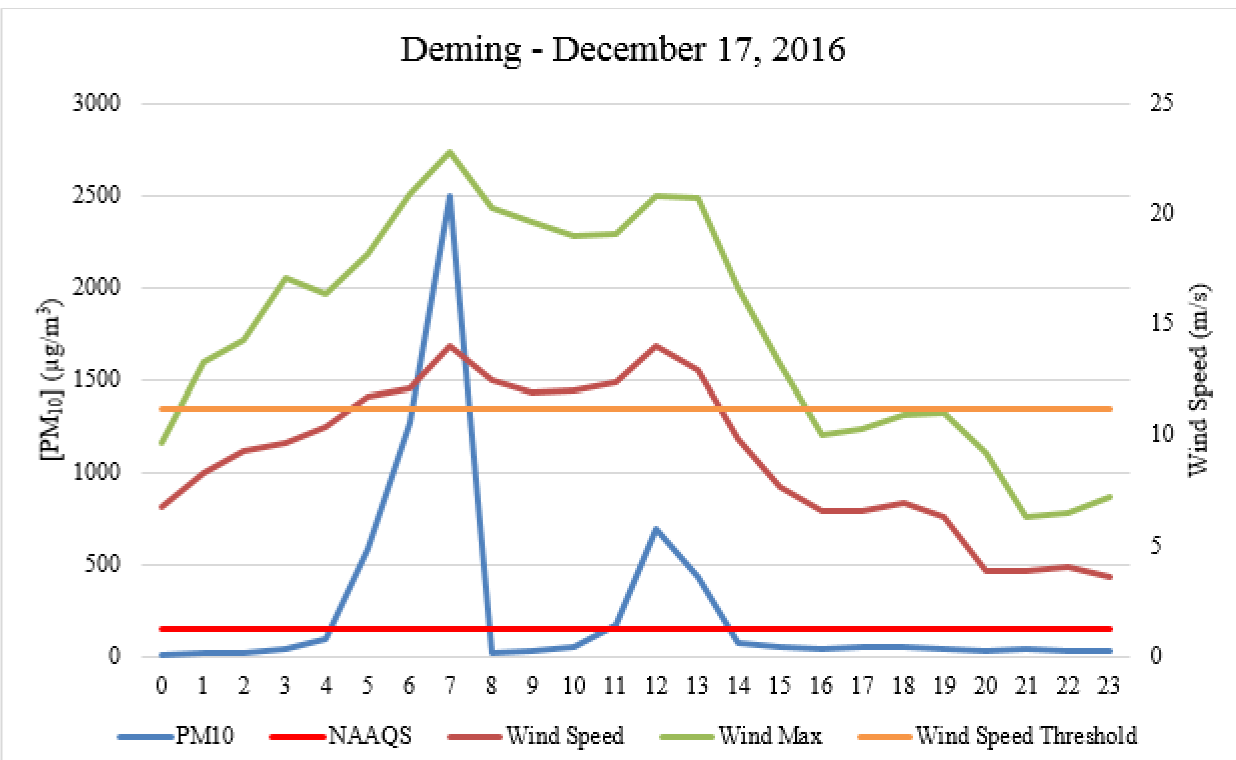

Figure 13-23. Deming monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

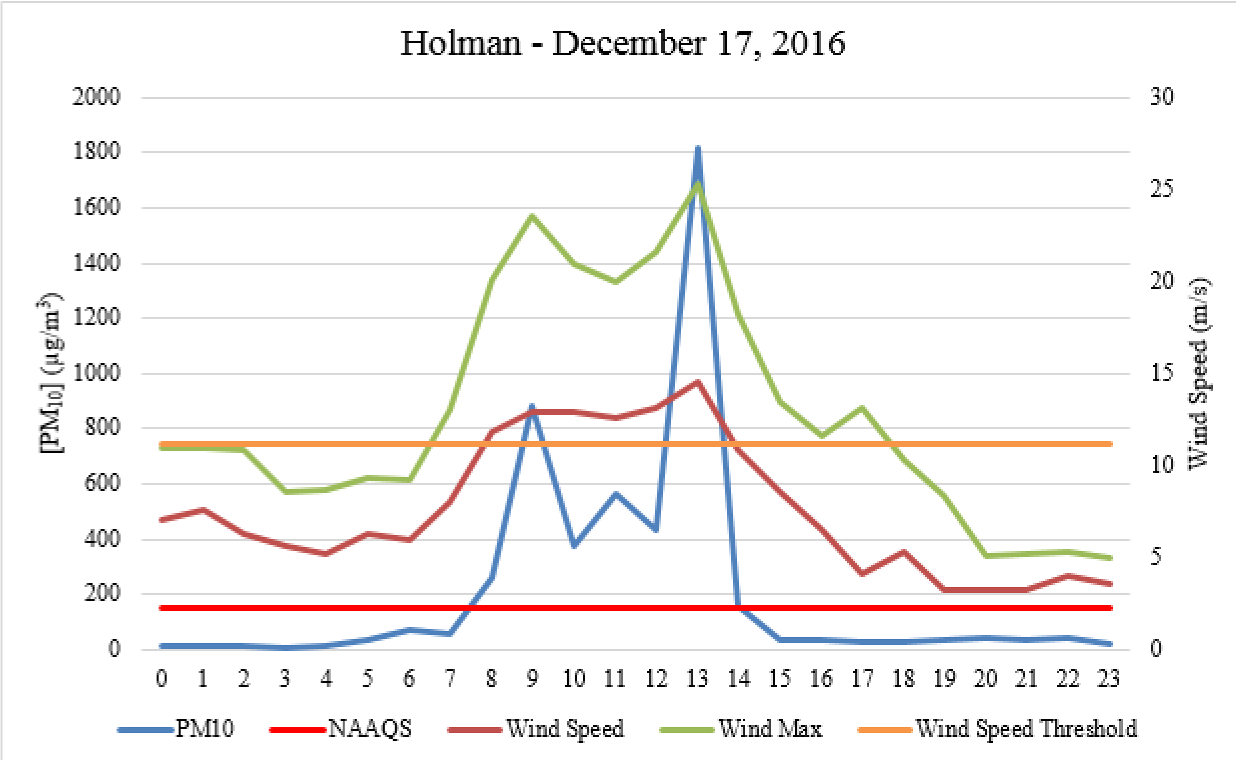

Figure 13-24. Holman monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

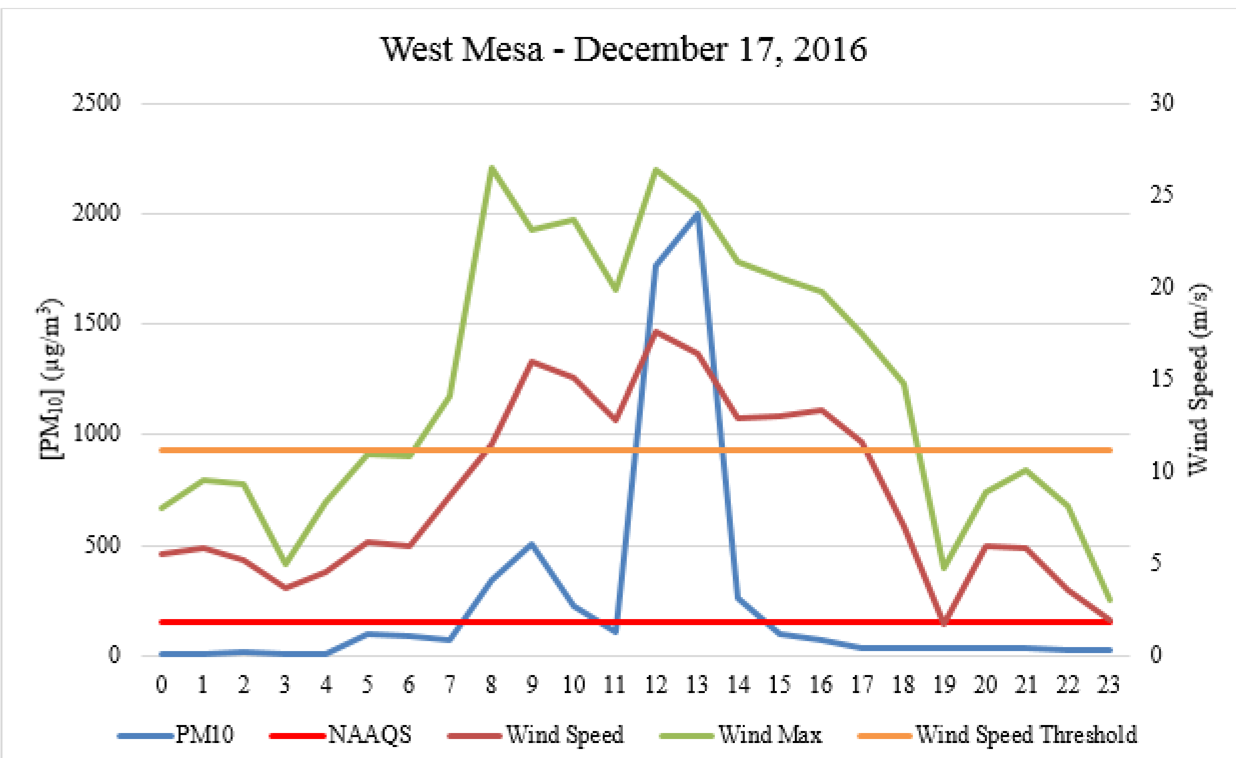

Figure 13-25. West Mesa monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2011-2015, the Anthony, Chaparral, Deming, Desert View, Holman, and West Mesa monitoring sites recorded 54, 43, 31, 43, 29, & 21 exceedances of the PM_{10} NAAQS (Figures 13-26 through 13-32). The maximum 24-hour average PM_{10} concentration at these sites were 1739 (Anthony), 1606 (Chaparral), 1098 (Deming), 1691 (Desert View), 1449 (Holman), & 487 (West Mesa) µg/m^3 recorded in 2012 for all the NMED monitoring sites with the exception of the West Mesa monitoring site which was recorded in 2013. High wind blowing dust events in southern New Mexico can occur at any time of the year, but the majority of these days occur during the spring windy season, from March through May. NMED has documented that all exceedances have been caused by high wind blowing dust events.

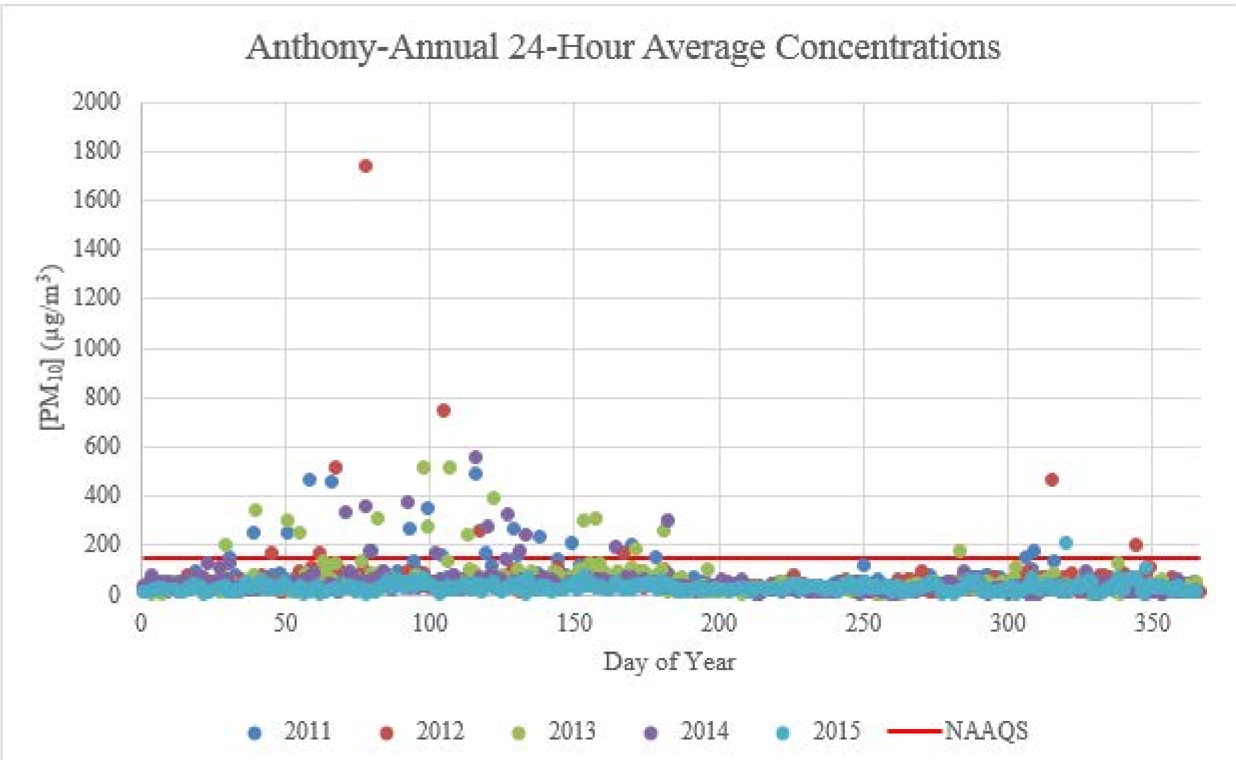

Figure 13-26. 24-hour averages by day of year from 2011-2015 for the Anthony monitoring site.

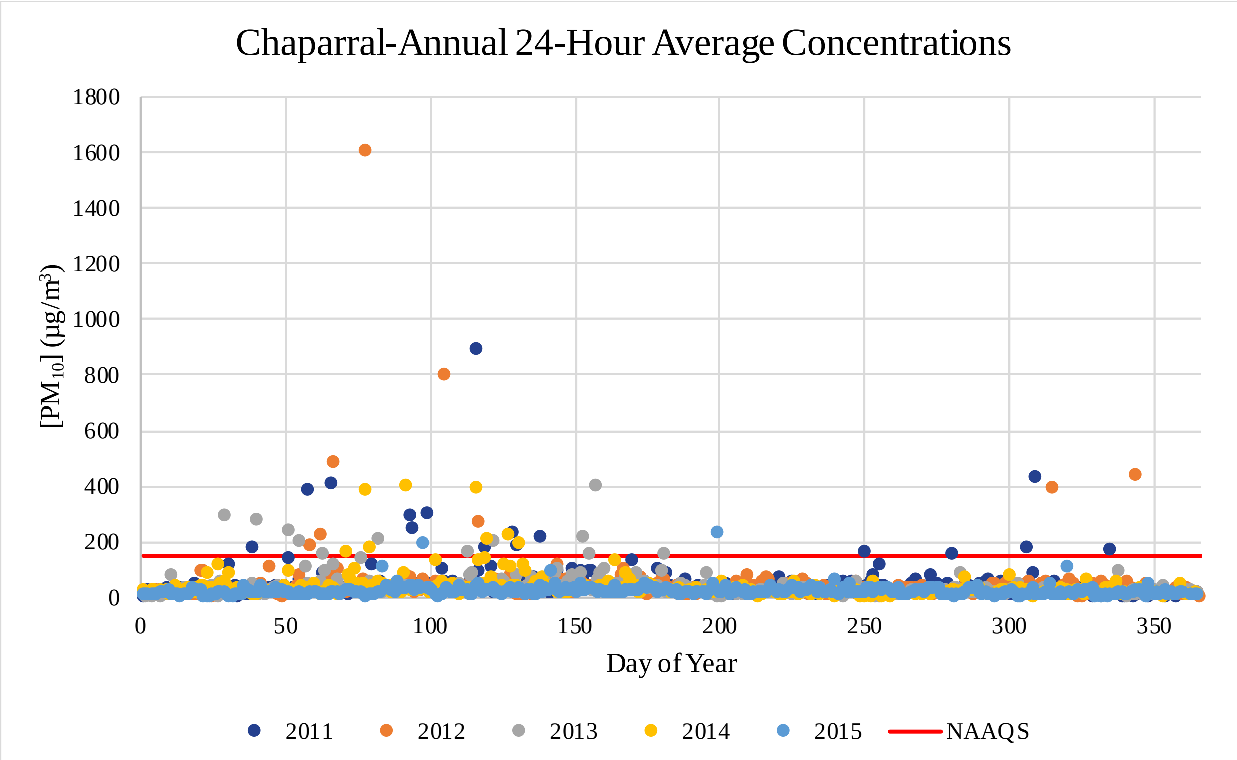

Figure 13-27. 24-hour averages by day of year from 2011-2015 for the Chaparral monitoring site.

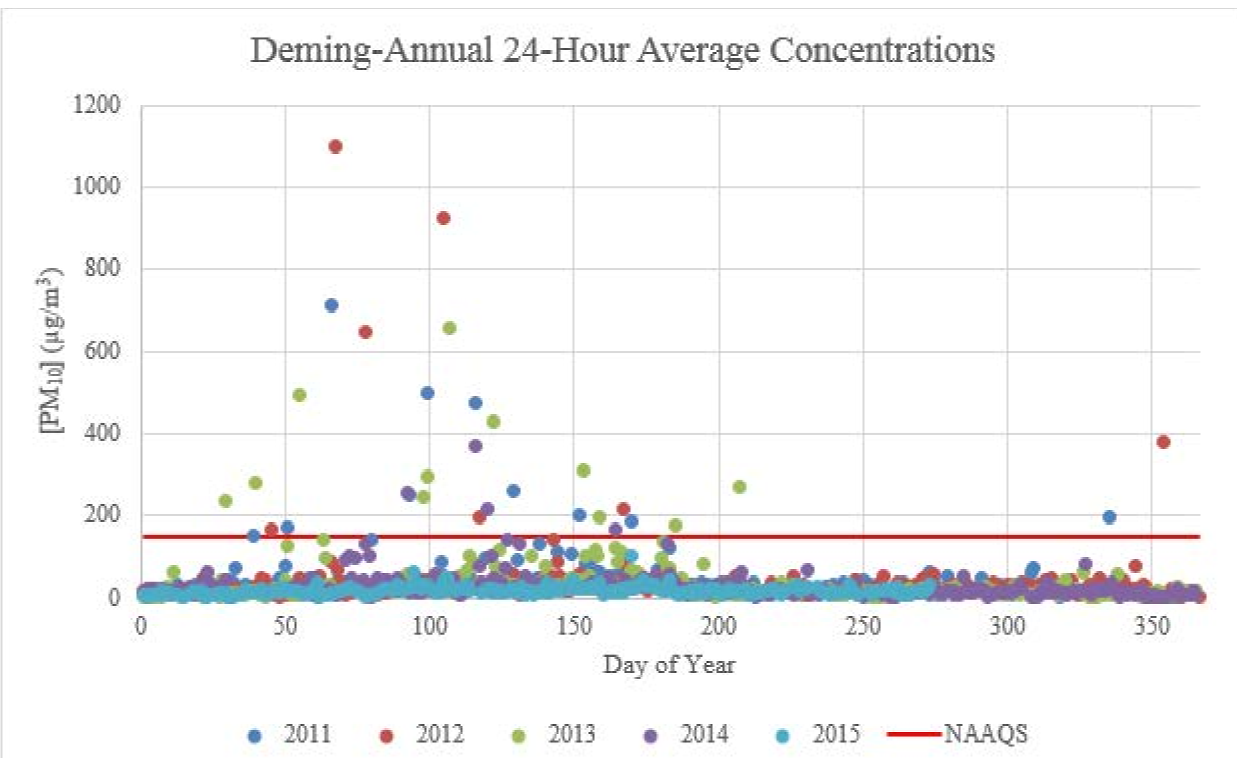

Figure 13-28. 24-hour averages by day of year from 2011-2015 for the Deming monitoring site.

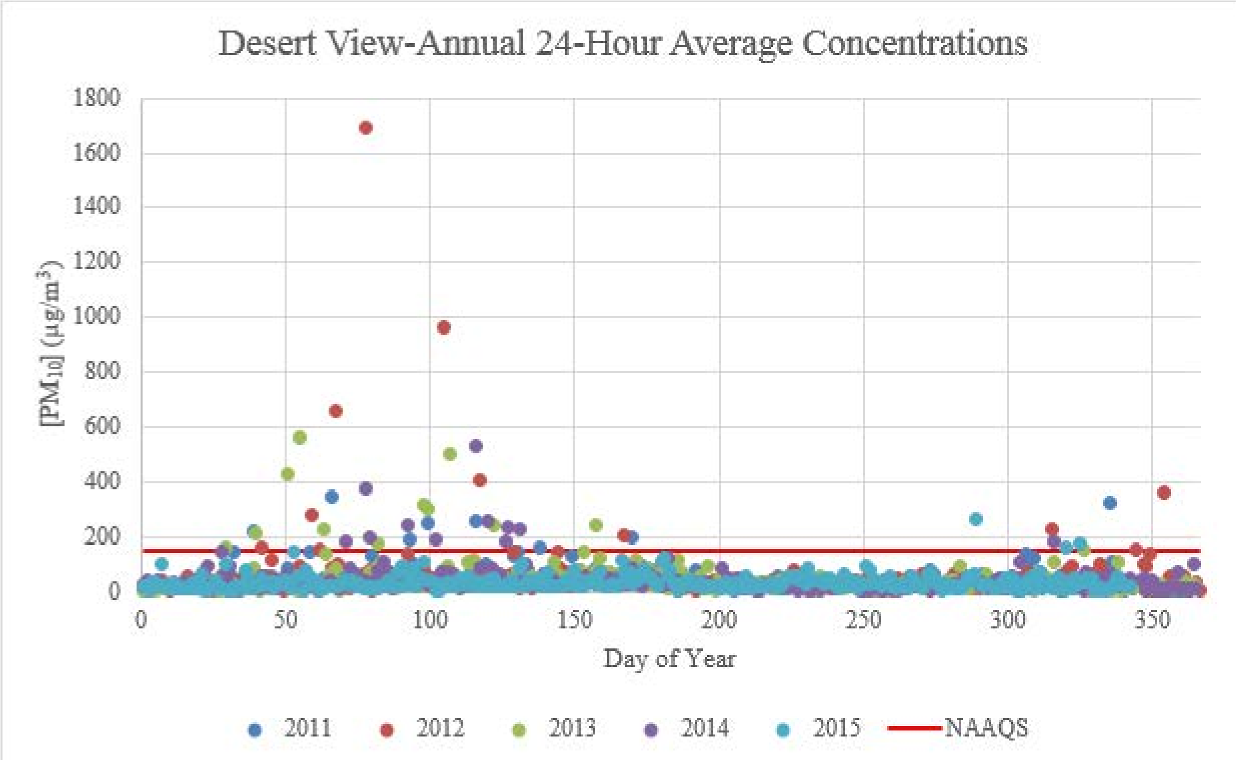

Figure 13-29. 24-hour averages by day of year from 2011-2015 for the Desert View monitoring site.

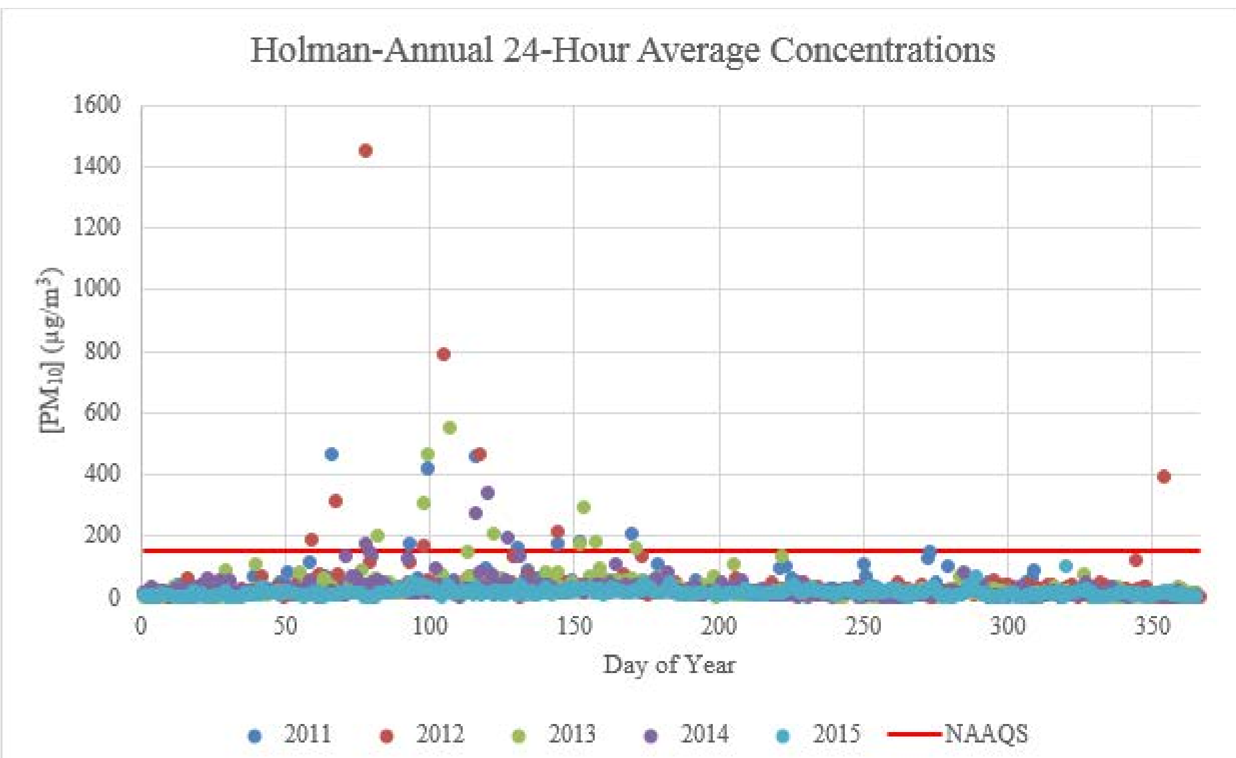

Figure 13-30. 24-hour averages by day of year from 2011-2015 for the Holman monitoring site.

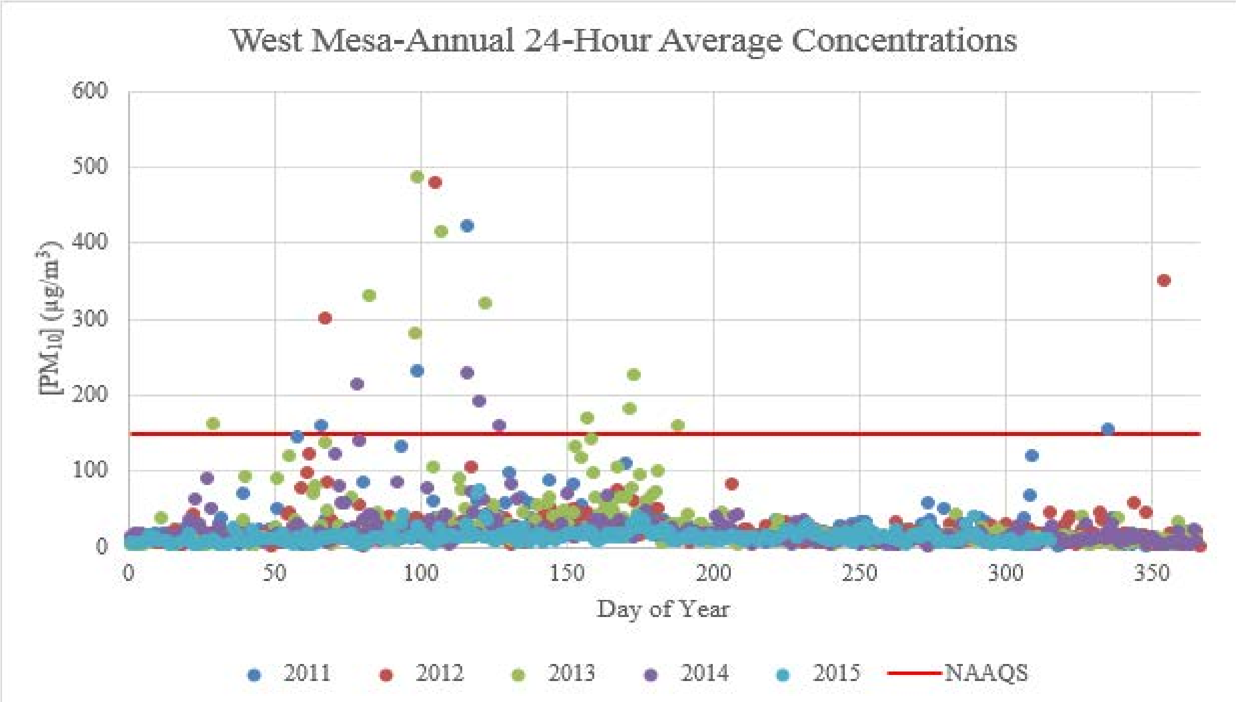

Figure 13-31. 24-hour averages by day of year from 2011-2015 for the West Mesa monitoring site

Spatial and Temporal Variability

As demonstrated in Figure 13-32, all NMED monitoring sites recorded elevated 24-Hour Average PM_{10} concentrations compared to the days preceding and following the event. Daily averages for the days surrounding the event did not surpass 60 µg/m^3, demonstrating the influence high winds have on PM_{10} concentrations in the area.

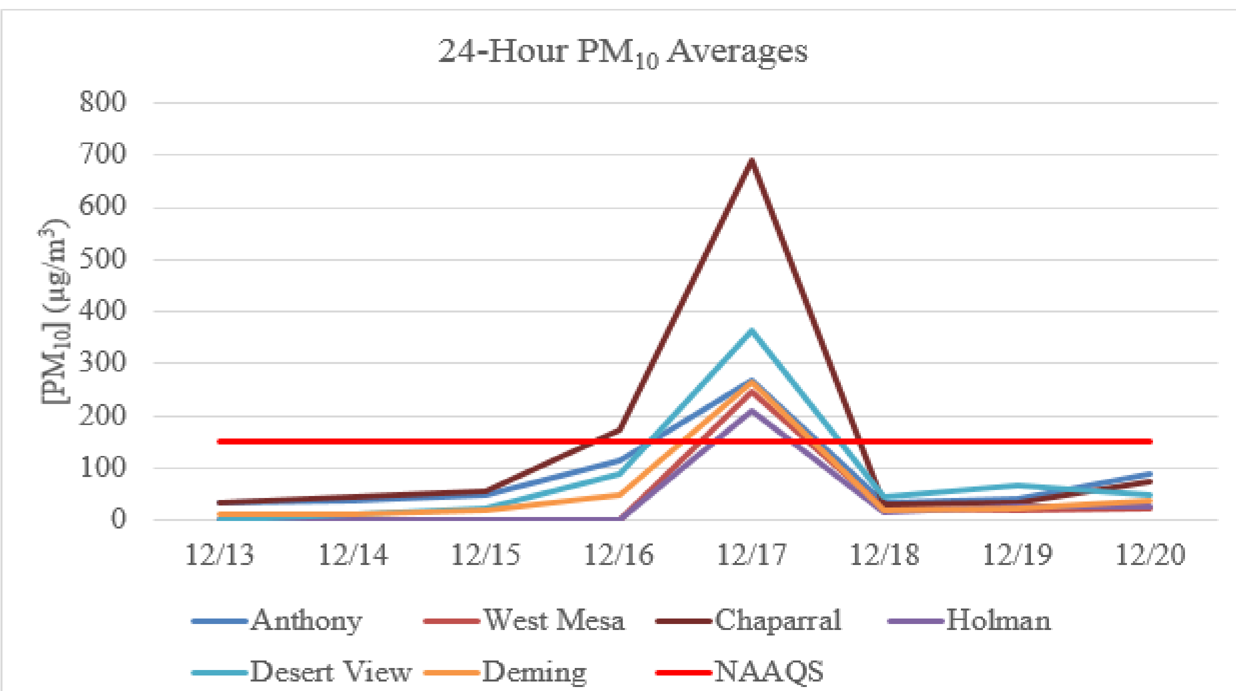

Figure 13-32. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

Percentile Ranking

Table 13-3 shows the 24-Hour Average PM_{10} data distribution recorded at NMED monitoring sites, including high wind blowing dust events flagged with a request to exclude data in the AQS database for exceedances of the standard from 2011-2015. The recorded values for this day (268 (Anthony), 689 (Chaparral), 209 (Holman), 363 (Desert View), 246 (West Mesa), & 266 (Deming)µg/m^3) are above the 99th percentile of historical data with the exception of the Anthony monitoring site which is above the 95th percentile of historical data.

Statistic\Monitoring Site	Anthony	West Mesa	Chaparral	Holman	Desert View	Deming
Max	1739	487	1606	1449	1691	1098
99th Percentile	307	160	255	198	253	254
95th Percentile	99	59	91	68	99	68
75th Percentile	54	23	36	31	42	30
50th Percentile	38	16	24	21	28	20
25th Percentile	25	11	16	14	19	13
5th Percentile	13	5	6	6	9	6
Mean	49	23	36	30	40	30

Table 13-3. NMED monitoring sites PM_{10} 24-hour average data distribution. Includes data flagged in AQS for exclusion due to high wind blowing dust events (RJ).

CCR Conclusion

On this day a high wind blowing dust event occurred, generating PM_{10} emissions that resulted in elevated concentrations at the Anthony, Chaparral, Deming, Desert View, Holman, and Deming monitoring sites. The monitored PM_{10} 24-Hour Averages of 268 (Anthony), 689 (Chaparral), 266 (Holman), 363 (Desert View), 246 (West Mesa), & 266 (Deming)µg/m^3, respectively, are above the 95th for the Anthony monitoring site and 99th for all of the other NMED monitoring sites percentile of data monitored over the previous five years. Meteorological conditions were consistent with past event days and elevated PM_{10} concentrations. The comparisons and analyses provided in the CCR section of this demonstration support NMED's position that the event affected air quality in such a way that a clear causal relationship exists between the high wind blowing dust event and the monitored exceedances on this day, satisfying the CCR criterion.

Natural Event

The CCR and nRCP analyses show that this was a natural event caused by high wind and blowing dust. Based on the documentation provided in this demonstration, the event qualifies as a natural event. The exceedances associated with the event meets the regulatory definition of a natural event at 40 CFR 50.14(b)(8). This event transported windblown dust from natural and anthropogenic sources that have been reasonably controlled and accordingly, NMED has demonstrated that the event is a natural event and may be considered for treatment as an exceptional event.