2017 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 September 3, 2019 to October 2, 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, 2017, the New Mexico Environment Department (NMED) Air Quality Bureau (AQB) recorded 27 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 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)
February 12	299 (POC #1)	148	214	225	77	76
February 18	58 (POC #1)	58	164	16	17	15
February 23	71 (POC #1)	86	175	66	36	44
February 28	124 (POC #1)	218	338	137	13	102
March 23	308 (POC #1)	721	538	211	169	157
March 31	208 (POC #1)	222	475	139	149	226
April 4	60 (POC #1)	186	74	25	32	54
April 25	213 (POC #1)	450	288	154	111	184
May 6	83 (POC #1)	46	58	31	30	224
May 16	196 (POC #2)	201	335	76	46	76
June 24	111 (POC #2)	74	79	144	101	196

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.

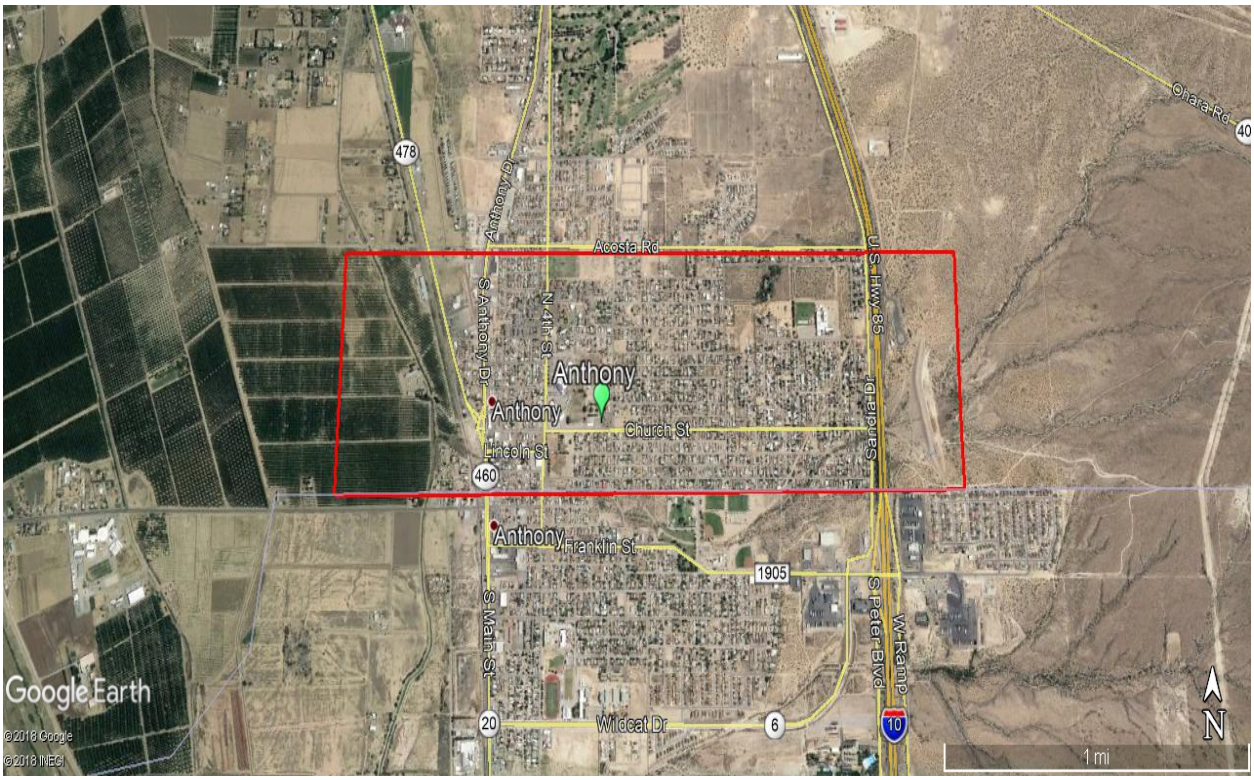


Figure 2-1. Anthony PM_{10} nonattainment area.

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.

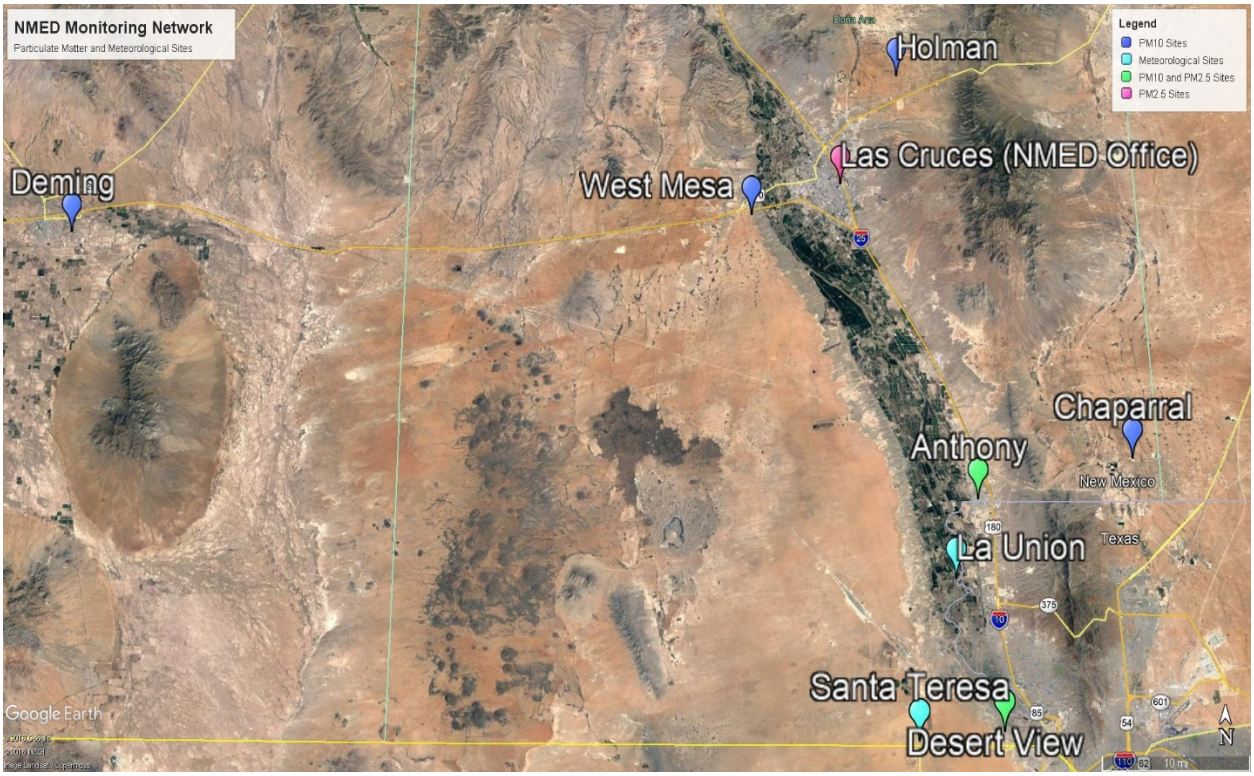


Figure 2-2. NMED monitoring network sites in Doña Ana and Luna Counties.

3. HIGH WIND EXCEPTIONAL EVENT: February 12, 2017

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, Desert View, and Holman 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 3-1).

AQS Flag	AQS ID	Site Name	24-Hour Average Concentration	Max 1-Hour Wind Speed	Max Gust
RJ	35-013-0016	6CM Anthony	299 µg/m³	11.6 m/s	21.1 m/s
RJ	35-013-0021	6ZM Desert View	214 µg/m³	10 m/s	20.8 m/s
RJ	35-013-0019	6ZL Holman	225 µg/m³	17.2 m/s	27.3 m/s

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

Very active weather scenario starting this morning with a cold front moving to the southwest and was approaching eastern portions while to the west a deep upper level low pressure system was drifting toward northern Baja. 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 1800 hour, an area of low pressure moved over southeastern Arizona and southwestern New Mexico. Aloft, the low-pressure center of the storm system hovered off the coast of southern 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 3-2). Tight gradients behind the front will also support strong winds especially across the southern zones and western facing slopes.

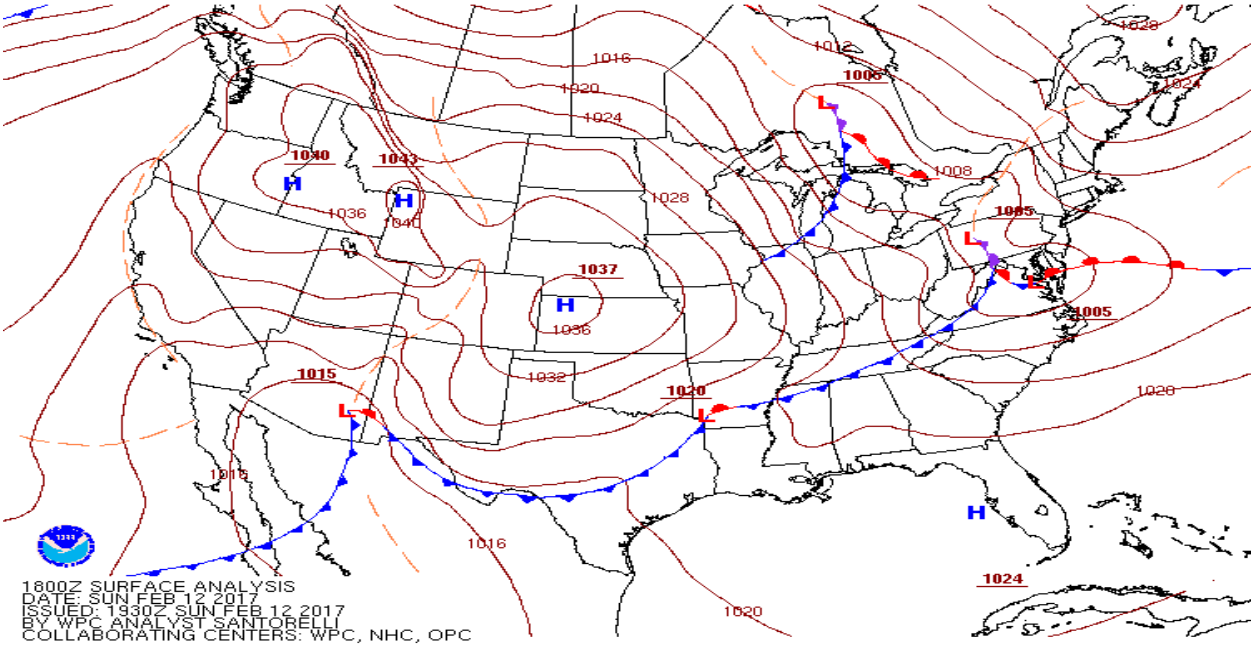


Figure 3-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

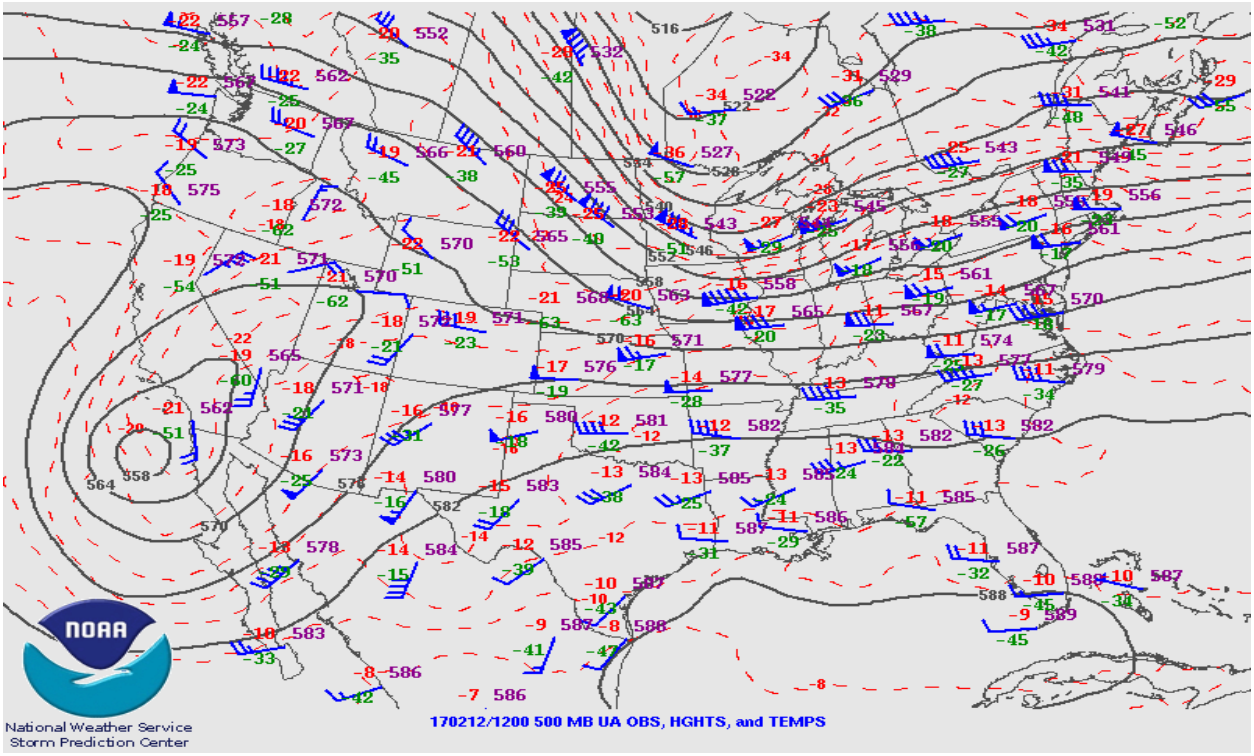


Figure 3-2. Upper air weather map for February 12, 2017 at the 1200 hour. Wind barbs depict wind speed (knots) and direction.

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

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, Chaparral, Holman, West Mesa and Deming monitoring sites beginning at the 0900 hour and lasted through the 1800 hour. PM_{10} concentrations began to exceed the NAAQS at the Anthony, Desert View and, Holman monitoring sites beginning at the 0800 hour. Hourly concentrations remained elevated through the 1800 hour. Table 3-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event. Table 3-3 summarizes the 5-minute wind speeds for the La Union monitoring site for the 1700 hour in which the sustained wind speeds exceed 9 m/s for 40 minutes and above 11.2 m/s for 5 minutes at the 0535 hour.

Hour	Anthony			Holman			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)
0800	290	1.7	5.2	132	4.5	12.8	320	7.4	13.2
0900	1318	4.2	13.9	317	6.4	20.3	249	8.4	15.2
1000	1090	3.9	10.9	498	12.6	20.8	915	10.6	19.1
1100	848	5.7	12	280	10.2	19.9	664	11.4	19.9

1200	674	4.9	14.7	249	11.1	19.7	632	12	19.4
1300	347	4.6	12.9	295	12.4	20	305	11.5	18.7
1400	224	4.6	11	554	13.7	22.8	315	11.4	19.7
1500	641	5.1	12.8	1467	17.2	25.8	351	12	19.9
1600	440	5.9	16.2	688	16.5	27.3	312	11.6	20.6
1700	247	9	18.5	483	11.9	23.6	403	11.3	21.4
1800	141	3.7	14.1	117	7.5	17.6	139	6.8	19.9

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

Hour	Wind Speed (m/s)
0500	7.7
0505	8.5
0510	6.8
0515	7.5
0520	7
0525	9.2
0530	11.1
0535	11.5
0540	9.7
0545	9
0550	10.2
0555	9.8

Table 3-3. 5-Minute Wind Speeds for the La Union monitoring site for the 0500 Hour.

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 at the southern border of Arizona and New Mexico 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 Holman and Desert View monitoring sites recorded wind speeds above this threshold for 7 hours from the 1000 to the 1700 hour (Figure 1-5). The Wind speeds at the upwind Desert View monitoring site also reached the high wind threshold. Table 3-3 indicates that the 11.2 m/s high wind threshold was sustained for the La Union monitoring site for 5 minutes at the 0535 hour.

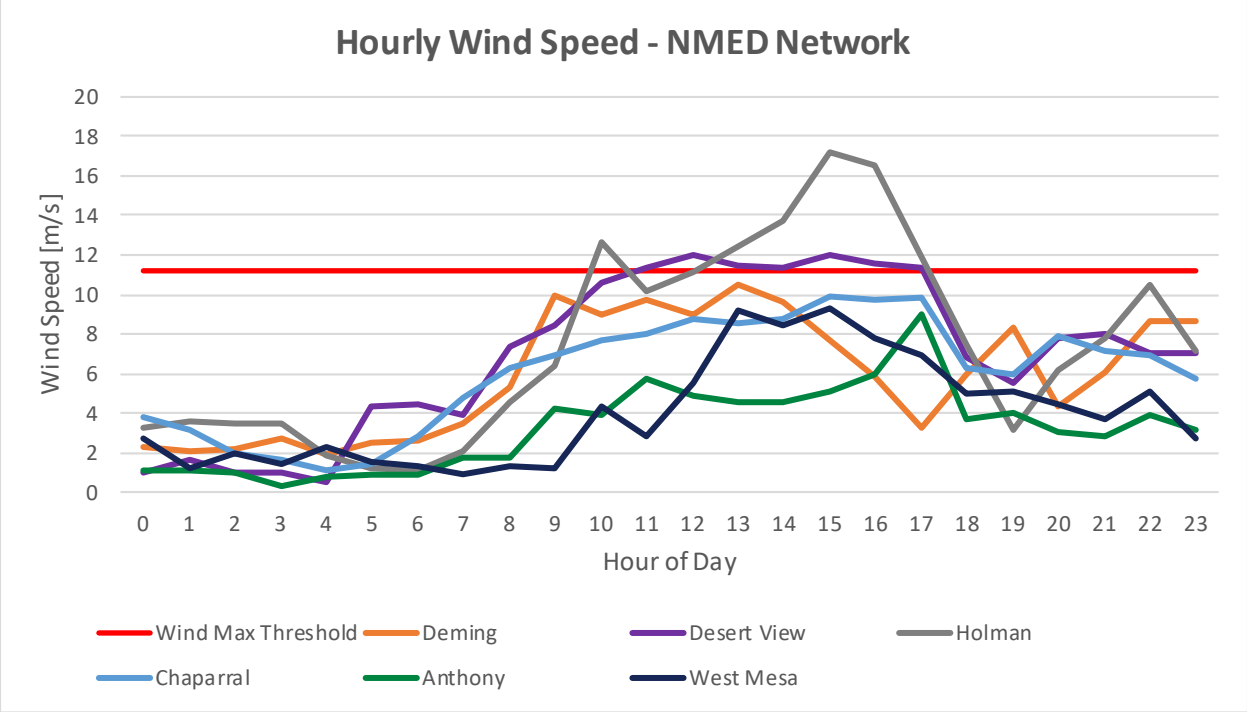


Figure 3-3. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

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 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 exceedances 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 the VIIRS satellite imagery with dust plumes originating upwind of NMED's monitoring sites near Ascension and Janos, Chih. The Aerosol Optical Depth imagery characterizes the dust as warm colors along the border area. 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 3-4).

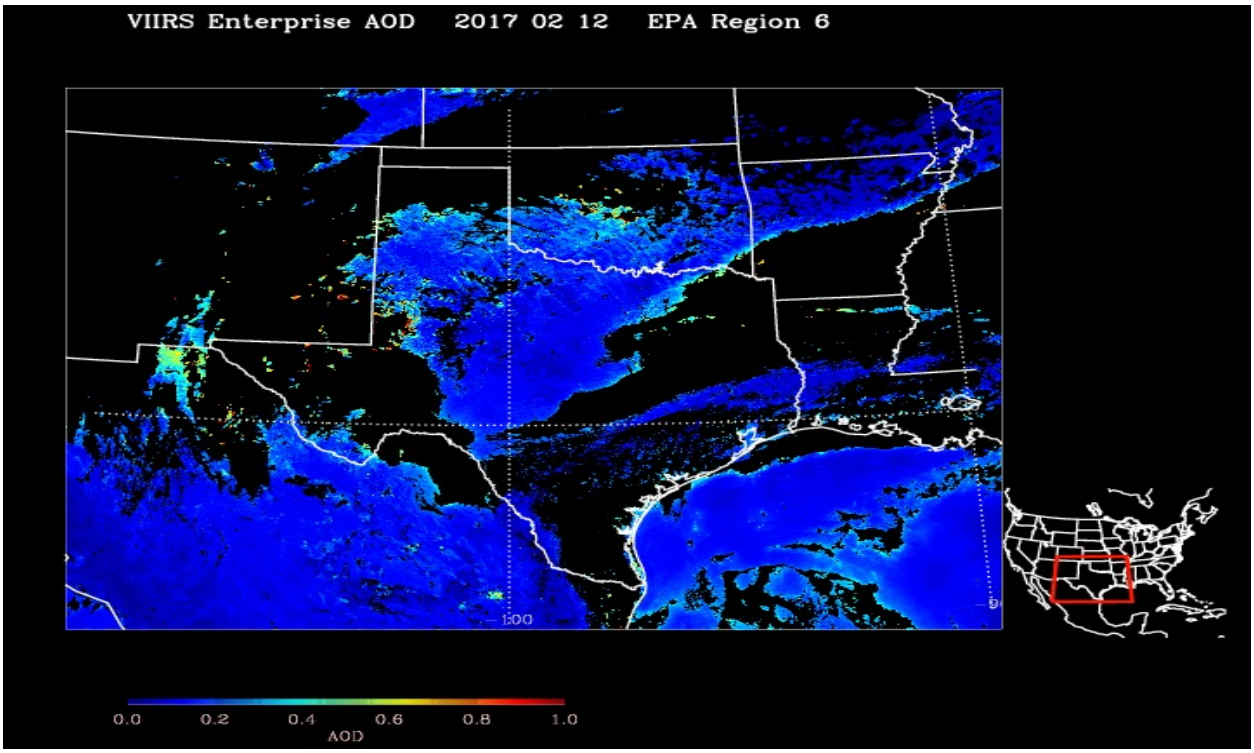


Figure 3-4. VIIRS Aerosol Optical Depth imagery from the Suomi NPP Satellite showing southwestern New Mexico, northern Chihuahua and western Texas. Imagery obtained from NASA's EOSDIS Worldview website. Warm colors represent dust plumes.

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 today and tonight with east winds gusting around 40 to 50 mph with gusts to 60 mph along western slopes… Wind Advisory from 8 AM this morning to midnight… High Wind Warning from 10 AM this morning to midnight"

Spatial and Transport Analysis

HYSPLiT Backtrajectory Analysis

A back-trajectory analysis using the HYSPLIT (NOAA Air Resources Laboratory HYSPLIT transport and dispersion model (Draxler et al., 2015; Rolph et al., 2017) shows that the air masses traveled from New Mexico, Texas 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 (Figure 3-5). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

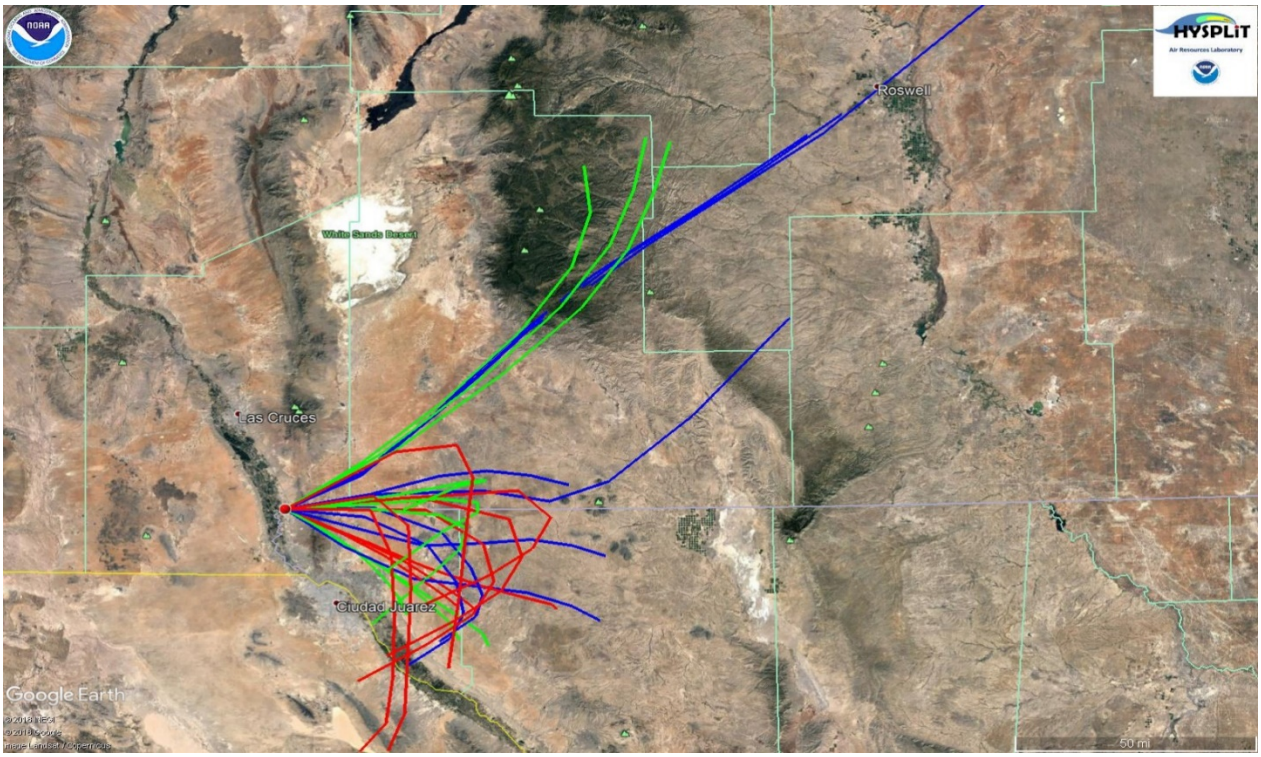


Figure 3-5. HYSPLiT back-trajectory analyses using the Ensemble mode for Anthony monitoring site

Wind Direction and Elevated PM_{10} Concentrations

Pollution roses (Figures 3-6 through 3-8) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m^3 (0900 -1800 hour). During the event, winds blew from the east approximately 70-80% of the time coinciding with peak PM_{10} concentrations.

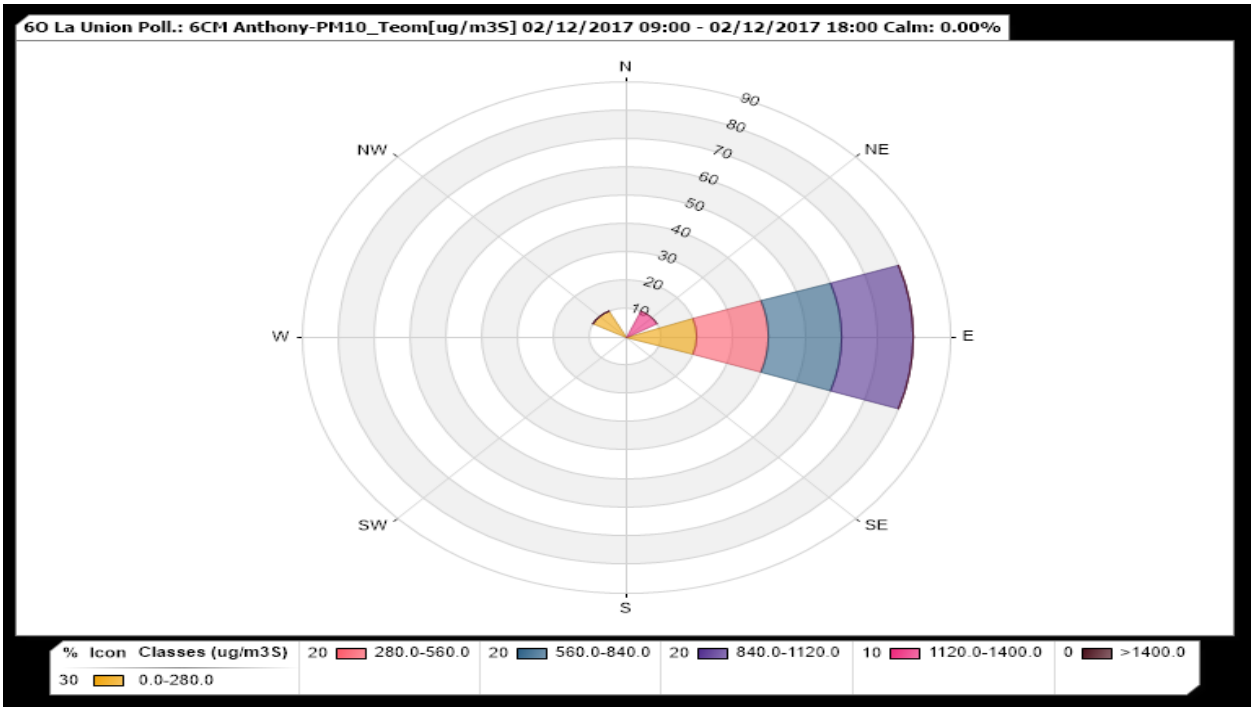


Figure 3-6. Pollution rose for the Anthony monitoring site.

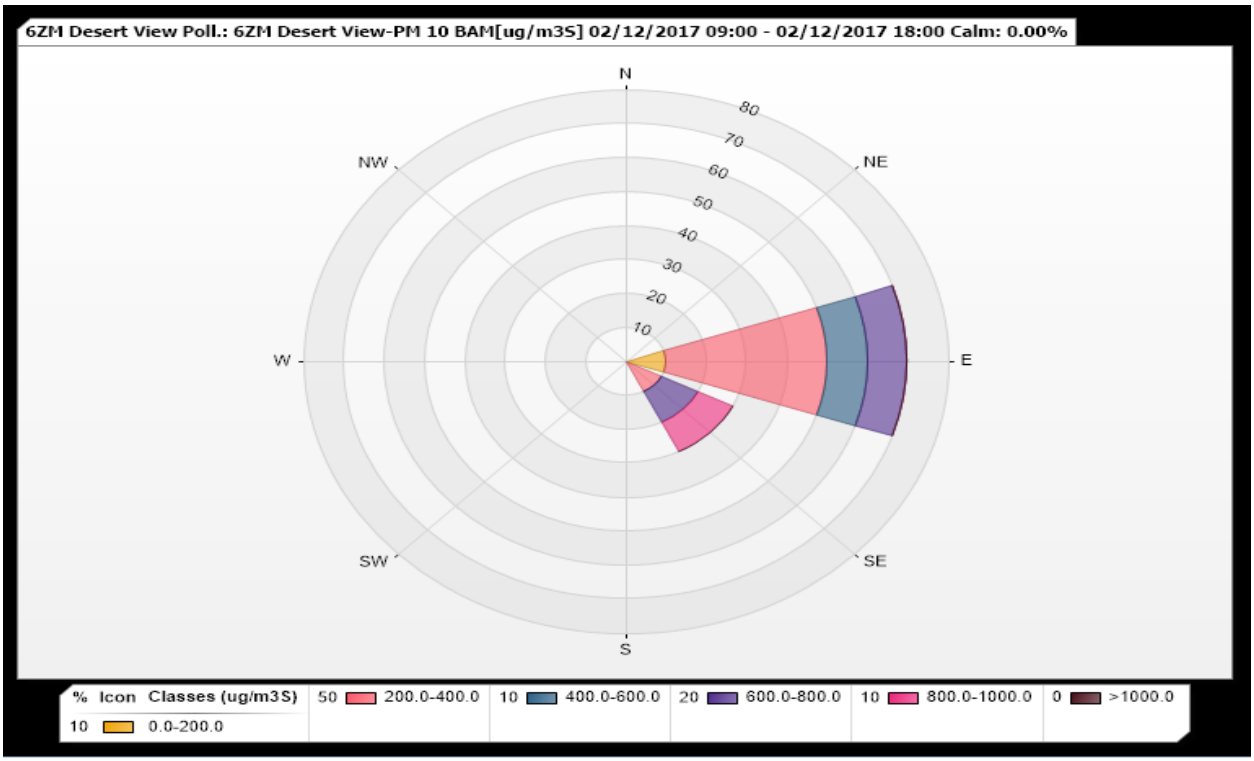


Figure 3-7. Pollution rose for the Desert View monitoring site

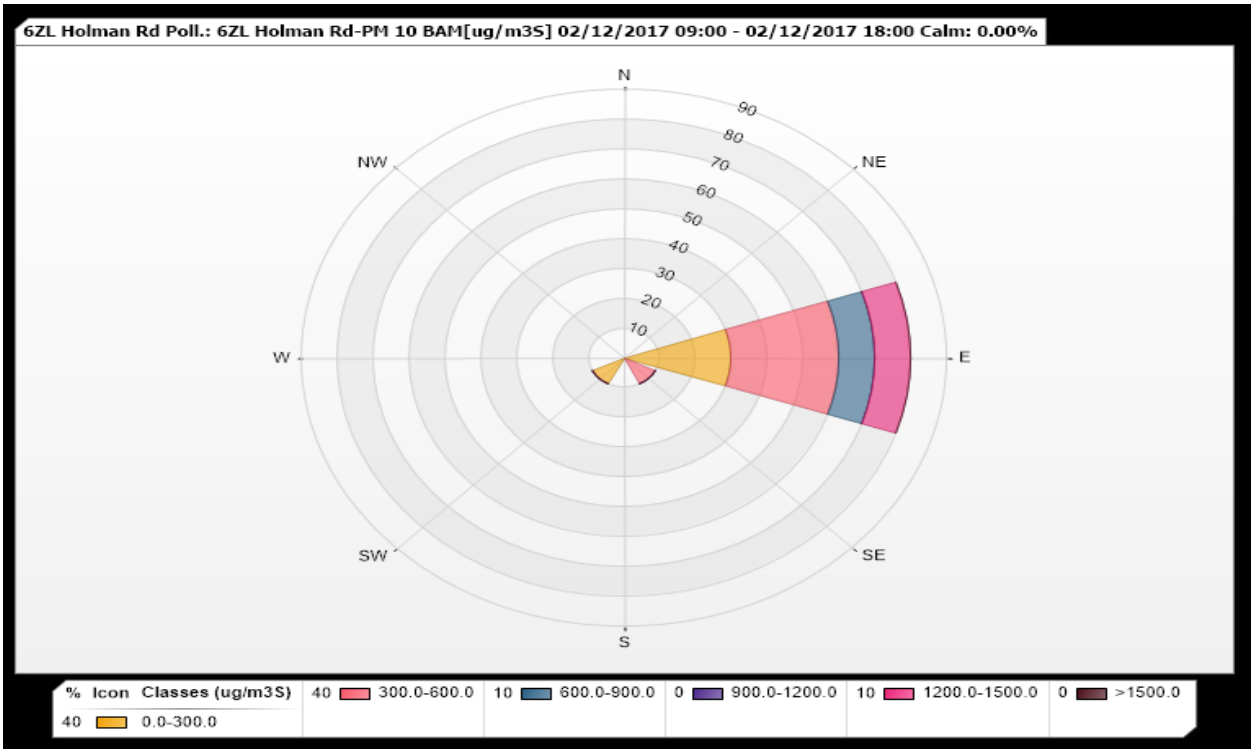


Figure 3-8. Pollution rose for the Holman monitoring site

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

The high wind blowing dust event generated strong east southeasterly winds beginning at the 0900 hour and lasting through the 1800 hour. During this time, peak hourly PM_{10} concentrations ranged from 427 to 1467 µg/m^3 at NMED monitoring sites (Figure 3-9). 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 to 17.2 m/s were recorded at Desert View and Holman monitoring sites during the peak PM_{10} concentrations of the event. The time series plots in Figures 3-10 through 3-12 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

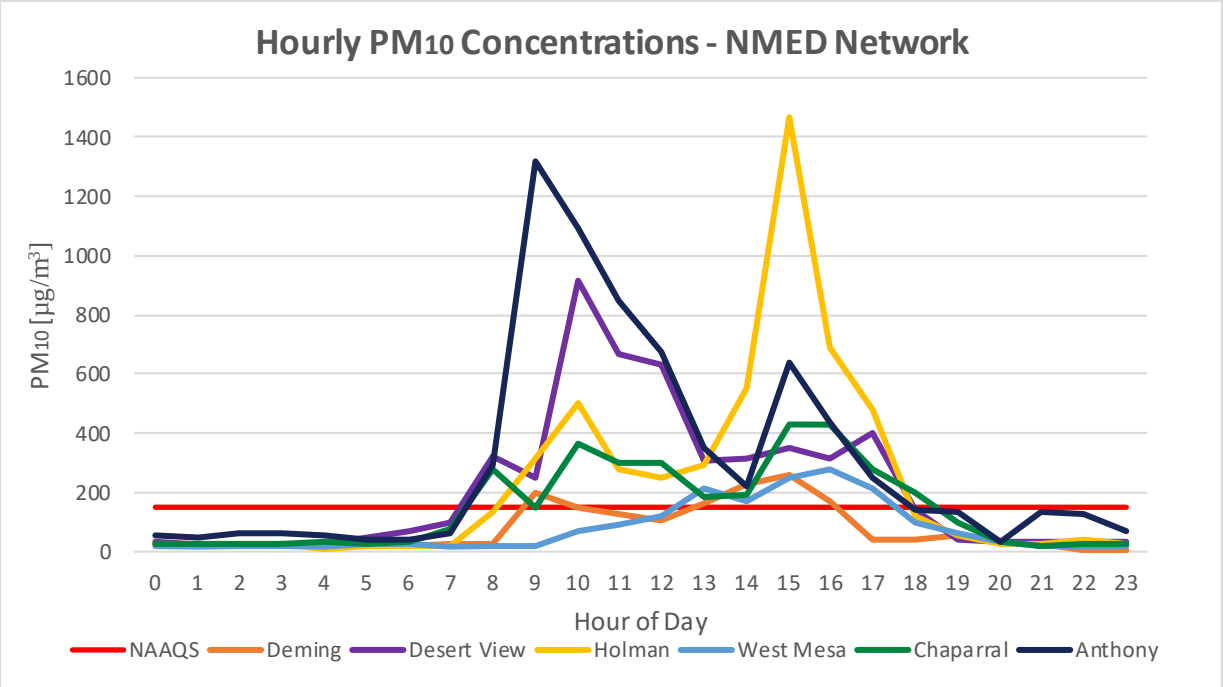


Figure 3-9. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

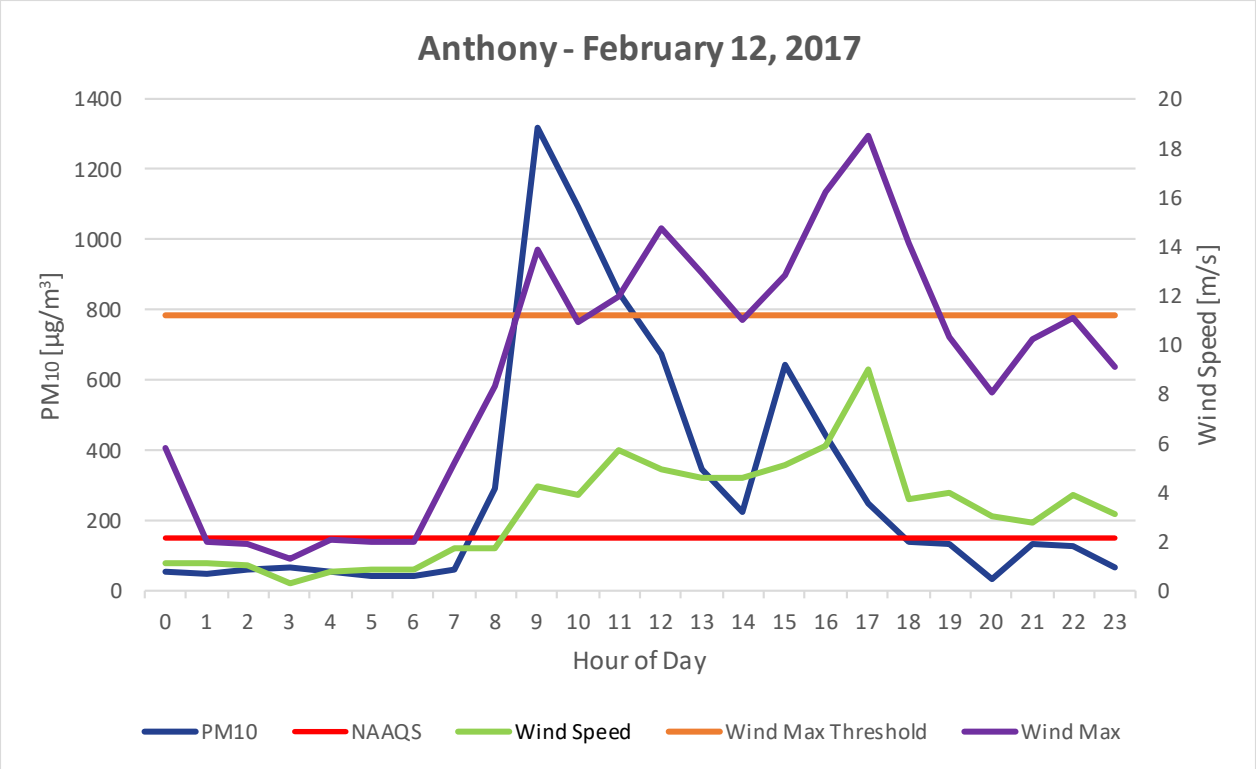


Figure 3-10. Anthony monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

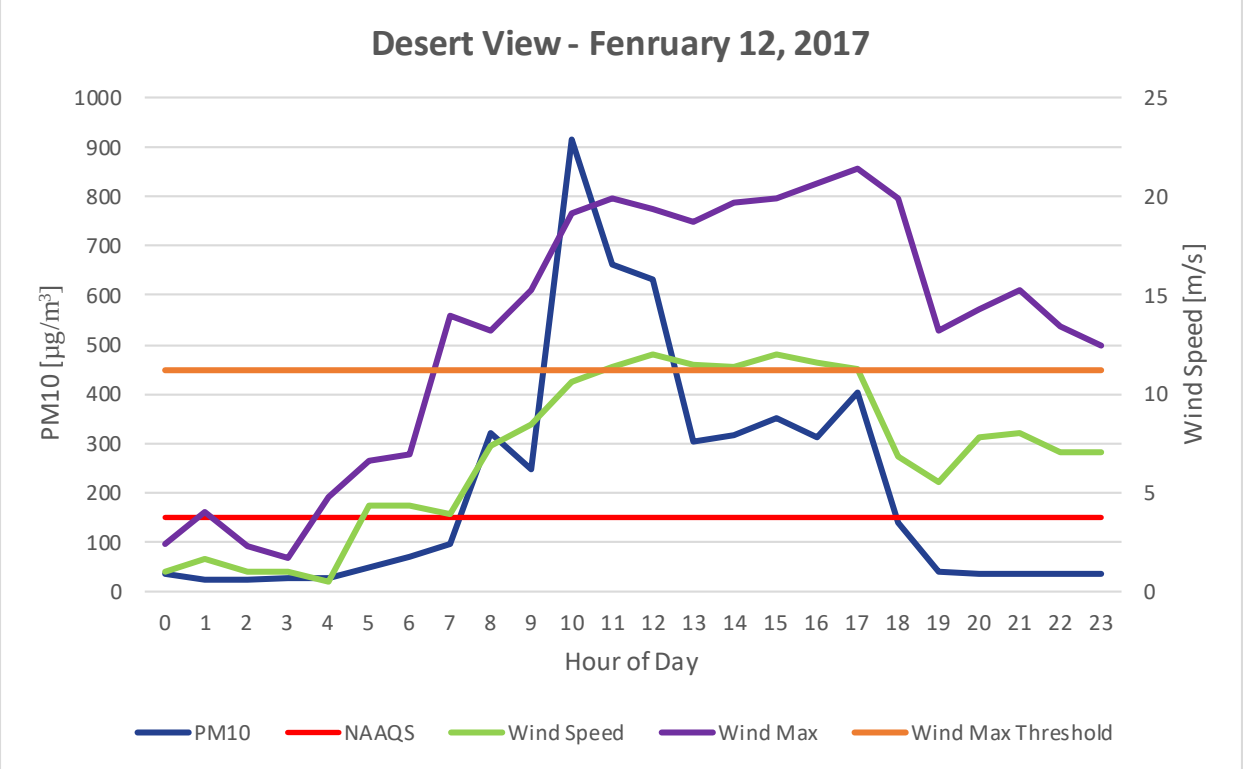


Figure 3-11. Desert View monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

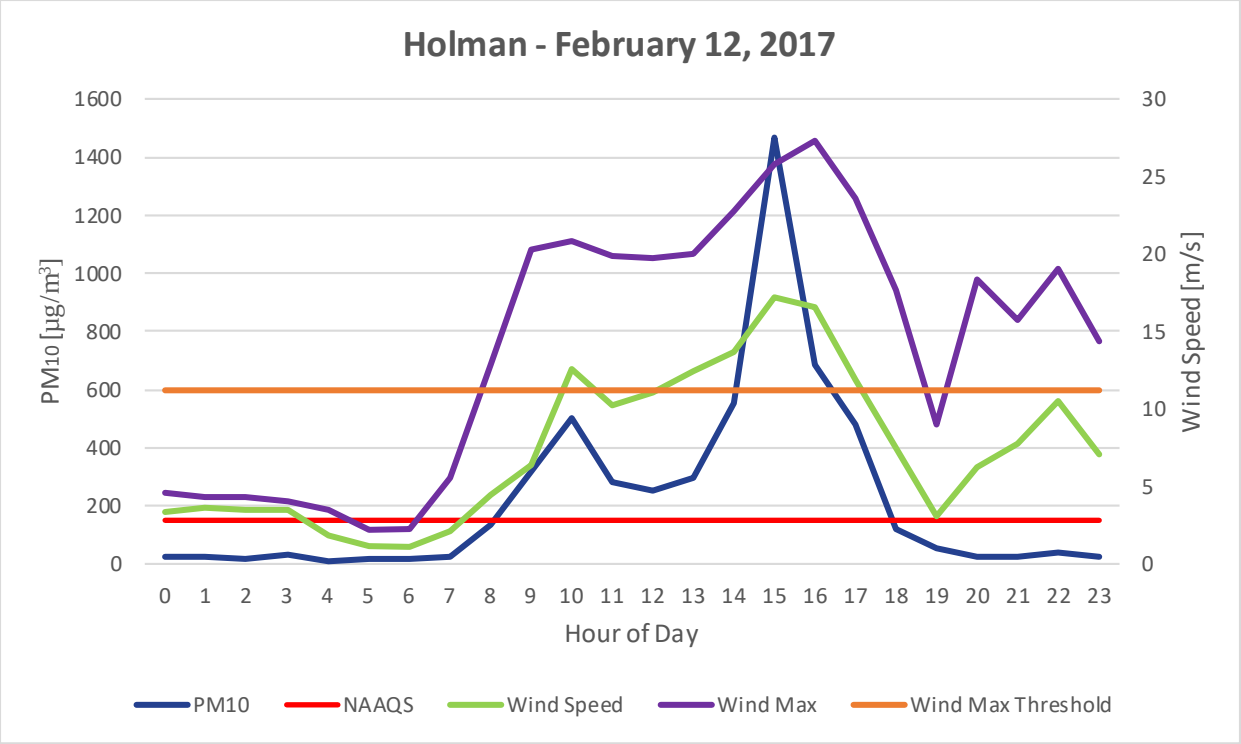


Figure 3-12. Holman monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2012-2016, the Anthony, Holman, and Desert View monitoring sites recorded 43, 22, & 43 exceedances of the PM_{10} NAAQS (Figure 3-13). The maximum 24-hour average PM_{10} concentrations, respectively, were 1739 (Anthony), 1449(Holman), & 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.

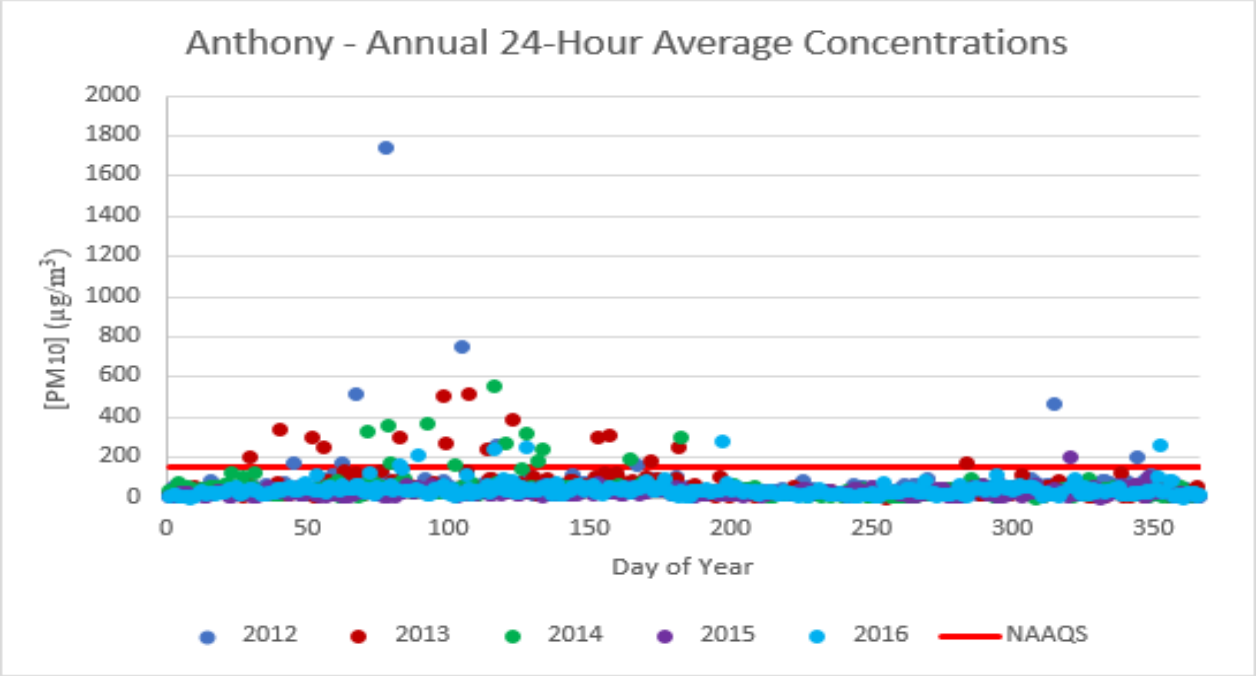


Figure 3-13. 24-hour averages by day of year from 2012-2016 for Anthony monitoring site.

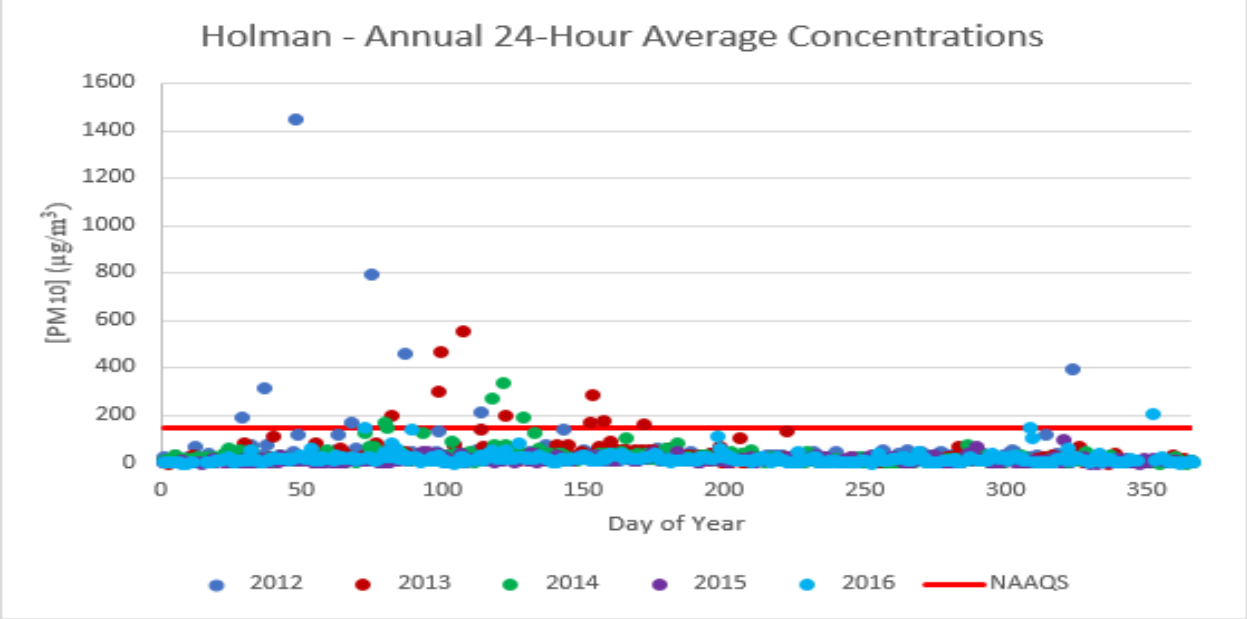


Figure 3-14. 24-hour averages by day of year from 2012-2016 for Holman monitoring site.

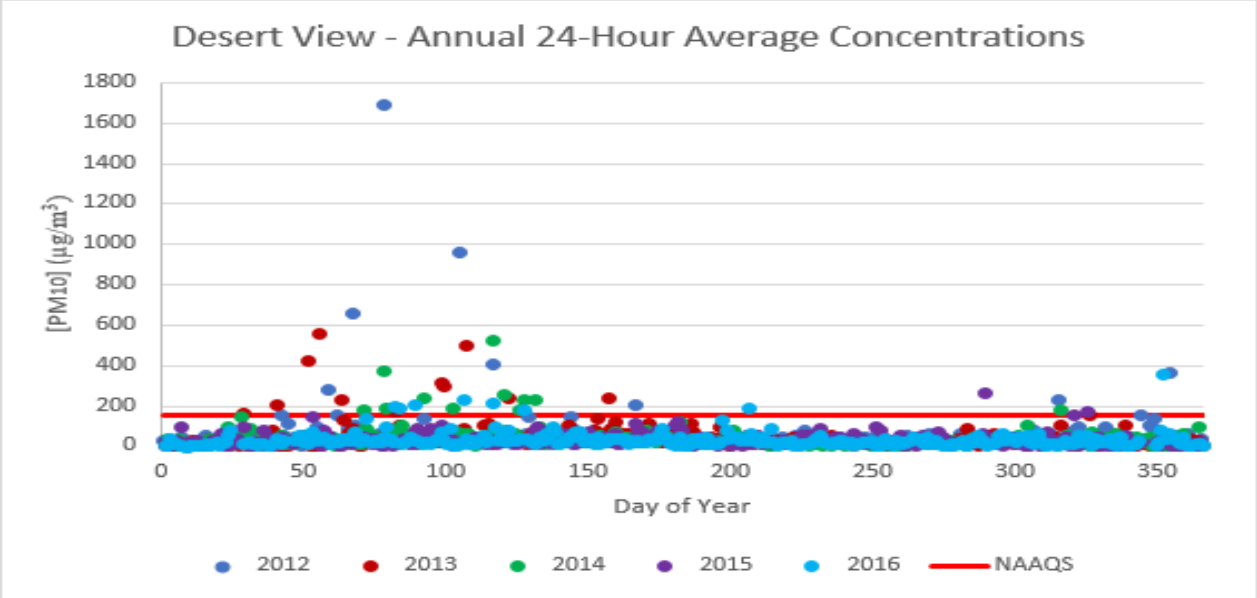


Figure 3-15. 24-hour averages by day of year from 2012-2016 for Desert View monitoring site.

Spatial and Temporal Variability

As demonstrated in Figure 3-16, 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 70 µg/m^3, demonstrating the influence high winds have on PM_{10} concentrations in the area.

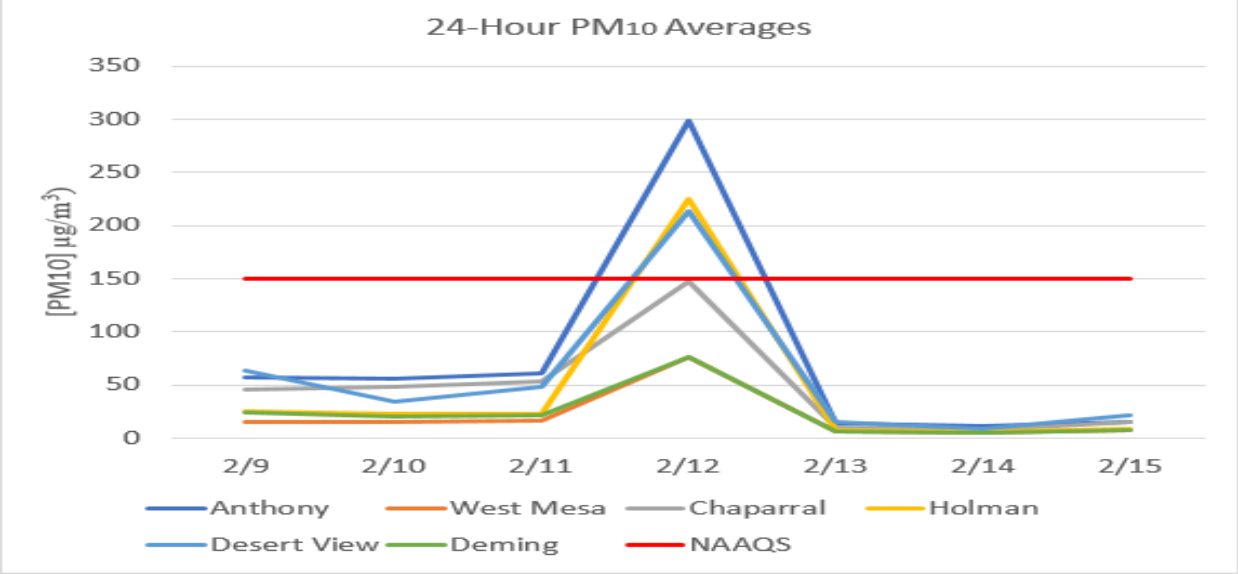


Figure 3-16. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

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 2012-2016. The recorded values for this day 299 (Anthony), 225 (Holman), & 214 (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	288	148	218	178	244	216
95th Percentile	95	50	79	60	95	61
75th Percentile	51	21	34	30	42	27
50th Percentile	36	14	23	20	28	19
25th Percentile	24	10	15	13	18	12
5th Percentile	13	5	6	6	8	6
Mean	46	21	32	28	39	27

Table 3-4. 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 Anthony, Holman, & Desert View monitoring sites. The monitored PM_{10} 24-Hour Averages of, 299 (Anthony), 225 (Holman), & 214 (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.

4. HIGH WIND EXCEPTIONAL EVENT: February 18, 2017

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 4-1).

AQS Flag	AQS ID	Site Name	24-Hour Average Concentration	Max 1-Hour Wind Speed	Max Gust
RJ	35-013-0021	6ZM Desert View	164 µg/m^3	8.1 m/s	16.6 m/s

Table 4-1. 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 4-1). At the 1800 hour, an area of low pressure moved below the great plains. Aloft, the deep slow-moving trough center of the storm system hovered off the coast of central Baja. As the day progressed this high humidity low pressure aloft slowly traveled east and aligned itself with New Mexico and the surface wind direction (Figure 4-2). Diurnal heating of the surface allowed winds aloft to mix down, increasing the surface wind velocities and providing the turbulence required for vertical mixing and entrainment of dust.

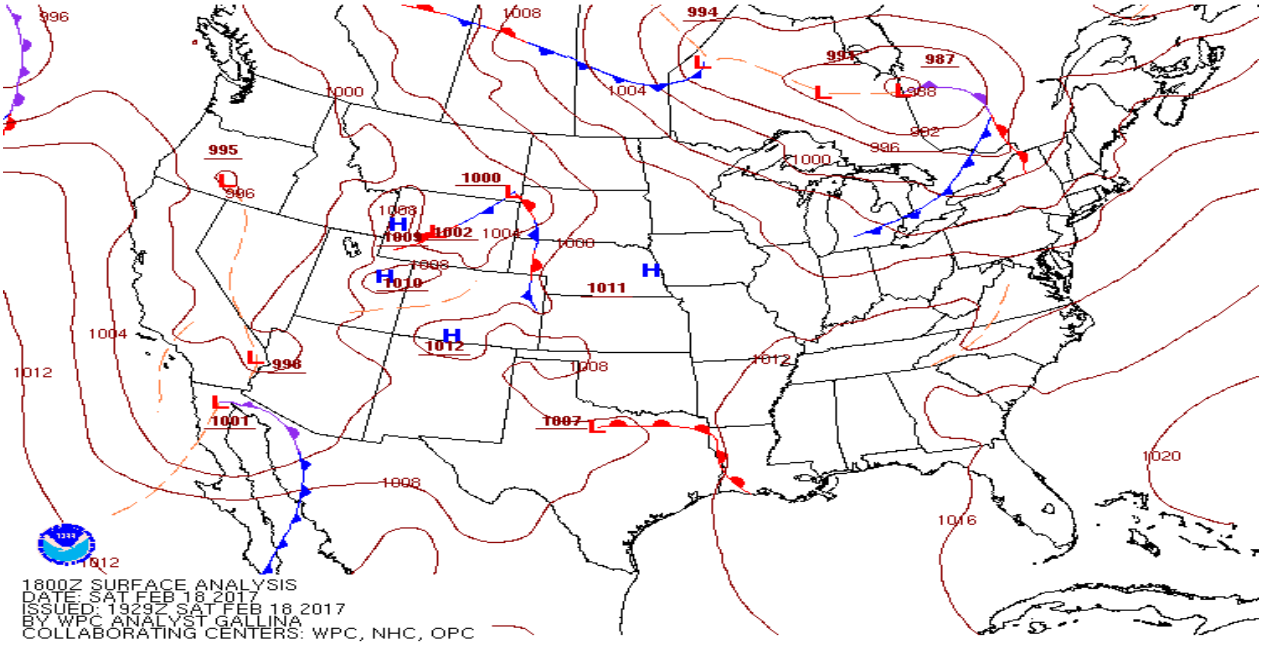


Figure 4-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

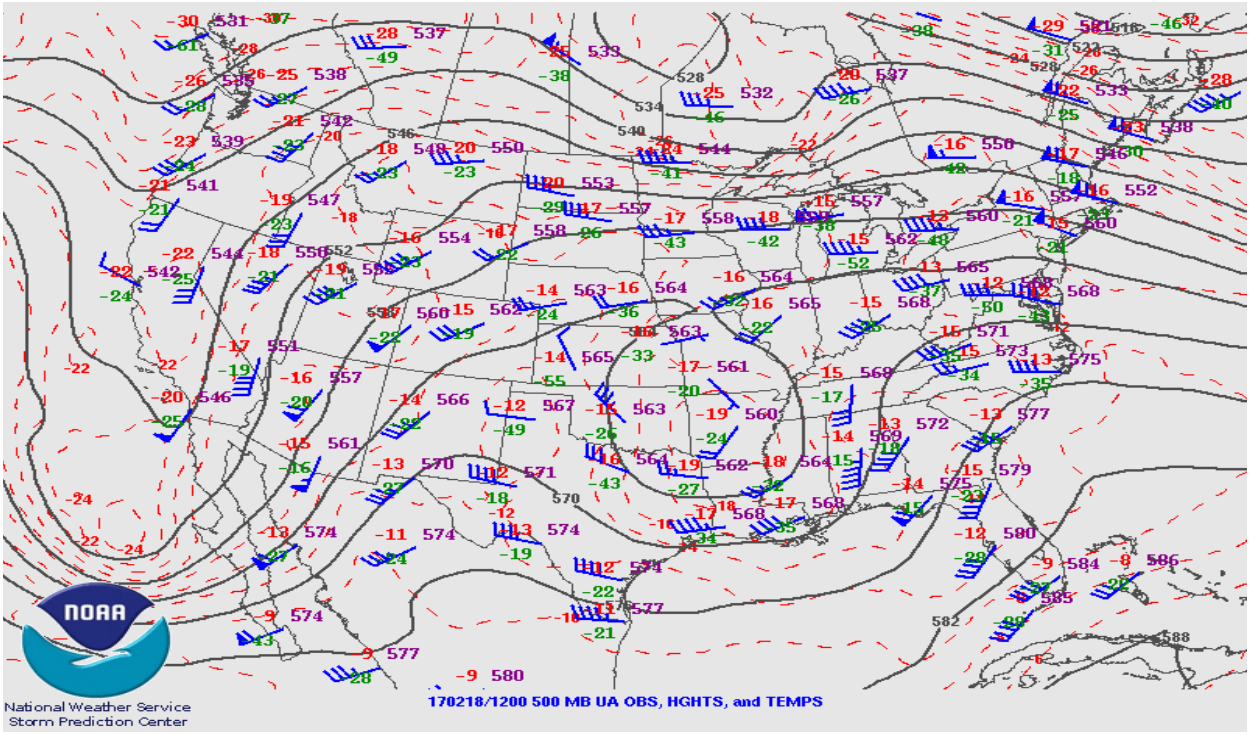


Figure 4-2. Upper air weather map for February 18, 2017 at the 1200 hour. Wind barbs depict wind speed (knots) and direction.

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. Anthropogenic sources of dust near NMED's monitoring sites include: disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

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 West Mesa monitoring site beginning at the 2100 hour and lasted through the 2100 hour. PM_{10} concentrations began to exceed the NAAQS at the Anthony, Desert View, and Chaparral monitoring sites beginning at the 2000 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. Table 4-3 indicates that the Desert View monitoring site recorded sustained wind speeds above 9 m/s for 30 minutes from the 2015 to the 2045 hour.

Hour	Desert View			Chaparral			West Mesa		
	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)
1900	44	2.9	5.4	34	3.2	4.7	19	2.2	3.5
2000	2681	8.1	16.6	105	3.9	14.5	124	8.3	4.6
2100	622	4.6	10.3	879	10.4	17.1	17	12	13.8
2200	31	2.5	6.2	44	8.4	13.5	0	6.4	11

Table 4-2. Hourly PM10, wind speed and wind gust data during the peak hours of the event.

Hour	Wind Speed (m/s)
2000	2.1
2005	2.2
2010	4.6
2015	9.5
2020	9.7
2025	10.8
2030	10.8
2035	10.2
2040	10.5
2045	10.6
2050	8.4
2055	7.6

Table 4-3. 5-Minute Wind Speeds for the Desert View monitoring site for the 2000 hour.

Meteorologists forecasted the high wind blowing dust event to occur this day, as the Pacific cold fronts that typically occur this time of year bring. Forecasts predicted strong winds as the storm approached the area with the area of low pressure tracking from west to east just off the coast of California aloft this 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 for the 2100 hour (Figure 4-3).

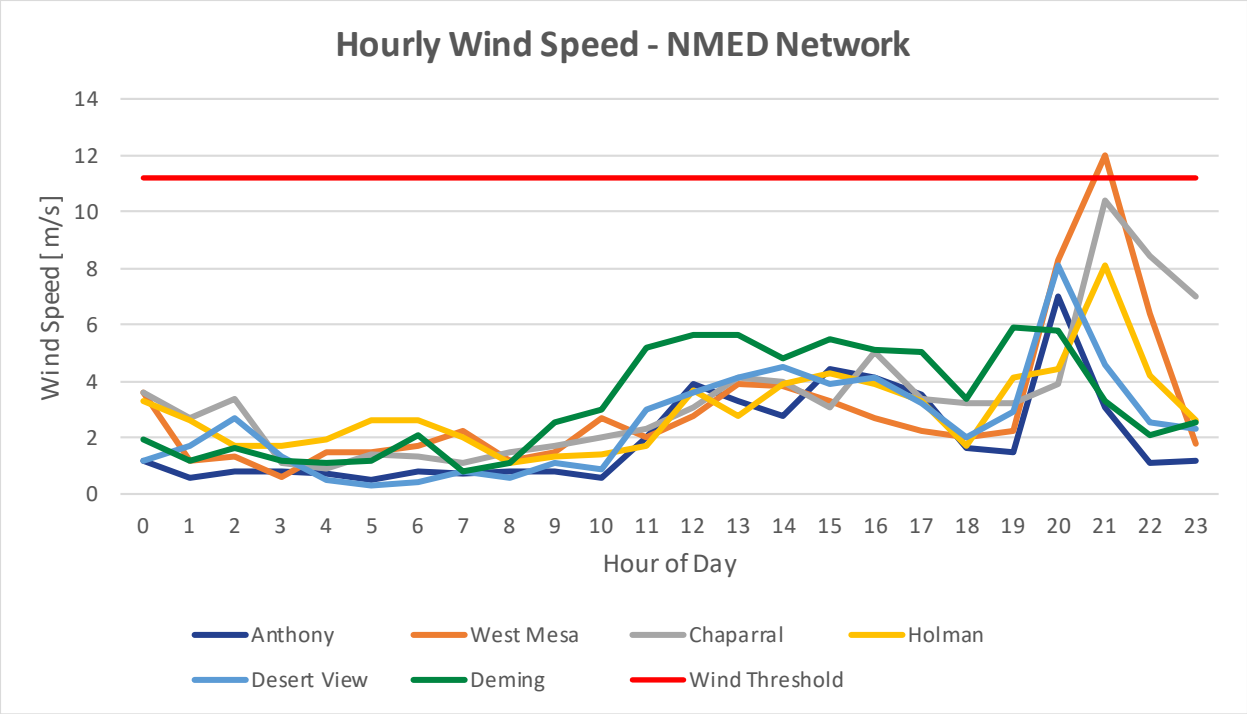


Figure 4-3. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

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 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 exceedances 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

No satellite imagery was available for the use of the demonstration. Cloud cover limited satellites ability to show blowing dust plumes.

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

The National Weather Service (NWS) issued a Winter Weather Advisory for this date. This was in place for southwestern New Mexico more particularly for upper elevations to warn the public of the winter weather events. An excerpt from the NWS Wind Advisory can be found below:

"Winter Weather Advisory from midnight tonight to noon MST Sunday"

Spatial and Transport Analysis

HYSPLiT Backtrajectory Analysis

A back-trajectory analysis using the HYSPLIT (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 4-4). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

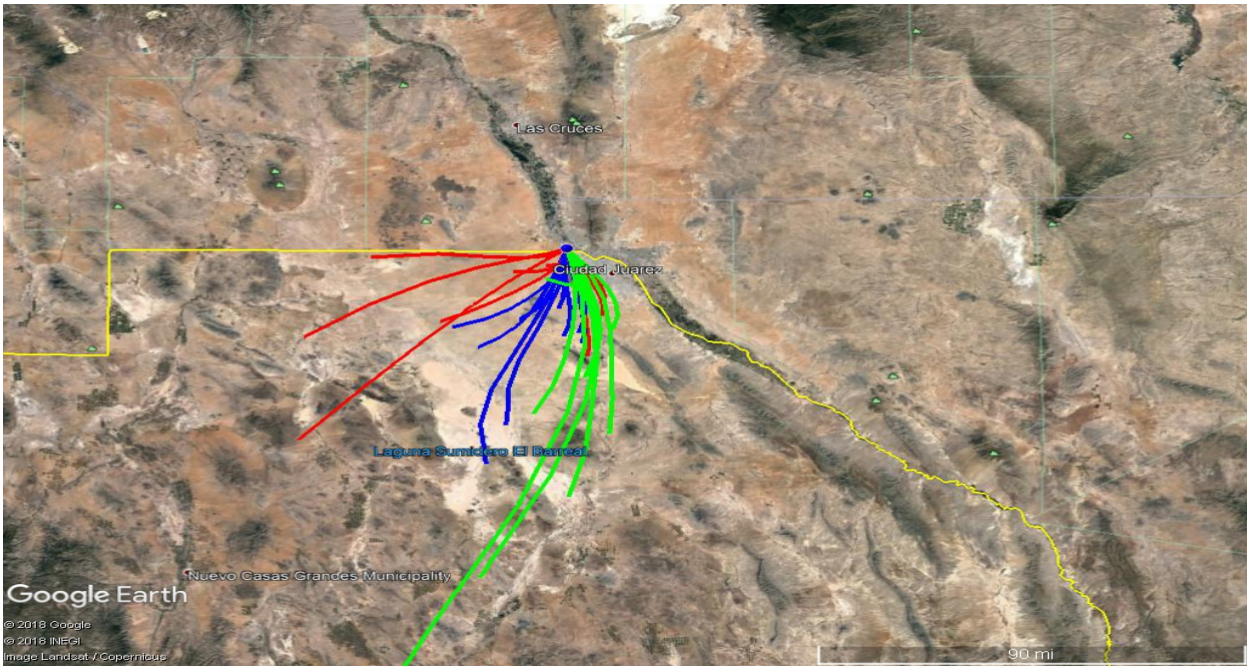


Figure 4-4. HYSPLiT back-trajectory analyses using the Ensemble mode for Desert View monitoring site

Wind Direction and Elevated PM_{10} Concentrations

Pollution rose (Figure 4-5) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m^3 (1900 -2200 hour). During the event, winds blew from the west approximately 50%, northwest 25%, and south 25% of the time coinciding with peak PM_{10} concentrations.

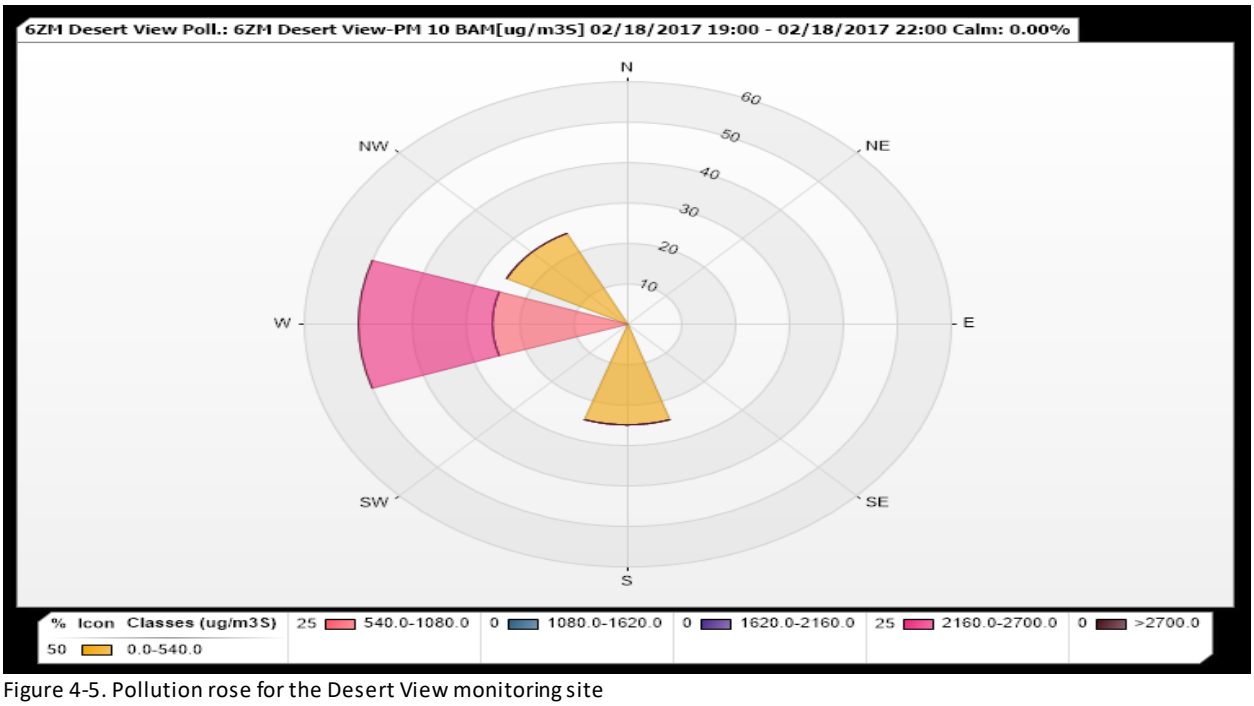


Figure 4-5. Pollution rose for the Desert View monitoring site

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

The high wind blowing dust event generated strong southerly winds for the 2100 hour. During this time, peak hourly PM_{10} concentrations ranged from 685 to 2681 µg/m³ at NMED monitoring sites (Figure 4-6). 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 m/s were recorded at the West mesa monitoring site during the peak PM_{10} concentrations of the event. The time series plot in Figure 4-7 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

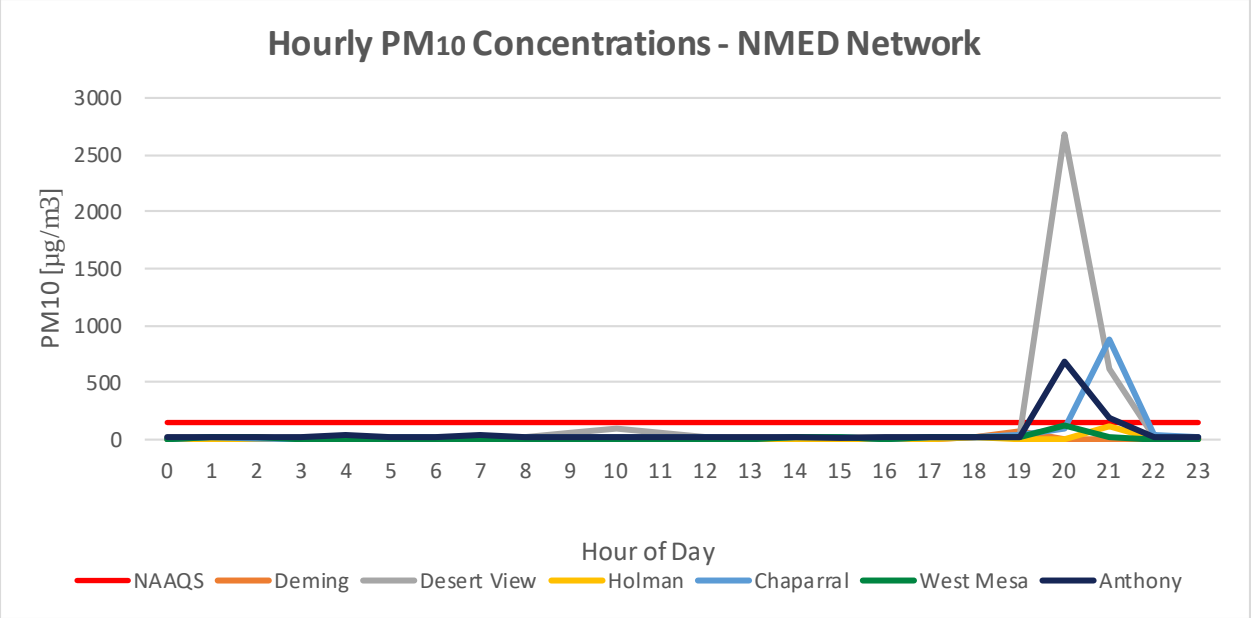


Figure 4-6. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

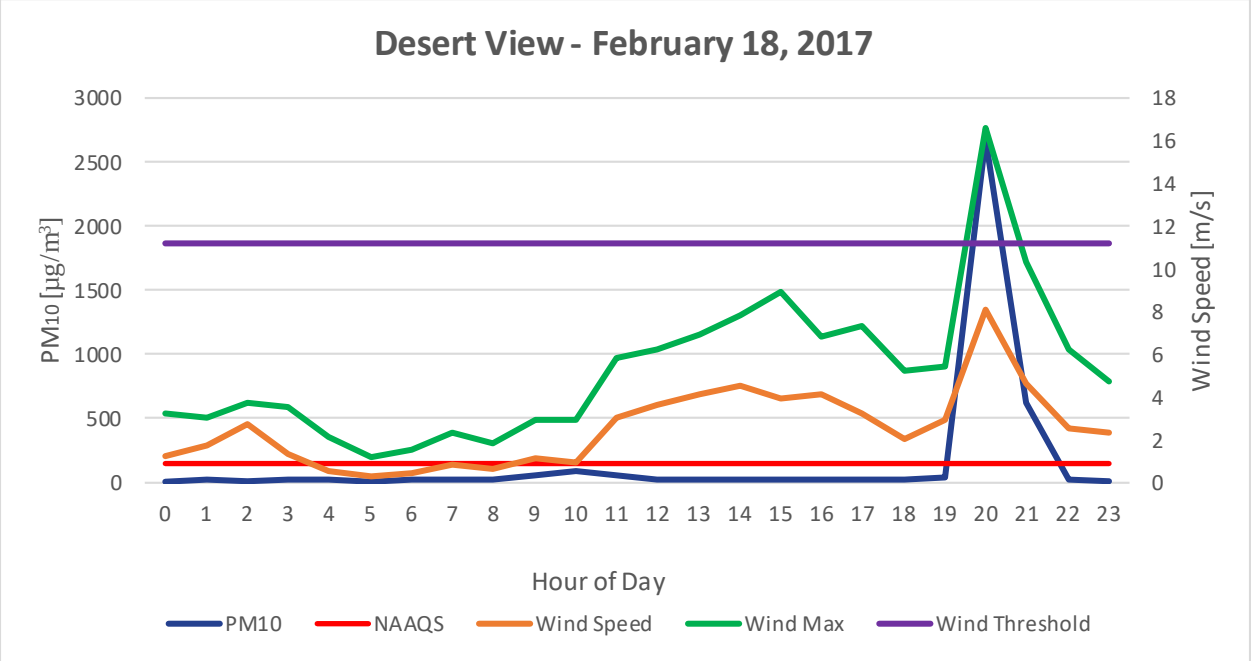


Figure 4-7. NMED monitoring network hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2012-2016, the Desert View monitoring site recorded 43 exceedances of the PM_{10} NAAQS (Figure 4-8). 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.

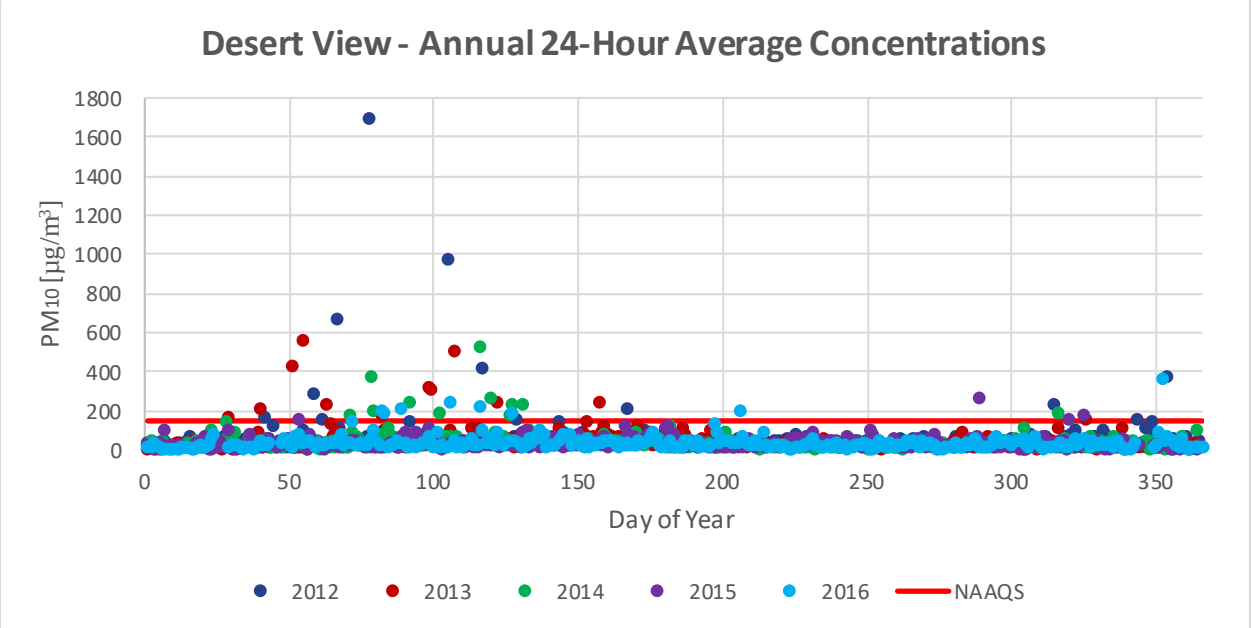


Figure 4-8. 24-hour averages by day of year from 2012-2016.

Spatial and Temporal Variability

As demonstrated in Figure 4-9, 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.

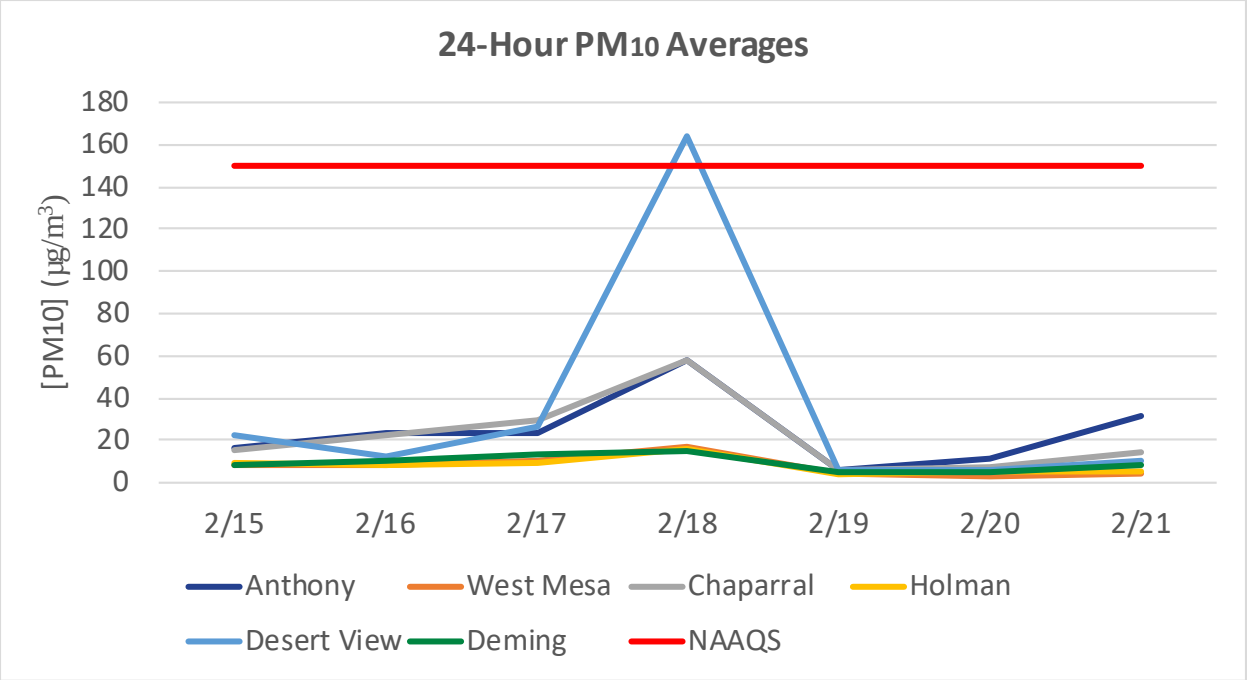


Figure 4-9. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

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 2012-2016. The recorded value for this day (164 µg/m³) is above the 95th percentile of historical data.

Statistic\MonitoringSite	Anthony	West Mesa	Chaparral	Holman	Desert View	Deming
Max	1739	487	1606	1449	1691	1098
99th Percentile	288	148	218	178	244	216
95th Percentile	95	50	79	60	95	61
75th Percentile	51	21	34	30	42	27
50th Percentile	36	14	23	20	28	19
25th Percentile	24	10	15	13	18	12
5th Percentile	13	5	6	6	8	6
Mean	46	21	32	28	39	27

Table 4-4. 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 164 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 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: February 23, 2017

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 5-1).

AQS Flag	AQS ID	Site Name	24-Hour Average Concentration	Max 1-Hour Wind Speed	Max Gust
RJ	35-013-0021	6ZM Desert View	175 µg/m^3	11.8 m/s	21.2 m/s

Table 5-1. 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 5-1). At the 2100 hour, an area of low pressure moved over the Oklahoma panhandle. Aloft, the low-pressure center of the storm system hovered over the Great Plains. 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 providing the turbulence required for vertical mixing and entrainment of dust.

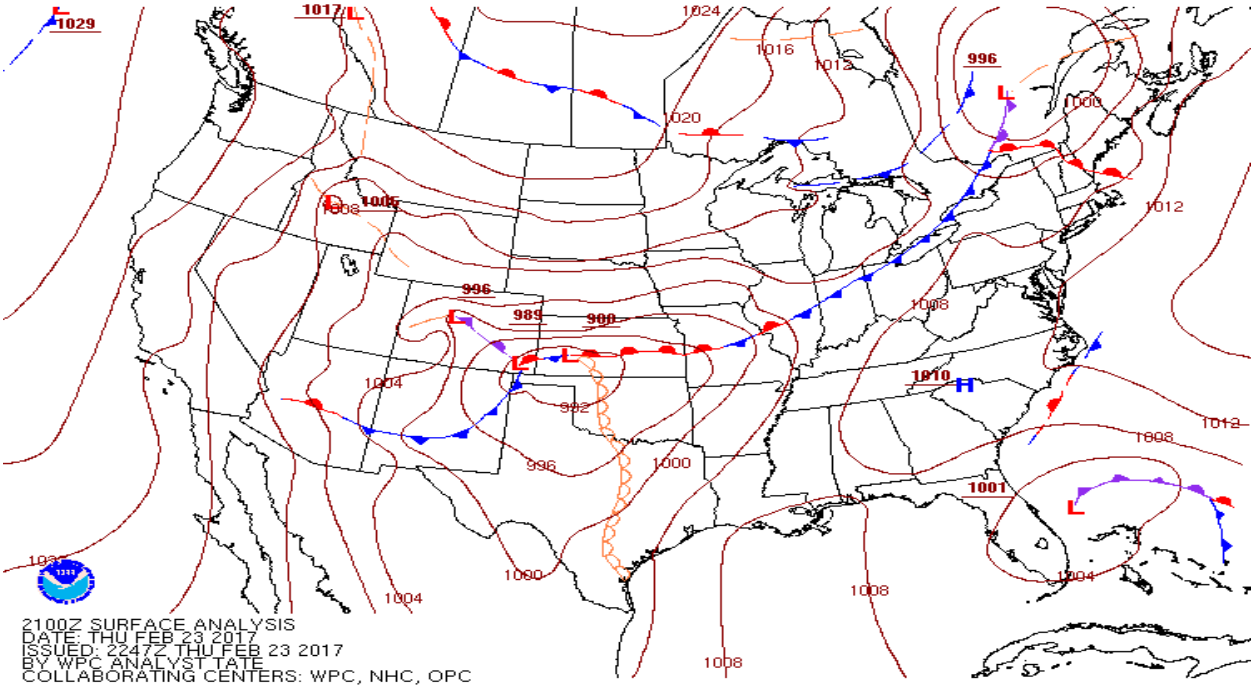


Figure 5-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

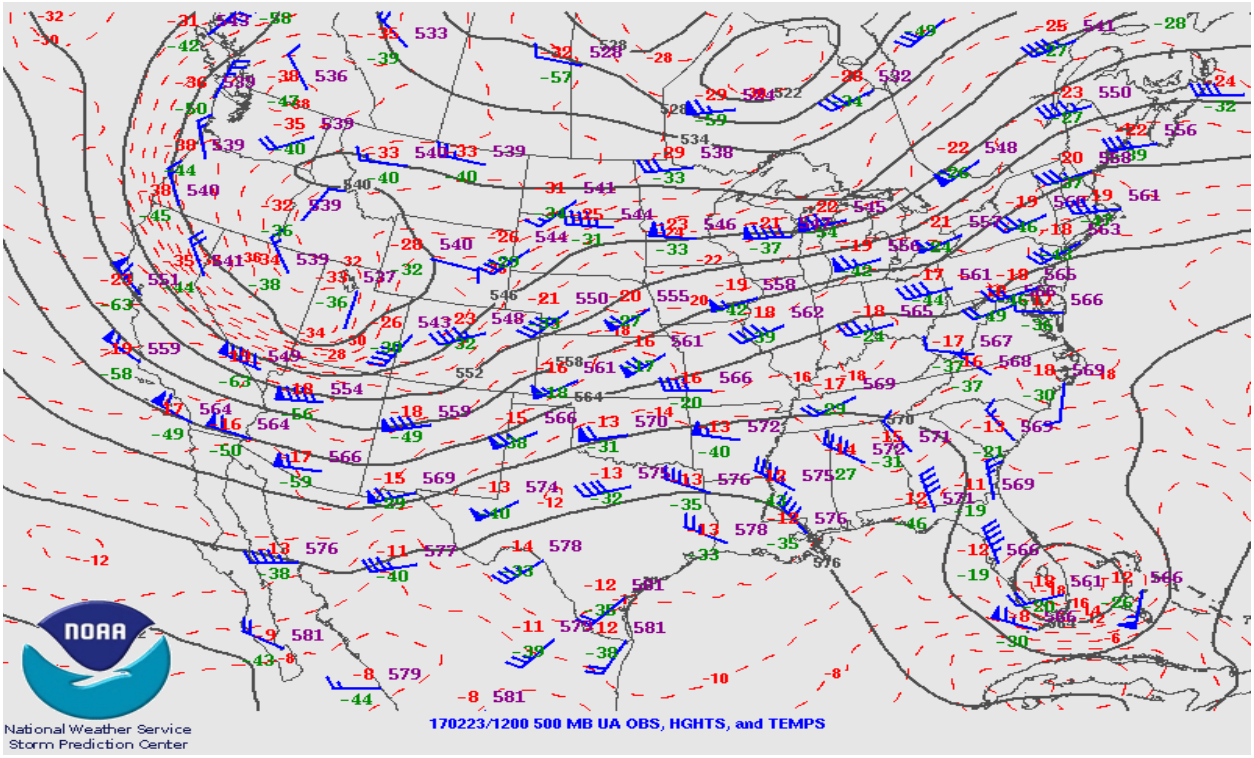


Figure 5-2. Upper air weather map for February 23, 2017 at the 1200 hour. Wind barbs depict wind speed (knots) and direction.

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. Anthropogenic sources of dust near NMED's monitoring sites include: disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

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, Chaparral, Holman, West Mesa and Deming monitoring sites beginning at the 0800 hour and lasted through the 1700 hour. PM_{10} concentrations began to exceed the NAAQS at the Anthony and Chaparral monitoring sites beginning at the 1000 hour. Hourly concentrations remained elevated through the 1600 hour. Table 5-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event.

Hour	Desert View			Anthony			Chaparral		
	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)
0800	17	1.9	7.1	32	3.2	9.8	53	8.8	15.8
0900	90	7.4	14.3	146	8.6	13.9	117	10.2	17.4
1000	129	8.6	15.3	188	9.5	14.8	180	11.3	17.5
1100	937	10.7	19.2	102	9	14	158	11.5	19.8
1200	718	10.7	19.9	146	9.5	15.8	180	11.9	19.2
1300	1038	11.8	21.2	212	10.3	16.1	180	12.2	19.5

1400	459	9.5	17.7	157	9.6	16.2	376	13.2	20.7
1500	151	8.8	16.3	95	9.2	15.8	180	12.1	20.9
1600	197	9.4	16.9	82	7.8	13.4	51	9.9	16.6
1700	132	8.4	15.1	38	7.1	12	41	9.2	15.3

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, aloft an upper short wave moved across Colorado and at the same time a strong surface trough over the Oklahoma panhandle. 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 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 Desert View, West Mesa, Chaparral, and Holman monitoring sites recorded wind speeds above this threshold for 9 hours from the 0800 to the 1600 hour (Figure 5-3). The wind speeds at the upwind Deming monitoring site also reached the high wind threshold.

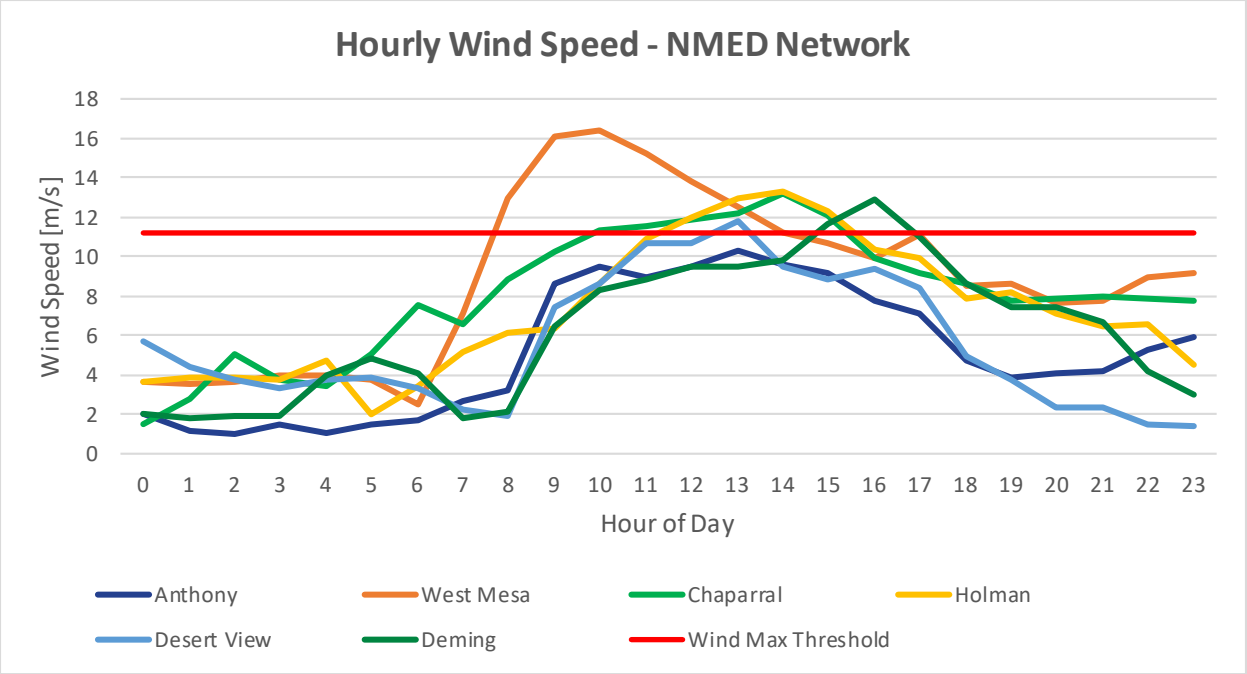


Figure 5-3. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

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

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 represented as pink bands from the VIIRS RGB dust product as 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 (Figures 5-4 & 5-5). 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 site at the time of the satellite pass (12:24 and 2:05 PM MDT) that captured the imagery.

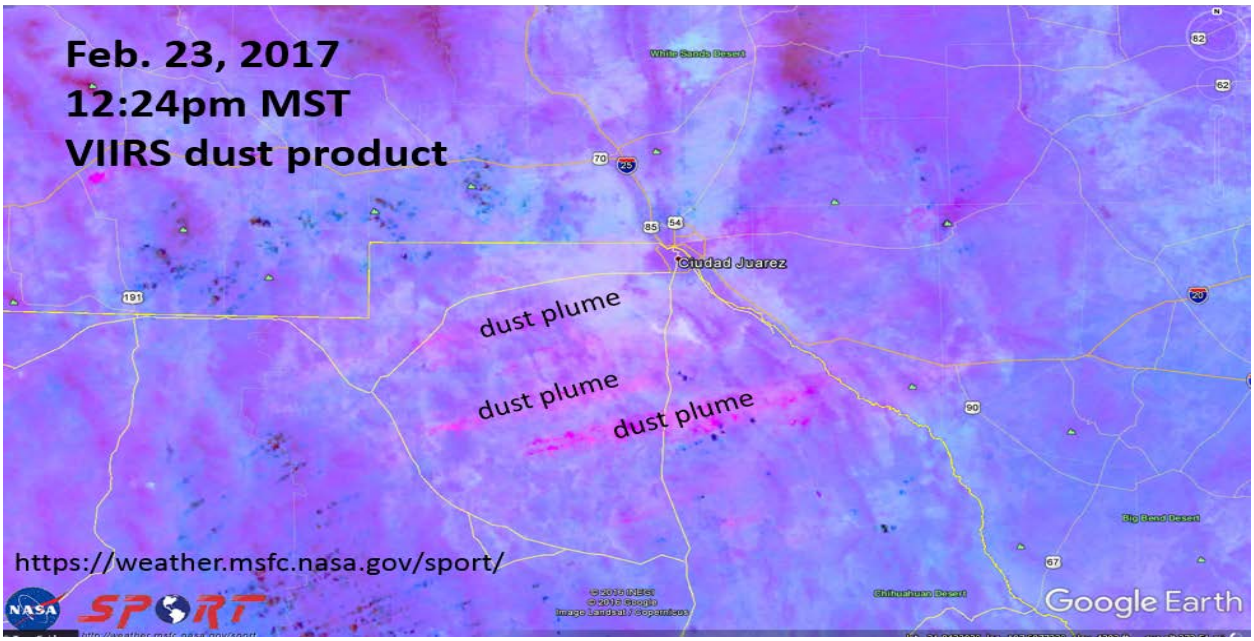


Figure 5-4. VIIRS RGB dust product imagery from the Suomi NPP Satellite showing southwestern New Mexico, northern Chihuahua and western Texas. Imagery obtained from NASA's SPORT website. Pink area represents dust plumes.

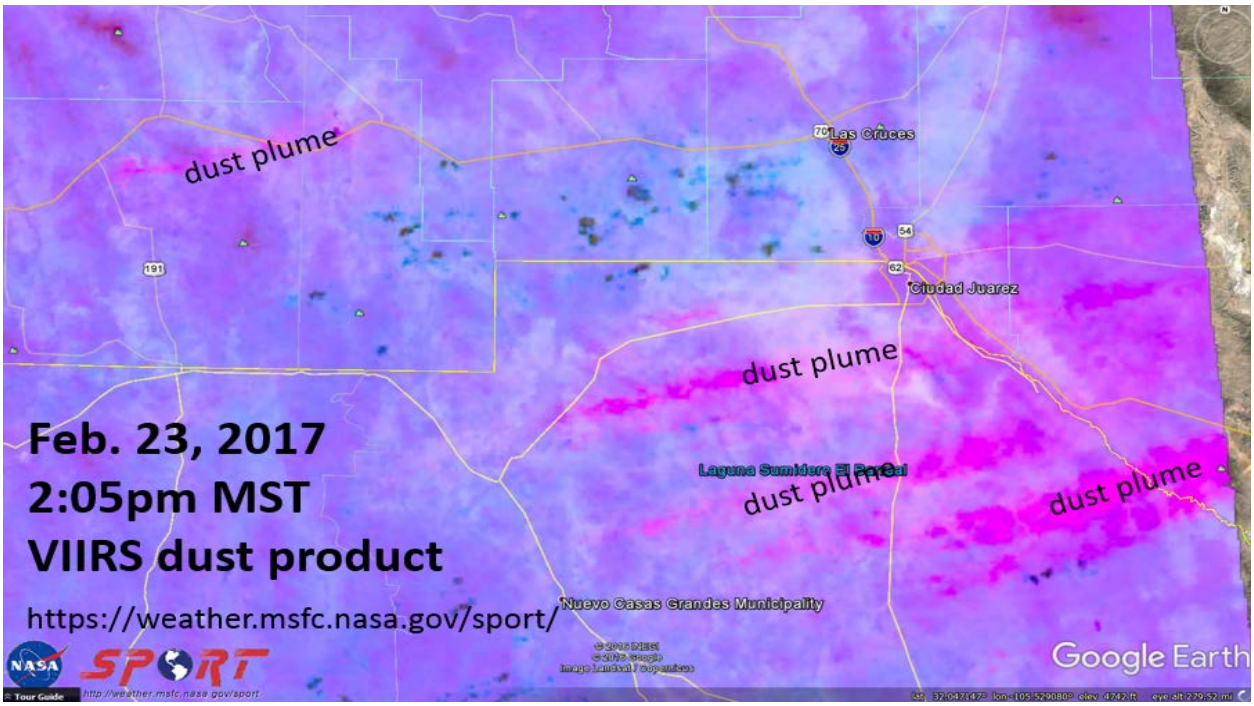


Figure 5-5. VIIRS RGB dust product imagery from the Suomi NPP Satellite showing southwestern New Mexico, northern Chihuahua and western Texas. Imagery obtained from NASA's SPORT website. Pink area represents dust plumes.

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 westerly winds today in the 30 to 35 mph range with gusts to 45 mph expected…High wind warning from 11 am this morning to 6 am MST Friday"

Spatial and Transport Analysis

HYSPLiT Backtrajectory Analysis

A back-trajectory analysis using the HYSPLIT (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 5-6). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

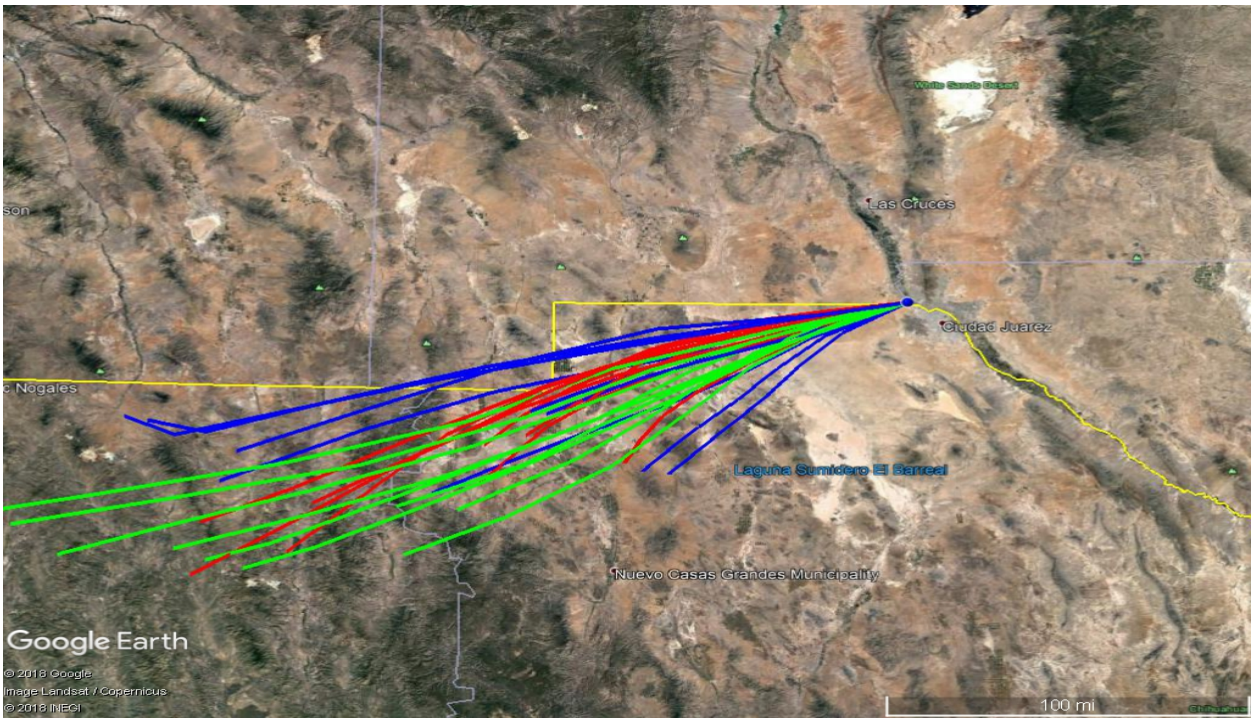


Figure 5-6. HYSPLiT back-trajectory analyses using the Ensemble mode for Desert View Monitoring site

Wind Direction and Elevated PM_{10} Concentrations

A pollution rose (Figure 5-7) was created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m³ (1000 -1700 hour). During the event, winds blew from the west 100% of the time coinciding with peak PM_{10} concentrations.

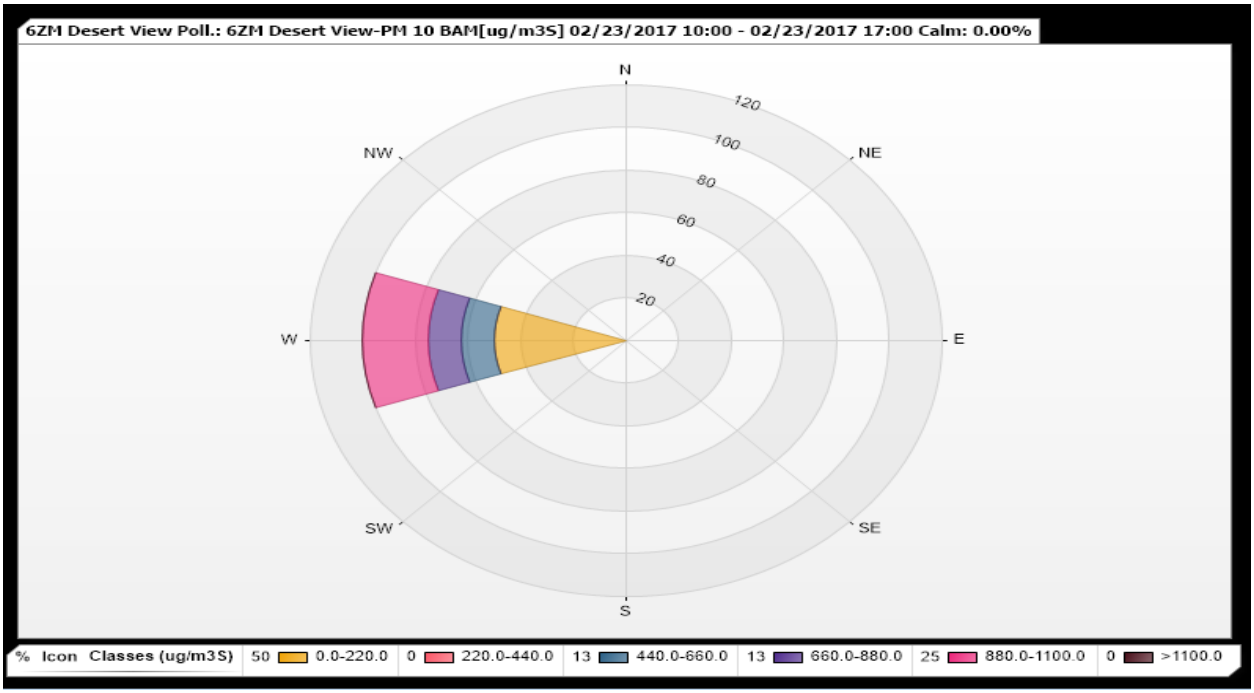


Figure 5-7. Pollution rose for the Desert View monitoring site

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

The high wind blowing dust event generated strong southwesterly winds beginning at the 0800 hour and lasting through the 1700 hour. During this time, peak hourly PM_{10} concentrations ranged from 212 to 1038 µg/m³ at NMED monitoring sites (Figure 5-8). 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 10.3 to 16.4 m/s were recorded at Anthony and West Mesa monitoring sites during the peak PM_{10} concentrations of the event. The time series plot in Figure 5-9 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

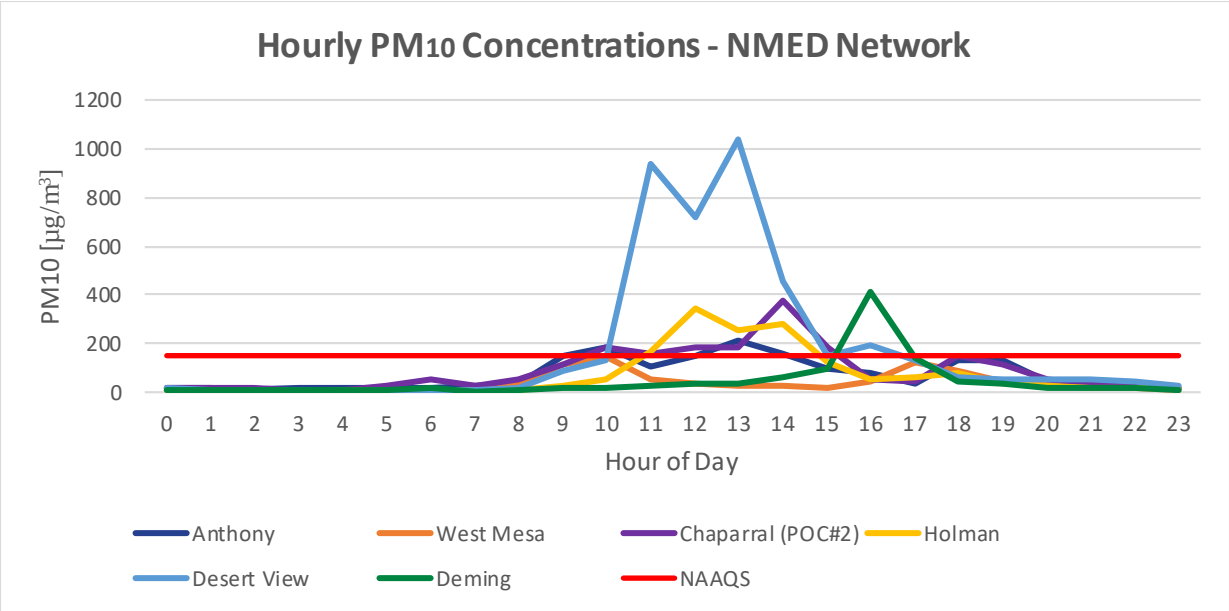


Figure 5-8. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

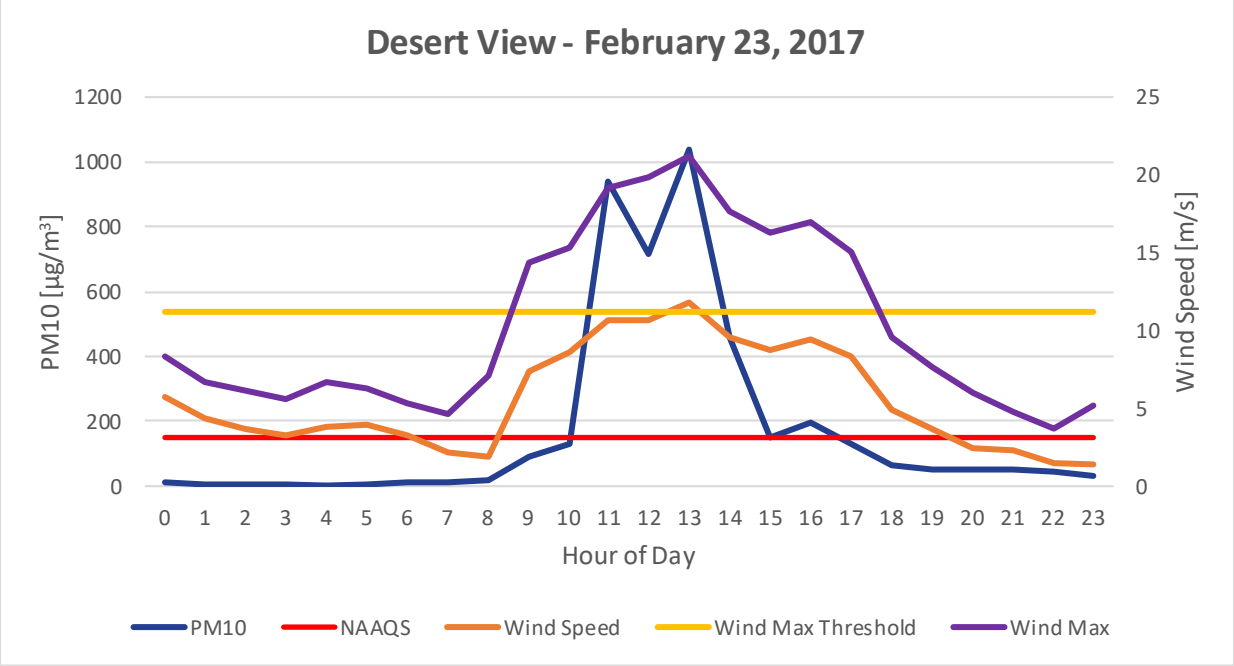


Figure 5-9. NMED monitoring network hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2012-2016, the Desert View monitoring site recorded 43 exceedances of the PM_{10} NAAQS (Figure 5-10). 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.

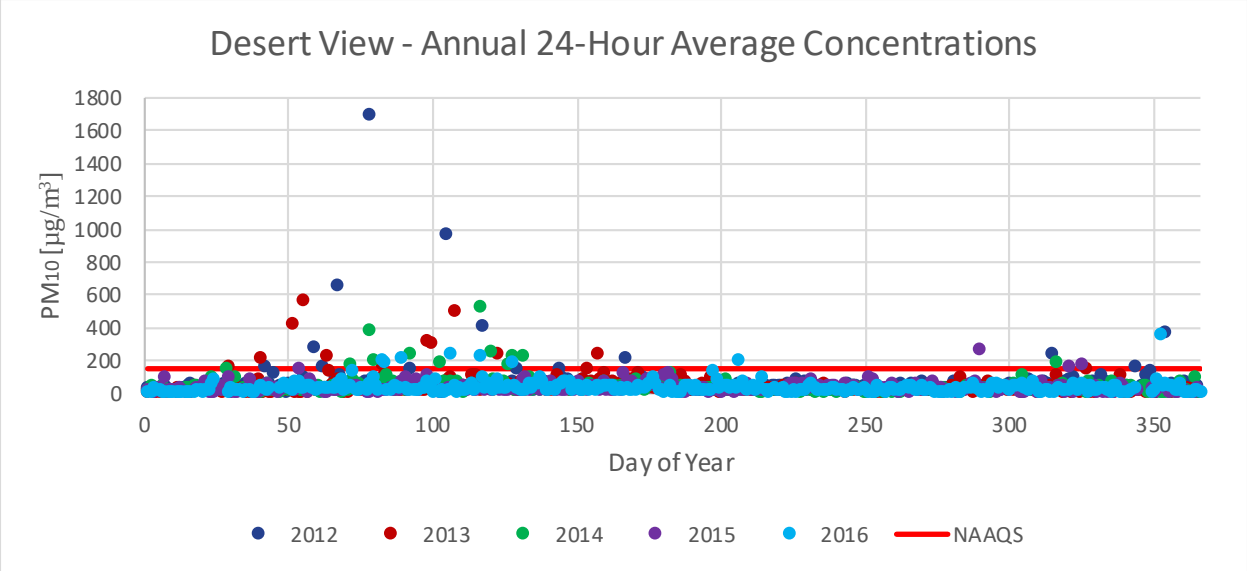


Figure 5-10. 24-hour averages by day of year from 2012-2016 for the Desert View monitoring site.

Spatial and Temporal Variability

As demonstrated in Figure 5-11, 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 30 µg/m³, demonstrating the influence high winds have on PM_{10} concentrations in the area.

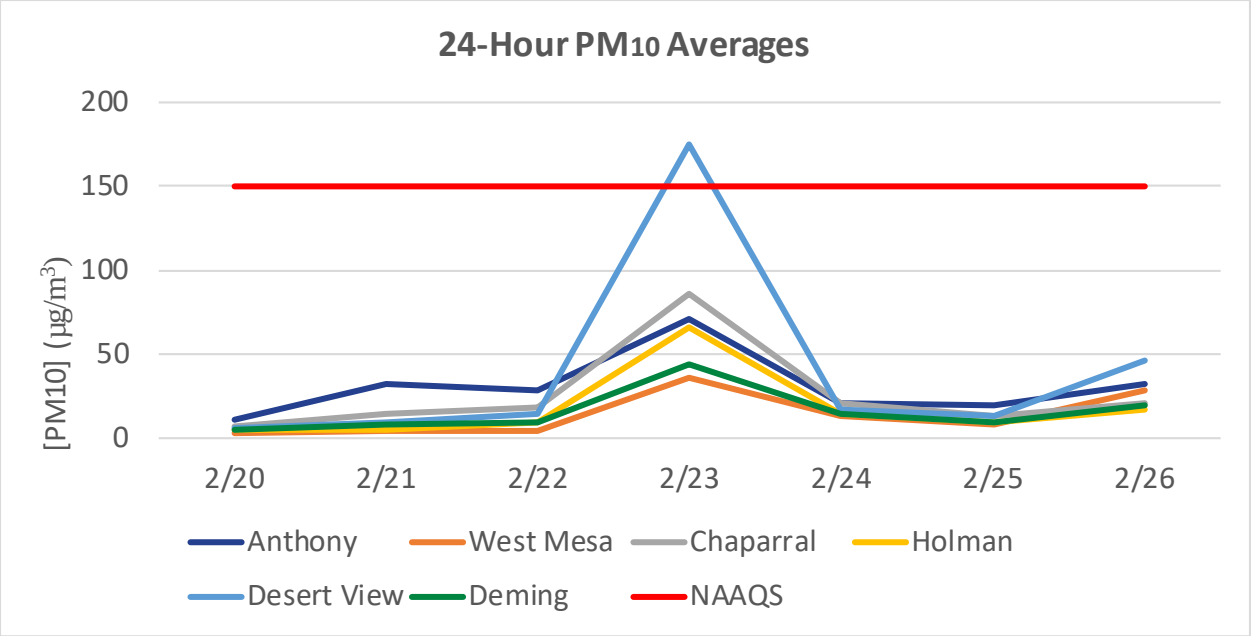


Figure 5-11. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

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 2012-2016. The recorded value for this day (175 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	288	148	218	178	244	216
95th Percentile	95	50	79	60	95	61
75th Percentile	51	21	34	30	42	27
50th Percentile	36	14	23	20	28	19
25th Percentile	24	10	15	13	18	12
5th Percentile	13	5	6	6	8	6
Mean	46	21	32	28	39	27

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 the Desert View monitoring site. The monitored PM_{10} 24-Hour Average of 175 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.

6. HIGH WIND EXCEPTIONAL EVENT: February 28, 2017

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 6-1).

AQS Flag	AQS ID	Site Name	24-Hour Average Concentration	Max 1-Hour Wind Speed	Max Gust
RJ	35-013-0020	6ZK Chaparral	218 µg/m³ (POC #2)	13.8 m/s	23.5 m/s
RJ	35-013-0021	6ZM Desert View	338 µg/m³	12.9 m/s	22.7 m/s

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

A sharp trough swung across the southwestern U.S. and passed over New Mexico during the afternoon. Timing was perfect for the vertical mixing that the maximum temperatures brought. Pressure gradients remained tight due to the position at the base of the passing trough. 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 panhandle of Oklahoma. Aloft, the low-pressure center of the storm system hovered over the coast of southern California. 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 providing the turbulence required for vertical mixing and entrainment of dust.

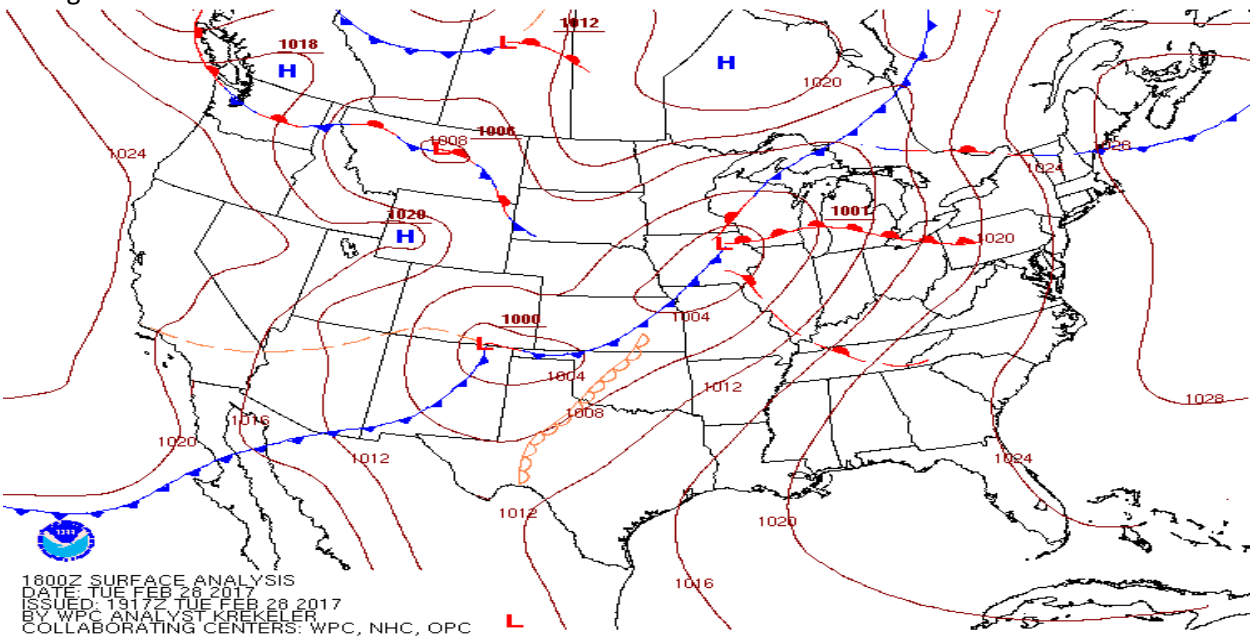


Figure 6-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

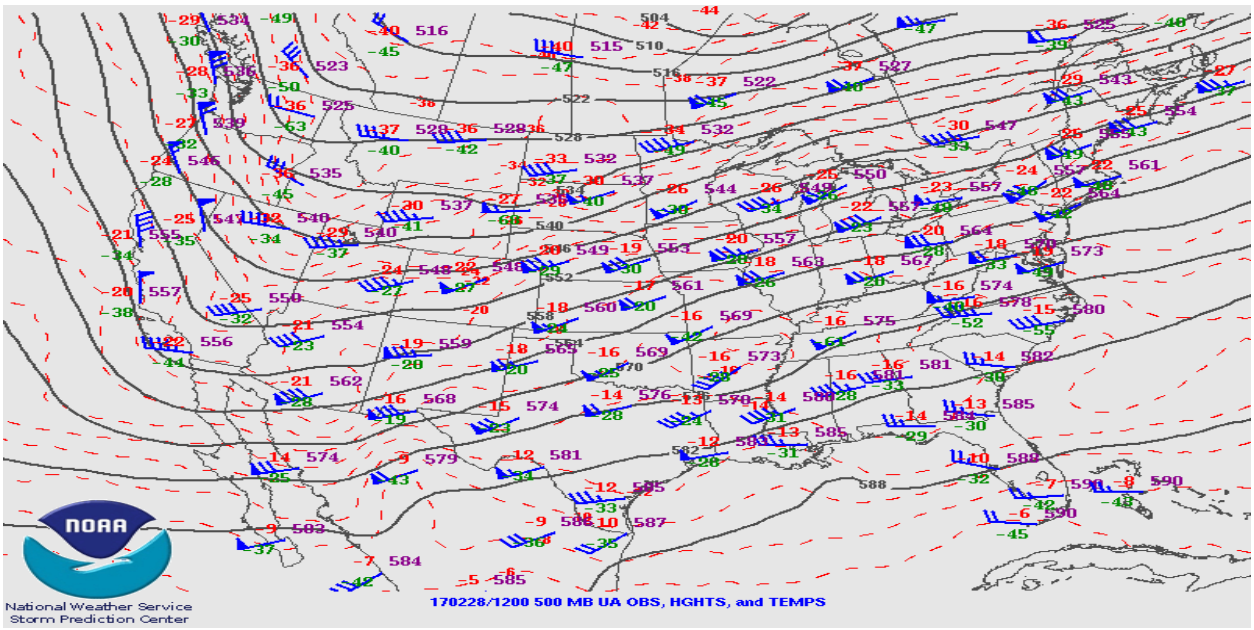


Figure 6-2. Upper air weather map for February 28, 2017 at the 1200 hour. Wind barbs depict wind speed (knots) and direction.

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. Anthropogenic sources of dust near NMED's monitoring sites include: disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

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 West Mesa and Deming monitoring sites beginning at the 0900 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 0900 hour. Hourly concentrations remained elevated through the 1700 hour. Table 6-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event.

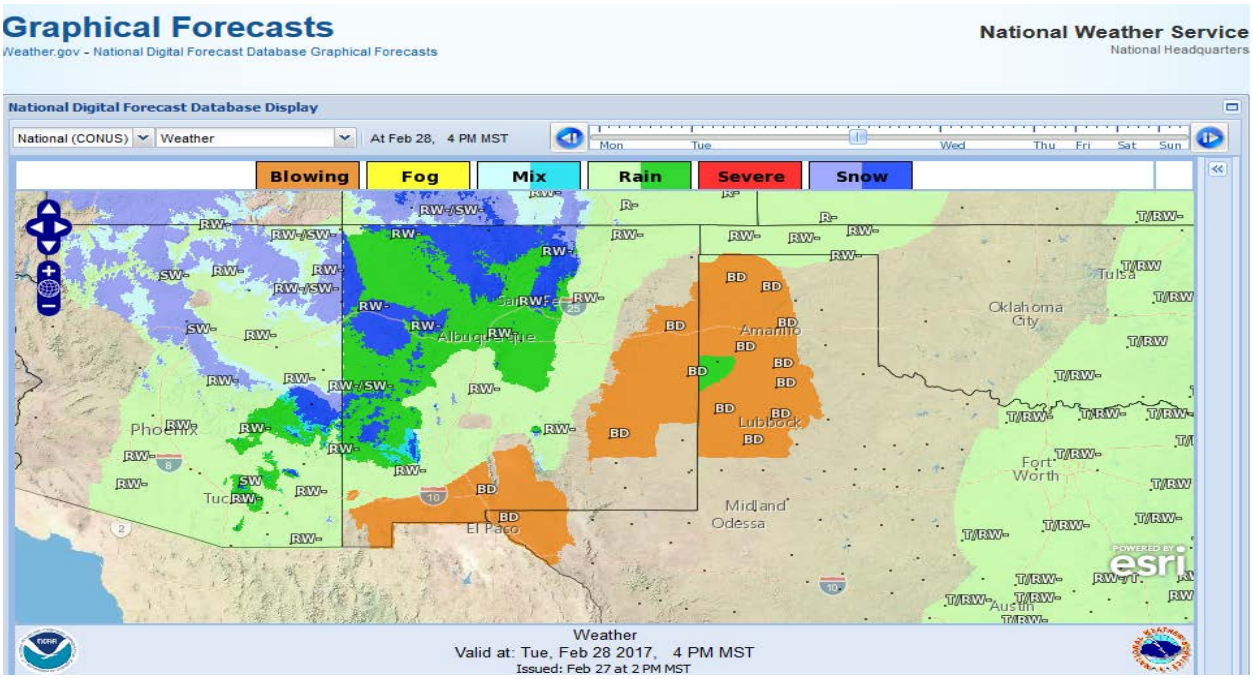
Hour	Chaparral			Desert View			West Mesa		
	PM_{10} ($\mu g/m^3$)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} ($\mu g/m^3$)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} ($\mu g/m^3$)	Wind Speed (m/s)	Wind Gust (m/s)
0900	178	8.1	20.3	14	5.5	11.5	24	10	19.6
1000	161	7.9	18.4	171	7.4	13.2	322	15.6	23.7
1100	1296	12.1	23.5	2388	10.9	22.7	183	14.6	21.6
1200	950	13.8	22	2522	12.9	20.2	356	15.1	24.3
1300	725	12.7	23.1	1094	11.9	19.5	676	15.6	24.1
1400	615	12.6	20.6	349	9.7	19	124	13.6	22.6
1500	503	13	20.7	483	9.9	20.2	51	11.7	19.2
1600	222	12.1	19.8	596	9.4	18.2	61	11.9	19.2
1700	80	10.5	19.3	183	8.2	16.7	129	11.6	17.7

Table 6-2. 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 at the panhandle of Oklahoma 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 (Figure 6-3).

Forecast for El Paso, TX
Today and Tomorrow's Forecast

Monday, Feb 27:	Moderate	Yellow	Particle Pollution (10 microns)
Tuesday, Feb 28:	Unhealthy for Sensitive Groups	Orange	Particle Pollution (10 microns)



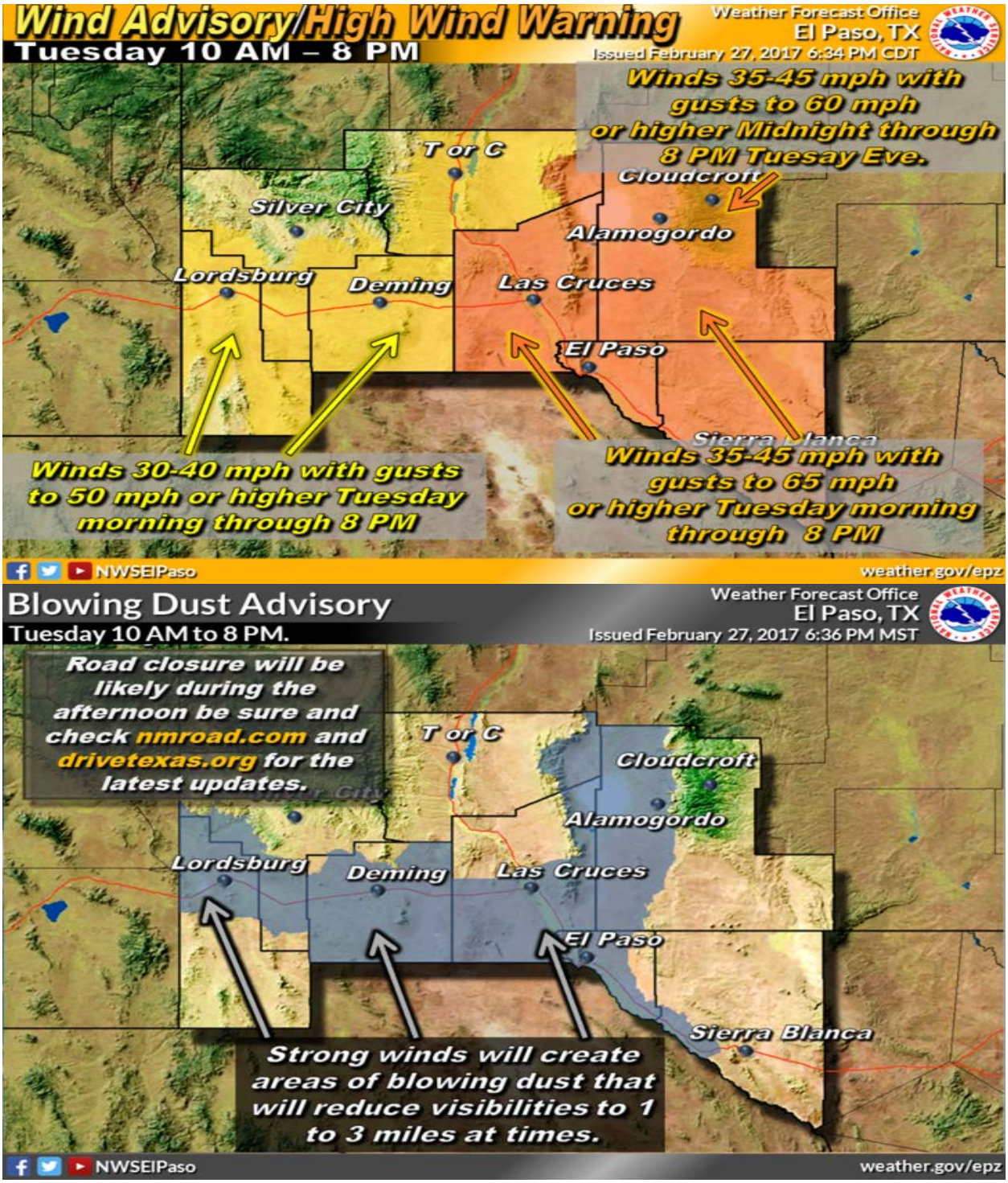


Figure 6-3. NWS Forecast Graphic for the event.

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 Anthony, Chaparral, Desert View, Holman, and West Mesa monitoring sites recorded wind speeds above this threshold for 9 hours from the 0900 to the 1700 hour (Figure 6-4). The Wind speeds at the upwind Deming monitoring site also reached the high wind threshold.

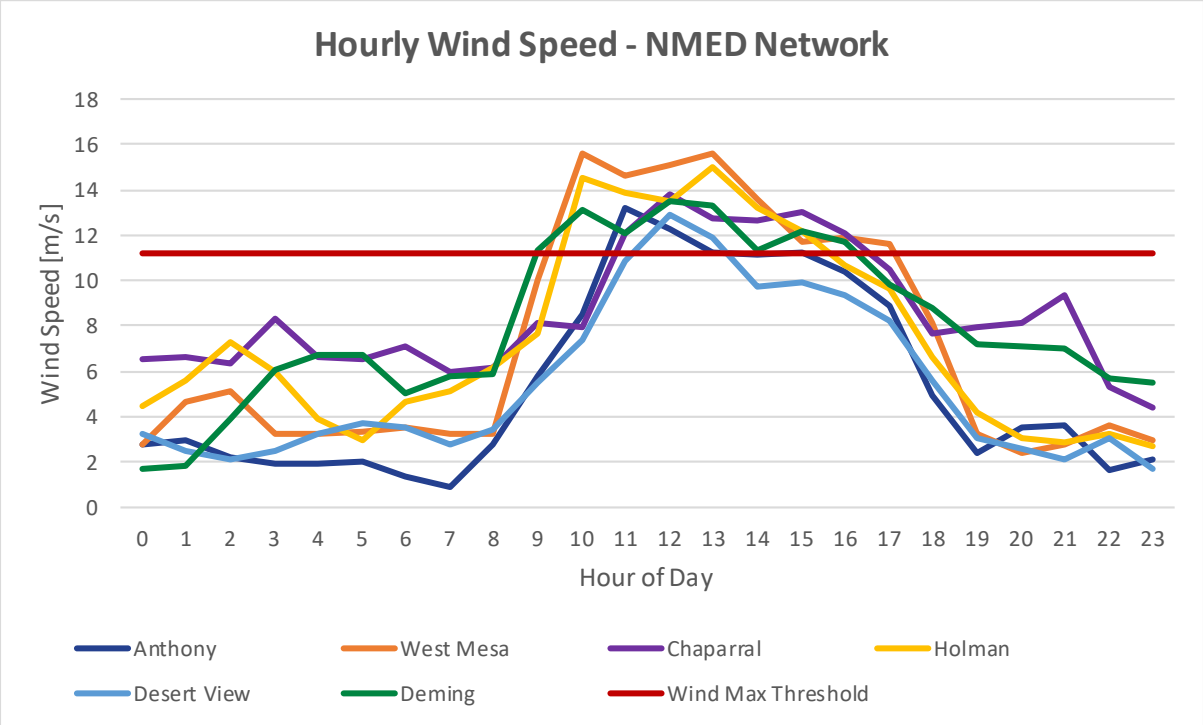


Figure 6-4. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

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 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 Desert View monitoring technician reported seeing a large plume of dust overcome the site and shake the structure housing the equipment because of the strong wind gusts. The technician reported low visibility conditions on-site.

The documentation and analysis presented in this section demonstrates that all identified sources that may have caused or contributed to the exceedances 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 VIIRS satellite RGB dust imagery with dust plumes originating upwind of NMED's monitoring sites near Ascension and Janos, Chih. which are represented as pink bands. 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 6-5). 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 (1230 hour MDT) that captured the imagery.

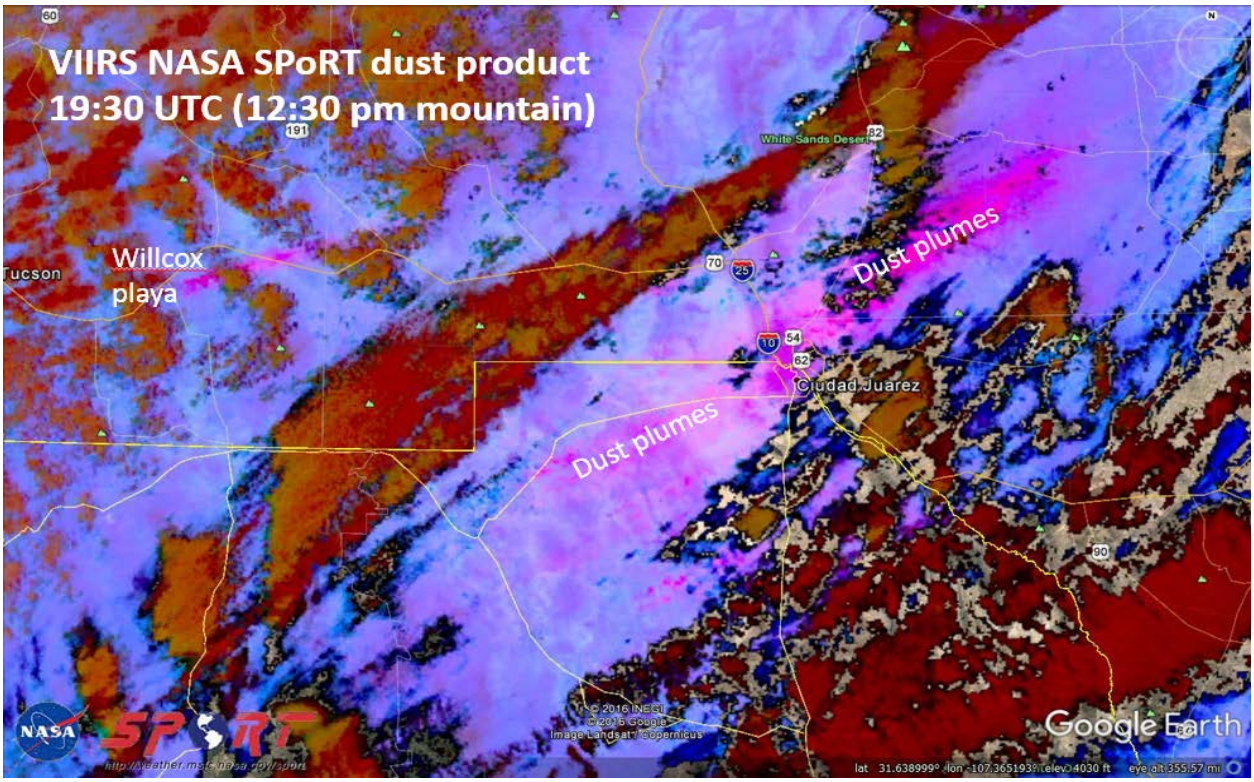


Figure 6-5. VIIRS RGB dust product imagery from the Suomi NPP Satellite showing southwestern New Mexico, northern Chihuahua and western Texas. Imagery obtained from NASA's SPORT website via NM Border Blog's website by Dr. Dave DuBois.

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 6-6). 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 can be found below:

"Gusty and dusty will prevail with sustained winds as high as 40 mph and gusts to near 60 mph. Driving will be difficult and blowing dust will make for dangerously low visibilities and road closures."

"Blowing Dust Advisory from 10 AM this morning to 8 PM MST this evening…High Wind Warning from 10 AM this morning to 8 PM MST this evening."

Pacific storm causes strong winds Tuesday in southern New Mexico

Sun-News Reports , . Published 11:14 a.m. MT Feb. 28, 2017 | **Updated 6:56 p.m. MT Feb. 28, 2017**

(Photo: Sun-News file photo)

LAS CRUCES — It was a good day to stay inside Tuesday.

Multiple weather hazards, including a High Wind Warning, a Blowing Dust Advisory and a Red Flag Warning (http://forecast.weather.gov/showsigwx.php?warnzone=NMZ411&warncounty=NMC013&firewxzone=NMZ112&local_place1=2%20Miles%20ESE%20Dona%20Ana%20NM&product1=High+Wind+Warning&lat=32.3913&lon=-106.815#.WLWzMDsrKM8) were in effect most of Tuesday in Las Cruces, southern New Mexico and far west Texas. Stronger than usual winds howled into early evening Tuesday.

At San Augustin Pass, a peak gust of 94 mph happened at 2:15 p.m. Tuesday. That speed was considered at the high end of a Category I (http://www.nhc.noaa.gov/aboutsshws.php) hurricane-force wind.

From about 1 p.m. until 3 p.m., when winds were their strongest and blowing dust was more of factor, visibility in Las Cruces was reduced to 3 miles. But blowing dust was more of a problem in other areas of southern New Mexico. Along a portion of Interstate 10, between Deming and the Arizona state line, the highway was closed to traffic from about 9 a.m. until 4 p.m. because visibility, at times, dropped to less than one-quarter mile.

At 1:15 p.m. Las Cruces experienced its strongest gusts, 59 mph at Las Cruces International Airport. The National Weather Service has an Automated Weather Observation System at the airport that measures and records weather data.

Because of the wind and dust, the Environmental Protection Agency alerted Las Cruces the city's air quality was anticipated to be in the "unhealthy" range for people with sensitivities to dust. People with lung or heart disease, older adults and children were the greatest risks, according to the EPA.

By noon, the humidity in Las Cruces had dropped to 10 percent because of the wind. But temperatures in Las Cruces dropped from a mid-morning high of 68 degrees Fahrenheit to 63 degrees by late afternoon.

No major incidents were reported to Las Cruces police as a result of the windy weather. However, there were posts on the Sun-News' Facebook page of a semi-trailer rollover that happened near the U.S. Border Patrol checkpoint, on I-25, about 20 miles north of Las Cruces. No injuries were immediately reported, but southbound traffic on I-25 was backed up until the semi-trailer could be removed.

Diana Alba Soular
@AlbaSoular

Follow

One of those windy, dusty days here in #LasCruces.
#BadHairDayforEveryone #nmwx
1:26 PM - 28 Feb 2017

1 5

Figure 6-6. Las Cruces Sun News press release describing the high wind event.

Spatial and Transport Analysis

HYSPLiT Backtrajectory Analysis

A back-trajectory analysis using the HYSPLIT (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 (Figure 6-7). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

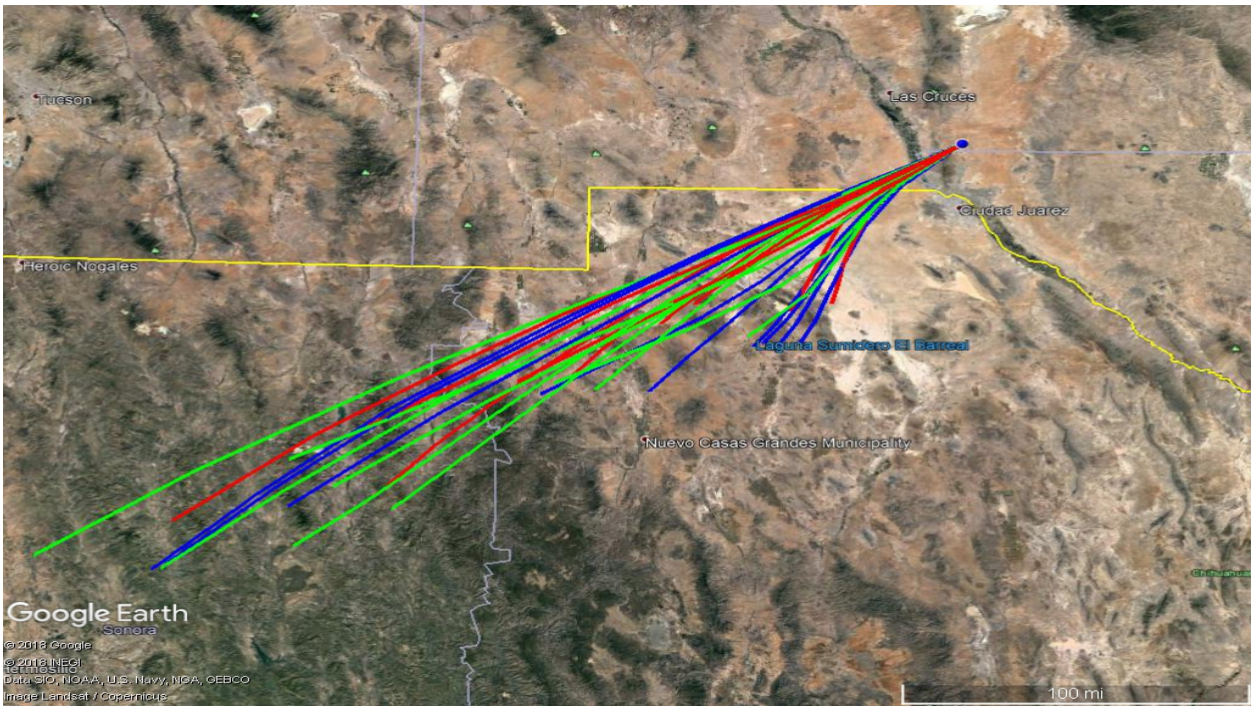


Figure 6-7. HYSPLiT back-trajectory analyses using the Ensemble mode for Chaparral monitoring site.

Wind Direction and Elevated PM_{10} Concentrations

Pollution roses (Figures 6-8 & 6-9) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m³ (0900 -1700 hour). During the event, winds blew from the west southwest 100% of the time coinciding with peak PM_{10} concentrations.

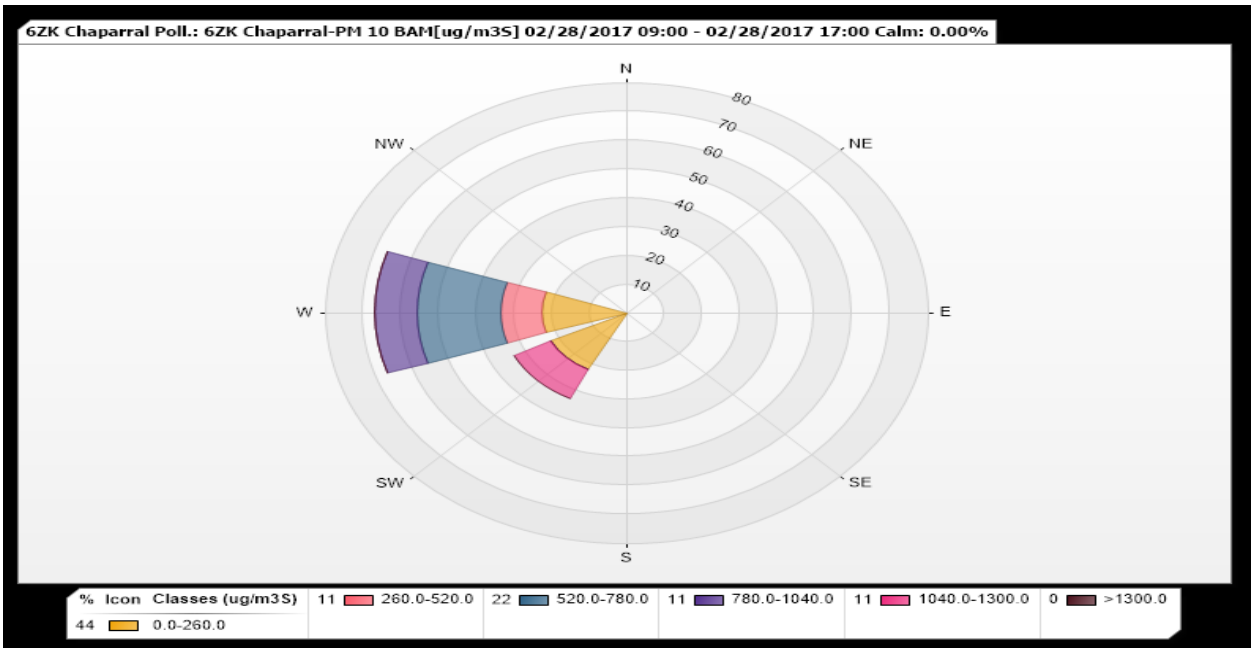


Figure 6-8. Pollution rose for the Chaparral monitoring site.

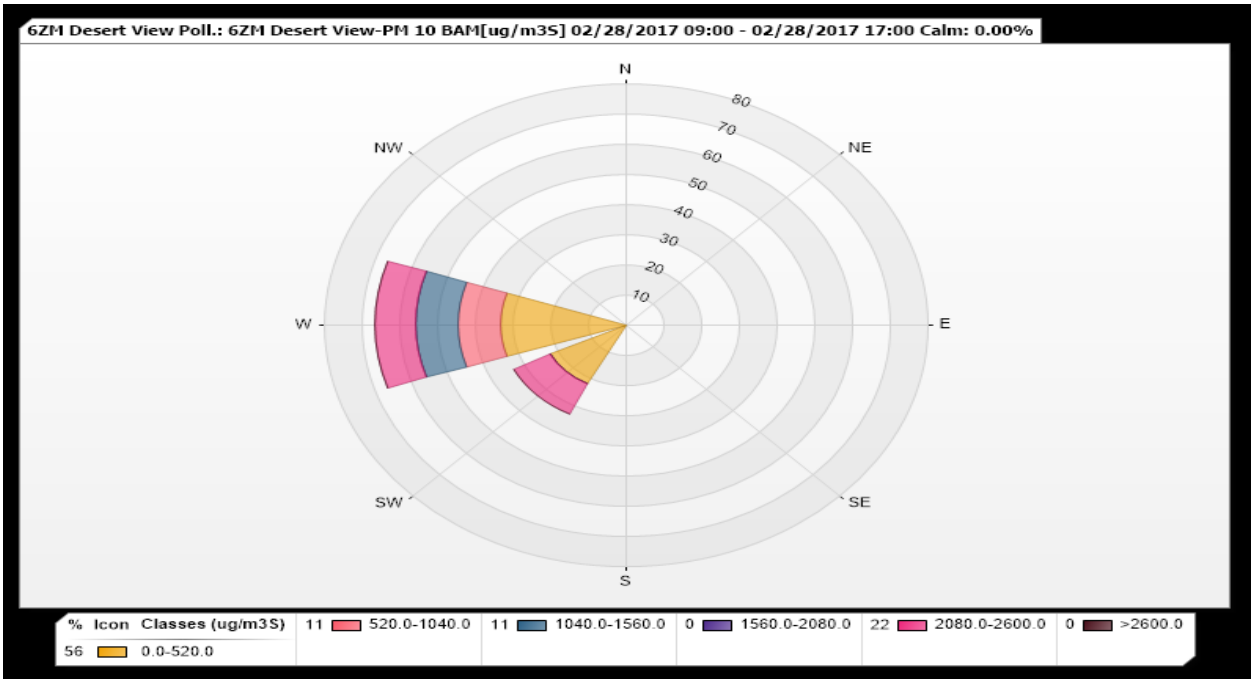


Figure 6-9. Pollution rose for the Desert View monitoring site.

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

The high wind blowing dust event generated strong southwesterly winds beginning at the 0900 hour and lasting through the 1700 hour. During this time, peak hourly PM_{10} concentrations ranged from 935 to 2522 µg/m^3 at NMED monitoring sites (Figure 6-10). 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 12.9 to 15.6 m/s were recorded at the Desert View and West Mesa monitoring sites during the peak PM_{10} concentrations of the event. The time series plots

in Figures 6-11 & 6-12 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

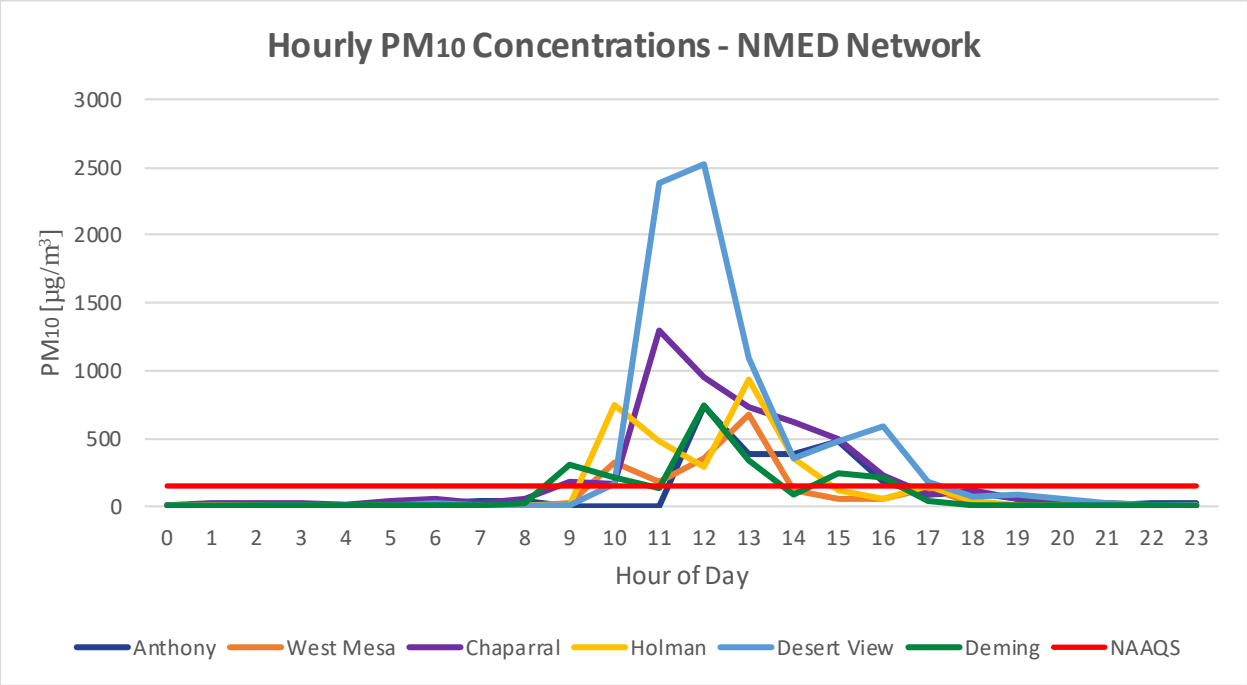


Figure 6-10. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

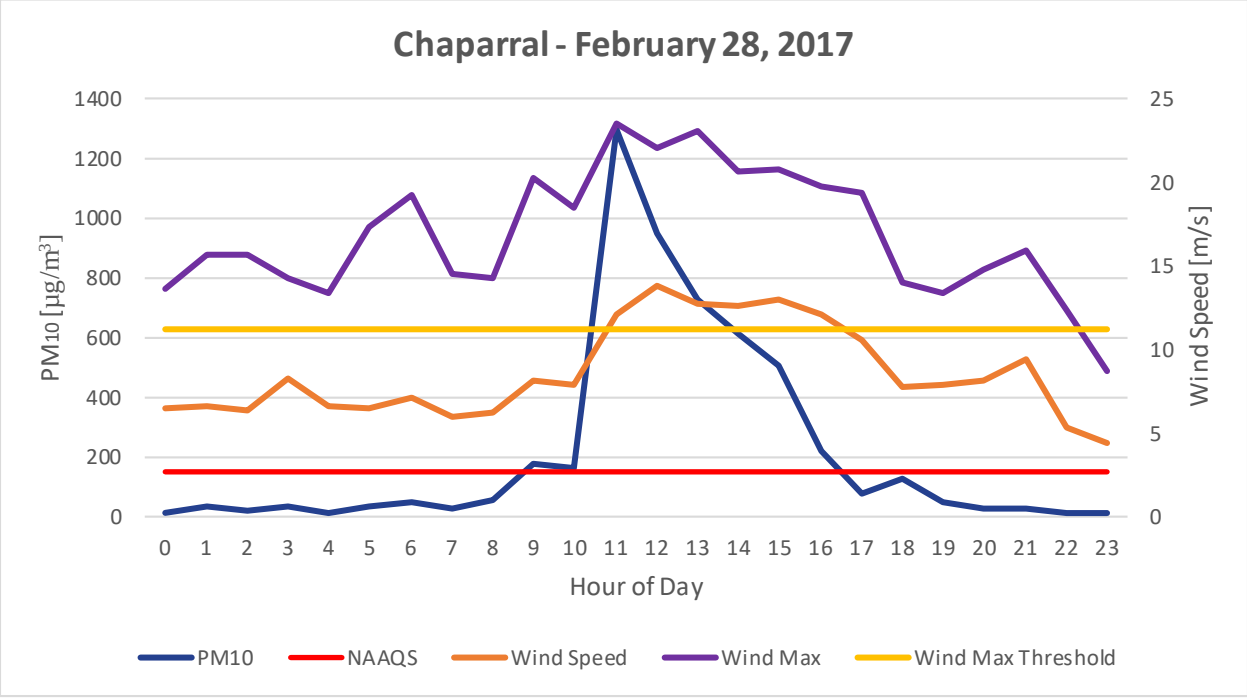


Figure 6-11. NMED monitoring network hourly PM_{10} and wind speed data for the high wind blowing dust event.

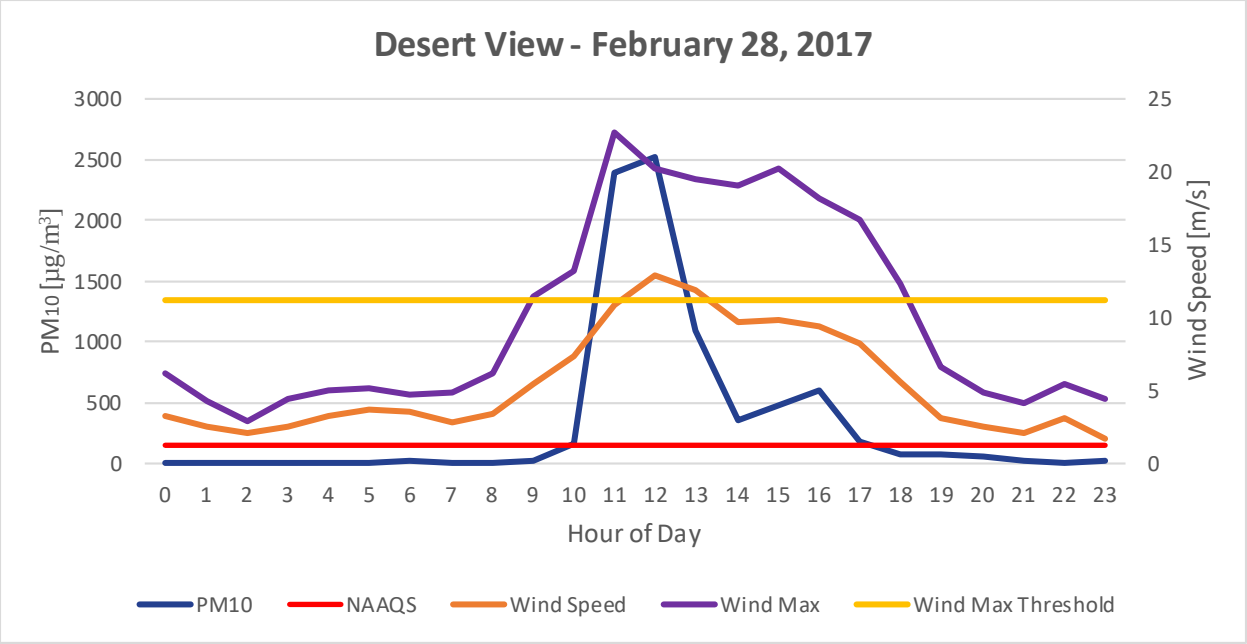


Figure 6-12. NMED monitoring network hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2012-2016, the Chaparral and Desert View monitoring sites recorded 35 & 43 exceedances of the PM_{10} NAAQS, respectively (Figure 6-13 & 6-14). The maximum 24-hour averages PM_{10} concentrations 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.

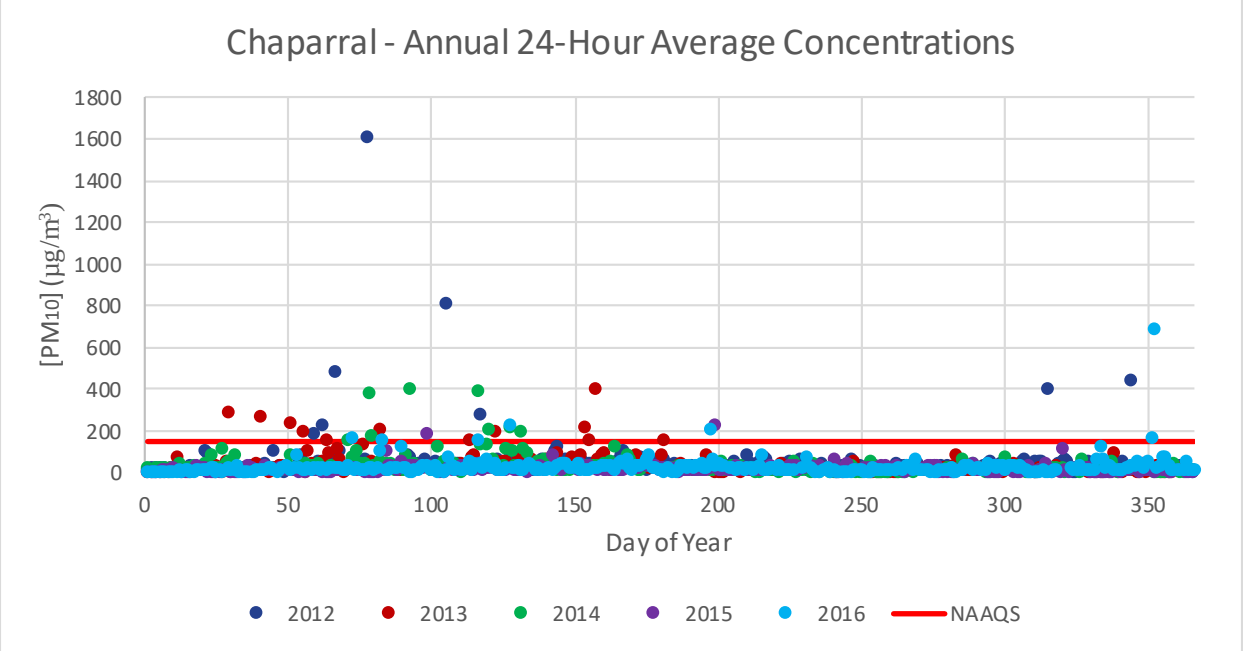


Figure 6-13. 24-hour averages by day of year from 2012-2016 for the Chaparral monitoring site.

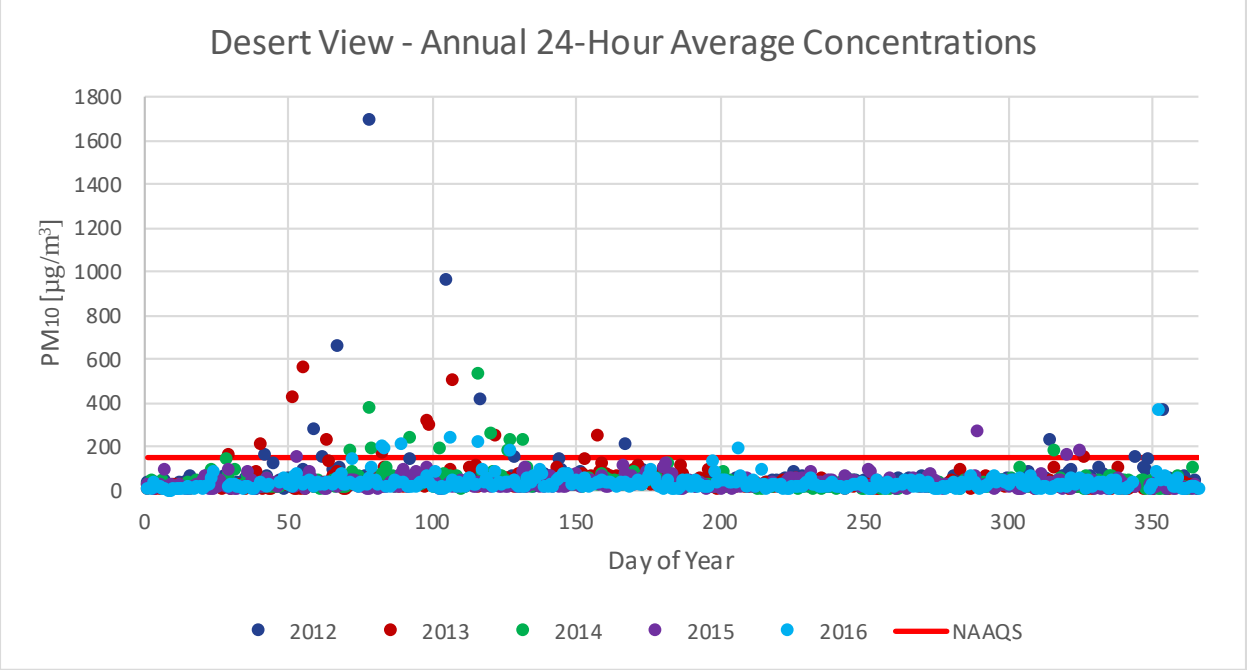


Figure 6-14. 24-hour averages by day of year from 2012-2016 for the Desert View monitoring site.

Spatial and Temporal Variability

As demonstrated in Figure 6-15, 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 30 µg/m^3, demonstrating the influence high winds have on PM_{10} concentrations in the area.

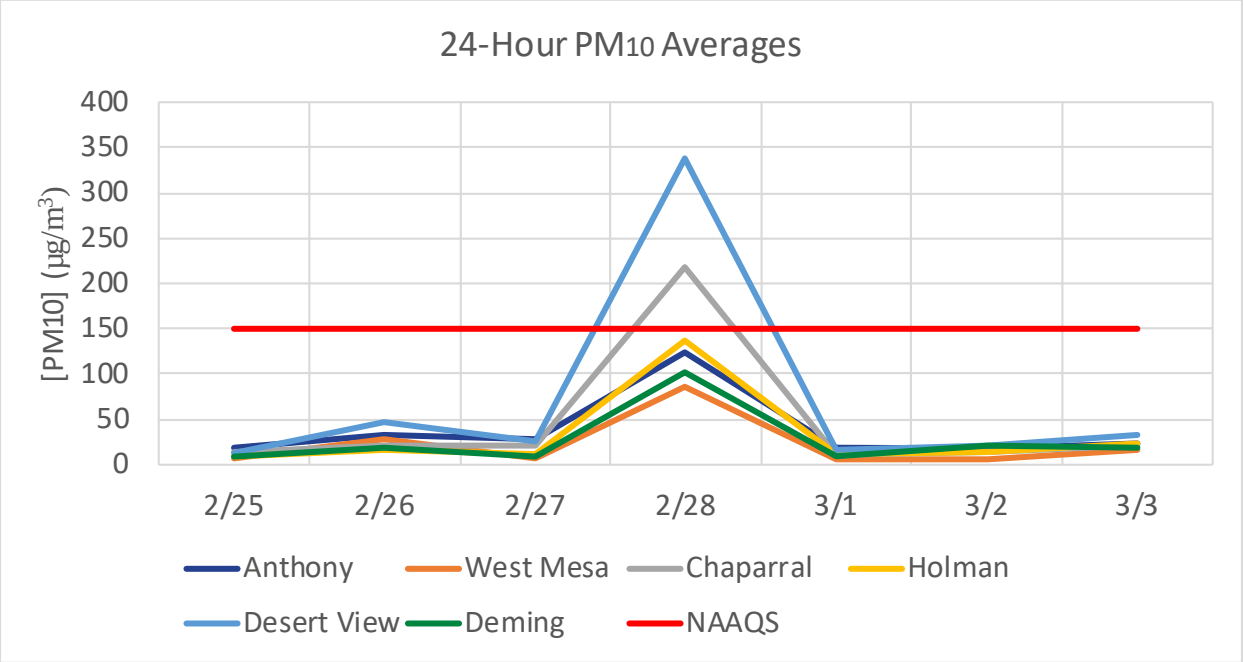


Figure 6-15. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

Percentile Ranking

Table 6-3 shows the 24-Hour Average PM_{10} data distribution recorded at 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 2012-2016. The recorded values for this day 1606 (Chaparral) & 1691 (Desert View) µg/m^3 are above the 99th percentile of historical data, setting the maximum values for both monitoring sites.

Statistic\MonitoringSite	Anthony	West Mesa	Chaparral	Holman	Desert View	Deming
Max	1739	487	1606	1449	1691	1098
99th Percentile	288	148	218	178	244	216
95th Percentile	95	50	79	60	95	61
75th Percentile	51	21	34	30	42	27
50th Percentile	36	14	23	20	28	19
25th Percentile	24	10	15	13	18	12
5th Percentile	13	5	6	6	8	6
Mean	46	21	32	28	39	27

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 Chaparral and Desert View monitoring sites. The monitored PM_{10} 24-Hour Averages of 1606 (Chaparral) and 1691 (Desert View) µg/m^3 are above the 99th 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: March 23, 2017

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 7-1).

AQS Flag	AQS ID	Site Name	24-Hour Average Concentration	Max 1-Hour Wind Speed	Max Gust
RJ	35-013-0020	6ZK Chaparral	721 µg/m³ (POC #2)	15.5 m/s	24.7 m/s
RJ	35-013-0016	6CM Anthony	308 µg/m³	12.7 m/s	21.6 m/s
RJ	35-013-0021	6ZM Desert View	538 µg/m³	11.4 m/s	23.2 m/s
RJ	35-029-0003	7E Deming	157 µg/m³	14.4 m/s	22.9 m/s
RJ	35-013-0019	6ZL Holman	211 µg/m³	14.7 m/s	25.7 m/s
RJ	35-013-0024	6WM West Mesa	169 µg/m³	17.1 m/s	26 m/s

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

A deep upper low moved into Nevada this morning with a trailing trough extending into Arizona. This system with an associated cold front moved across New Mexico and Texas. The downslope winds plus upper dynamics in advance of the trough induced strong cyclogeneses over eastern Colorado with a surface trough extending over eastern New Mexico. This scenario greatly increased mid and low-level winds. Warm dry air masses aloft with dry lapse rates allows for stronger flows aloft to mix downwards. As the storm system moved through the state, a pressure gradient formed over southeastern Arizona, southwestern New Mexico and northern Mexico (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 over the Baja Peninsula. 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 providing the turbulence required for vertical mixing and entrainment of dust.

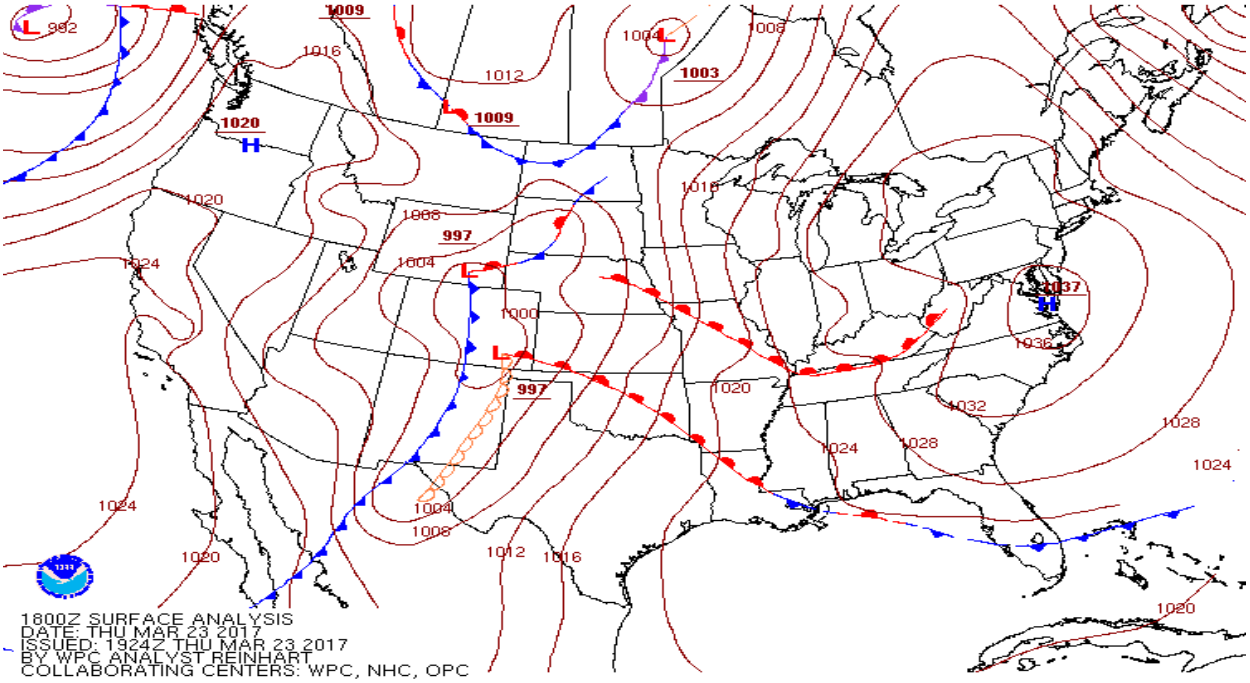


Figure 7-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

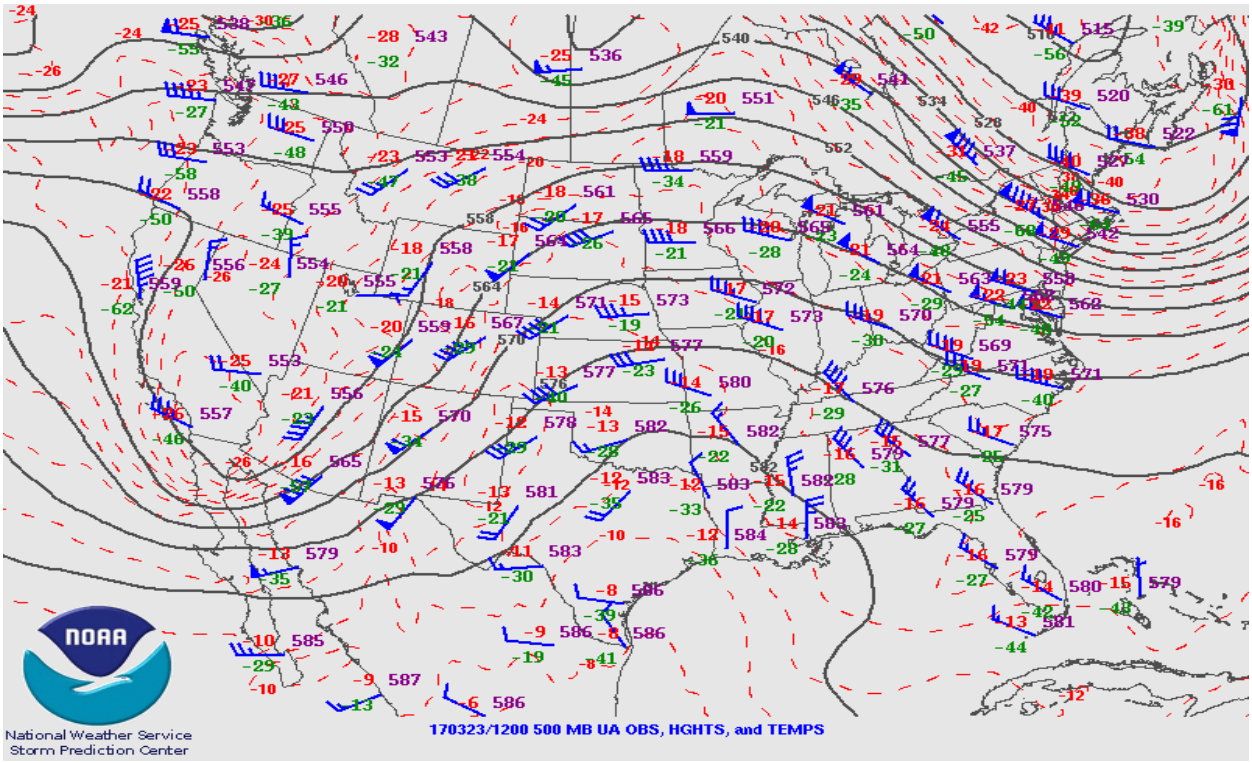


Figure 7-2. Upper air weather map for March 23, 2017 at the 1200 hour. Wind barbs depict wind speed (knots) and direction.

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. Anthropogenic sources

of dust near NMED's monitoring sites include: disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

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, Chaparral, Holman, West Mesa and Deming monitoring sites beginning at the 0900 hour and lasted through the 2000 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 0800 hour. Hourly concentrations remained elevated through the 1900 hour. Table 7-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event.

Hour	Chaparral (POC#2)			Desert View			Anthony		
	PM_{10} ($\mu g/m^3$)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} ($\mu g/m^3$)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} ($\mu g/m^3$)	Wind Speed (m/s)	Wind Gust (m/s)
0800	97	4.1	9.5	205	8	15	145	1.4	8.8
0900	456	6.3	11.3	271	9.2	14.3	94	7.1	14.4
1000	598	7.6	17.4	576	8.7	16	79	7.4	15.2
1100	473	8.7	17.3	1108	9.1	18.1	203	7.2	12.5
1200	305	9.6	17.3	85	6.7	15.4	224	7.9	13.8
1300	986	9.7	18.8	986	9	17.2	1216	11.1	19.5
1400	4954	14.1	22.5	3401	10.8	21.2	2421	12.7	19.9
1500	3018	14	22.4	1404	9.6	20.1	705	11.9	20.9
1600	1409	14.2	22.4	2280	11.4	23.2	595	12.7	21.6
1700	2581	15.5	20.9	1099	10.2	21.2	502	12	20.4
1800	1118	14.1	19.5	293	8.9	16.8	245	11.3	19.4
1900	163	11.7	18.3	183	7.6	17.6	126	8.7	15.2

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 Baja Peninsula 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 7-3).

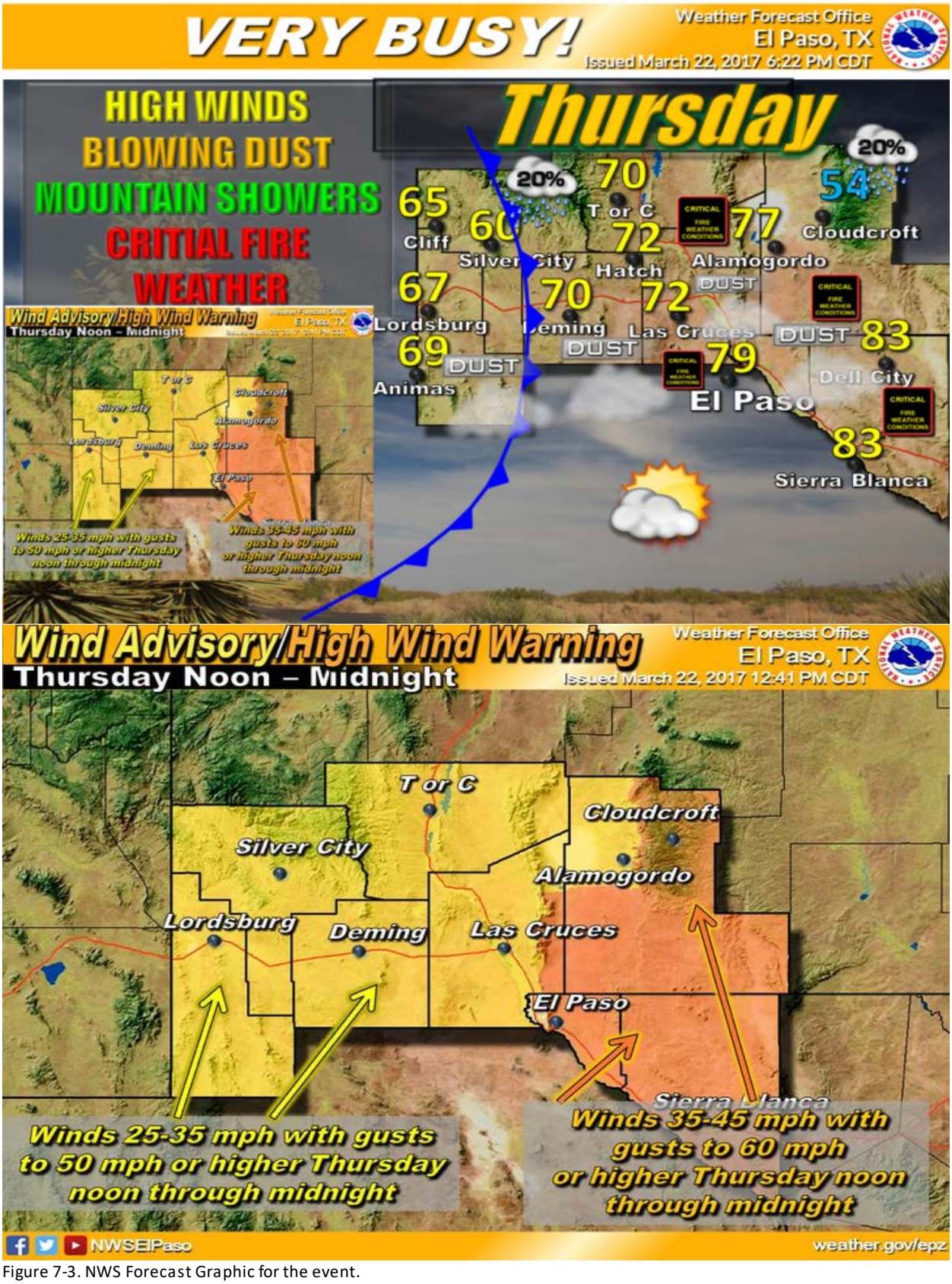


Figure 7-3. NWS Forecast Graphic for the event.

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 Anthony, Holman, West Mesa, Desert View, and Chaparral monitoring sites recorded wind speeds above this threshold for 7 hours from the 1200 to the 1900 hour (Figure 7-4). The Wind speeds at the upwind Deming monitoring site also reached the high wind threshold.

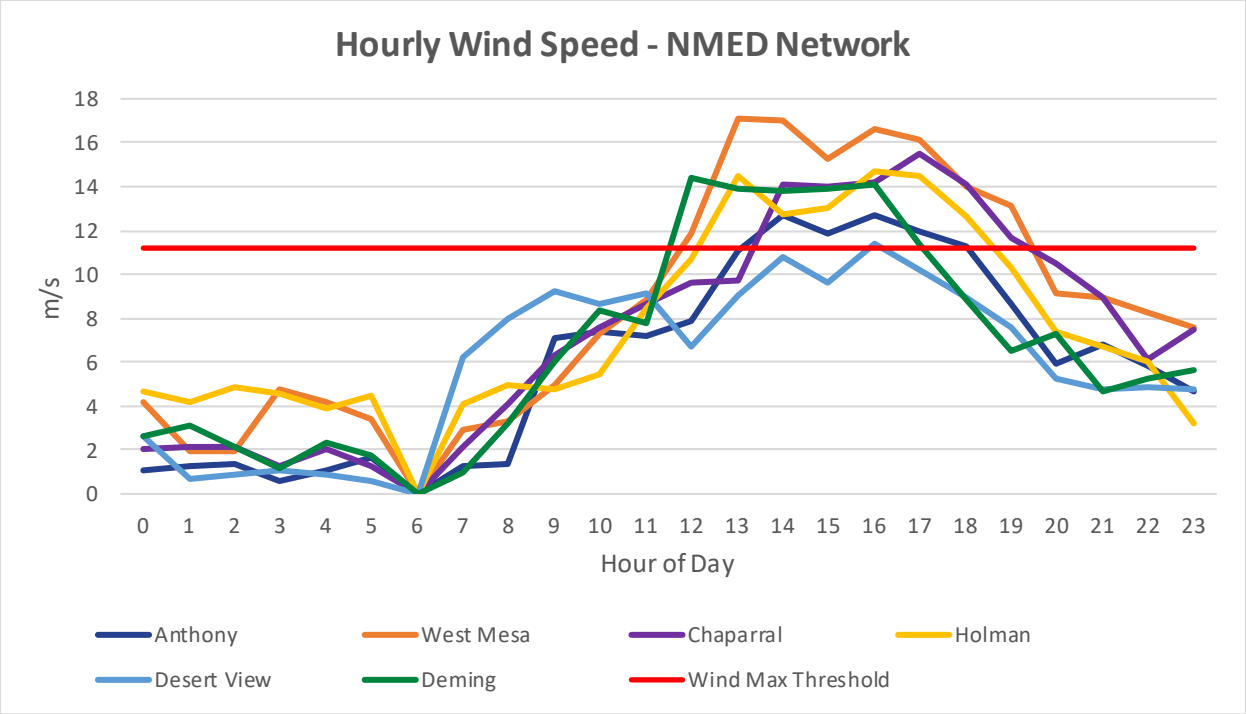


Figure 7-4. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

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.

Clear Causal Relationship (CCR)

Occurrence and Geographic Extent of the Event

Satellite Imagery

The event was captured on satellite imagery with dust plumes that are characterized as pink bands in the RGB Suomi VIIRS product 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 7-5). 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 (1437 hour MDT) that captured the imagery.

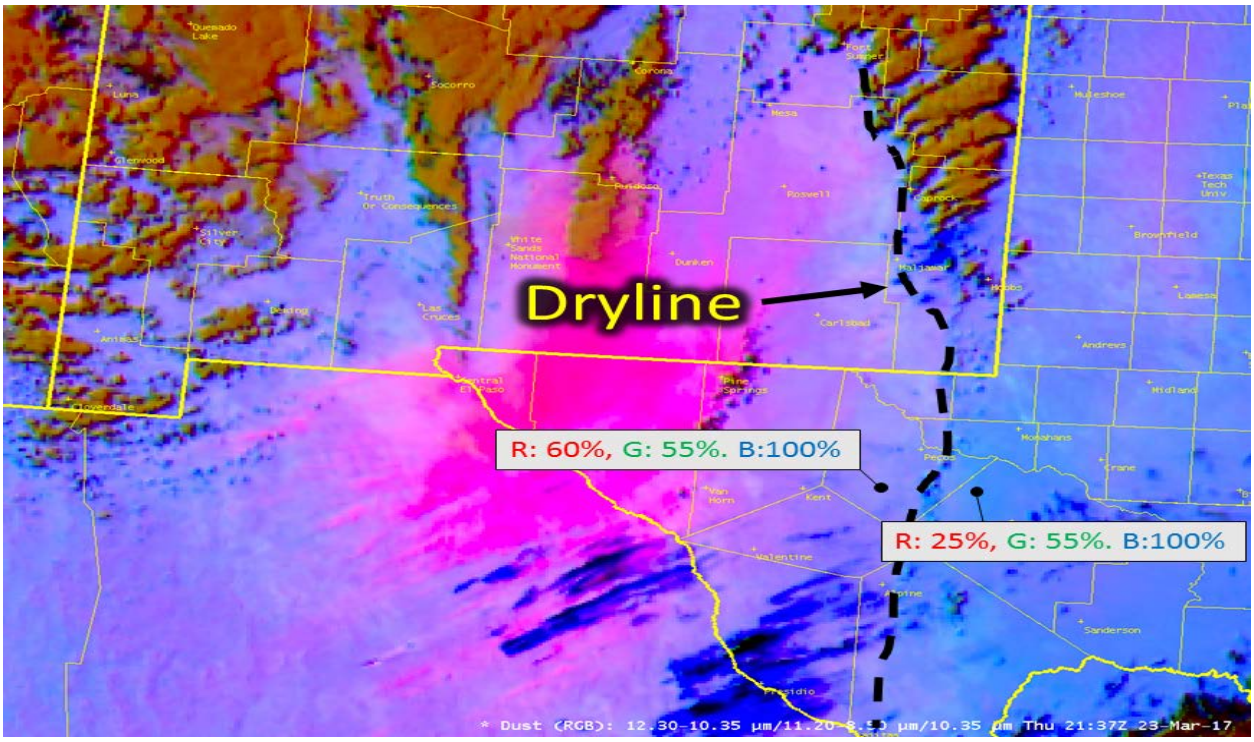


Figure 7-5. Dust RGB product imagery from the Suomi NPP Satellite showing southwestern New Mexico, northern Chihuahua and western Texas. Imagery obtained from NASA's SPoRT Worldview website. Pink area represents dust plumes.

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 7-3). 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 mainly during the afternoon and evening with winds gusting around 50 to 60 mph. Blowing dust will reduce the visibility to less than a mile over a few areas including along Interstate 10 between El Paso and Las Cruces and also around Deming and Lordsburg resulting in dangerous driving conditions."

Spatial and Transport Analysis

HYSPLiT Backtrajectory Analysis

A back-trajectory analysis using the HYSPLIT (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 (Figure 7-6). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

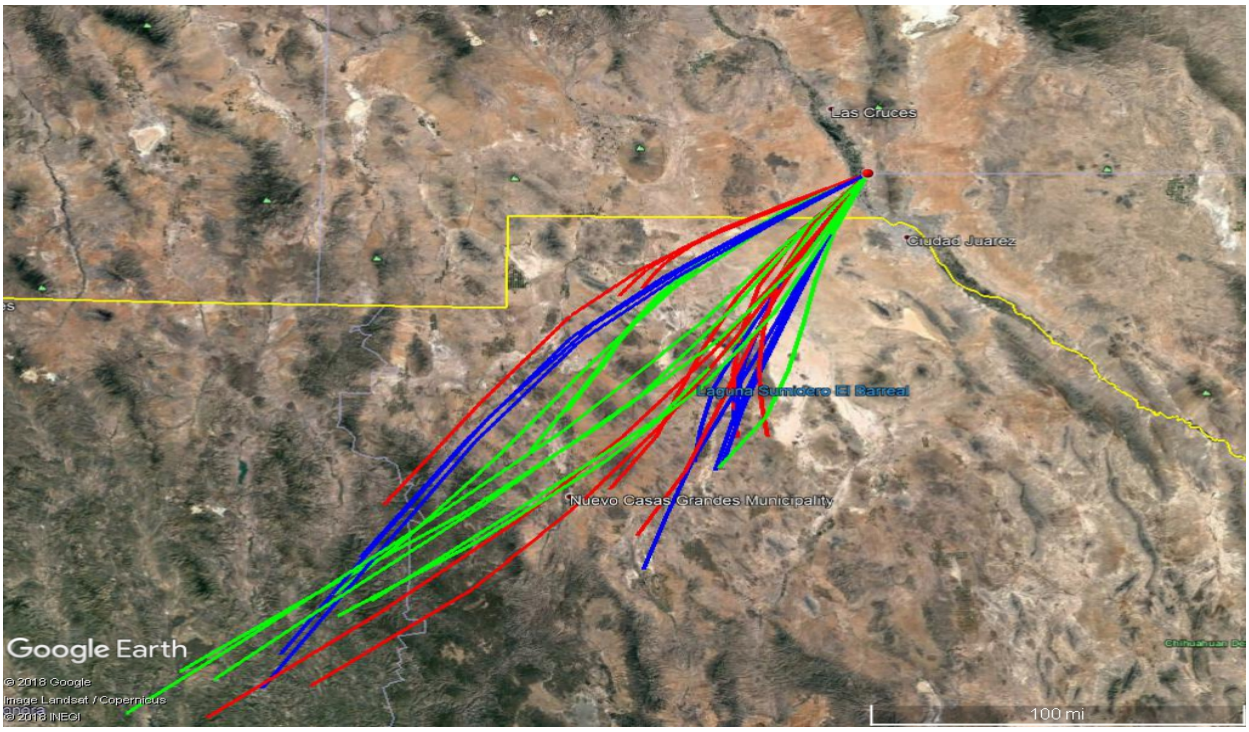


Figure 7-6. HYSPLiT back-trajectory analyses using the Ensemble mode for the Anthony monitoring site.

Wind Direction and Elevated PM_{10} Concentrations

Pollution roses (Figures 7-7 through 7-10) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m³ (0900 -1900 hour). During the event, winds blew from the west southwest approximately 60% - 90%; in addition, at the Deming monitoring site northwest approximately 40% of the time coinciding with peak PM_{10} concentrations.

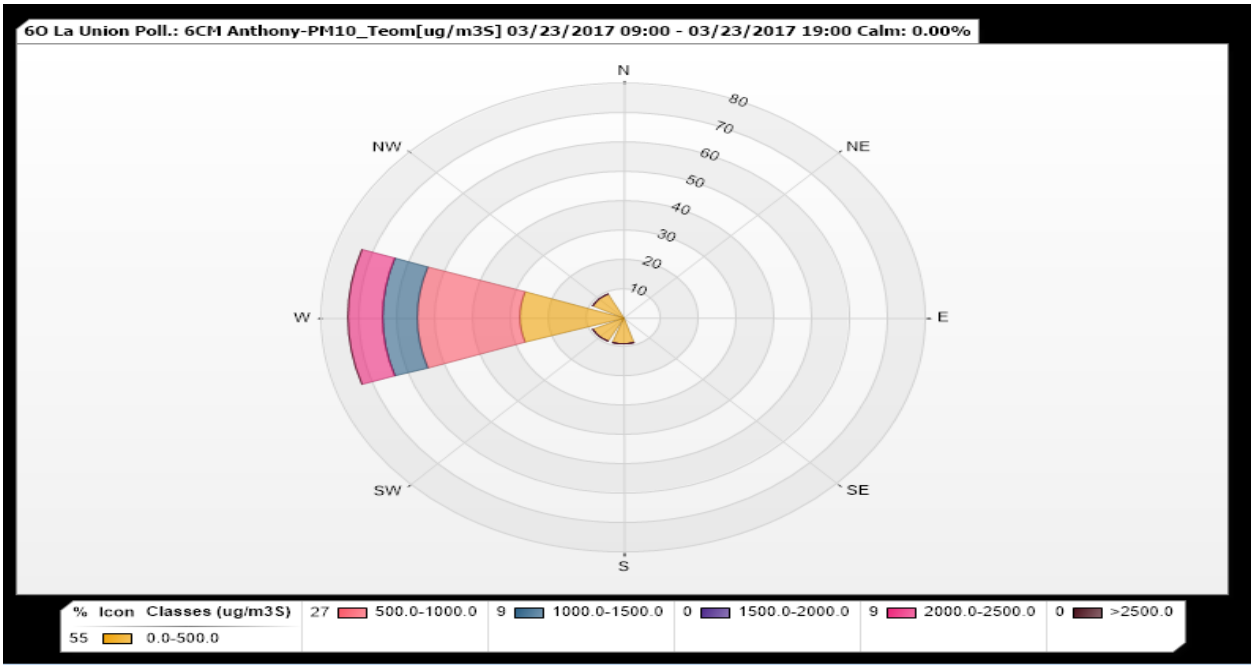


Figure 7-7. Pollution rose for the Anthony monitoring site.

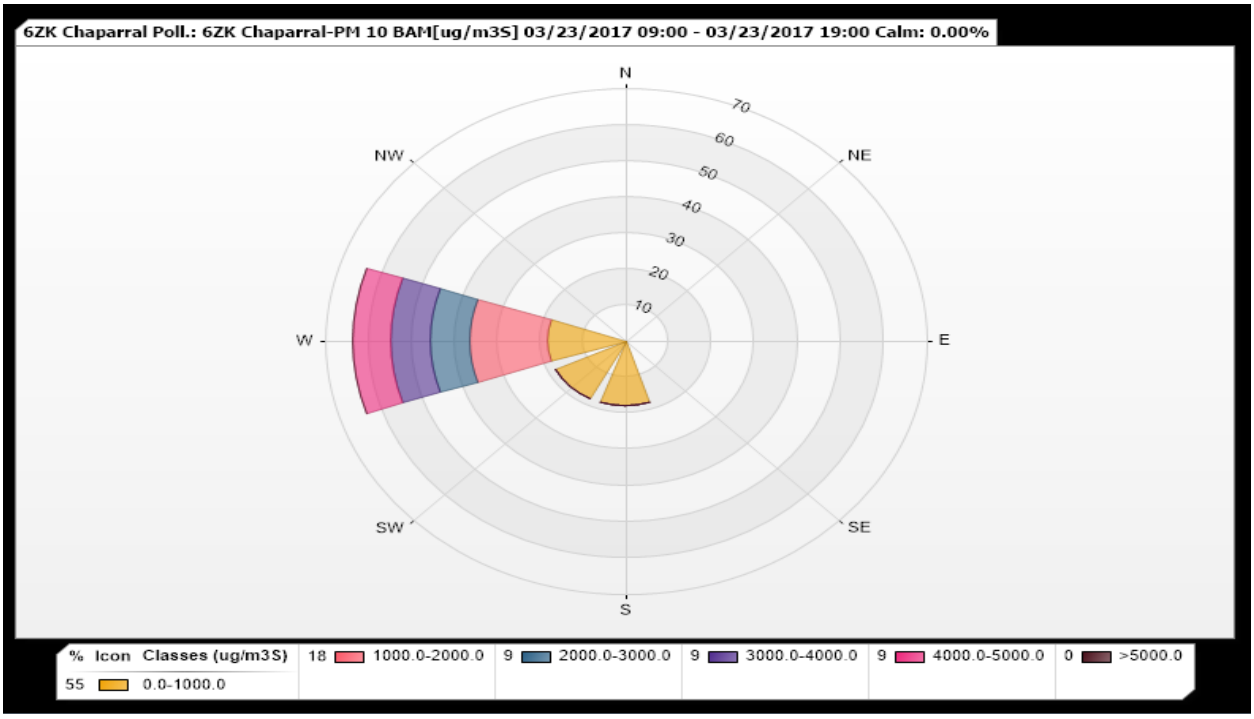


Figure 7-8. Pollution rose for the Chaparral monitoring site.

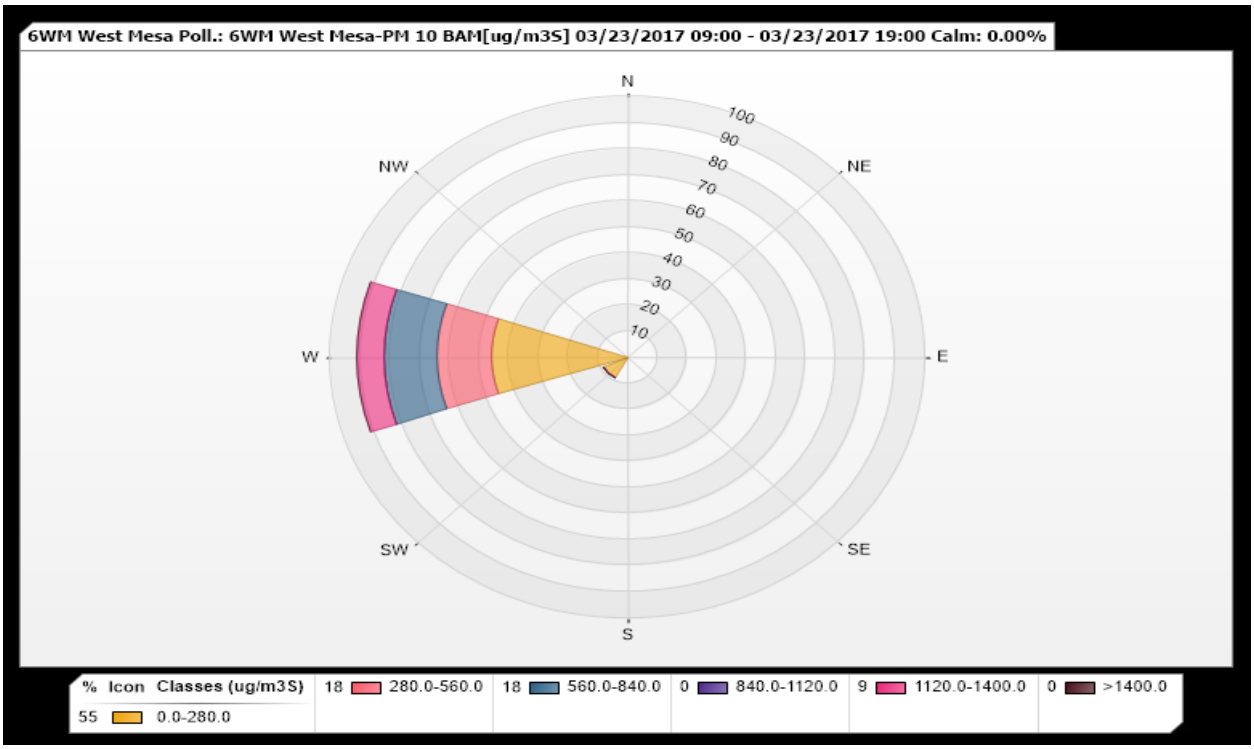


Figure 7-9. Pollution rose for the West Mesa monitoring site.

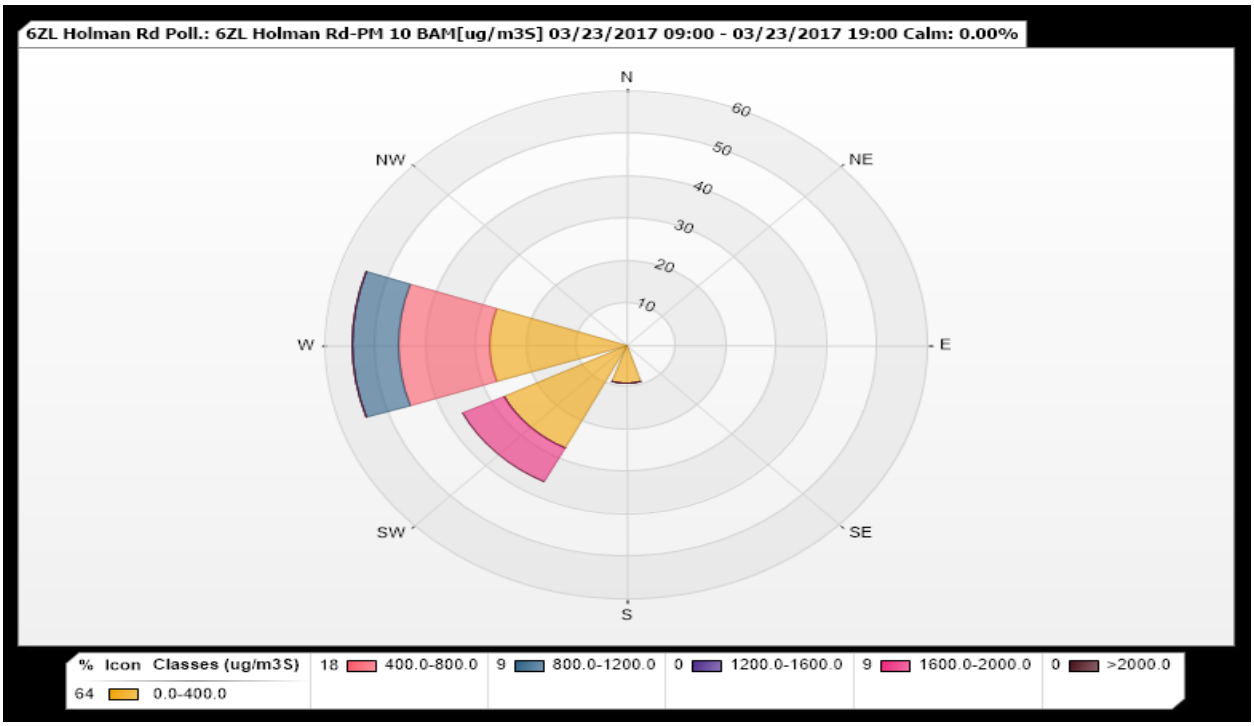


Figure 7-10. Pollution rose for the Holman monitoring site.

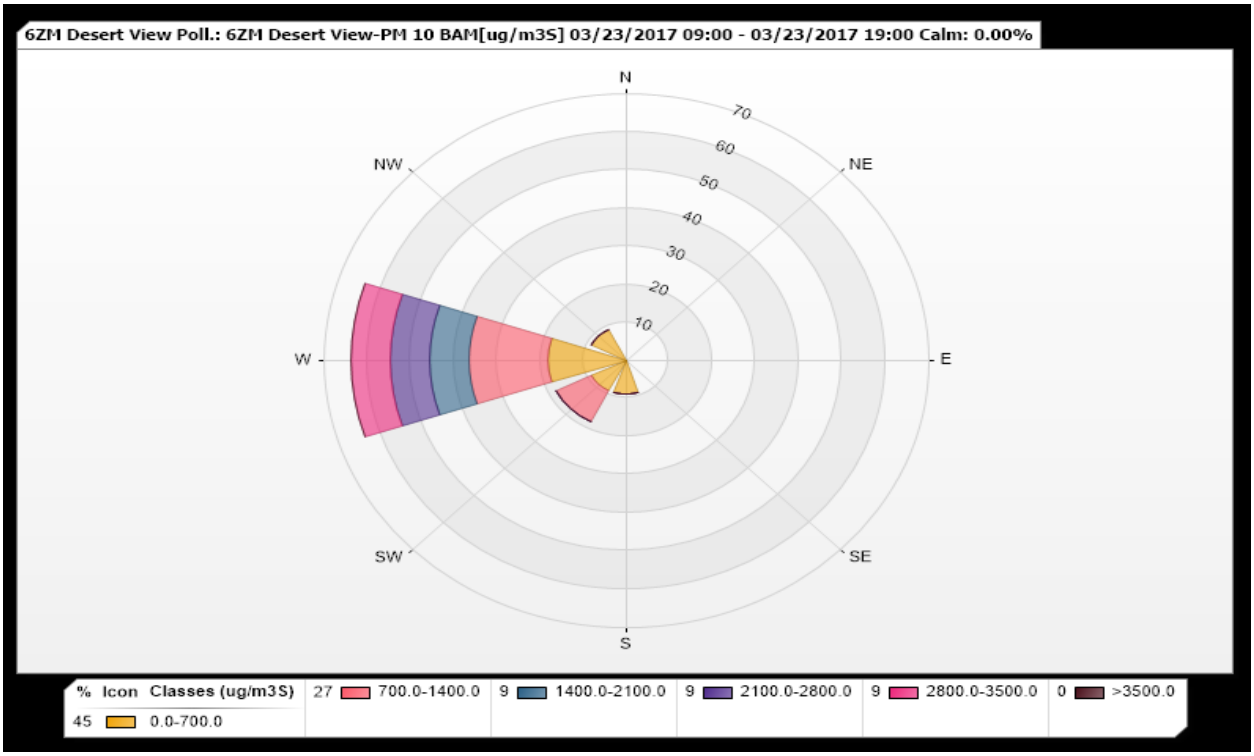


Figure 7-11. Pollution rose for the Desert View monitoring site.

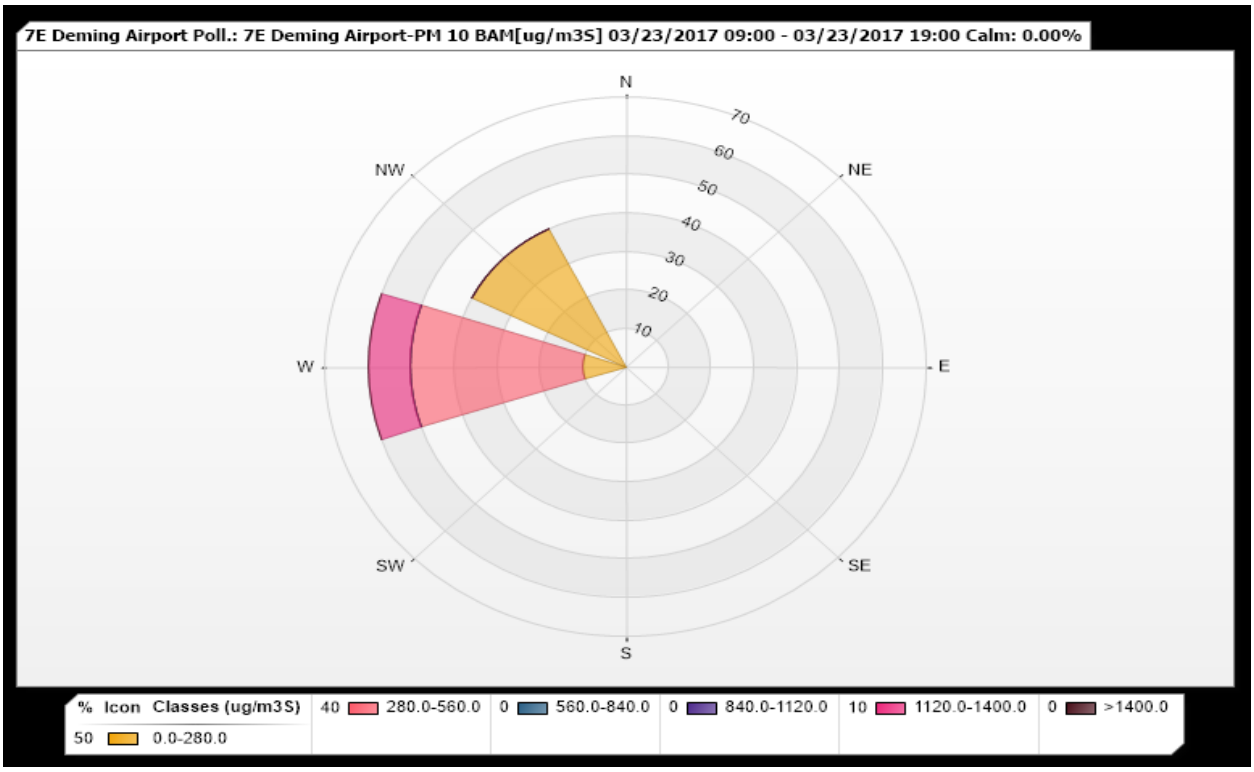


Figure 7-12. Pollution rose for the Deming monitoring site.

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

The high wind blowing dust event generated strong southwesterly winds beginning at the 0900 hour and lasting through the 1900 hour. During this time, peak hourly PM_{10} concentrations ranged from 490 to 4954 µg/m^3 at NMED monitoring sites (Figure 7-13). 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 17.1 m/s were recorded at Desert View and West Mesa monitoring sites, respectively, during the peak PM_{10} concentrations of the event. The time series plots in Figures 7-14 through 7-19 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

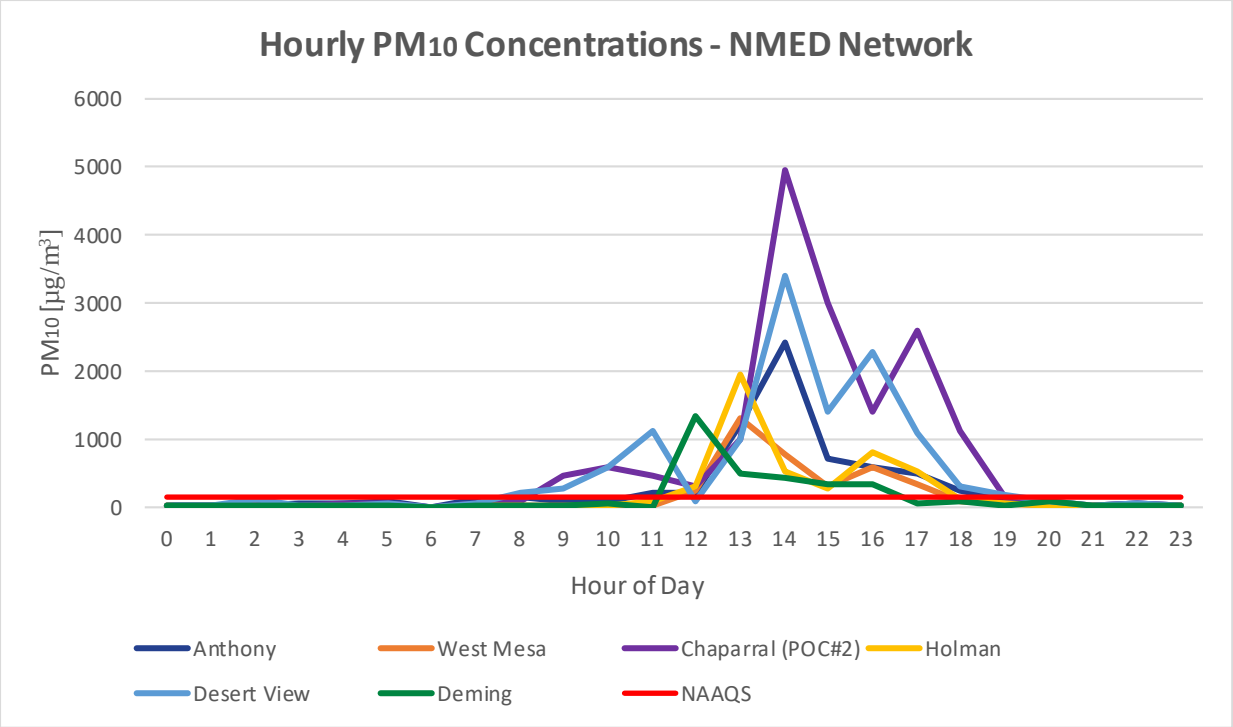


Figure 7-13. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

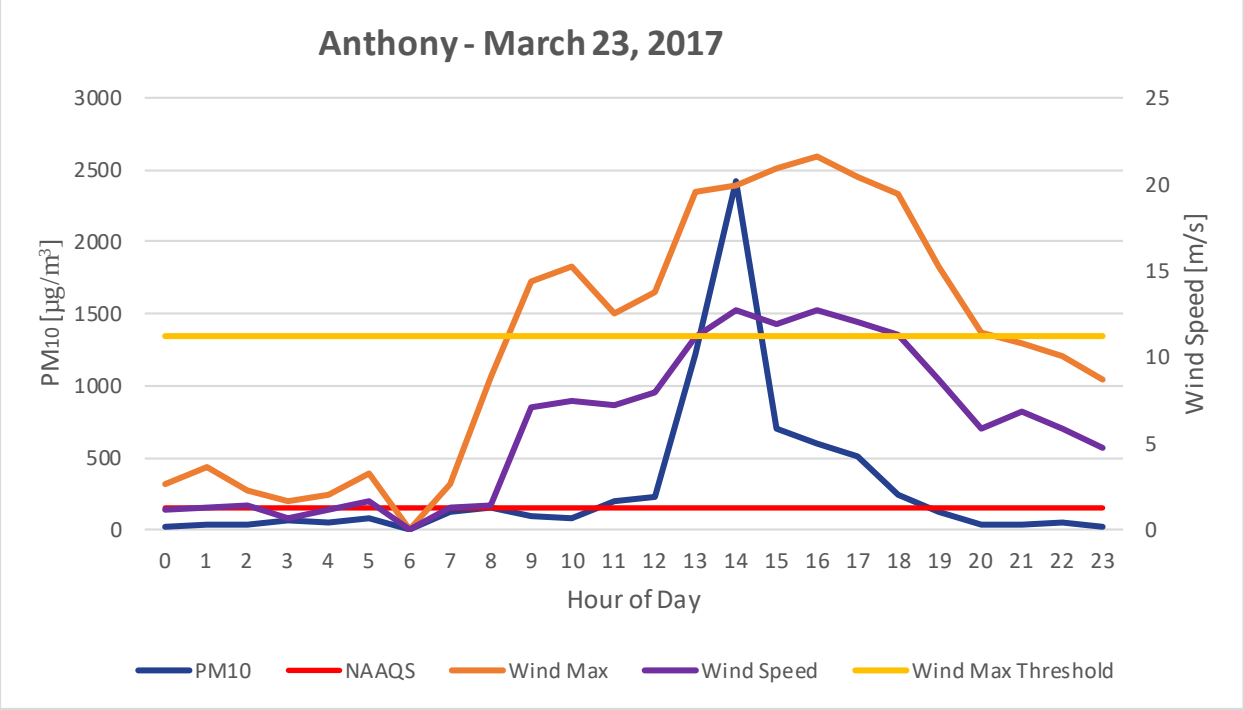


Figure 7-14. Anthony monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

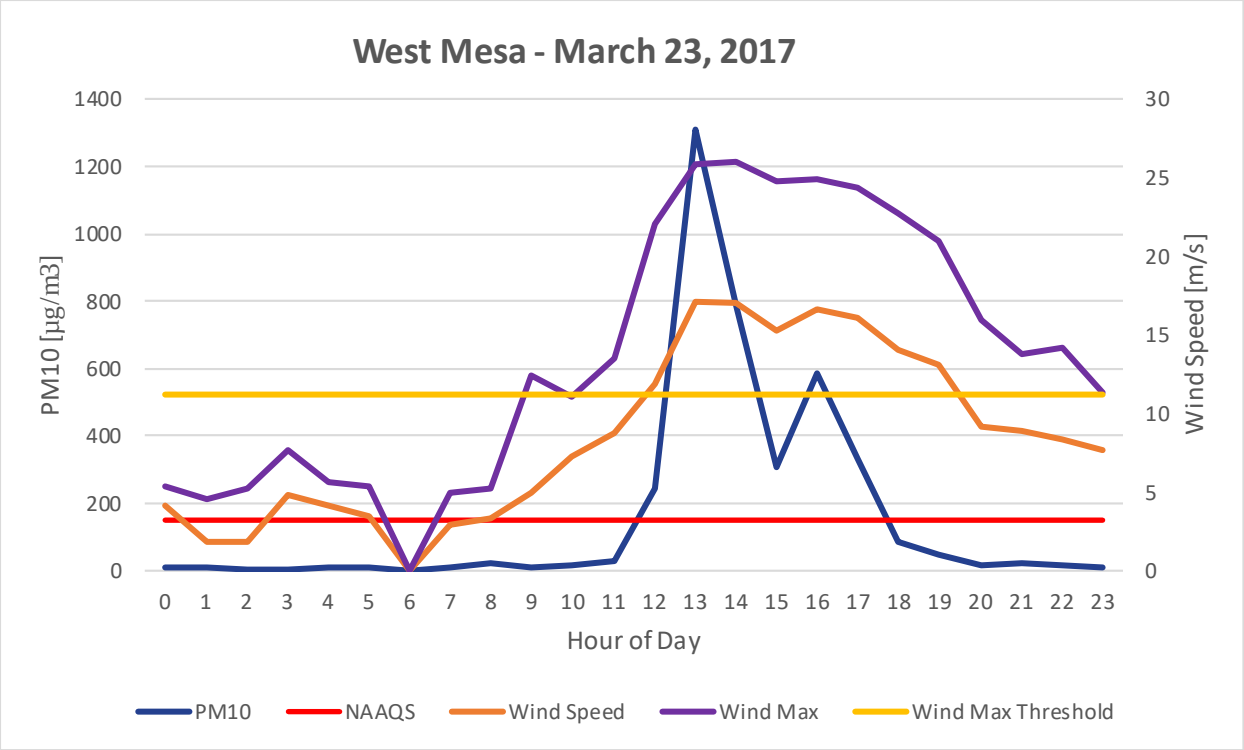


Figure 7-15. West Mesa monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

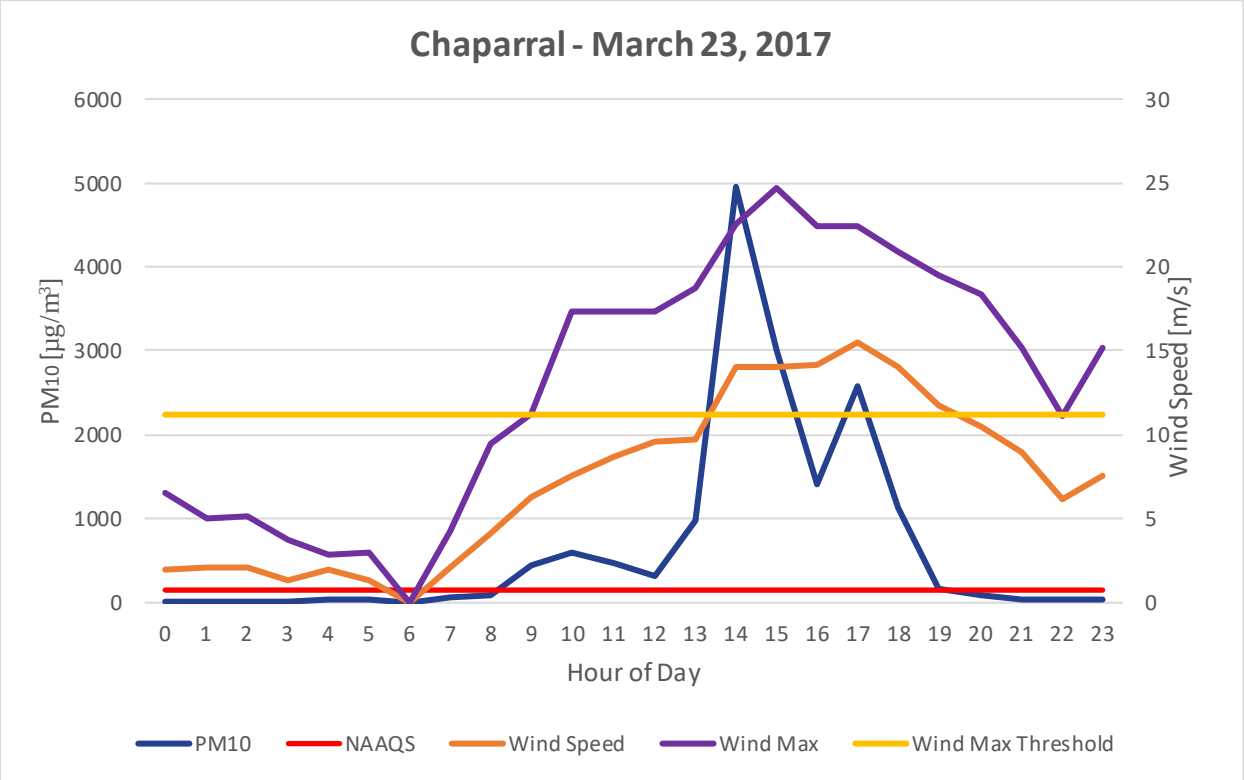


Figure 7-16. Chaparral monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

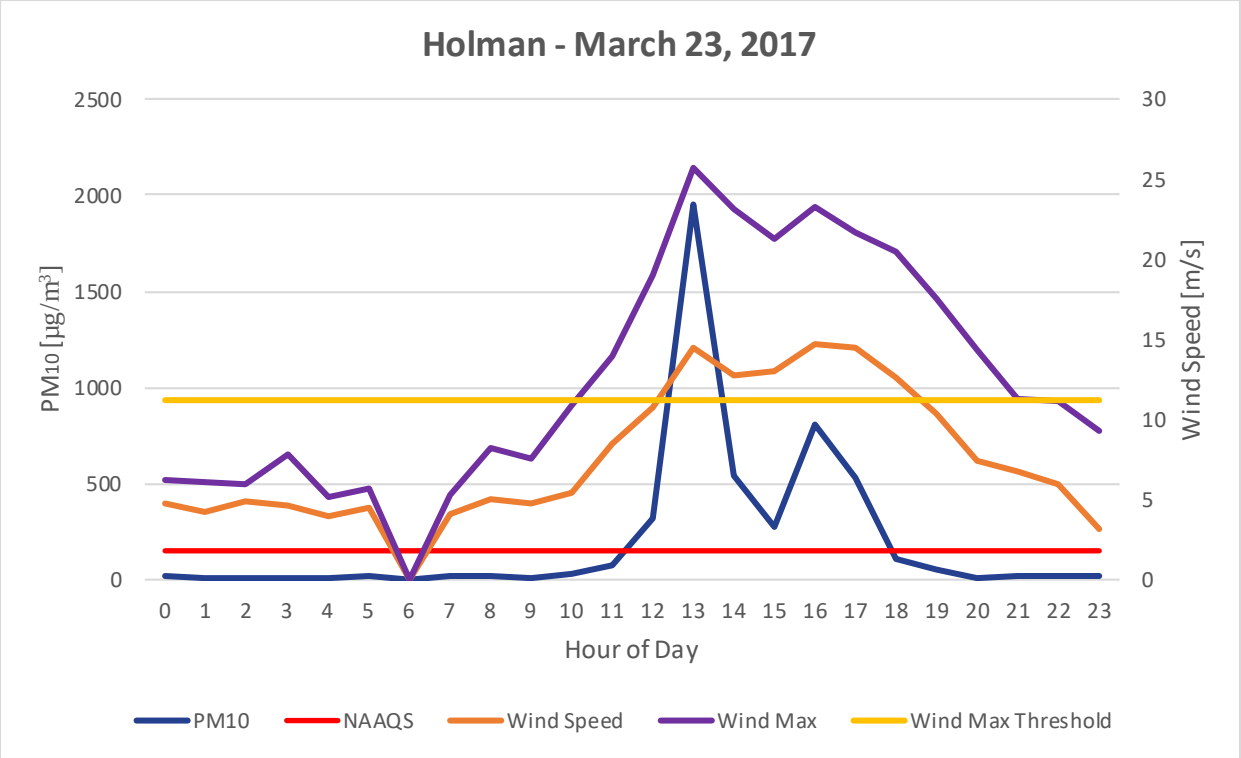


Figure 7-17. Holman monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

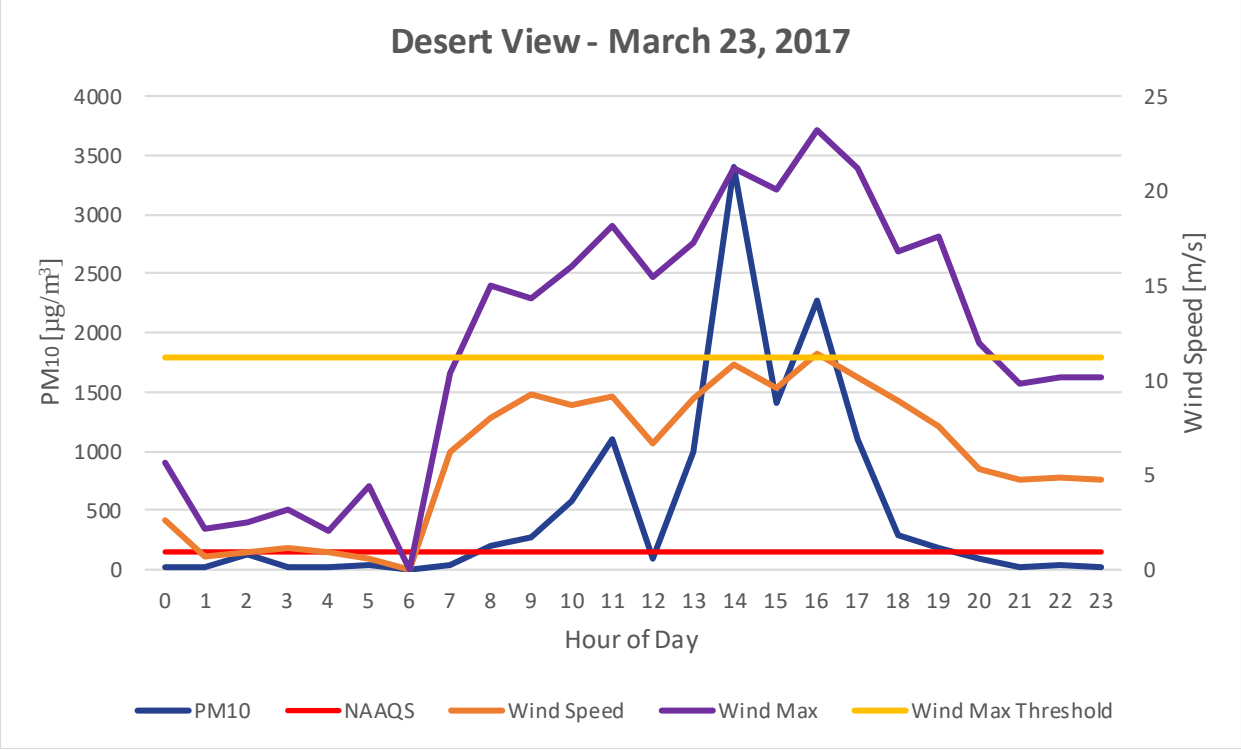


Figure 7-18. Desert View monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

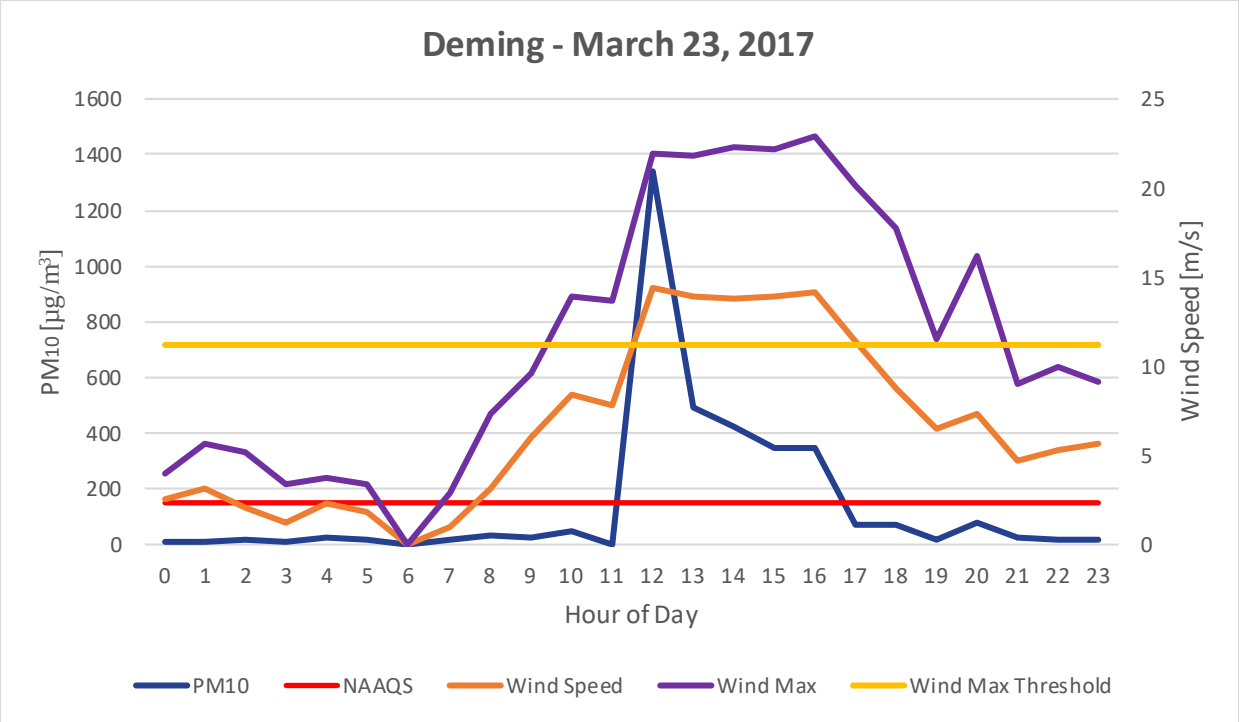


Figure 7-19. Deming monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2012-2016, the NMED monitoring sites recorded 43 (Anthony), 18 (West Mesa), 35 (Chaparral), 22 (Holman), 43 (Desert View), & 25 (Deming) exceedances of the PM_{10} NAAQS (Figures 7-20 through 7-25). The maximum 24-hour average PM_{10} concentration at this site, respectively, were 1739 (Anthony), 487 (West Mesa), 1606 (Chaparral), 1449 (Holman), 1691 (Desert View), 1098 (Deming) µg/m^3 recorded in 2012; 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.

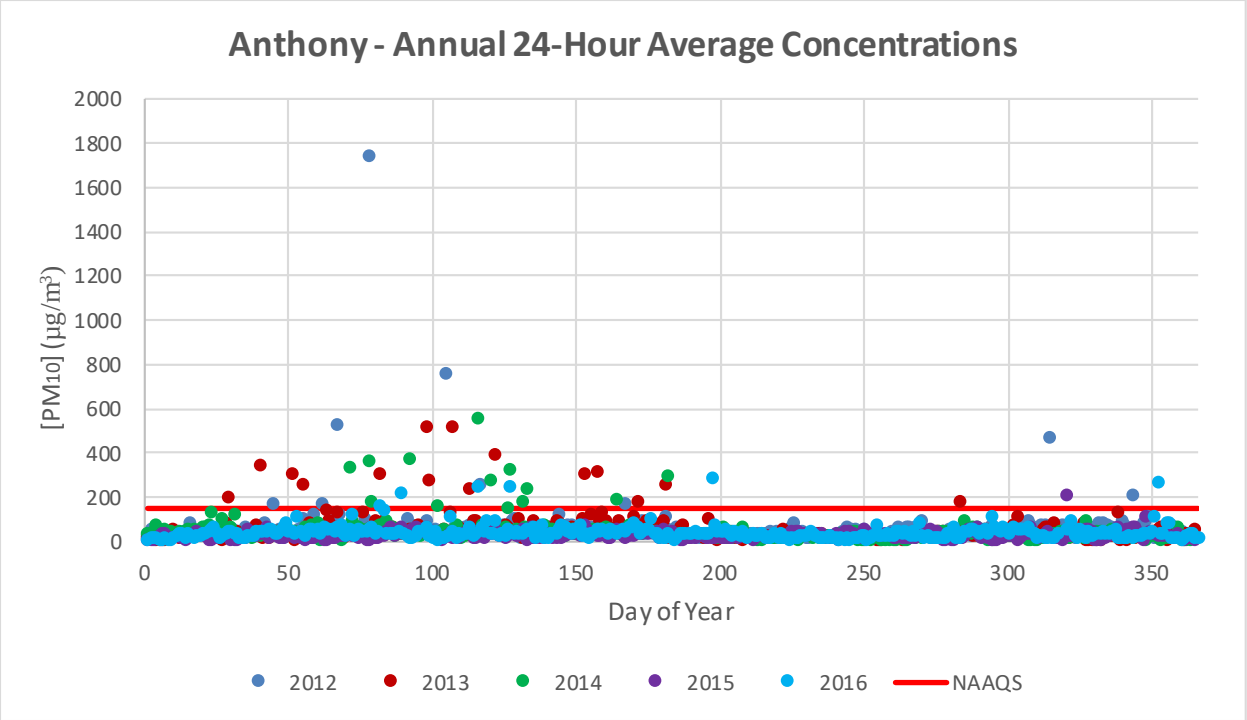


Figure 7-20. 24-hour averages by day of year from 2012-2016 for the Anthony monitoring site.

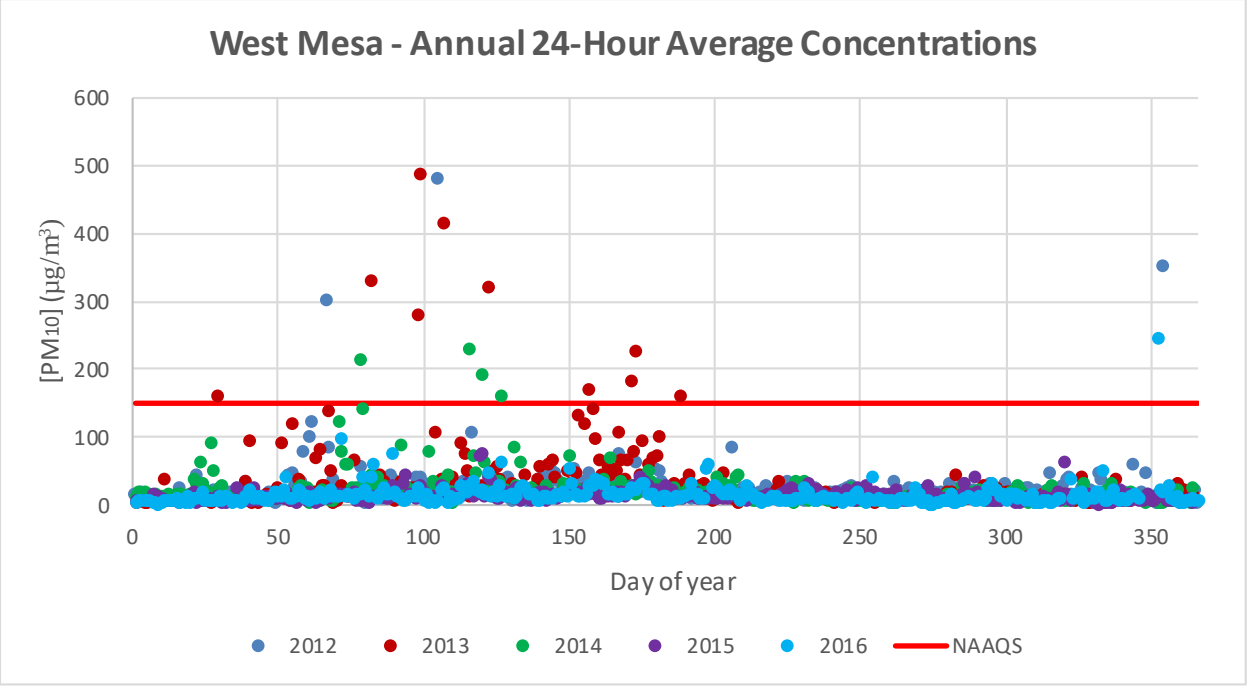


Figure 7-21. 24-hour averages by day of year from 2012-2016 for the West Mesa monitoring site.

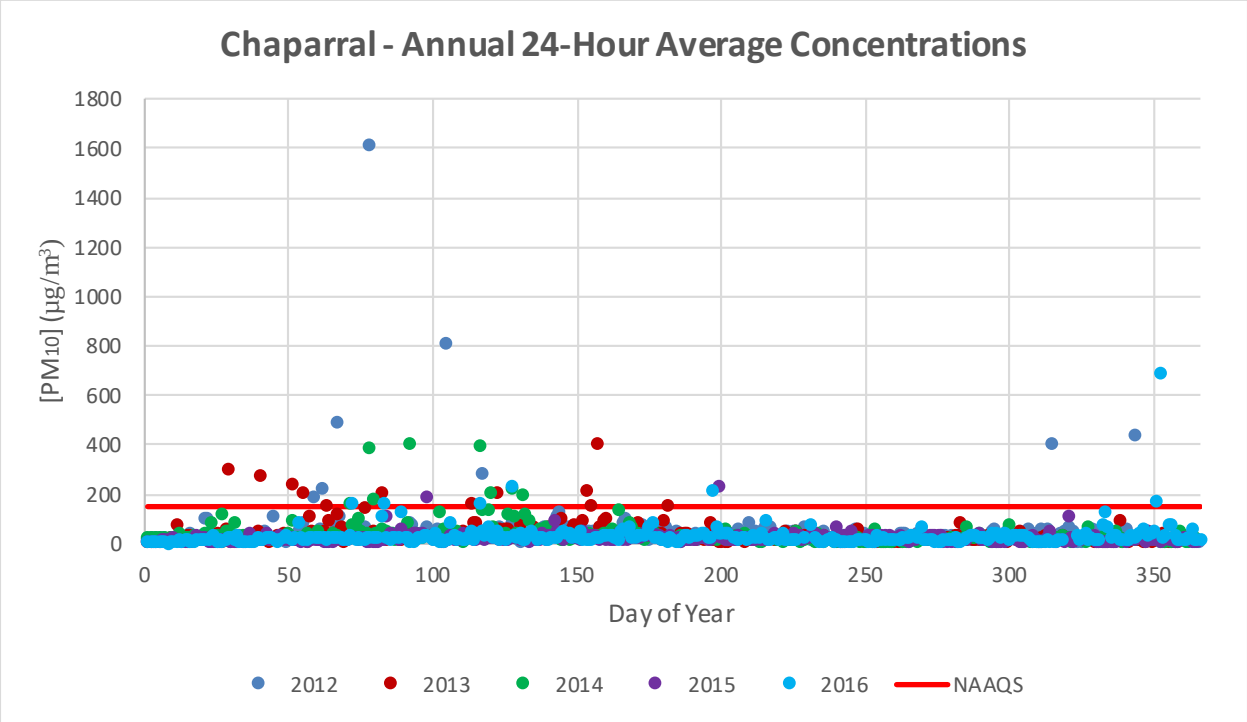


Figure 7-22. 24-hour averages by day of year from 2012-2016 for the Chaparral monitoring site.

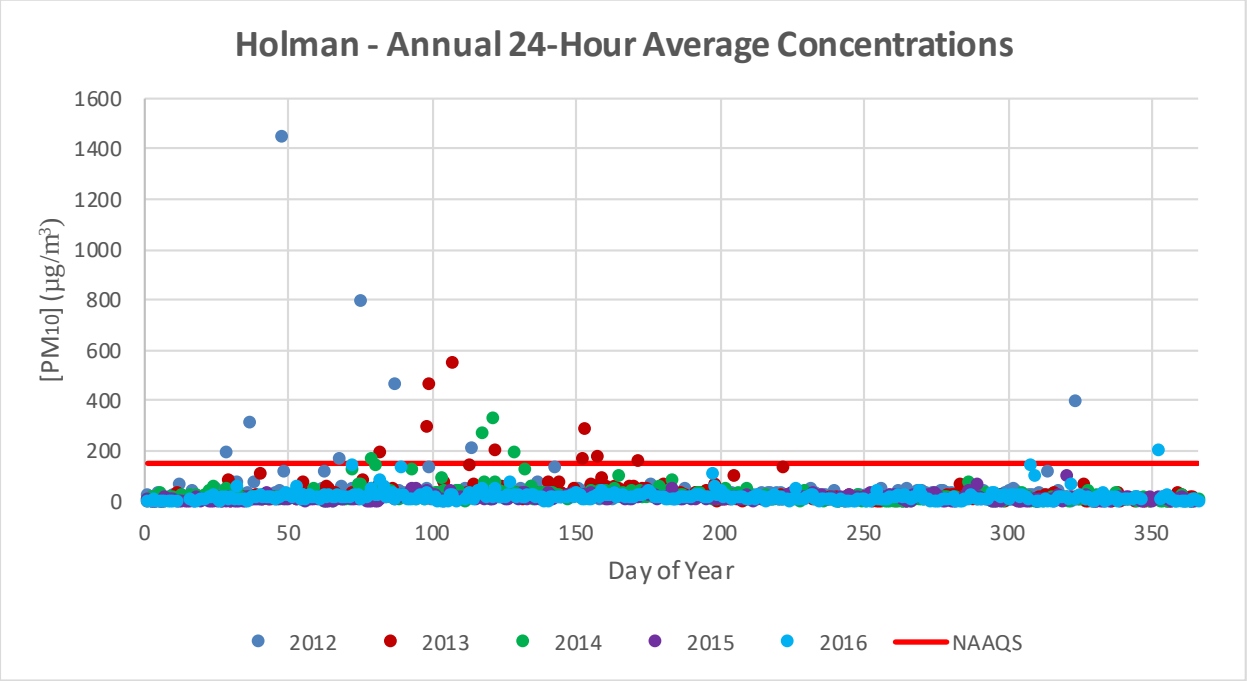


Figure 7-23. 24-hour averages by day of year from 2012-2016 for the Holman monitoring site.

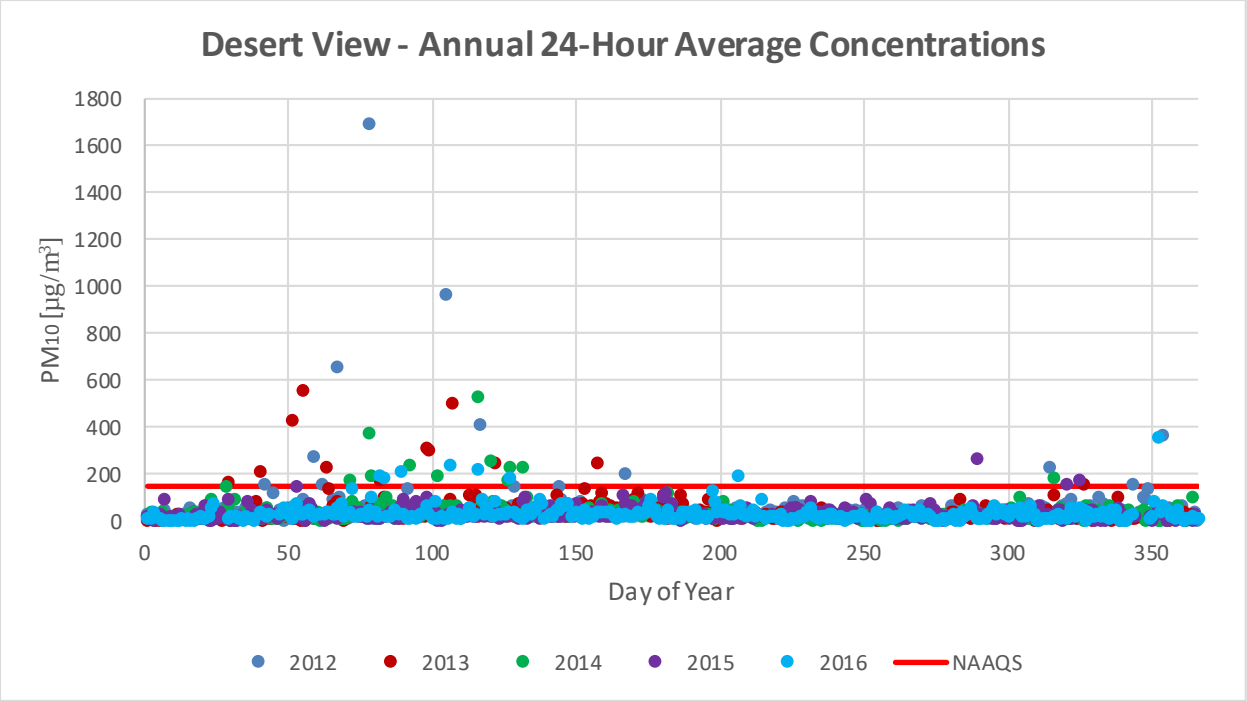


Figure 7-24. 24-hour averages by day of year from 2012-2016 for the Desert View monitoring site.

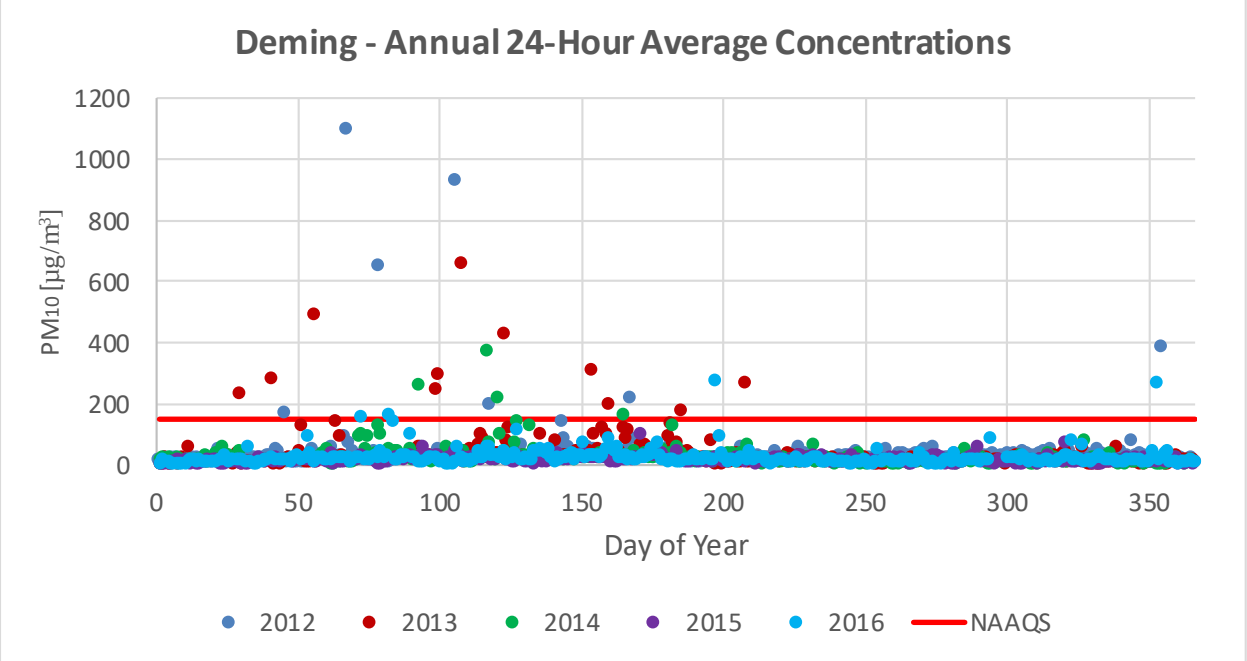


Figure 7-25. 24-hour averages by day of year from 2012-2016 for the Deming monitoring site.

Spatial and Temporal Variability

As demonstrated in Figure 7-26, 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.

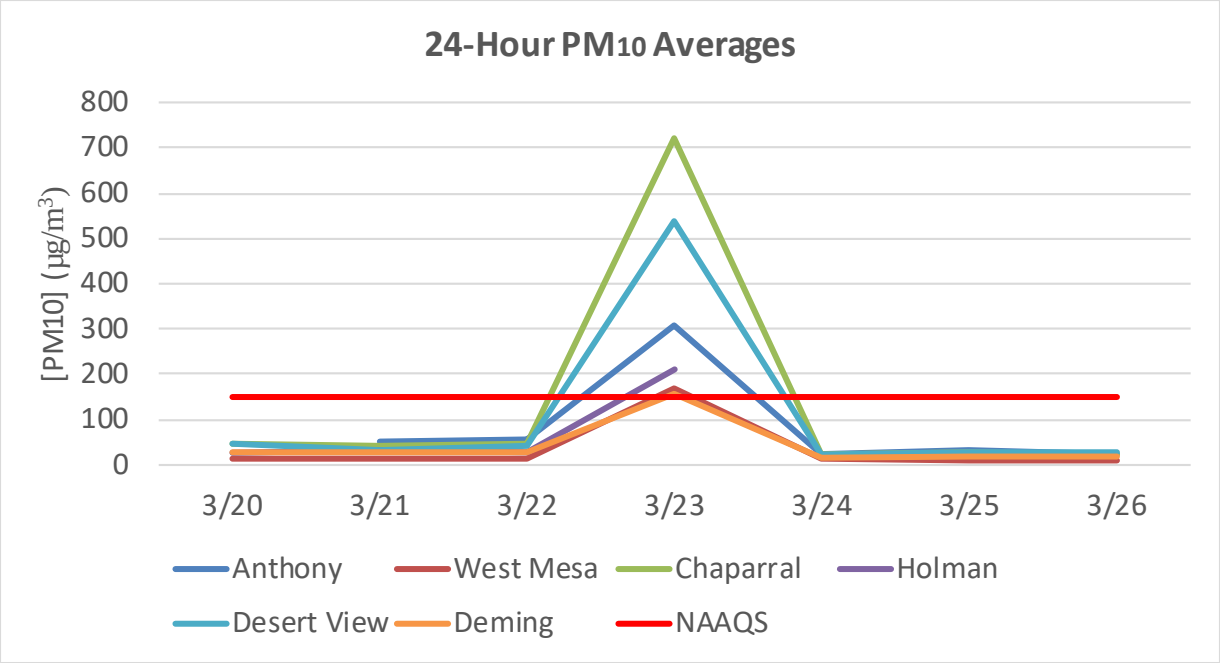


Figure 7-26. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

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 2012-2016. The recorded values for this day, 308 (Anthony), 169 (West Mesa), 721 (Chaparral), 211 (Holman), 538 (Desert View), & 157 (Deming) µg/m^3, respectively, are above the 99th percentile; except the Deming monitoring site which is above the 95th percentile of historical data.

Statistic\MonitoringSite	Anthony	West Mesa	Chaparral	Holman	Desert View	Deming
Max	1739	487	1606	1449	1691	1098
99th Percentile	288	148	218	178	244	216
95th Percentile	95	50	79	60	95	61
75th Percentile	51	21	34	30	42	27
50th Percentile	36	14	23	20	28	19
25th Percentile	24	10	15	13	18	12
5th Percentile	13	5	6	6	8	6
Mean	46	21	32	28	39	27

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 NMED monitoring sites. The monitored PM_{10} 24-Hour Averages of 308 (Anthony), 169 (West Mesa), 721 (Chaparral), 211 (Holman), & 538 (Desert View) µg/m^3 are above the 99th percentile; while the average of 157 (Deming) 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 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.

8. HIGH WIND EXCEPTIONAL EVENT: March 31, 2017

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, 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 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	222 µg/m³ (POC #2)	11.4 m/s	19.7 m/s
RJ	35-013-0016	6CM Anthony	208 µg/m³	13.2 m/s	22.8 m/s
RJ	35-013-0021	6ZM Desert View	475 µg/m³	13.7 m/s	24.1 m/s
RJ	35-029-0003	7E Deming	226 µg/m³	15.2 m/s	25.3 m/s

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

A deep low-pressure system with a cold front moved across the southwestern United States causing very windy conditions with blowing dust and low visibility and cool temperatures. 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 1200 hour, an area of low pressure moved over the state of Colorado and New Mexico. Aloft, the low-pressure center of the storm system hovered southeast of the Great Plains. 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 providing the turbulence required for vertical mixing and entrainment of dust.

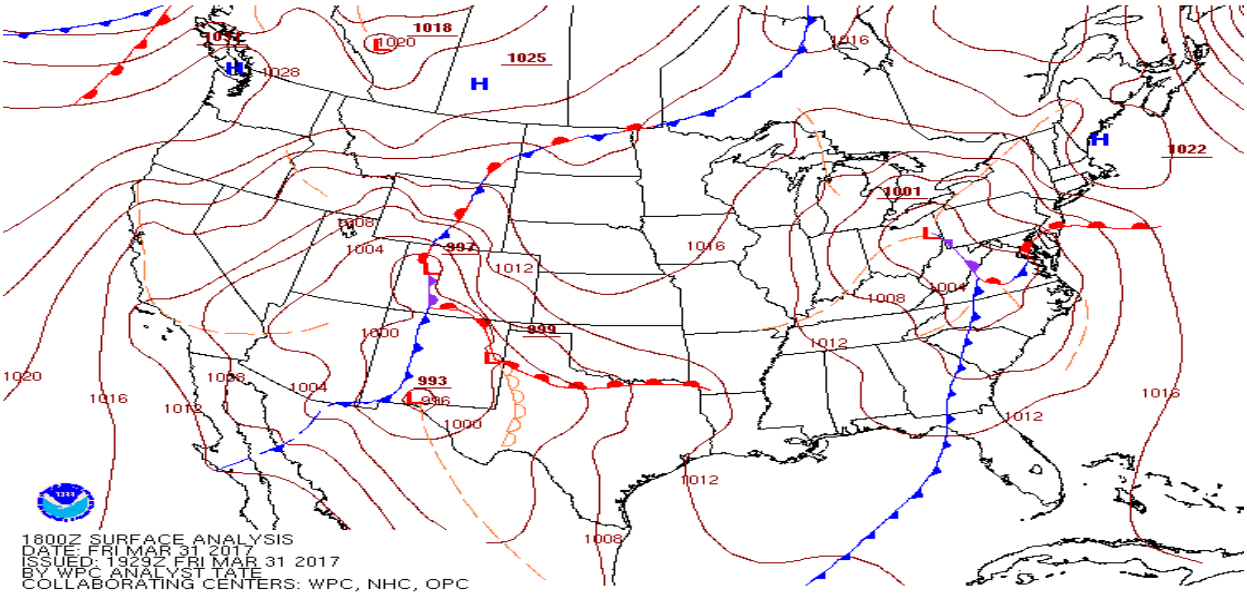


Figure 8-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

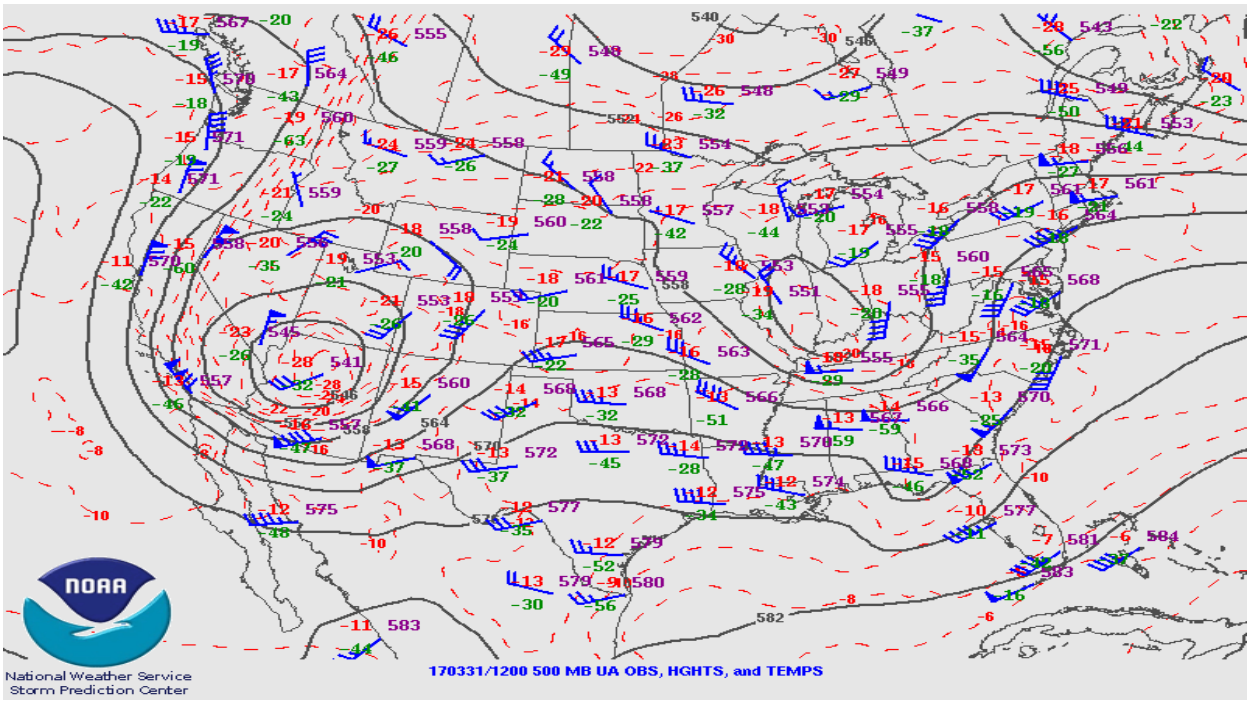


Figure 8-2. Upper air weather map for March 31, 2017 at the 1200 hour. Wind barbs depict wind speed (knots) and direction.

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. Anthropogenic sources of dust near NMED's monitoring sites include: disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

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, Chaparral, Holman, West Mesa and Deming monitoring sites beginning at the 0800 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 0800 hour. Hourly concentrations remained elevated through the 1800 hour. Table 8-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event.

Hour	Anthony			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)
0800	90	9.1	16.5	92	7.8	13.9	63	1.4	5.5
0900	278	9.1	14.7	302	9.2	16.5	544	12.2	20.2
1000	350	8.1	15.7	613	9.9	17.6	1370	15.2	25.3
1100	620	8.7	16.3	1169	10.2	17.7	202	11.3	18.8
1200	1416	12.8	19.9	2610	10.1	18.6	178	10.8	17.5
1300	375	10	17.4	901	9.6	19.7	197	10.5	16.8
1400	299	13.2	22.4	2315	12.3	22.1	246	12.2	19.7
1500	319	10.8	22.8	-------	13.7	24.1	1121	15.2	23.8

1600	175	6.3	11.1	1426	10.1	17.9	246	13.1	20.8
1700	247	5.7	12.8	486	5.2	14.3	102	10	17.4
1800	117	4.5	8.7	212	4	9.7	136	7.5	13.7

Table 8-2. 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 southeast of the Great Plains in the morning and moving across New Mexico in the afternoon. 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.

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 Anthony, Chaparral, Desert View, Holman, and West Mesa monitoring sites recorded wind speeds above this threshold for 8 hours, from the 0900 to the 1600 hour (Figure 8-3). The wind speeds at the upwind Deming monitoring sites also reached the high wind threshold.

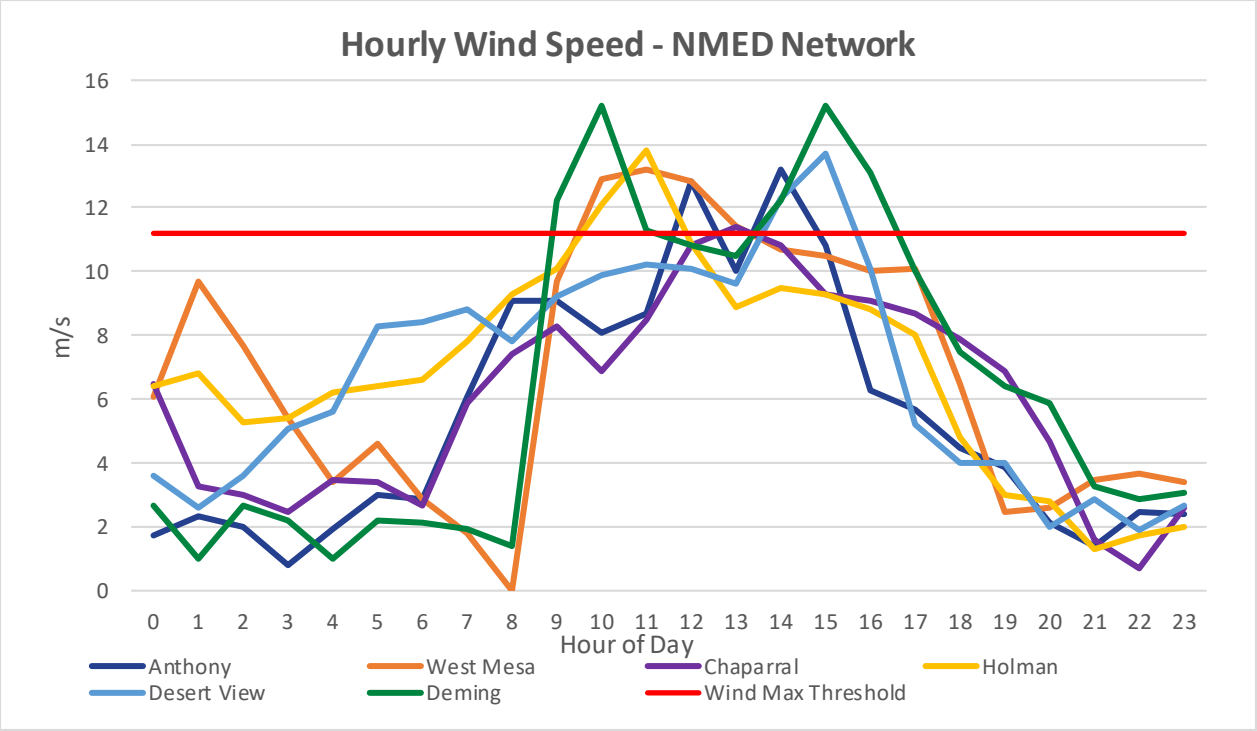


Figure 8-3. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

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 exceedances 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 8-4). 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 (1100 hour MDT) that captured the imagery.

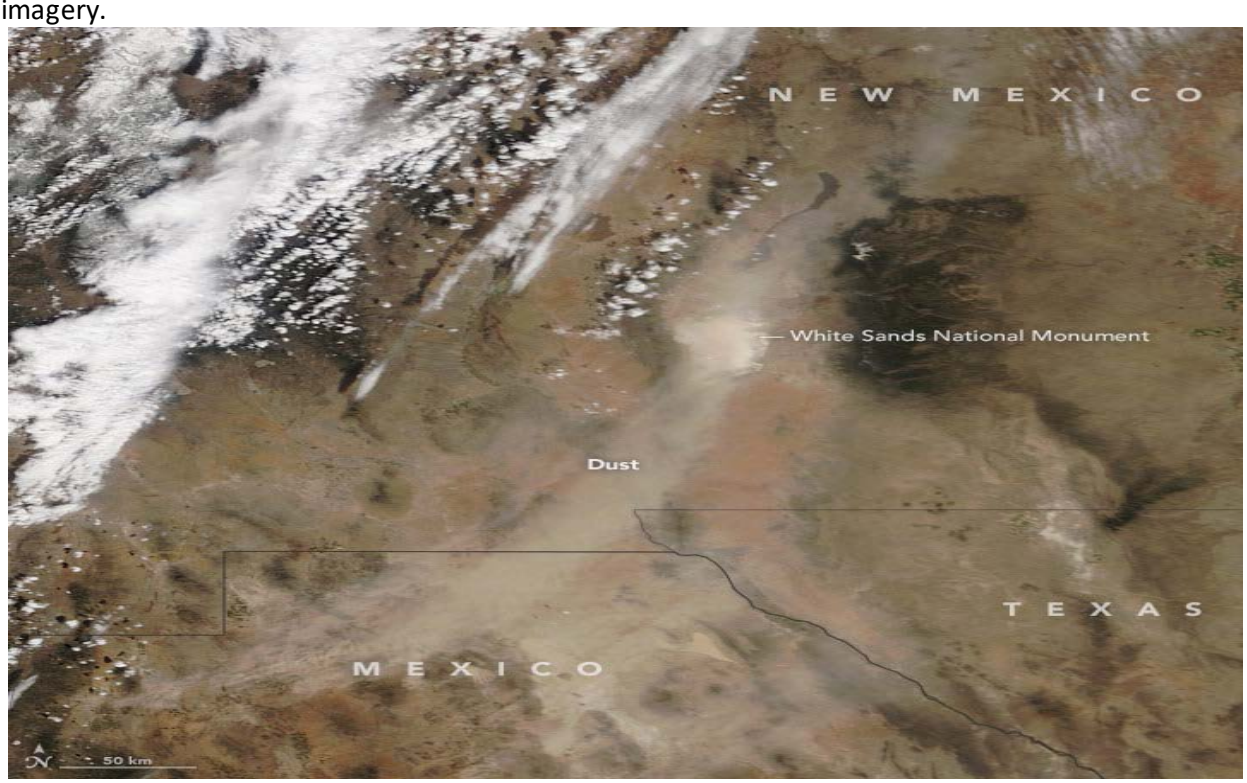


Figure 8-4. MODIS natural color imagery from the Terra Satellite showing southwestern New Mexico, northern Chihuahua and western Texas. Imagery obtained from NASA's EOSDIS Worldview website.

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

The National Weather Service (NWS) issued a Wind Advisory and a Blowing Dust Advisory for this date (Figure X-X). 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 through early tonight with west to southwest winds gusting from 50 to 60 mph. Blowing dust will reduce the visibility to under a half mile over some locations resulting in dangerous driving conditions including along portions of Interstate 10 between El Paso and Las Cruces and also around Deming and Lordsburg."

Spatial and Transport Analysis

HYSPLiT Backtrajectory Analysis

A back-trajectory analysis using the HYSPLIT (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 (Figure 8-5). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

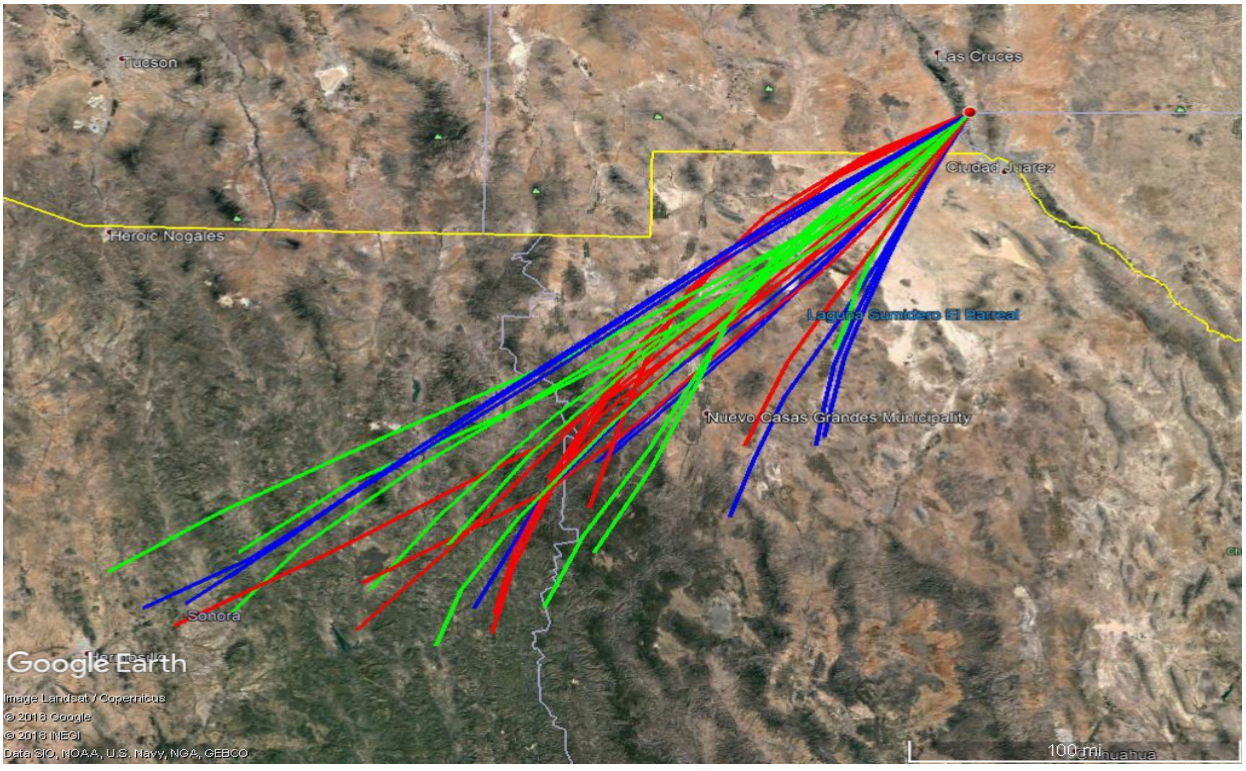


Figure 8-5. HYSPLiT back-trajectory analyses using the Ensemble mode for the Anthony monitoring site.

Wind Direction and Elevated PM_{10} Concentrations

Pollution roses (Figures 8-6 through 8-9) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m³ (0900 -1700 hour). During the event, winds blew from the west 40-90%; northwest 10-30%, southwest 10-30%, and south 10-20% of the time coinciding with peak PM_{10} concentrations.

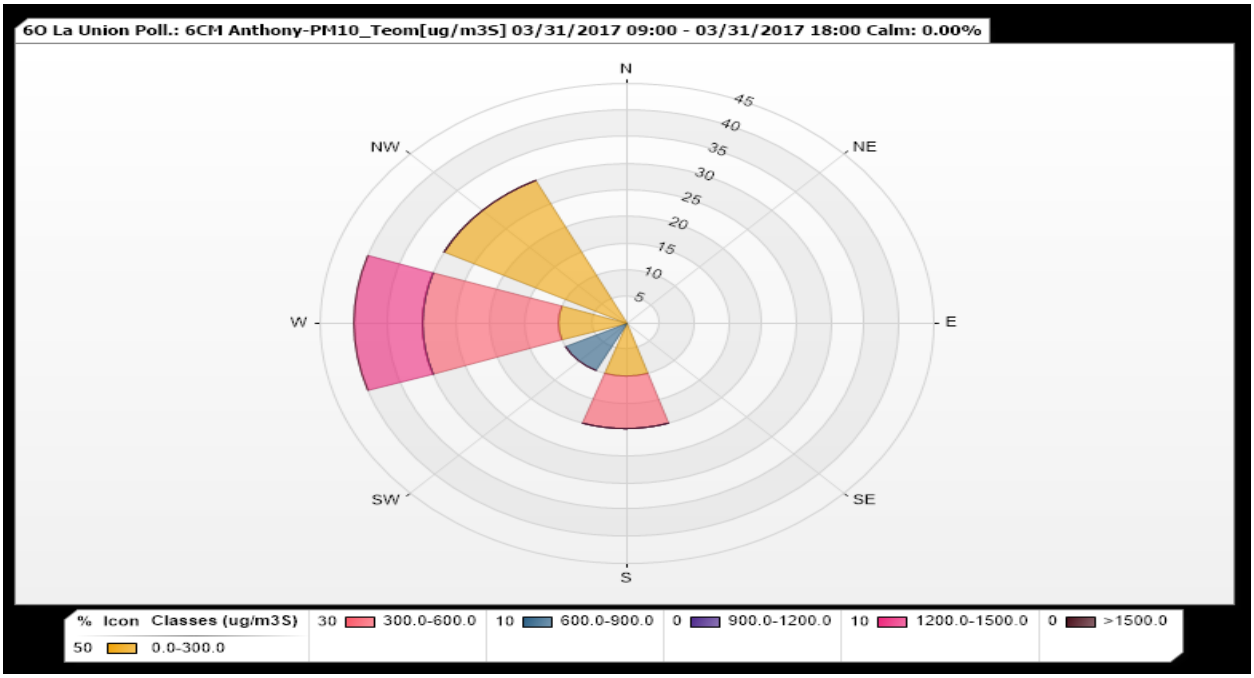


Figure 8-6. Pollution rose for the Anthony monitoring site

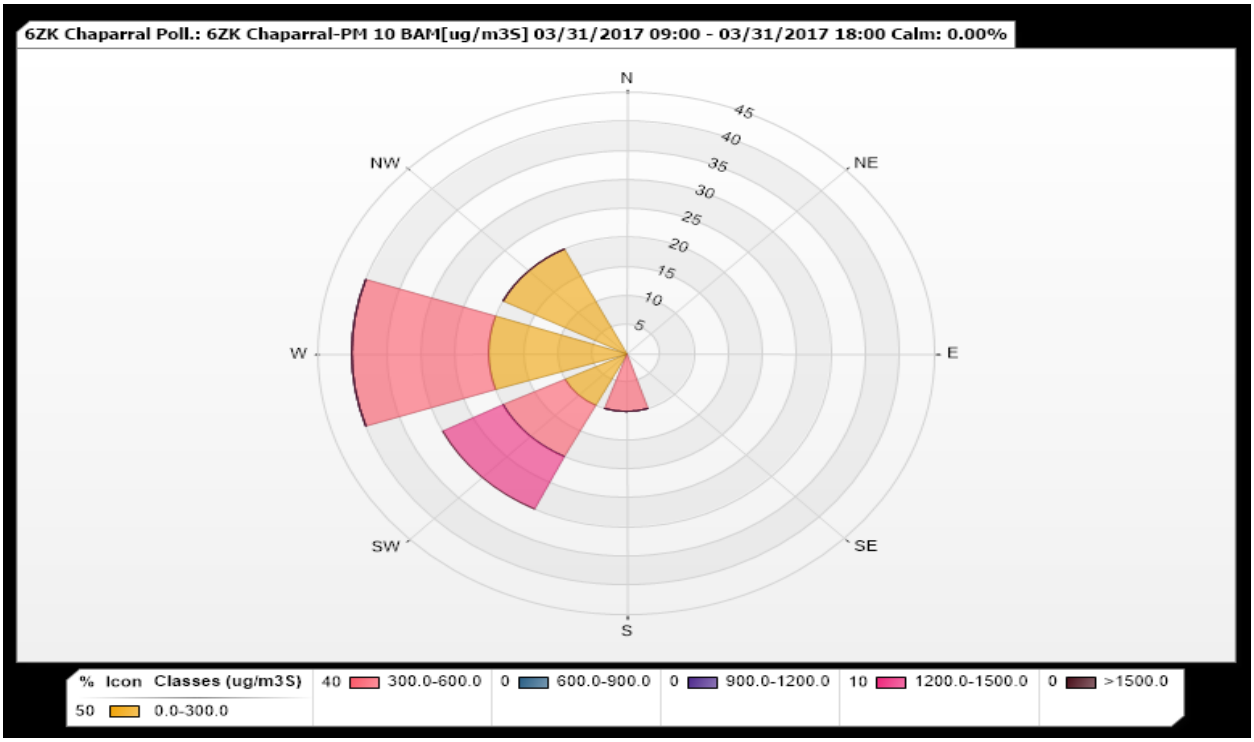


Figure 8-7. Pollution rose for the Chaparral monitoring site.

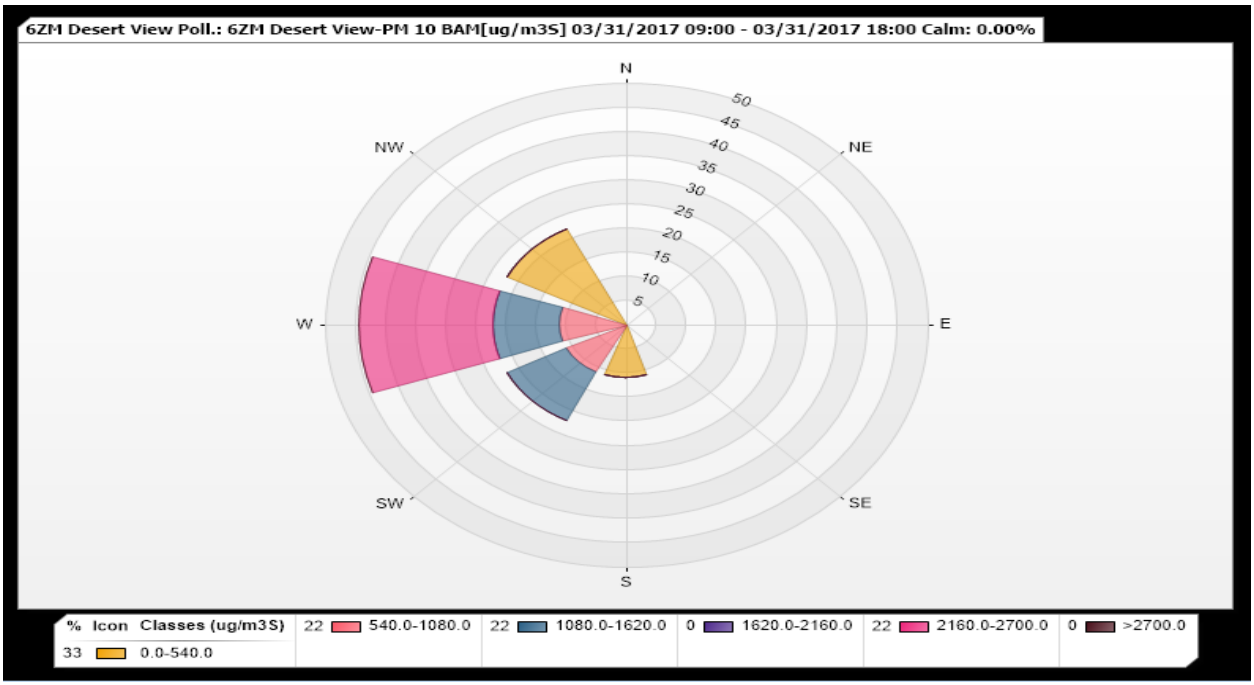


Figure 8-8. Pollution rose for the Desert View monitoring site.

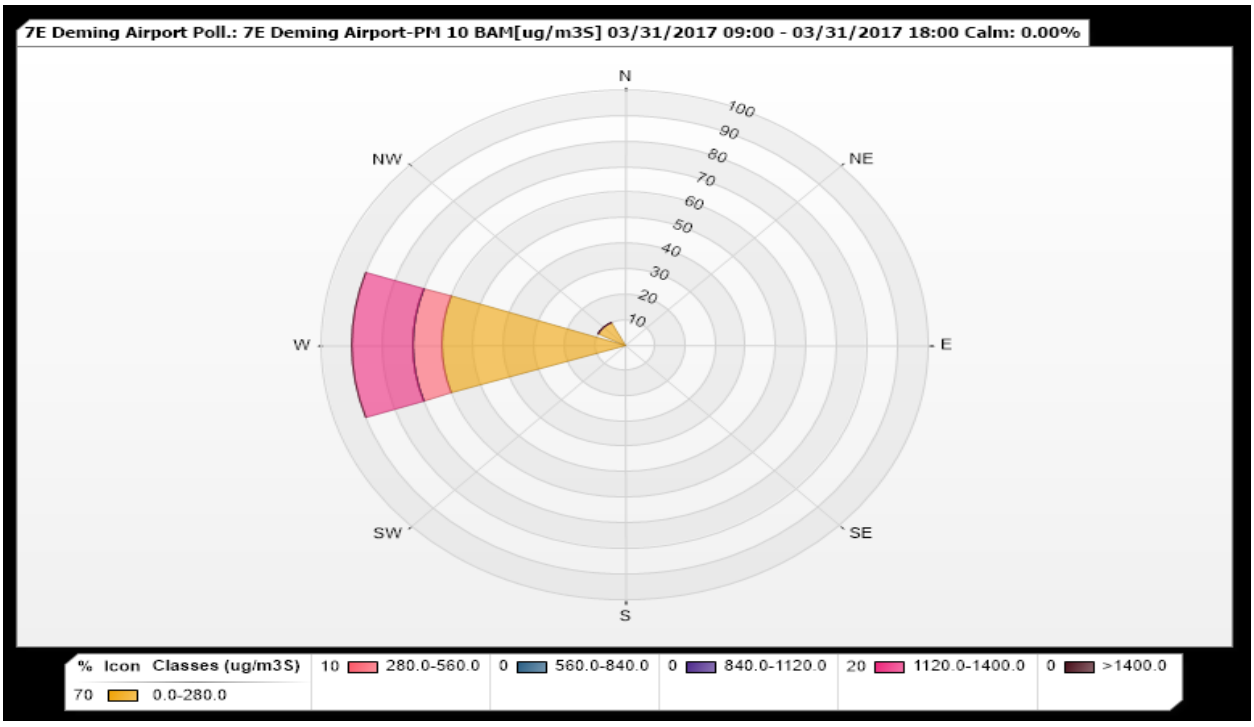


Figure 8-9. Pollution rose for the Deming monitoring site.

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

The high wind blowing dust event generated strong southwesterly winds beginning at the 0800 hour and lasting through the 1800 hour. During this time, peak hourly PM_{10} concentrations ranged from 950 to 2610 µg/m^3 at NMED monitoring sites (Figure 8-10). 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 11.4 to 15.2 m/s were recorded at Chaparral and Deming monitoring sites during the peak PM_{10} concentrations of the event. The time series plots in Figures 8-11 through 8-14 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

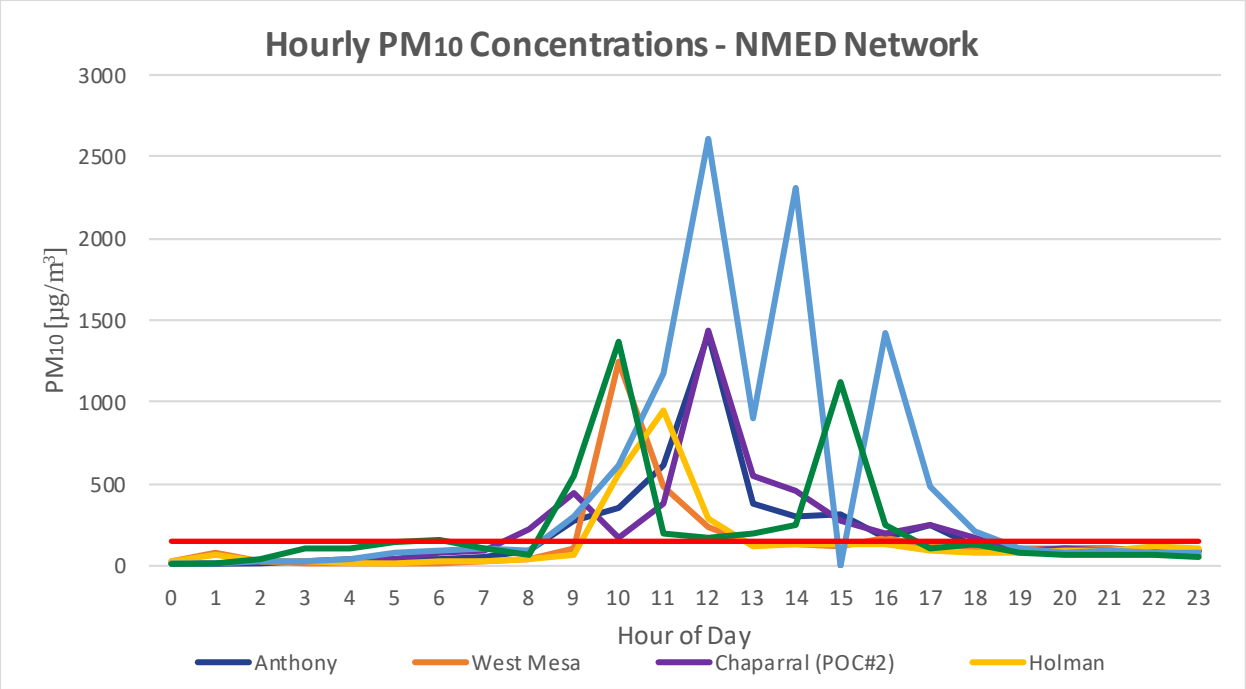


Figure 8-10. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

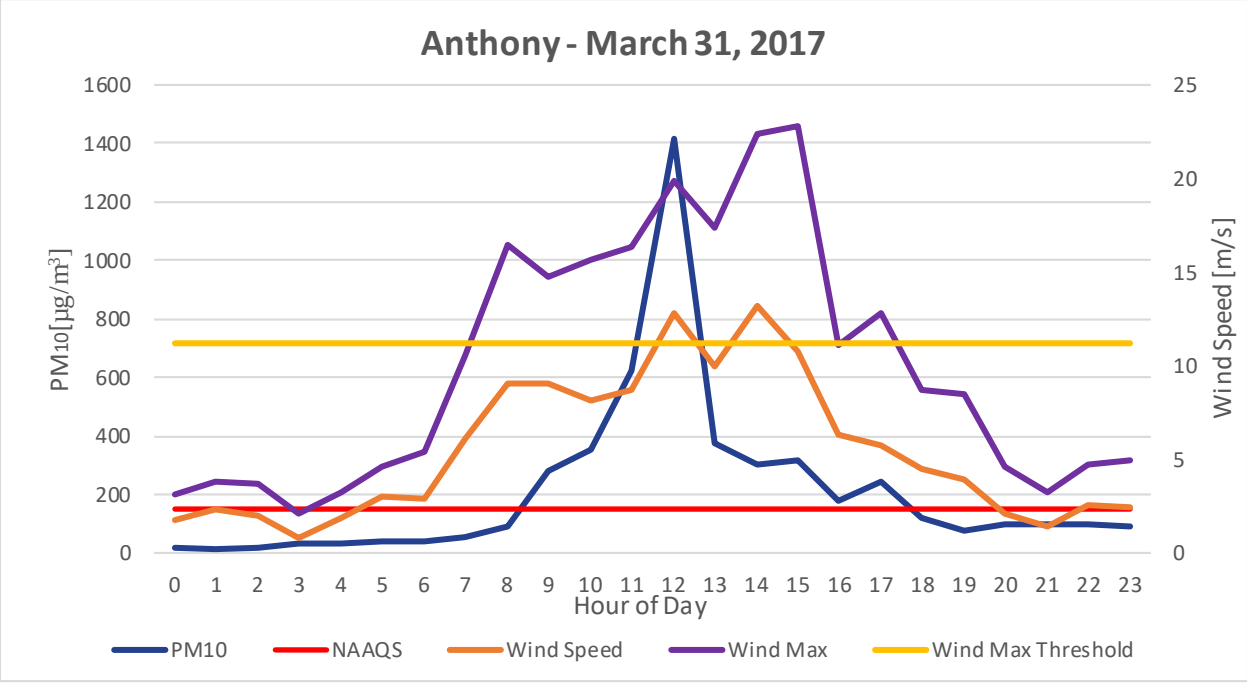


Figure 8-11. Anthony monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

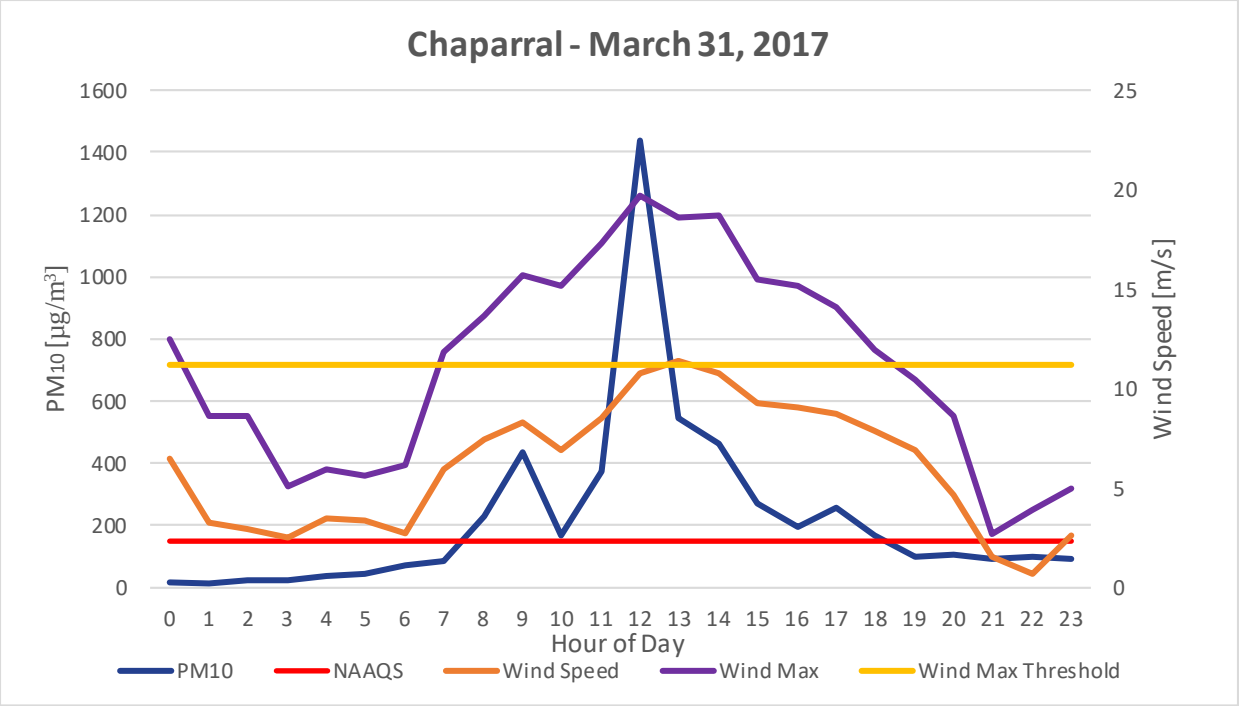


Figure 8-12. Chaparral monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

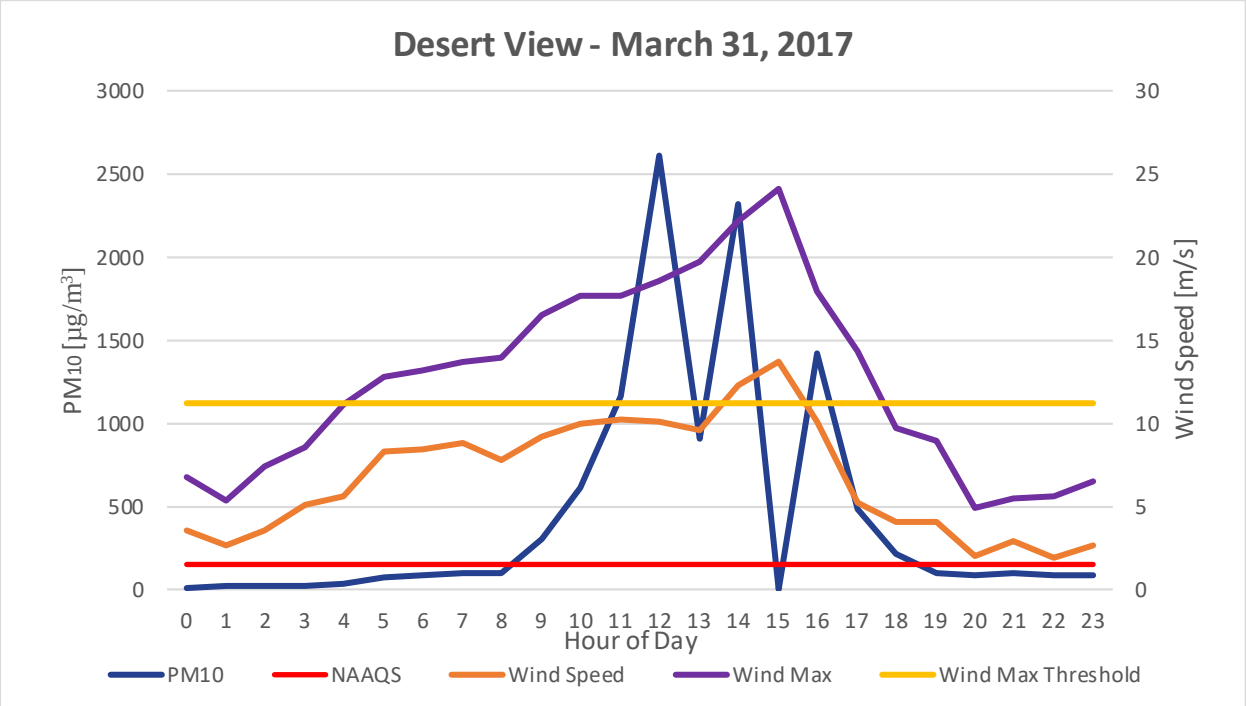


Figure 8-13. Desert View monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

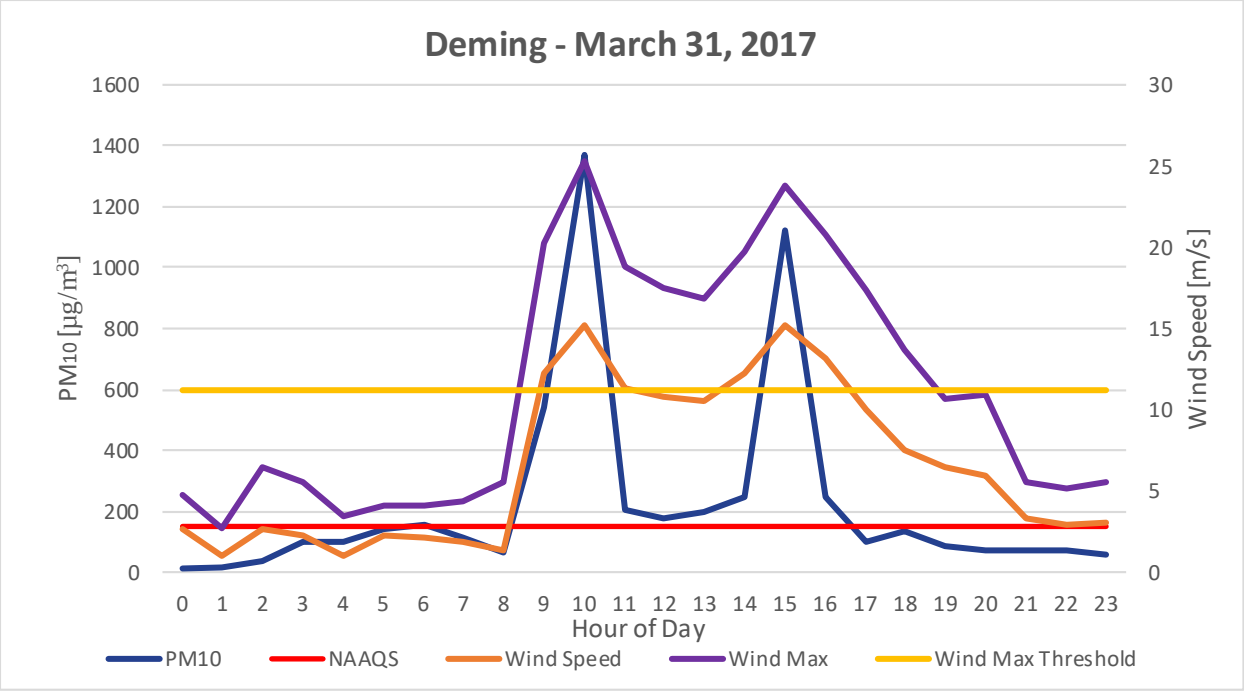


Figure 8-14. Deming monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2012-2016, the NMED monitoring sites recorded 43 (Anthony), 35 (Chaparral), 43 (Desert View), & 25 (Deming) exceedances of the PM_{10} NAAQS (Figures 8-15 through 8-18). The maximum 24-hour average PM_{10} concentrations, respectively, were 1739 (Anthony), 1606 (Chaparral), 1691 (Desert View), & 1098 (Deming) 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.

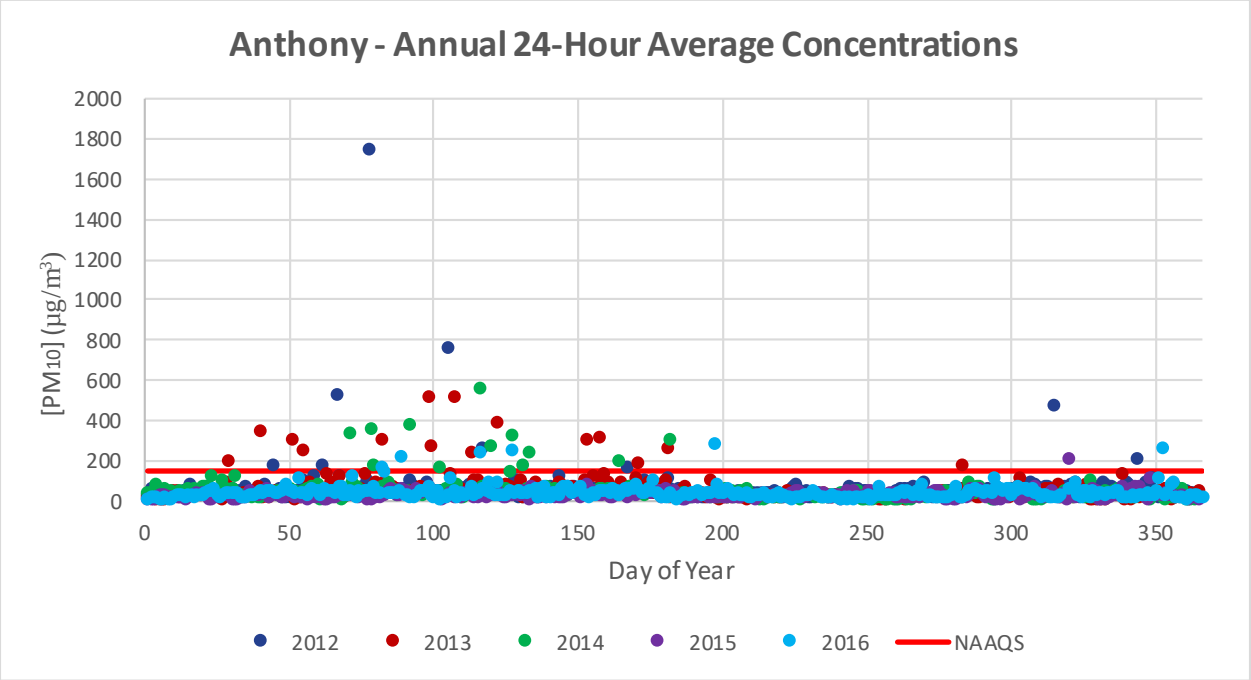


Figure 8-15. 24-hour averages by day of year from 2012-2016 for the Anthony monitoring site.

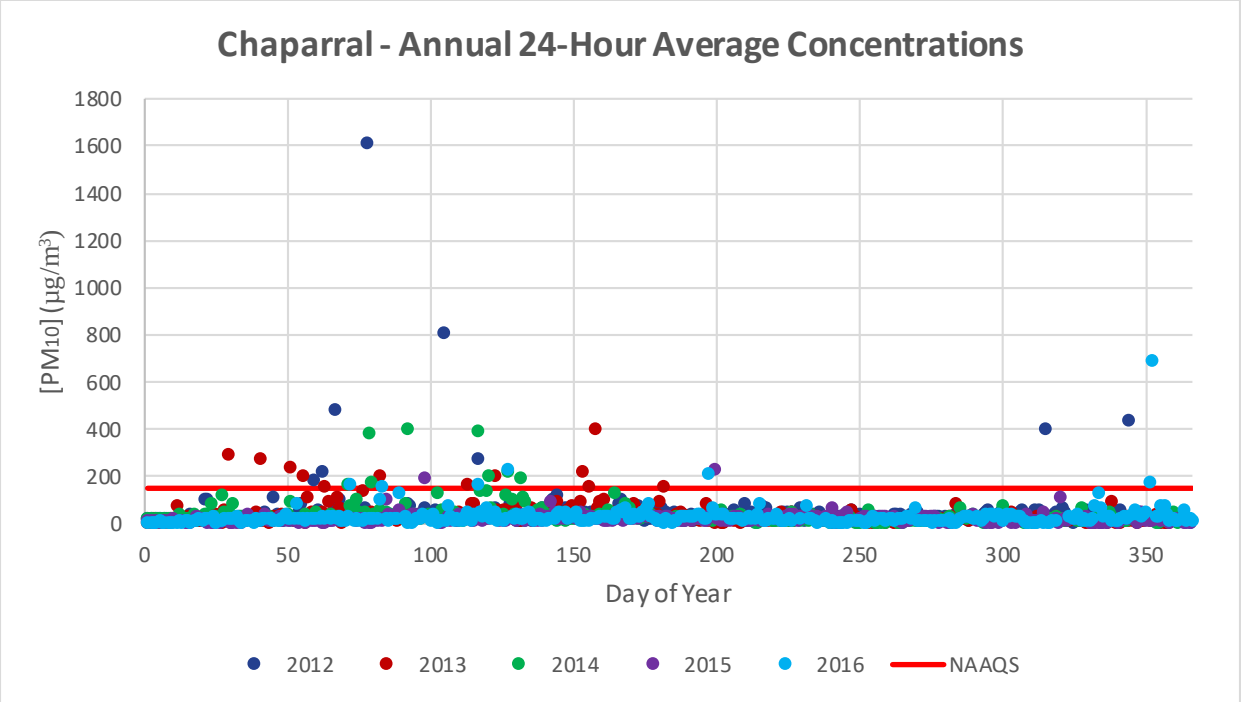


Figure 8-16. 24-hour averages by day of year from 2012-2016 for the Chaparral monitoring site.

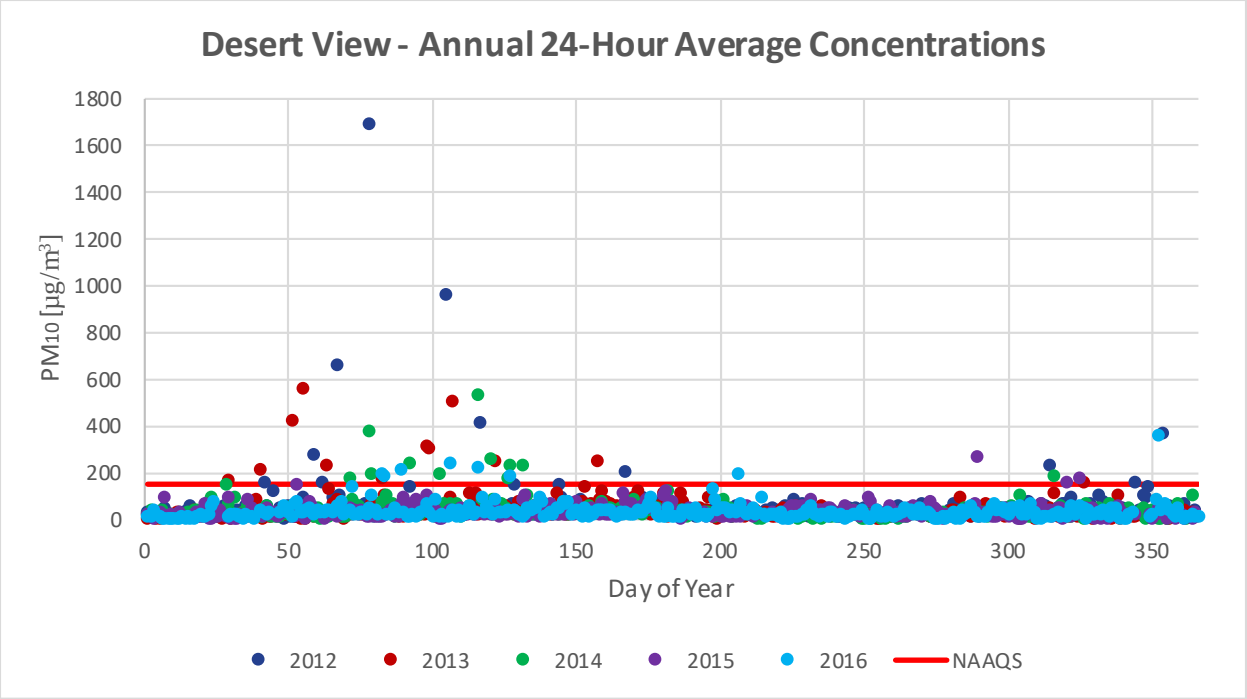


Figure 8-17. 24-hour averages by day of year from 2012-2016 for the Desert View monitoring site.

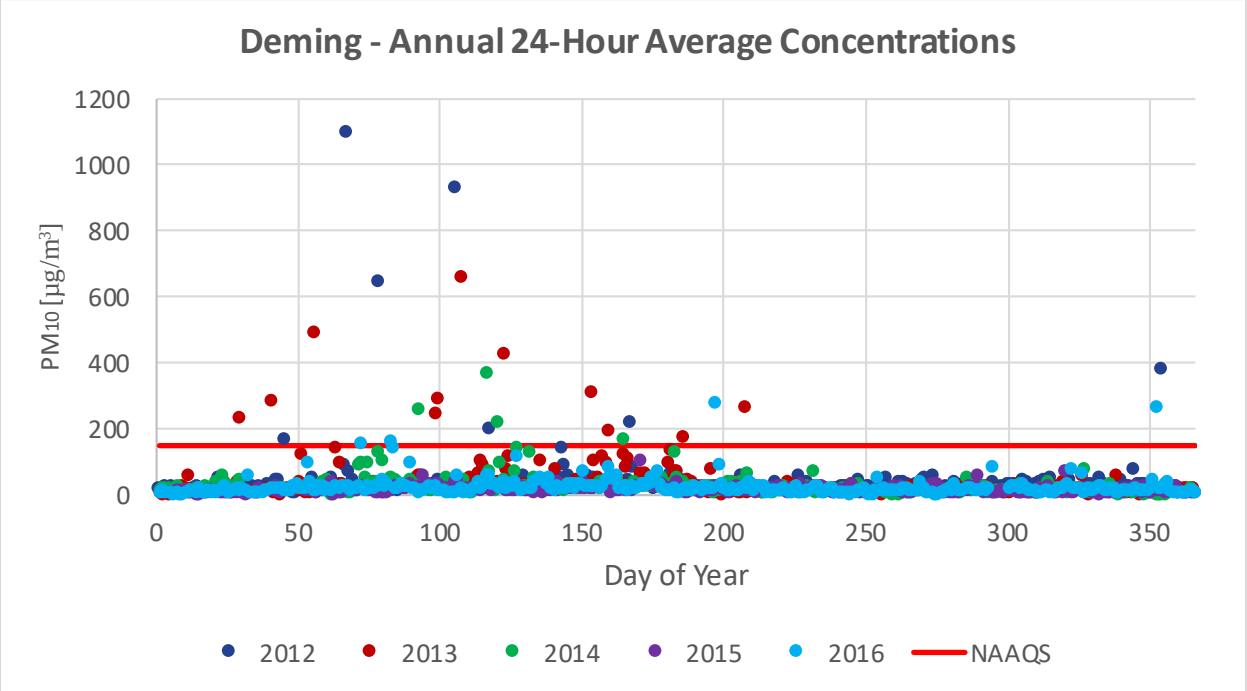


Figure 8-18. 24-hour averages by day of year from 2012-2016 for the Deming monitoring site.

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 50 µg/m³, demonstrating the influence high winds have on PM_{10} concentrations in the area.

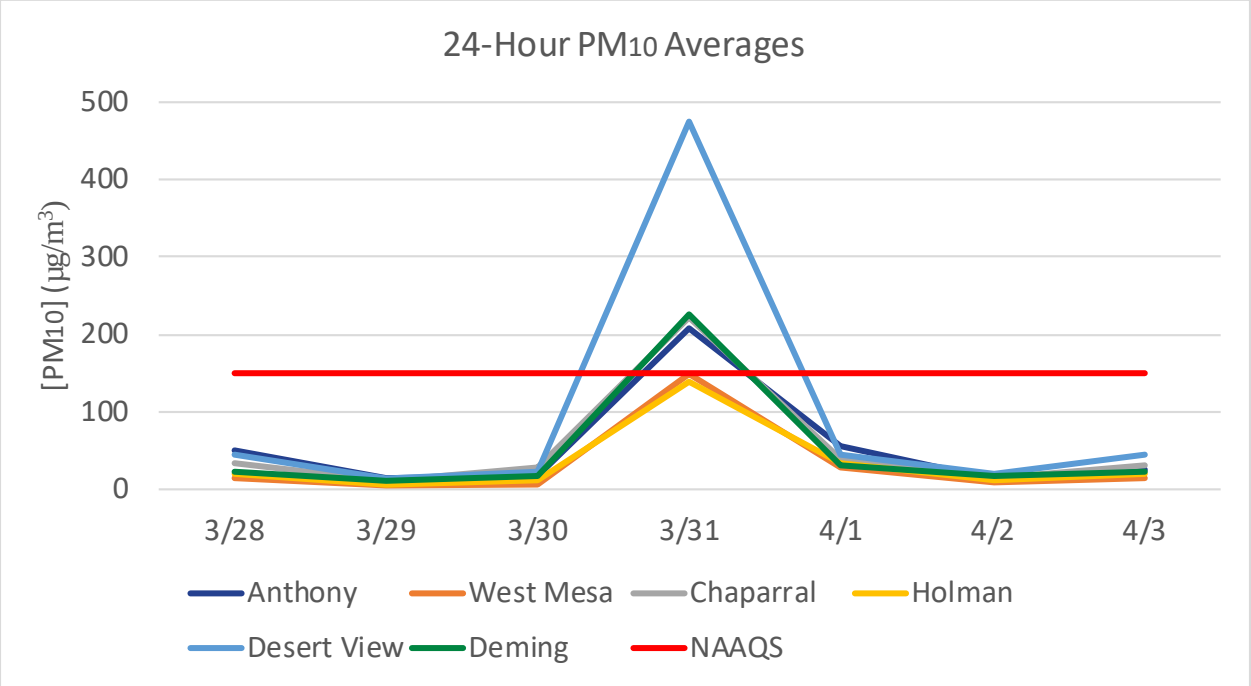


Figure 8-19. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

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 2012-2016. The recorded values for this day 208 (Anthony), 222 (Chaparral), 475 (Desert View), & 226 (Deming) µg/m^3 are near and above the 99th percentile of historical data.

Statistic\MonitoringSite	Anthony	West Mesa	Chaparral	Holman	Desert View	Deming
Max	1739	487	1606	1449	1691	1098
99th Percentile	288	148	218	178	244	216
95th Percentile	95	50	79	60	95	61
75th Percentile	51	21	34	30	42	27
50th Percentile	36	14	23	20	28	19
25th Percentile	24	10	15	13	18	12
5th Percentile	13	5	6	6	8	6
Mean	46	21	32	28	39	27

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 NMED monitoring sites. The monitored PM_{10} 24-Hour Averages of 208 (Anthony), 222 (Chaparral), 475 (Desert View), & 226 (Deming) µg/m^3 are near and above the 99th 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: April 4, 2017

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 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	35-013-0020	6ZK Chaparral	186 µg/m³ (POC #2)	14.8 m/s	24.3 m/s

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

A strengthening Pacific storm system moved into Northern New Mexico with strong and gusty winds. The winds were predicted to last through late afternoon before diminishing. Some blowing dust was also predicted across desert areas with these winds. A deep trough moved across New Mexico and into Texas. 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 Texas panhandle. Aloft, the low-pressure center of the storm system hovered at southern New Mexico. 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 providing the turbulence required for vertical mixing and entrainment of dust.

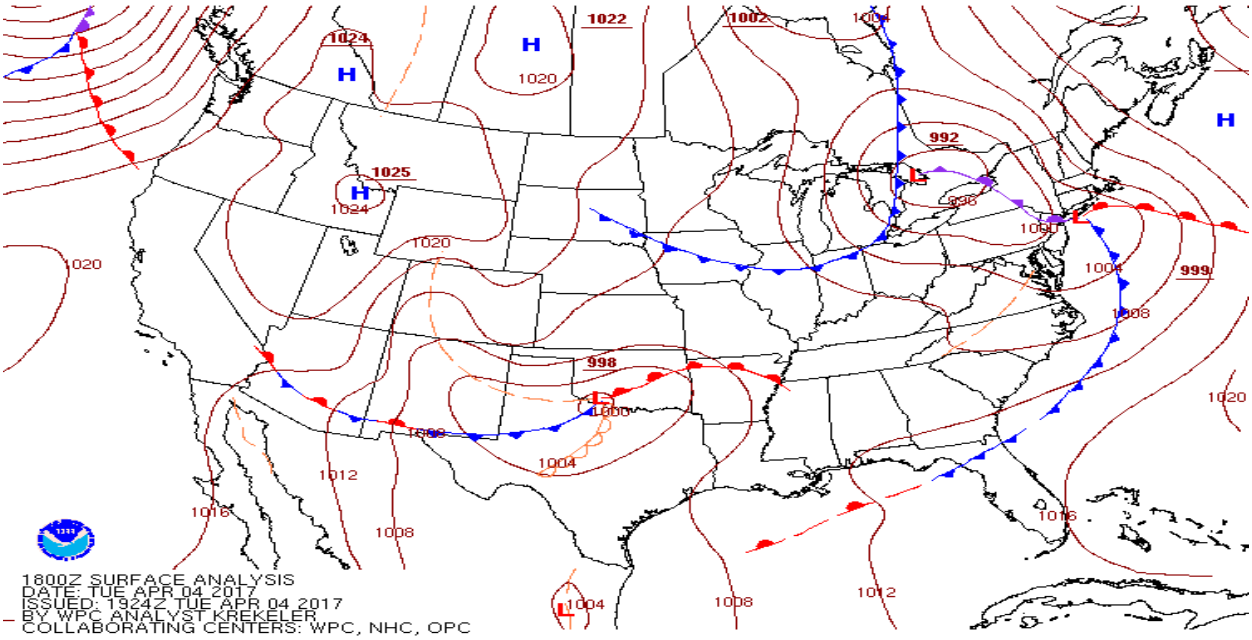


Figure 9-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

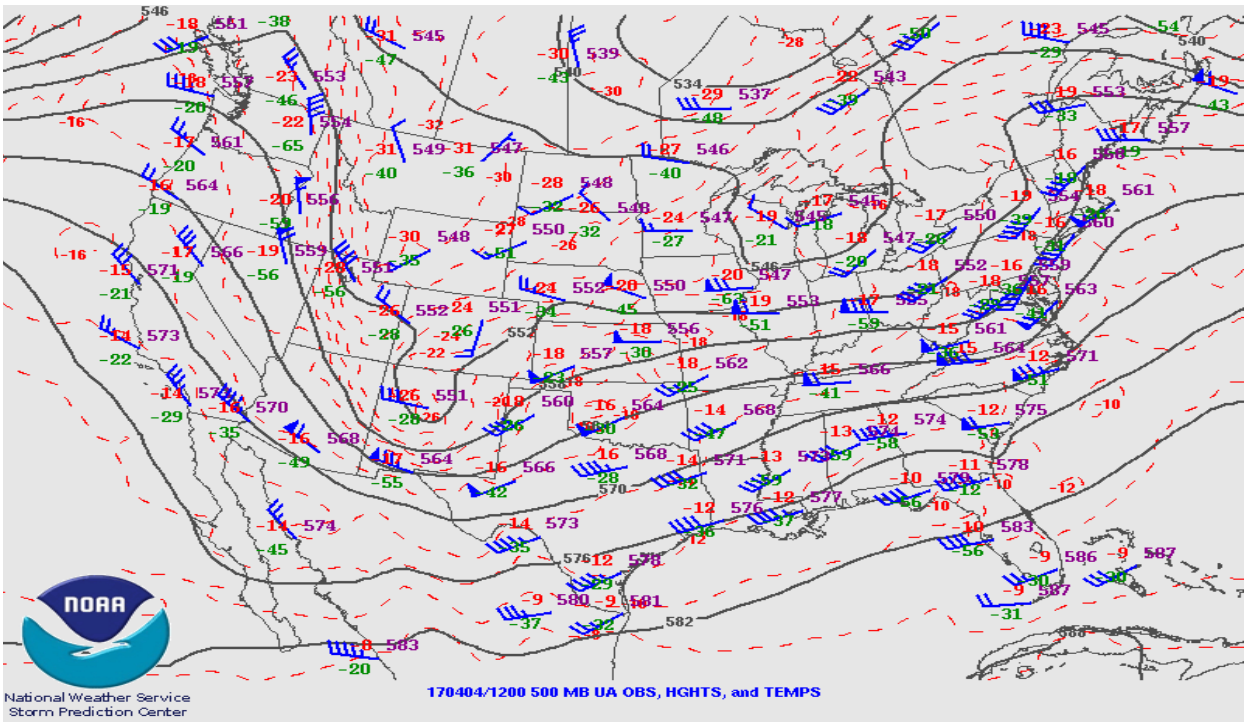


Figure 9-2. Upper air weather map for April 4, 2017 at the 1200 hour. Wind barbs depict wind speed (knots) and direction.

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

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, Chaparral, Holman, West Mesa and Deming monitoring sites beginning at the 0700 hour and lasted through the 1700 hour. PM_{10} concentrations began to exceed the NAAQS at the Chaparral and Deming monitoring sites beginning at the 0700 hour. Hourly concentrations remained elevated through the 1300 hour. Table 9-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event.

Hour	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)
0700	46	9.2	14.2	46	3.4	8.2	70	8.8	17
0800	596	12.4	22.1	78	7	15.7	190	12.3	19.6
0900	1179	14.8	24.3	219	8.2	17.3	146	13	20.4
1000	771	14.1	21.5	298	9.2	16.4	219	14.1	21
1100	515	13.1	21	271	9	16.3	127	13.2	19.9
1200	280	12	20	193	8.3	16.7	129	12.8	20.5
1300	200	11.4	19	124	7.1	15.8	97	12.1	18.8

1400	114	10.5	16.6	105	7	14.1	29	10.2	16.2
1500	63	9.2	15.1	66	6.5	15.4	14	9.3	14.5
1600	34	8.4	14.1	36	6	13.9	19	9.6	14.6
1700	31	6.9	12.2	22	5	11.1	19	9	14.4

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 at southern New Mexico in the morning and moving across New Mexico into the Texas panhandle 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 West Mesa monitoring sites recorded wind speeds above this threshold for 5 hours from the 0800 to the 1300 hour (Figure 9-3). The wind speeds at the upwind Deming monitoring site also reached the high wind threshold.

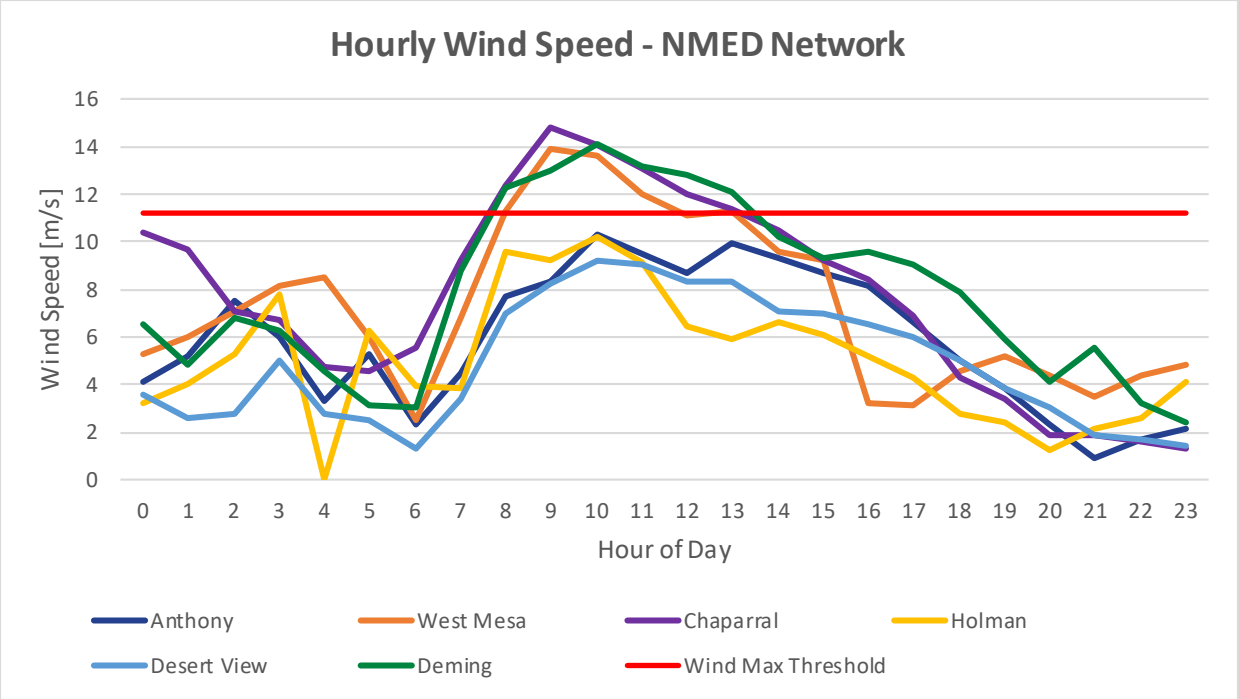


Figure 9-3. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

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 9-4). The dust plumes of interest appear to be limited to Mexico, orientated in a northwest fashion and traveling toward El Paso and NMED's monitoring site at the time of the satellite pass (1345 hour MDT) that captured the imagery.

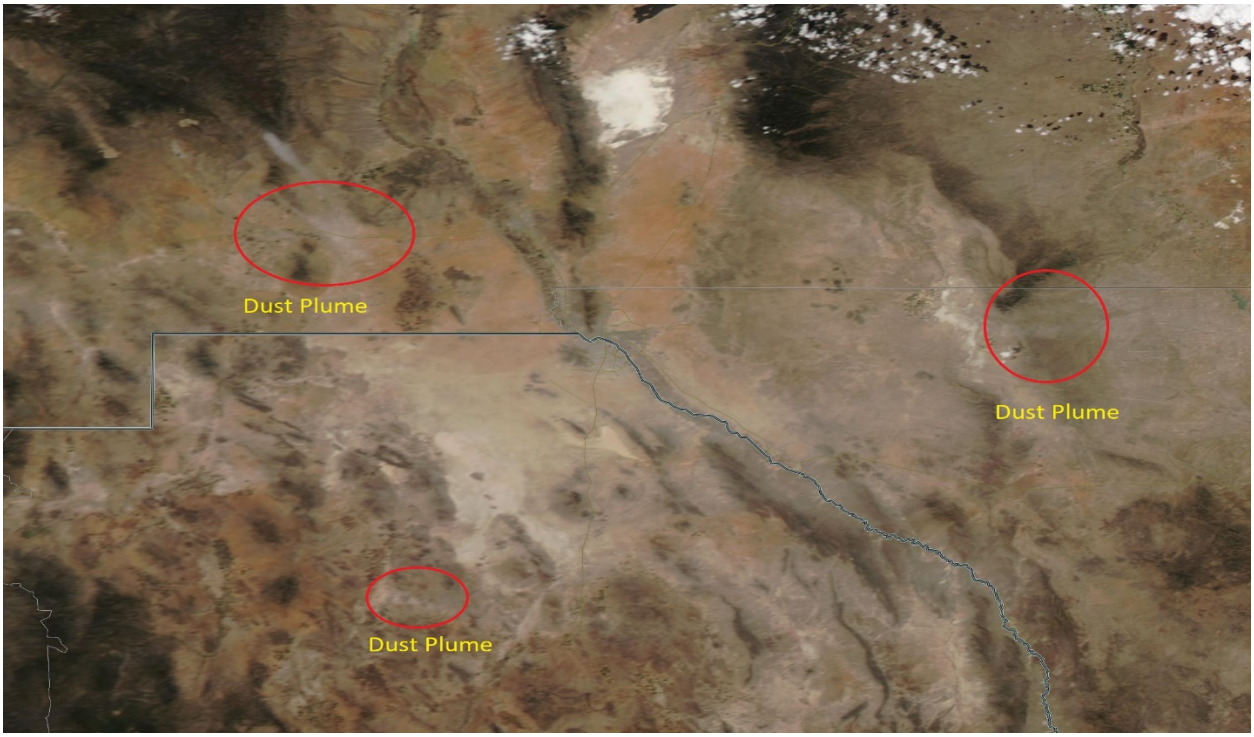


Figure 9-4. MODIS natural color imagery from the Aqua Satellite showing southwestern New Mexico, northern Chihuahua and western Texas. Imagery obtained from NASA's EOSDIS Worldview website.

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:

"Strong winds of 25 to 35 mph with gusts to 45 mph this morning and this afternoon. Stronger gusts of 50 to 60 mph along east slopes of terrain and over mountain tops. Patchy blowing dust across the desert areas…High Wind Warning until 7 PM MDT this evening."

Spatial and Transport Analysis

HYSPLiT Backtrajectory Analysis

A back-trajectory analysis using the HYSPLIT (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 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 9-5). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

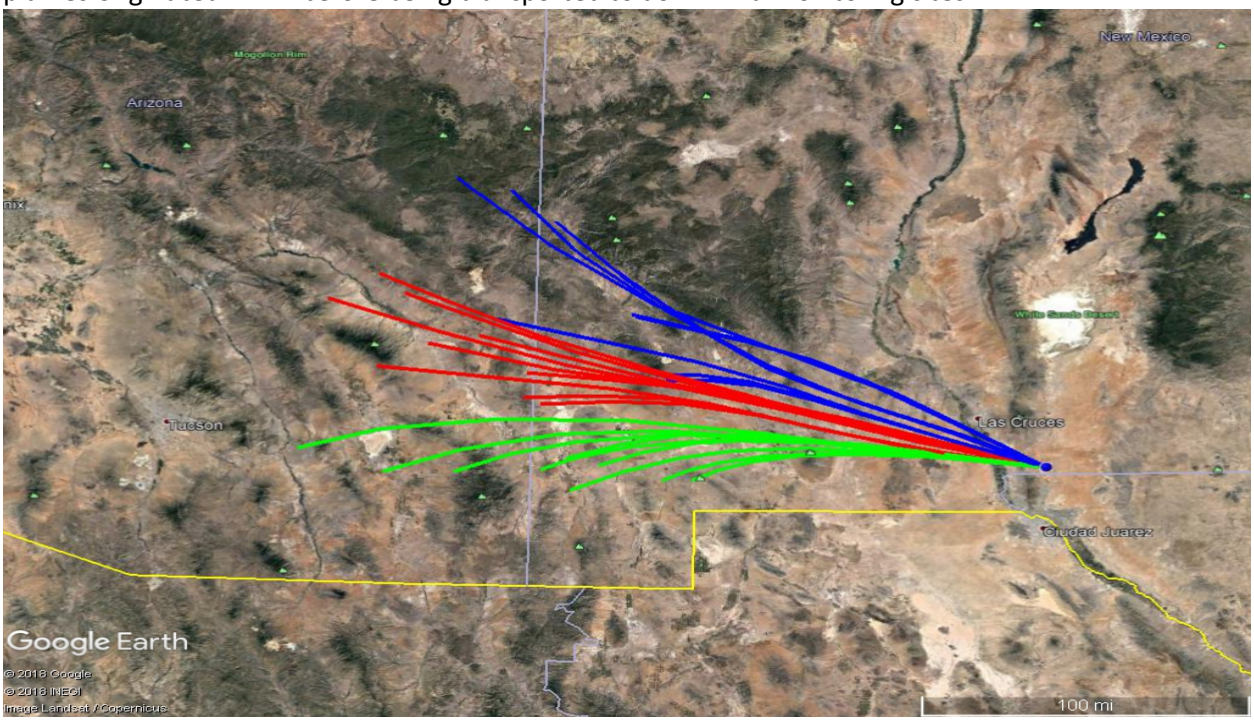


Figure 9-5. HYSPLiT back-trajectory analyses using the Ensemble mode for Chaparral monitoring site.

Wind Direction and Elevated PM_{10} Concentrations

A pollution rose (Figure 9-6) was created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m^3 (0700 -1400 hour). During the event, winds blew from the west 100% of the time coinciding with peak PM_{10} concentrations.

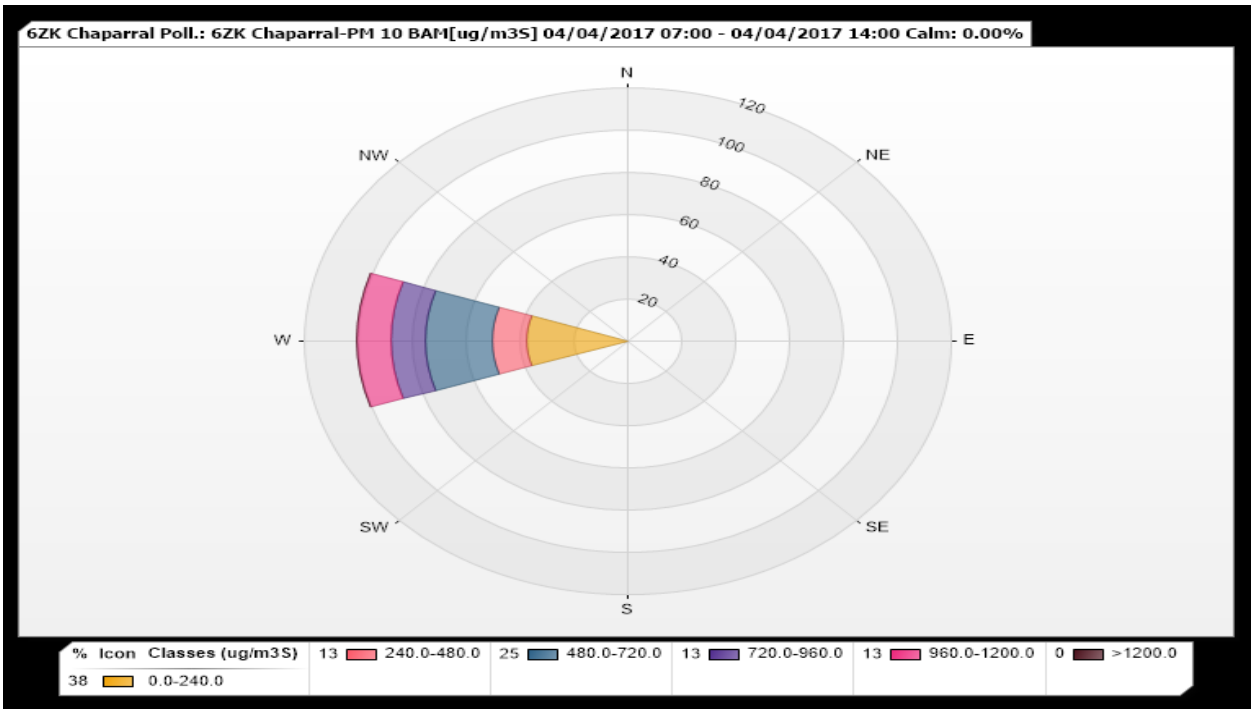


Figure 9-6. Pollution rose for the Chaparral monitoring site.

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

The high wind blowing dust event generated strong northwesterly winds beginning at the 0700 hour and lasting through the 1700 hour. During this time, peak hourly PM_{10} concentrations ranged from 219 to 1179 µg/m^3 at NMED monitoring sites (Figure 9-7). 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 hourly average wind speeds of 9.2 to 14.8 m/s were recorded at the Desert View and Chaparral monitoring sites during the peak PM_{10} concentrations of the event. The time series plot in Figure 9-8 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

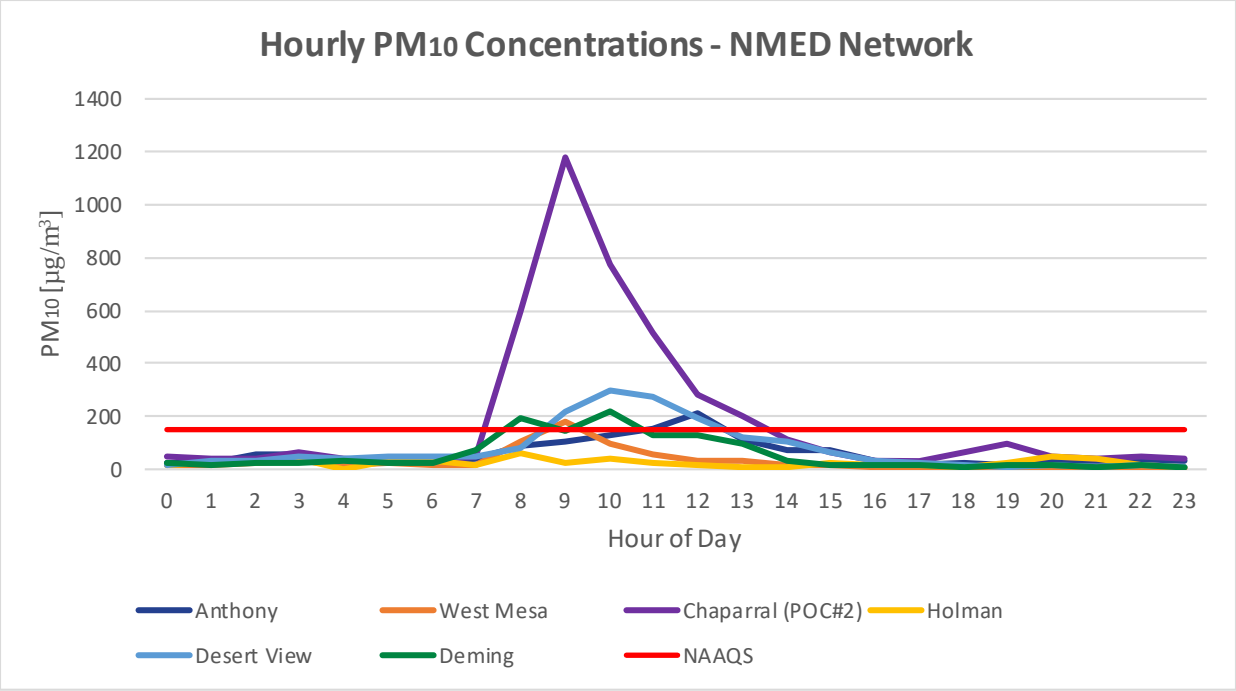


Figure 9-7. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

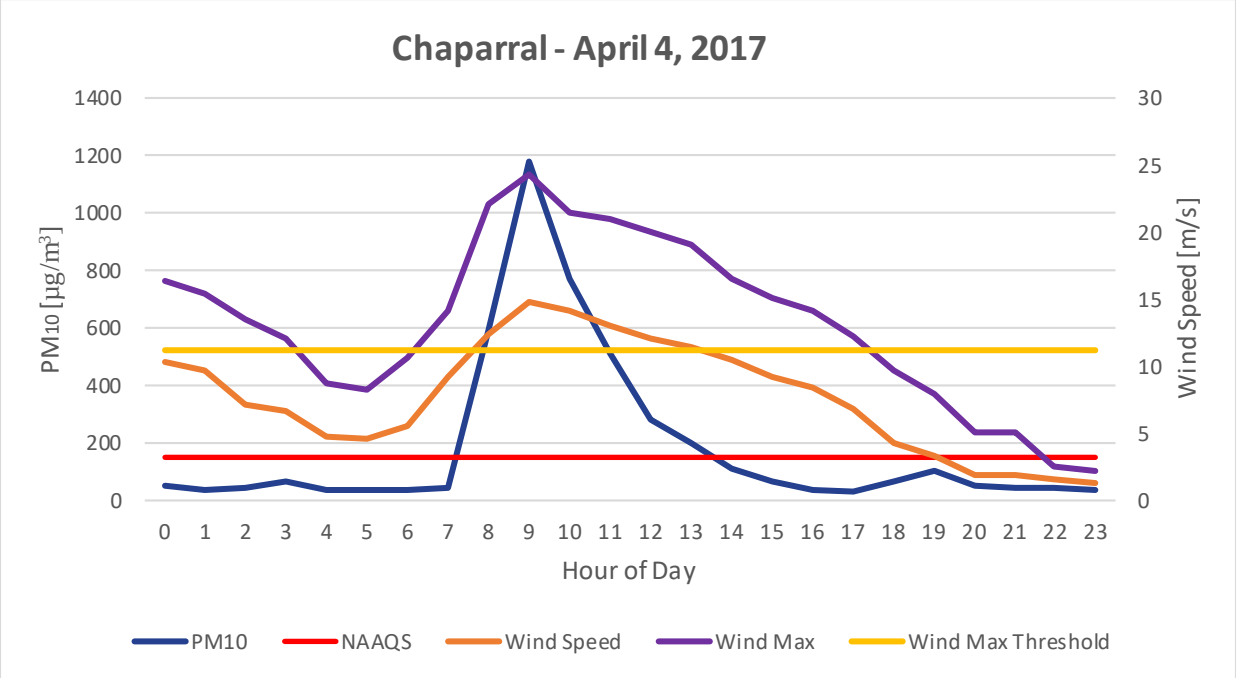


Figure 9-8. NMED monitoring network hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2012-2016, the Chaparral monitoring site recorded 35 exceedances of the PM_{10} NAAQS (Figure 9-9). The maximum 24-hour average PM_{10} concentration at this site was 1606 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.

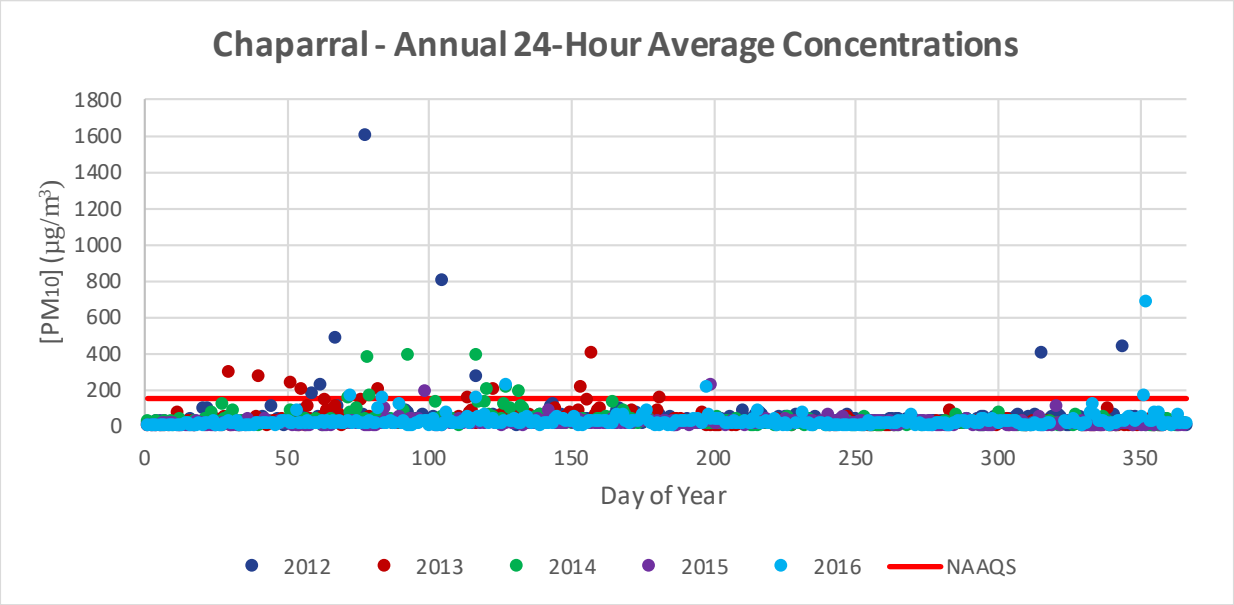


Figure 9-9. 24-hour averages by day of year from 2012-2016.

Spatial and Temporal Variability

As demonstrated in Figure 9-10, 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 60 µg/m³, demonstrating the influence high winds have on PM_{10} concentrations in the area.

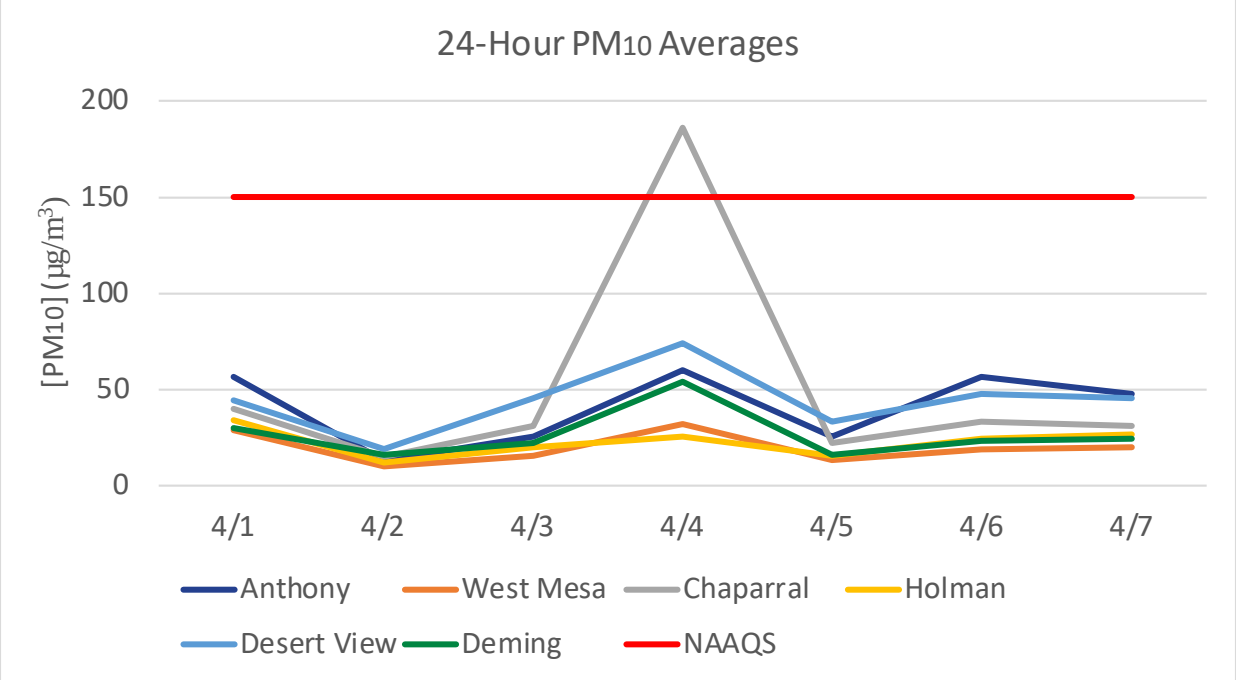


Figure 9-10. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

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 2012-2016. The recorded value for this day (186 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	288	148	218	178	244	216
95th Percentile	95	50	79	60	95	61
75th Percentile	51	21	34	30	42	27
50th Percentile	36	14	23	20	28	19
25th Percentile	24	10	15	13	18	12
5th Percentile	13	5	6	6	8	6
Mean	46	21	32	28	39	27

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 Chaparral monitoring site. The monitored PM_{10} 24-Hour Average of 186 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.

10. HIGH WIND EXCEPTIONAL EVENT: April 25, 2017

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, 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	450 µg/m³ (POC #2)	14 m/s	24.6 m/s
RJ	35-013-0016	6CM Anthony	213 µg/m³	11.6 m/s	21.1 m/s
RJ	35-013-0021	6ZM Desert View	288 µg/m³	10 m/s	20.8 m/s
RJ	35-029-0003	7E Deming	184 µg/m³	13.8 m/s	23.4 m/s

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

An approaching trough will form over the region as an area of low pressure has formed over southeastern Colorado and a tightening of the surface pressure gradient across the borderland. This along with the decent mixing aloft will create strong 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 10-1). Aloft, the low-pressure center of the storm system hovered over the four corners. As the day progressed this low pressure aloft traveled east and aligned itself with New Mexico and the surface wind direction (Figure 10-2). 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.

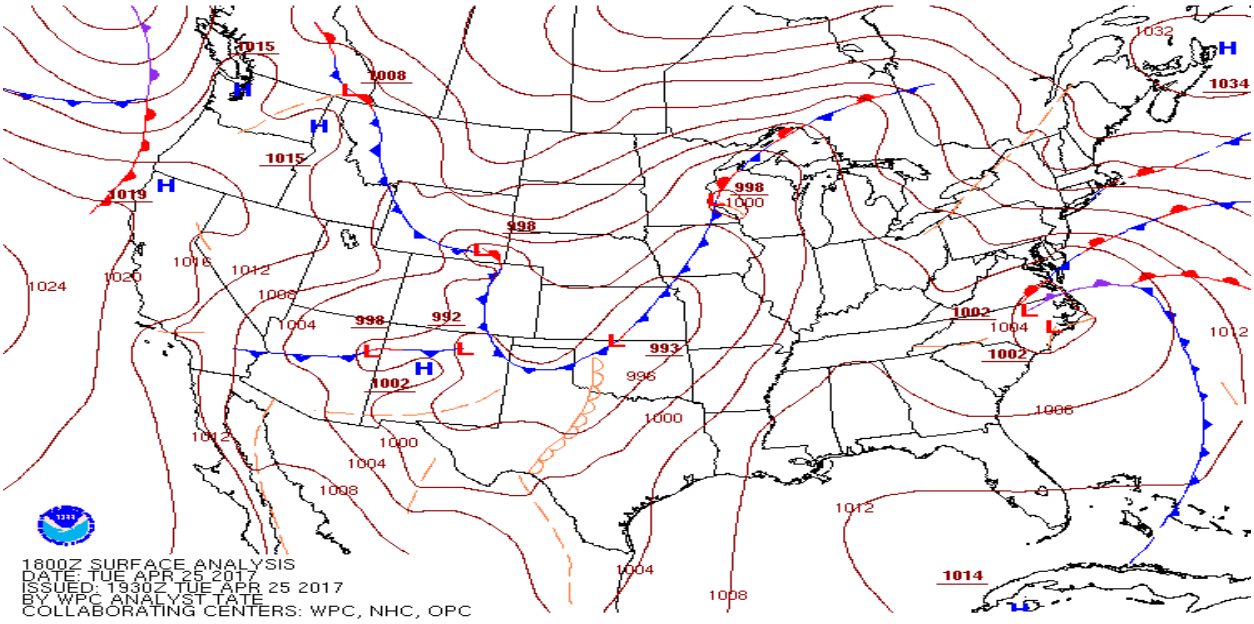


Figure 10-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

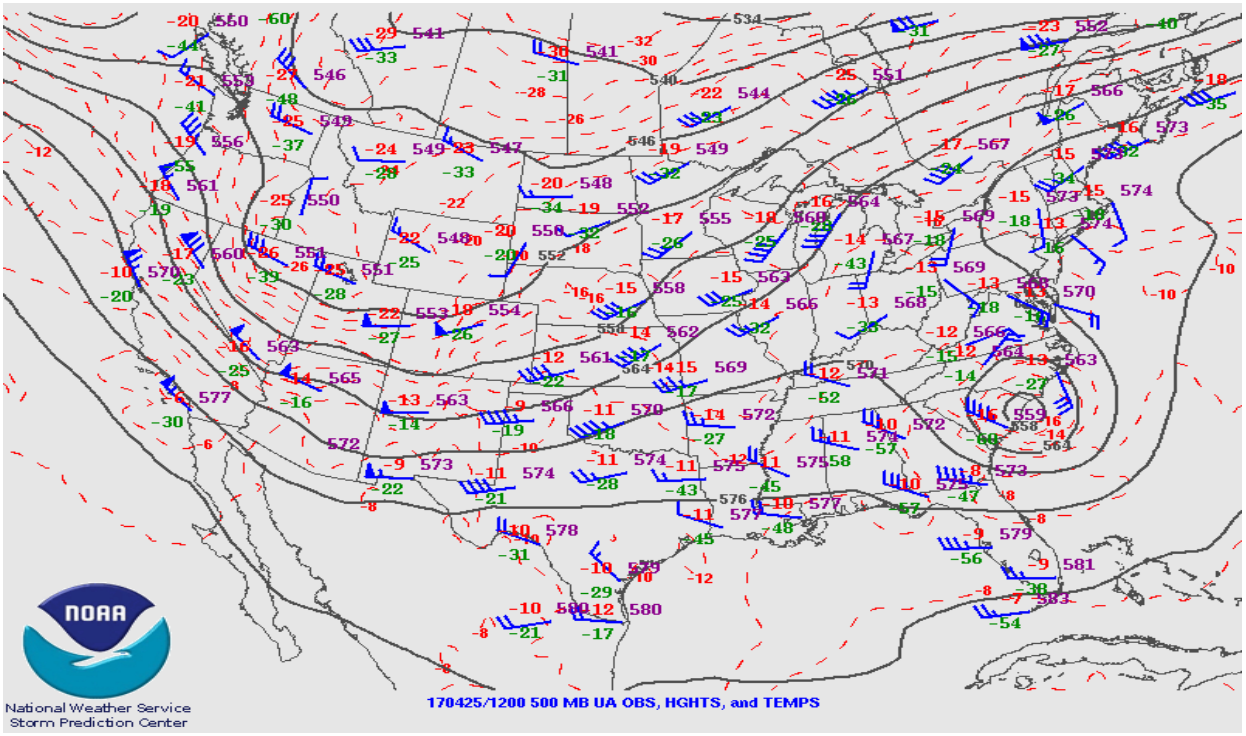


Figure 10-2. Upper air weather map for April 25, 2017 at the 1200 hour. Wind barbs depict wind speed (knots) and direction.

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. Anthropogenic sources of dust near NMED's monitoring sites include: disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

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, Chaparral, Holman, West Mesa and Deming monitoring sites beginning at the 0700 hour and lasted through the 2300 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 0700 hour. Hourly concentrations remained elevated through the 2100 hour. Table 10-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event. The wind speeds exceeded 9 m/s for 40 minutes lasting through the 1510 to the 1550 hour at the Desert View monitoring site (Table 10-3).

Hour	Anthony POC #1			Chaparral POC #2			Desert View		
	PM_{10} ($\mu g/m^3$)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} ($\mu g/m^3$)	Wind Speed (m/s)	Wind Gust (m/s)	PM_{10} ($\mu g/m^3$)	Wind Speed (m/s)	Wind Gust (m/s)
0700	158	6.3	12	241	10.3	17.1	193	7.5	14.4
0800	122	9.5	14.7	219	10.7	16.6	232	8.1	15.4
0900	281	9.4	17.4	490	11.9	21.2	544	9.4	16.9
1000	267	10.9	18.9	762	13.1	21.4	552	9	17.8

1100	831	10.8	19.9	942	13	24.6	566	9.4	19.4
1200	591	10.6	18.2	4227	14	22.9	769	9.6	18.6
1300	232	11.5	19.7	718	12.9	23.1	398	8.7	16.4
1400	216	11	21.1	193	10.7	17.8	398	8.8	17.5
1500	313	11.6	20.2	237	10.8	21.9	493	10	17.7
1600	354	10.5	18.8	505	11.1	18.1	613	9.8	20.8
1700	419	9.4	16.4	525	11.1	17.3	332	7.9	16.9
1800	350	8.2	14.2	469	11.2	17.8	324	6.6	15.3
1900	230	8.2	15.6	537	12.1	19.9	361	7.4	16.2
2000	138	5.2	12	195	10.5	18.9	293	6.9	16.8
2100	54	6.8	13.7	53	7.9	13.8	156	5.3	12.5
2200	41	5.7	12	70	6.8	11.2	90	6	13.5
2300	83	4.5	8.6	73	7.7	12.2	85	5.7	11

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

Hour	Wind Speed (m/s)
1500	9.4
1505	8
1510	9.7
1515	9.2
1520	11.1
1525	10.7
1530	11.2
1535	9.7
1540	10.4
1545	10.5
1550	12.2
1555	8.2

Table 10-3. 5-Minute Wind Speeds for the Desert View monitoring site for the 1500 hour.

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 10-3).

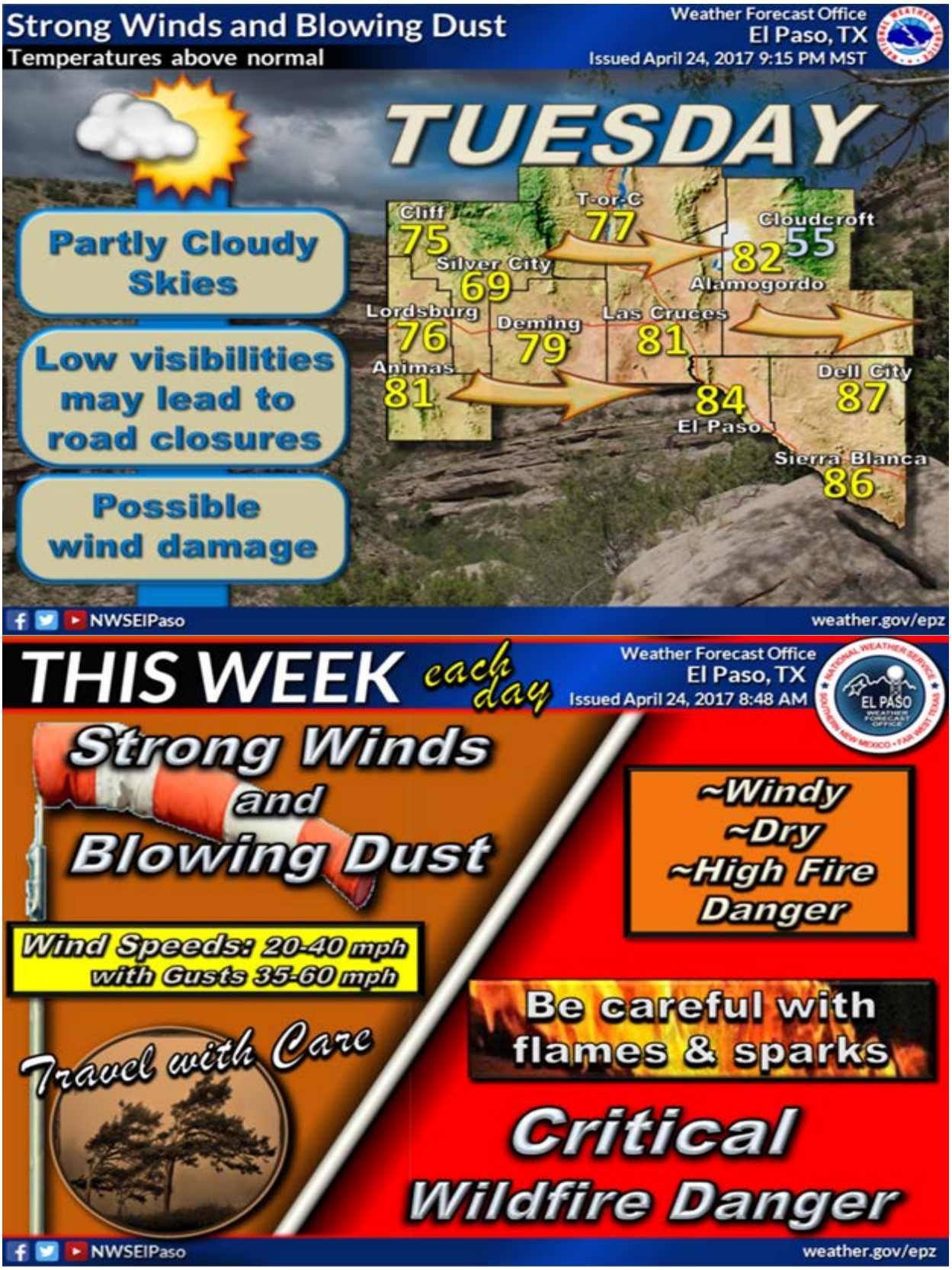


Figure 10-3. NWS Forecast Graphic for the event.

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 Anthony, West Mesa, Chaparral, and Holman monitoring sites recorded wind speeds above this threshold for 11 hours from the 0900 to the 1900 hour (Figure 10-4). The wind speeds at the upwind Deming monitoring sites also reached the high wind threshold. The 5-minute wind speeds at the Desert View monitoring site reached and exceeded 11.2 m/s sustained wind speed for the 1530 & 1550 hour (Table 10-3).

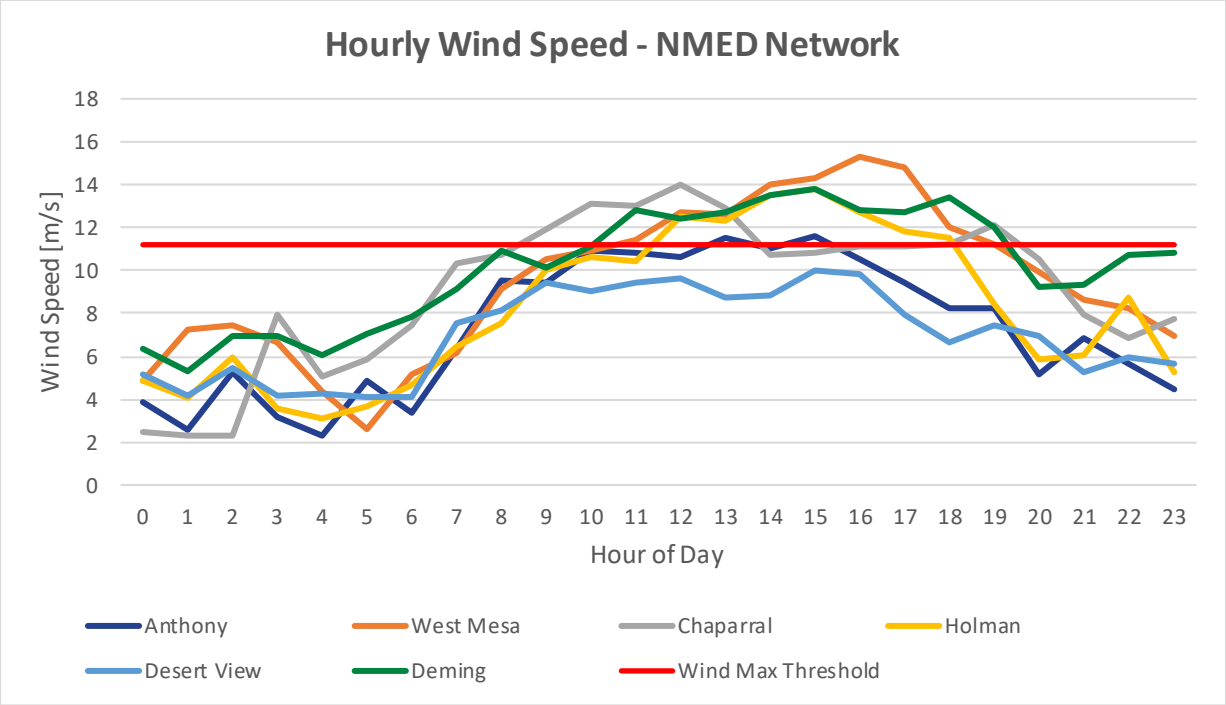


Figure 10-4. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

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 Desert View monitoring technician reported low visibility conditions on-site where the monitors are located.

The documentation and analysis presented in this section demonstrates that all identified sources that may have caused or contributed to the exceedances 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 located along the southwestern border of New Mexico, west Texas, and Northern Chihuahua of NMED's monitoring sites. The VIIRS Aerosol Optical Depth product represents the dust plumes as warmer colors on the plot. 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 10-5). 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(s) at the time of the satellite pass (1100 hour MDT) that captured the imagery.

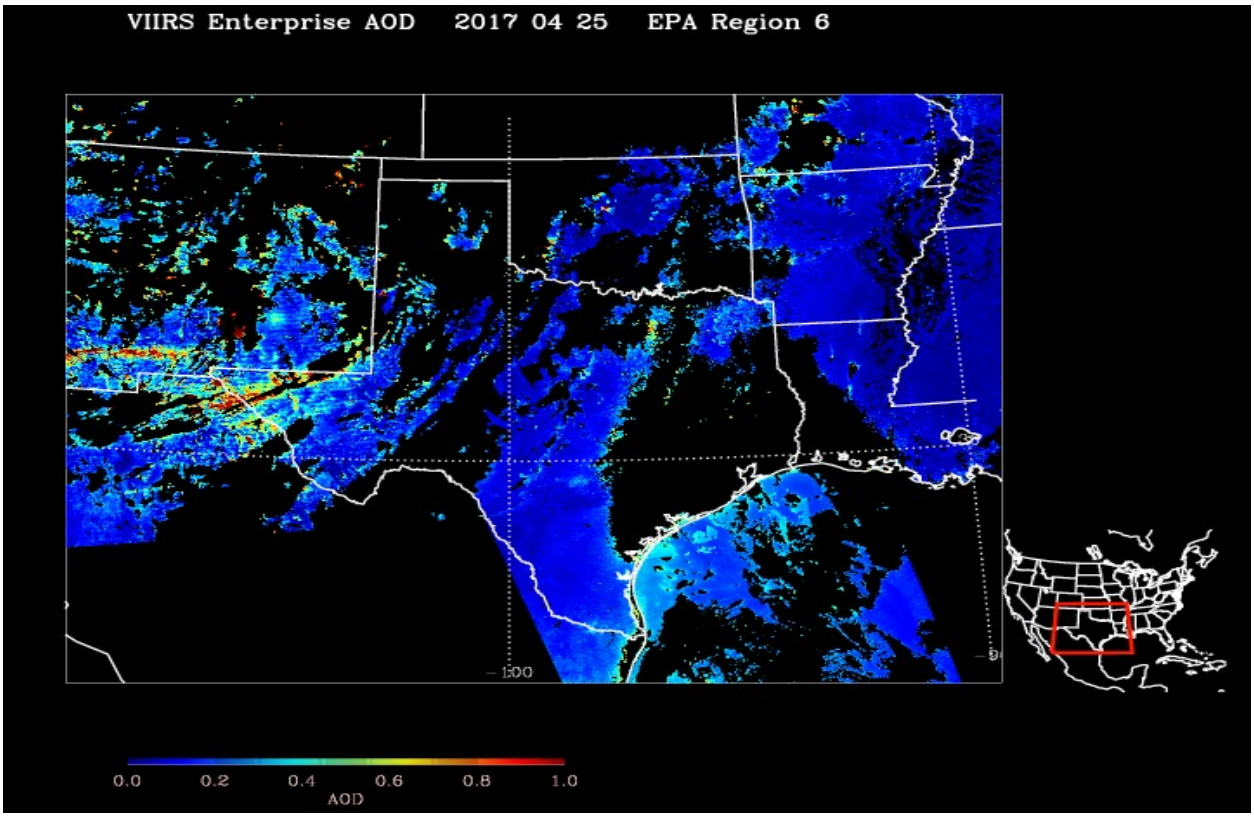


Figure 10-5. VIIRS Aerosol Optical Depth product imagery from the Suomi NPP Satellite showing southwestern New Mexico, northern Chihuahua and western Texas. Imagery obtained from IDEA website. Warm colors represent dust plumes.

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 10-3). 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 with winds gusting around 50 to 60 mph resulting in areas of blowing dust with the visibility under a mile across some locations. The high winds may also cause some property damage."

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 southeastern 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 (Figure 10-6). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

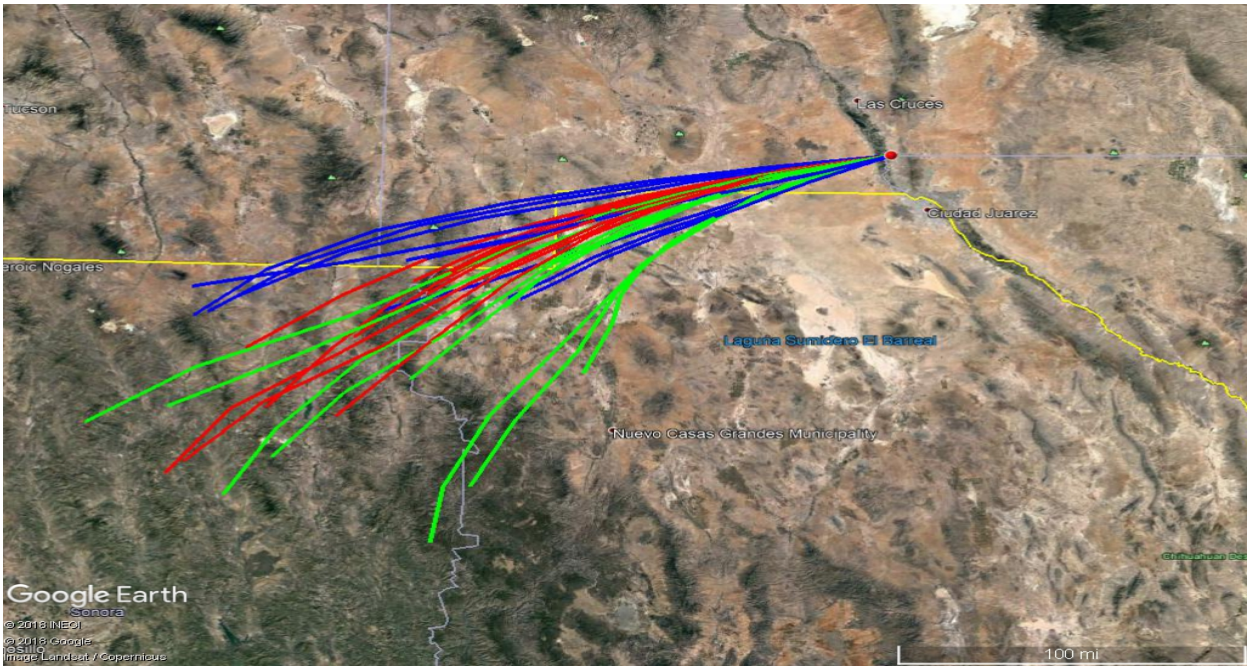


Figure 10-6. HYSPLiT back-trajectory analyses using the Ensemble mode for Anthony monitoring site.

Wind Direction and Elevated PM_{10} Concentrations

Pollution roses (Figures 10-7 through 10-10) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m³ (0900 -1800 hour). During the event, winds blew from the west 40-90%; northwest 10-30%, southwest 10-30%, and south 10-20% of the time coinciding with peak PM_{10} concentrations.

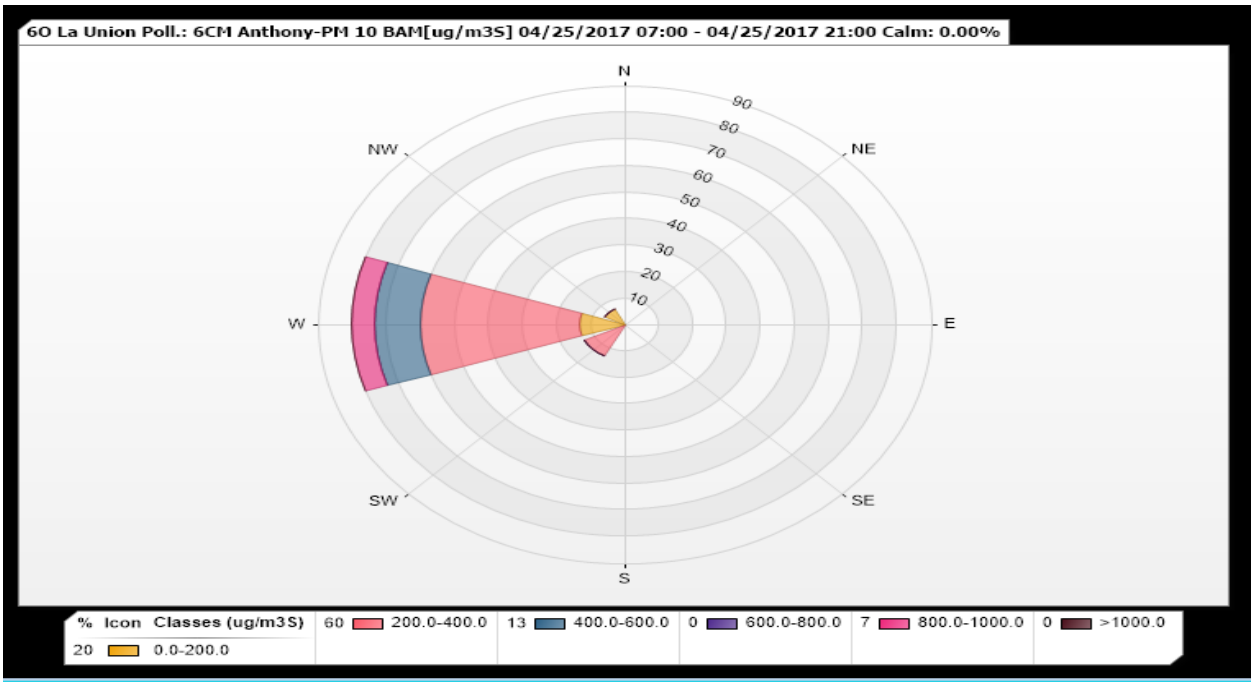


Figure 10-7. Pollution rose for the Anthony monitoring site.

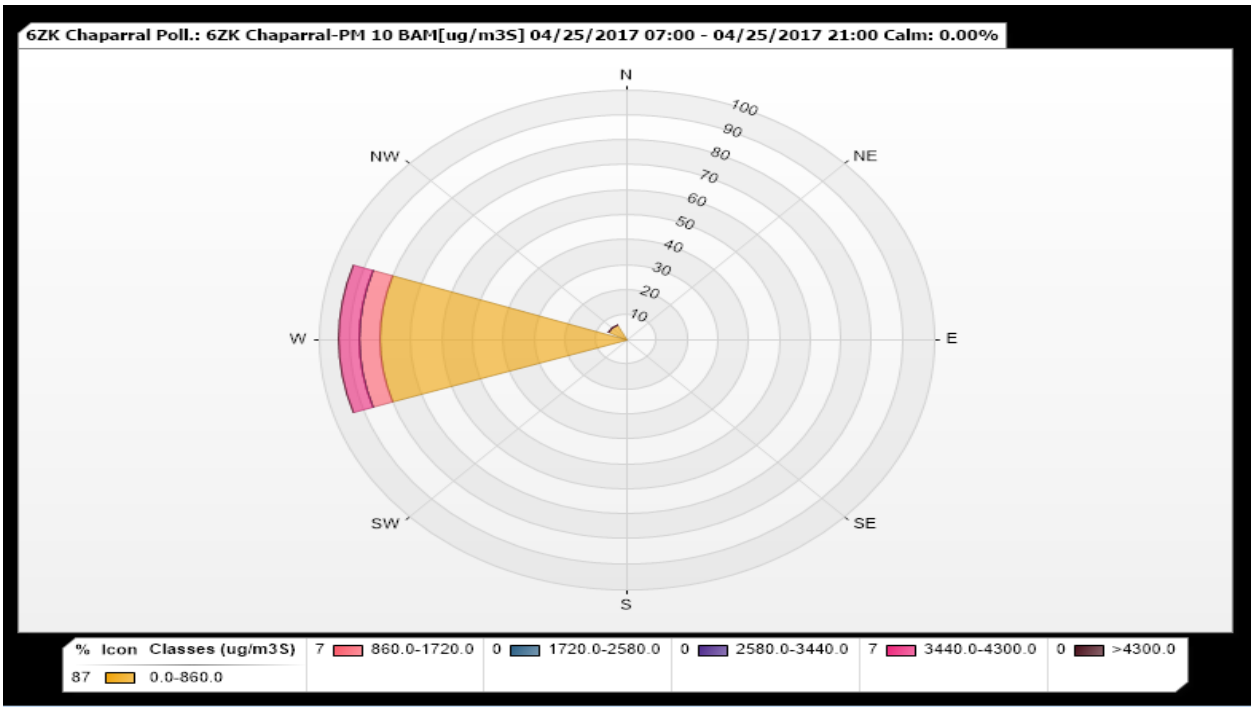


Figure 10-8. Pollution rose for the Chaparral monitoring site.

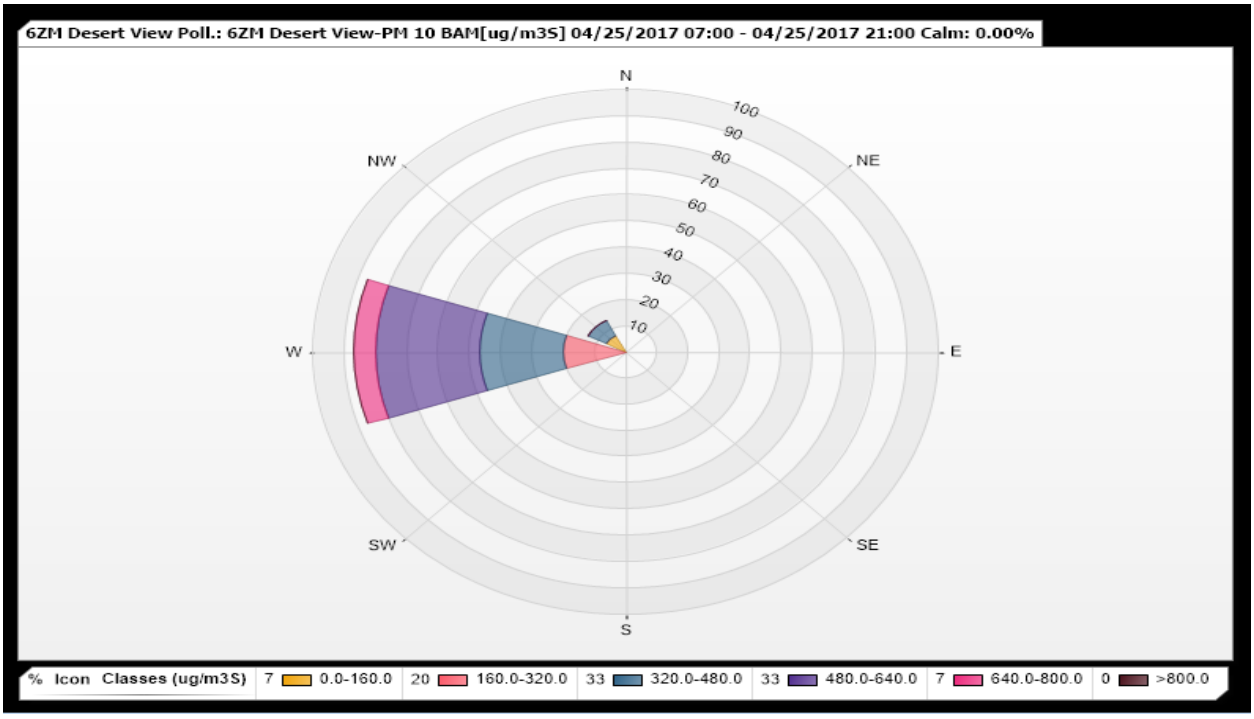


Figure 10-9. Pollution rose for Desert View monitoring site.

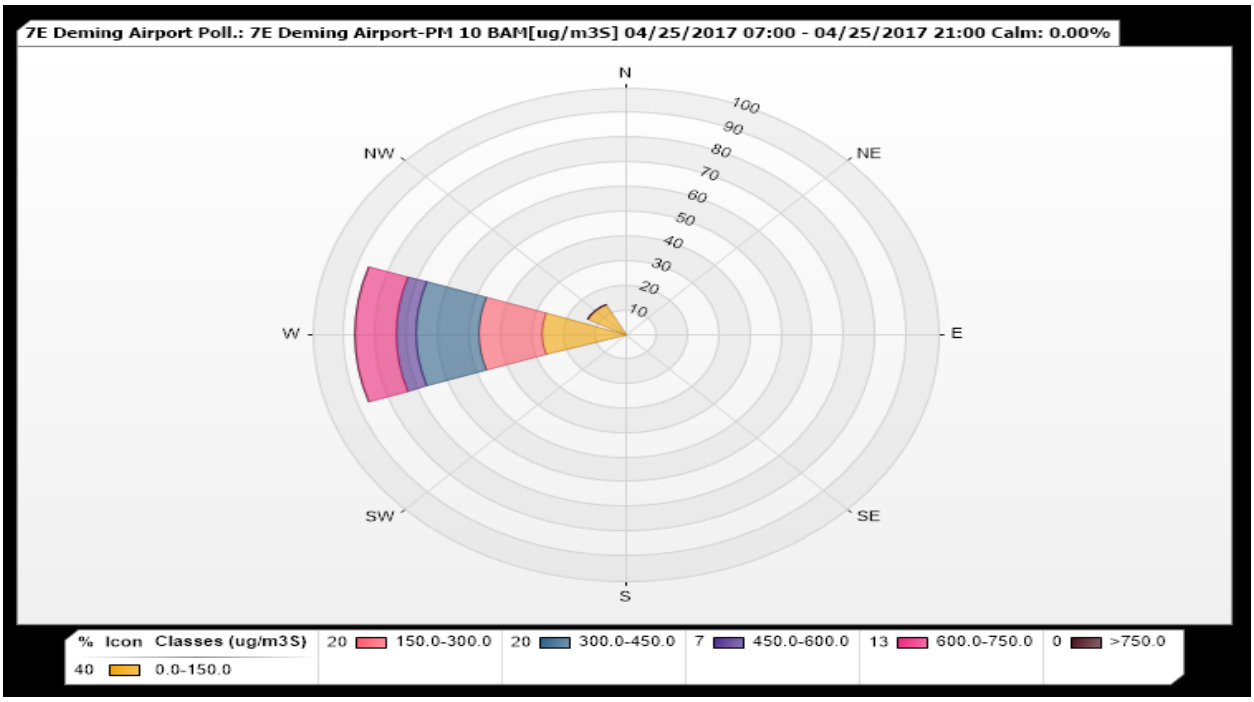


Figure 10-10. Pollution Rose for Deming monitoring site.

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

The high wind blowing dust event generated strong southwesterly winds beginning at the 0700 hour and lasting through the 2300 hour. During this time, peak hourly PM_{10} concentrations ranged from 442 to 4227 µg/m^3 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 10 to 15.3 m/s were recorded at Desert View and West Mesa monitoring sites during the peak PM_{10} concentrations of the event. The time series plots in Figures 10-12 through 10-15 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

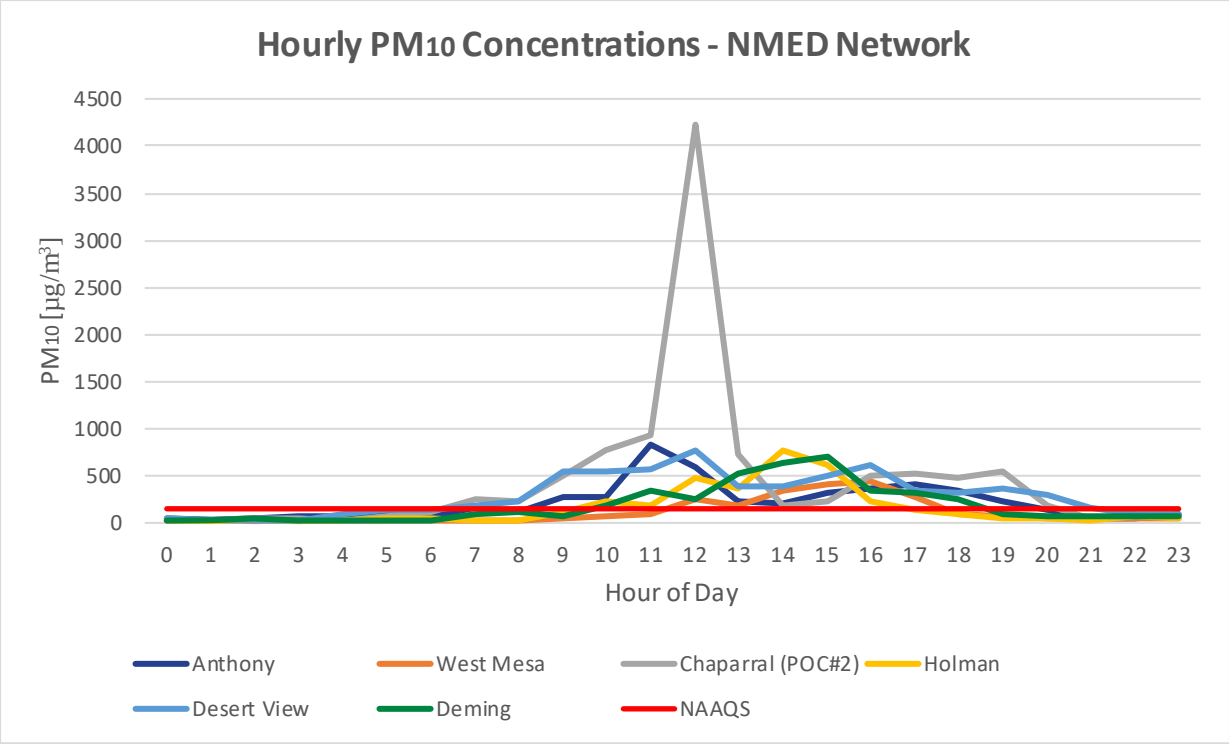


Figure 10-11. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

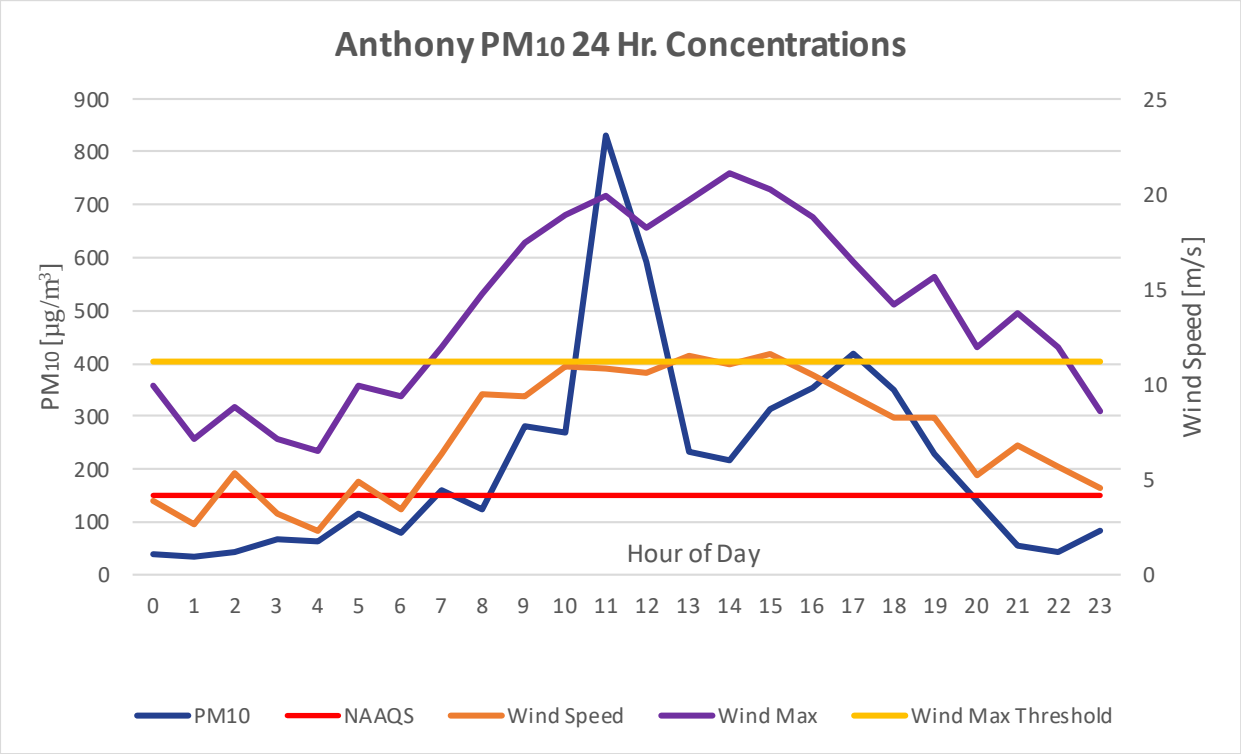


Figure 10-12. Anthony monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

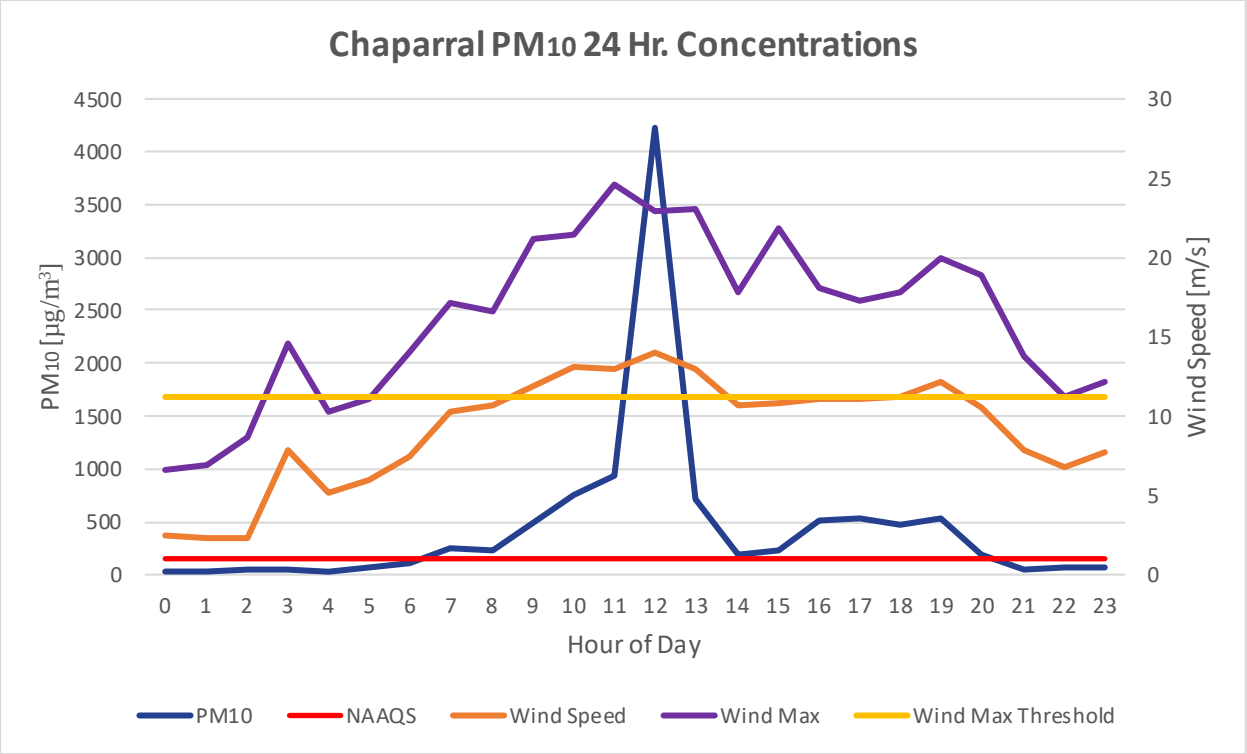


Figure 10-13. Chaparral monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

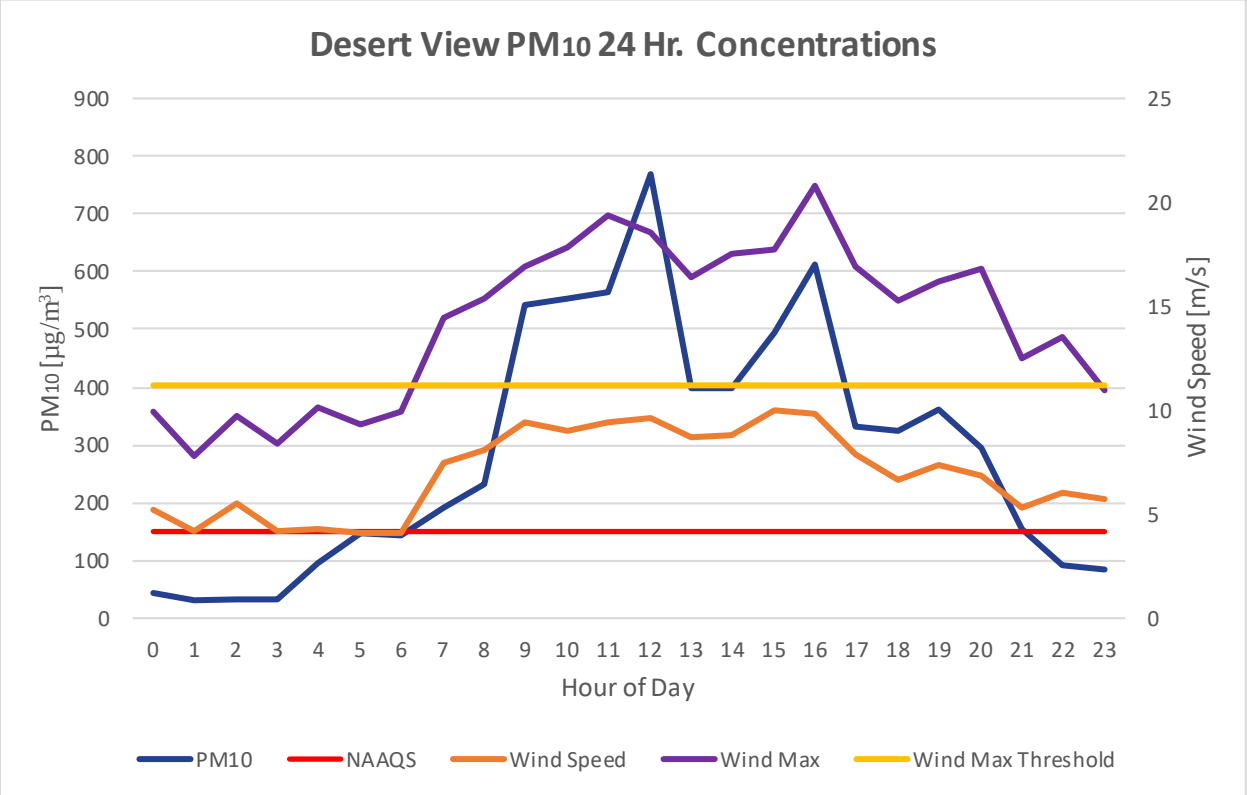


Figure 10-14. Desert View monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

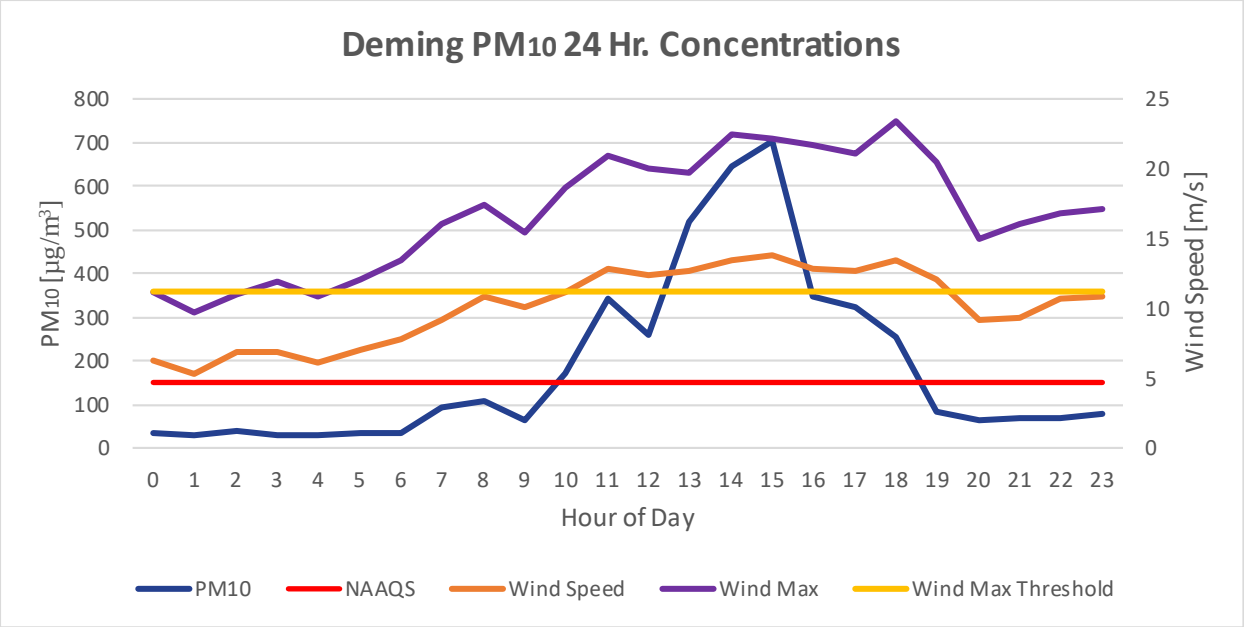


Figure 10-15. Deming monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2012-2016, the NMED monitoring sites recorded 43 (Anthony), 35 (Chaparral), 43 (Desert View), & 25 (Deming) exceedances of the PM_{10} NAAQS (Figure 10-16 through 10-19). The maximum 24-hour average PM_{10} concentration, respectively, are 1739 (Anthony), 1606 (Chaparral), 1691 (Desert View), & 1098 (Deming) 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.

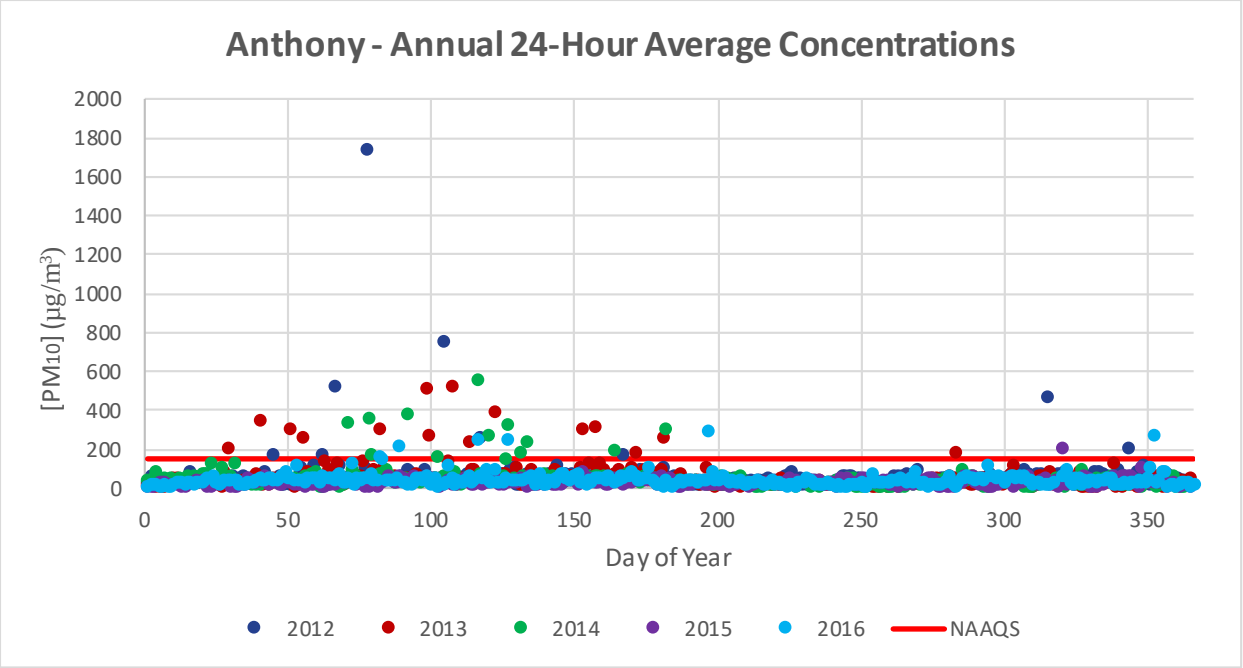


Figure 10-16. 24-hour averages by day of year from 2012-2016 for Anthony monitoring site.

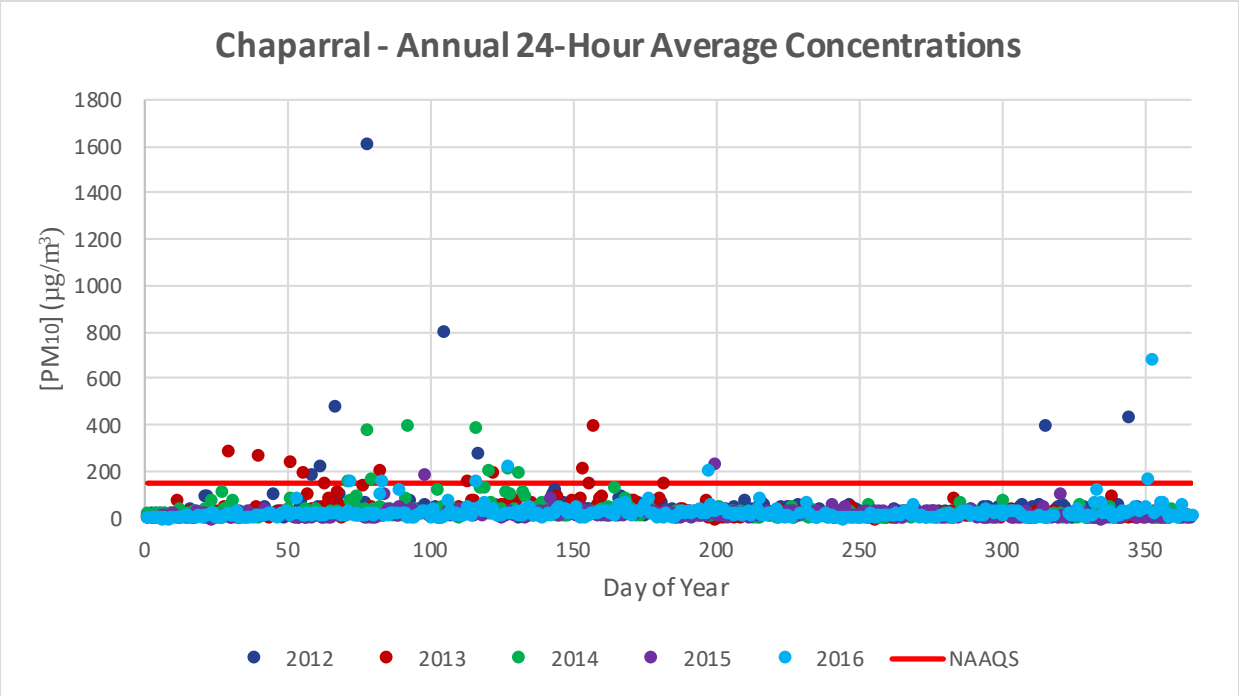


Figure 10-17. 24-hour averages by day of year from 2012-2016 for Chaparral monitoring site.

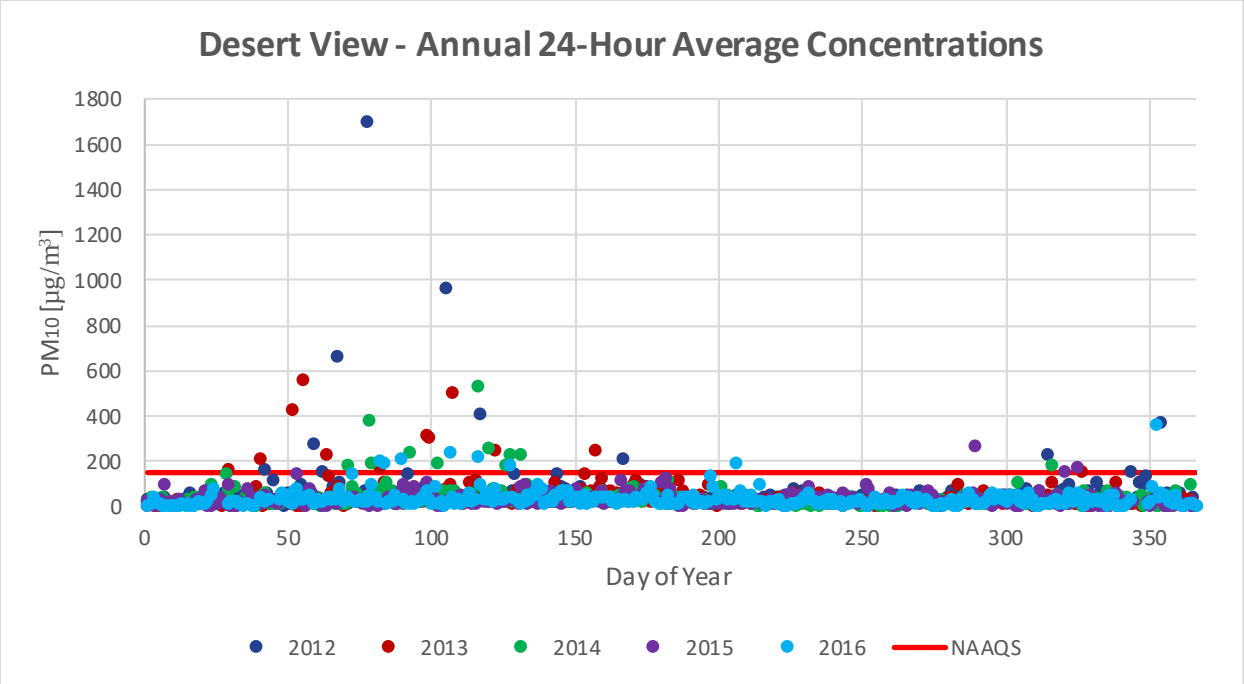


Figure 10-18. 24-hour averages by day of year from 2012-2016 for Desert View monitoring site.

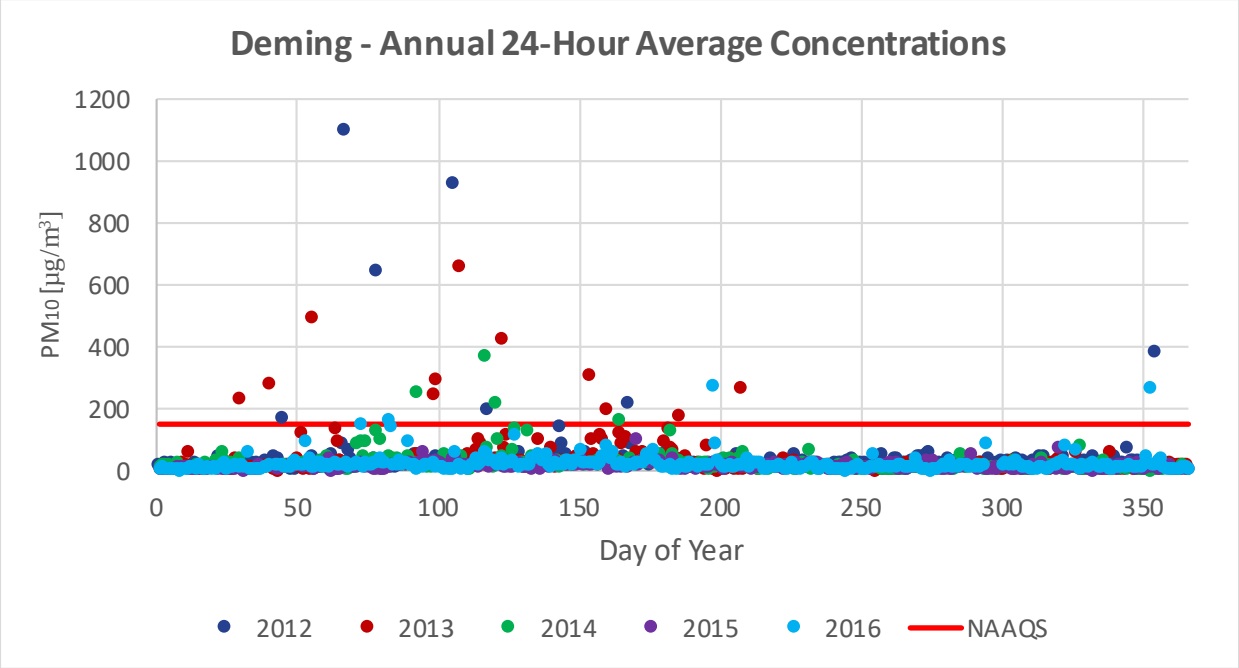


Figure 10-19. 24-hour averages by day of year from 2012-2016 for Deming monitoring site.

Spatial and Temporal Variability

As demonstrated in Figure 10-20, 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.

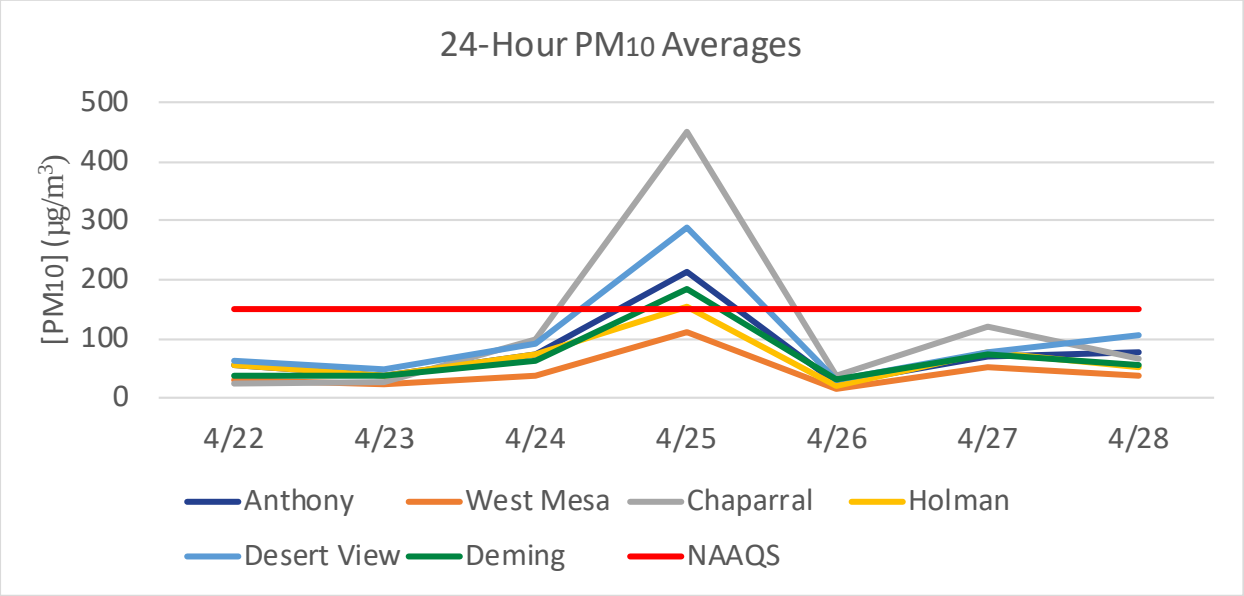


Figure 10-20. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

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 2012-2016. The recorded value for this day, respectively, 213(Anthony), 450 (Chaparral), 288 (Desert View), & 184 (Deming) µg/m^3 are above the 95th percentile of historical data.

Statistic\MonitoringSite	Anthony	West Mesa	Chaparral	Holman	Desert View	Deming
Max	1739	487	1606	1449	1691	1098
99th Percentile	288	148	218	178	244	216
95th Percentile	95	50	79	60	95	61
75th Percentile	51	21	34	30	42	27
50th Percentile	36	14	23	20	28	19
25th Percentile	24	10	15	13	18	12
5th Percentile	13	5	6	6	8	6
Mean	46	21	32	28	39	27

Table 10-4. 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 NMED monitoring sites. The monitored PM_{10} 24-Hour Averages of 213 (Anthony), 450 (Chaparral), 288 (Desert View), & 184 (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: May 6, 2017

Conceptual Model

A Pacific cold front caused high winds and blowing dust in Luna County resulting in an exceedance of the PM_{10} NAAQS at the Deming 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	35-029-0003	7E Deming	224 µg/m³	8.3 m/s	21.4 m/s

Table 11-1. 2017 PM_{10} Data flagged by NMED for exclusion pursuant to the EER.

A west coast trough closed off into a Pacific low over southern California. As the storm system moved through the state, a surface pressure gradient formed over southeastern Arizona, southwestern New Mexico and northern Mexico (Figure 11-1). At the 1800 hour, an area of low pressure moved over the Great Plains. Aloft, the area remains under a sharp ridge. As the day progressed this sharp ridge aloft traveled east and backed the winds west to southwest to south (Figure 11-2). 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.

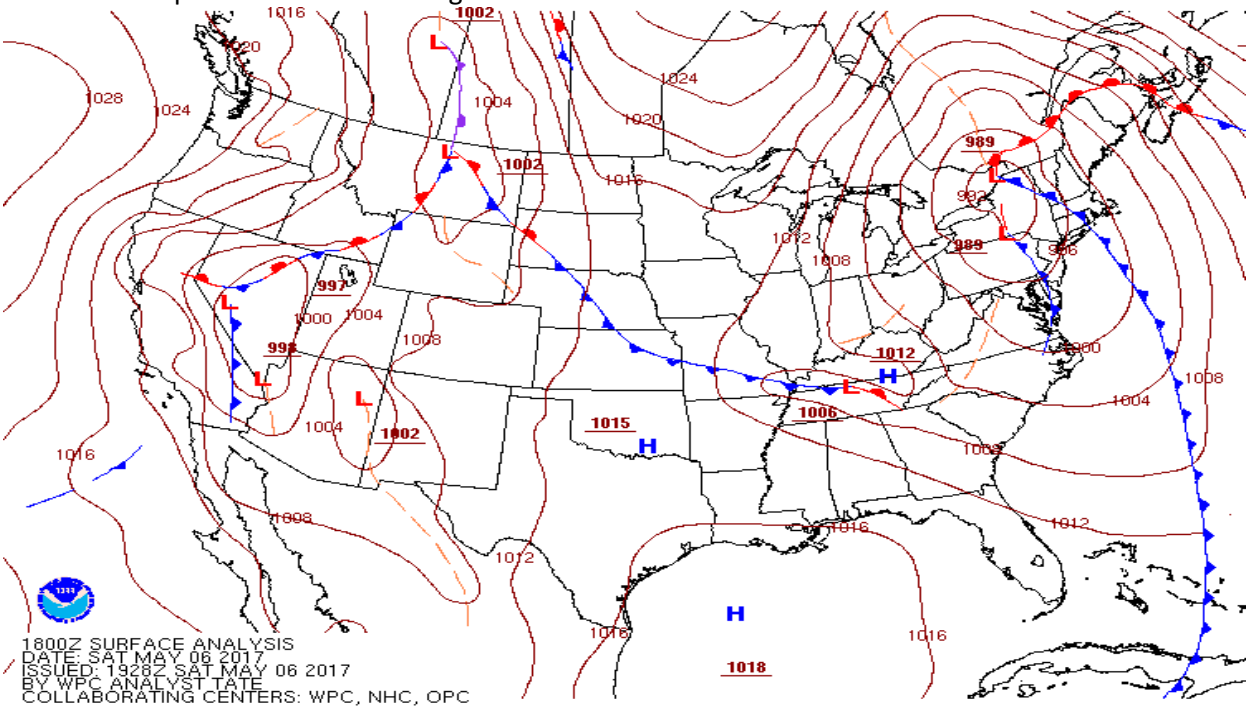


Figure 11-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

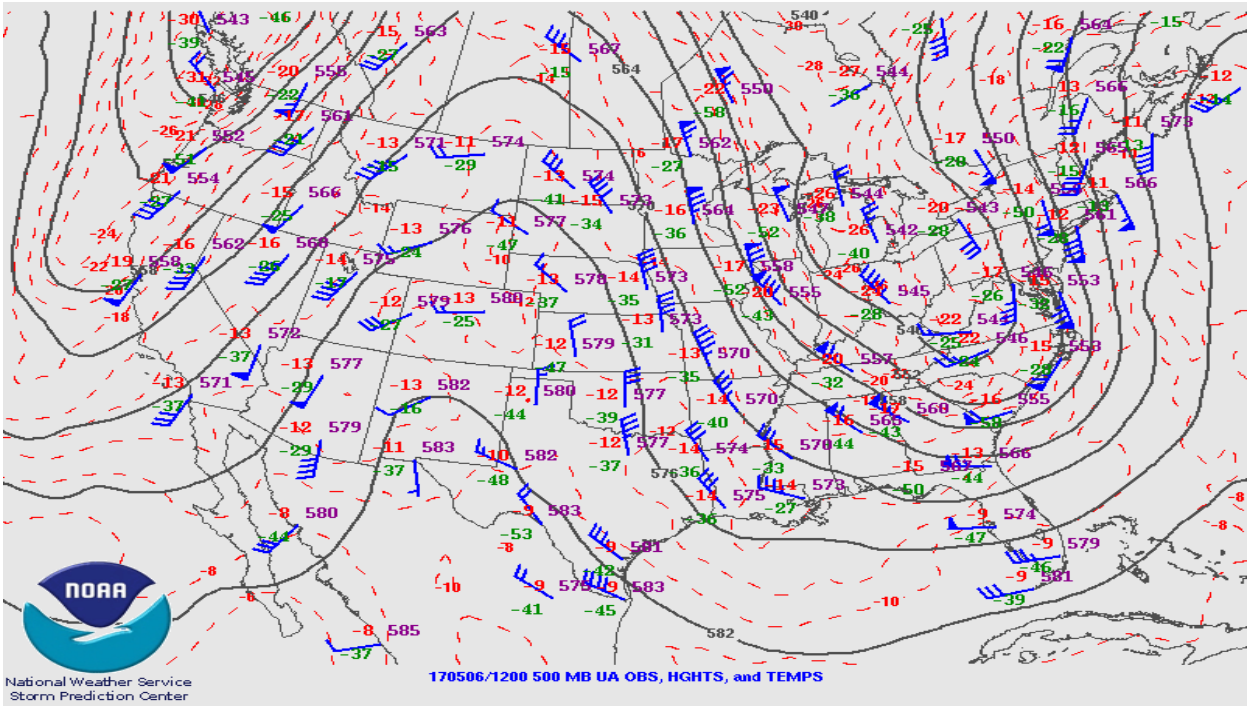


Figure 11-2. Upper air weather map for May 6, 2017 at the 1200 hour. Wind barbs depict wind speed (knots) and direction.

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. Anthropogenic sources of dust near NMED's monitoring sites include: disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

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 8 m/s (~18 mph) were recorded at the Deming monitoring site for the 1500 hour. PM_{10} concentrations began to exceed the NAAQS at the Anthony, Holman, and Deming monitoring sites beginning at the 1500 hour. Hourly concentrations remained elevated through the 1700 hour. Table 11-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event. The 5-minute wind speeds (Table 11-3) shows the wind speed fluctuations within the 1500 hour which indicates a thirty-minute period of sustained wind speeds along with 1 hour sustained wind gusts in excess of 20 m/s for the Holman and Deming monitoring sites (Table 11-2).

Hour	Anthony (POC#2)			Holman			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)
1400	63	7.5	13.5	14	7.8	13.9	34	5	11
1500	46	6.8	13.8	7	7.5	14.1	4295	8.3	21.4
1600	788	5.1	19.4	254	7.2	25.3	193	7.3	15.4
1700	66	6.2	11.7	107	4.4	21.4	58	3.9	10.6
1800	105	4.5	8.6	46	6.7	18	92	2.3	4

Table 11-2. Hourly PM10, wind speed and wind gust data during the peak hours of the event.

Date/Time	Wind Speed (m/s)
5/6/2017 1510 PM	6.2
5/6/2017 1515 PM	9.4
5/6/2017 1520 PM	12
5/6/2017 1525 PM	12.9
5/6/2017 1530 PM	8.7
5/6/2017 1535 PM	6.7
5/6/2017 1540 PM	8.5
5/6/2017 1545 PM	8.4
5/6/2017 1550 PM	7.5
5/6/2017 1555 PM	7.7
5/6/2017 1600 PM	8.7
5/6/2017 1605 PM	9.3
5/6/2017 1610 PM	8.2

Table 11-3. 5-minute wind speeds for the Deming monitoring site

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 Great Plains 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 sharp ridge over New Mexico 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 5 minutes from the 1520 to the 1525 hour combined with wind gusts up to 21.4 m/s (Tables 11-2 & 11-3 & Figure 11-3).

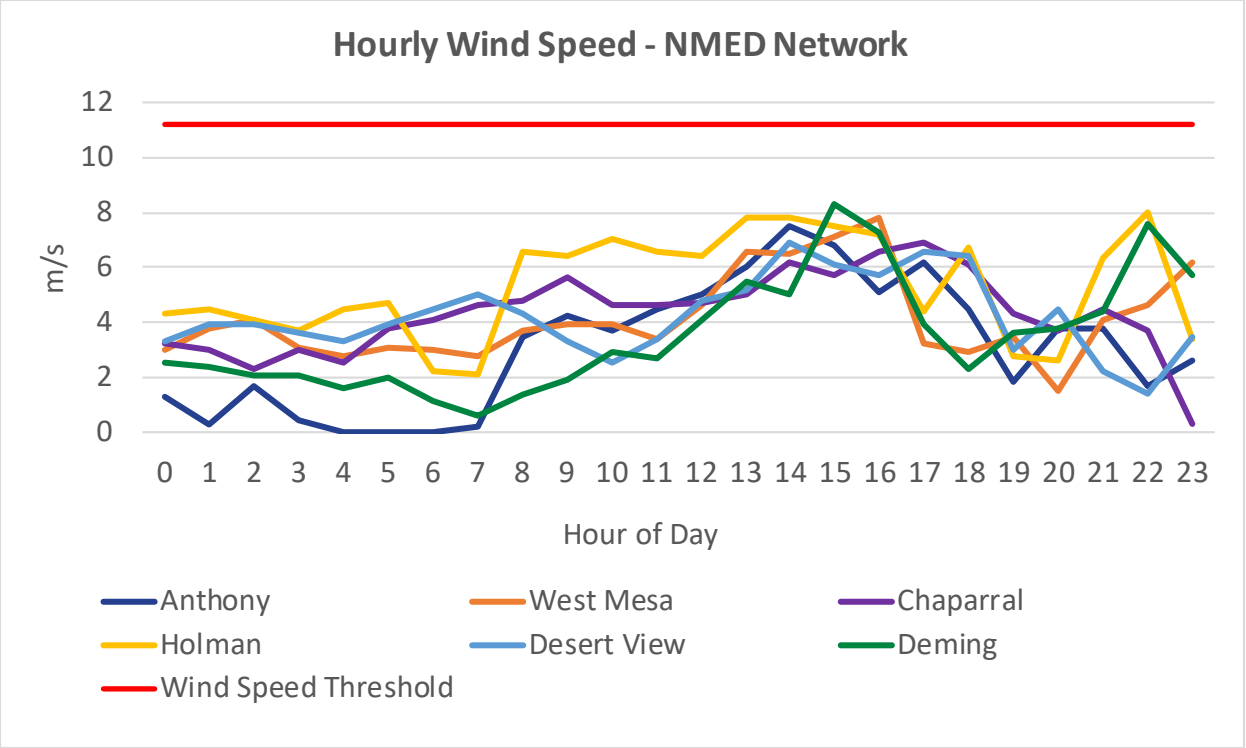


Figure 11-3. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

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 Luna and Hidalgo 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 exceedances 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. which is characterized as warm colors on the VIIRS Aerosol Optical Depth product. 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 11-4). 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.

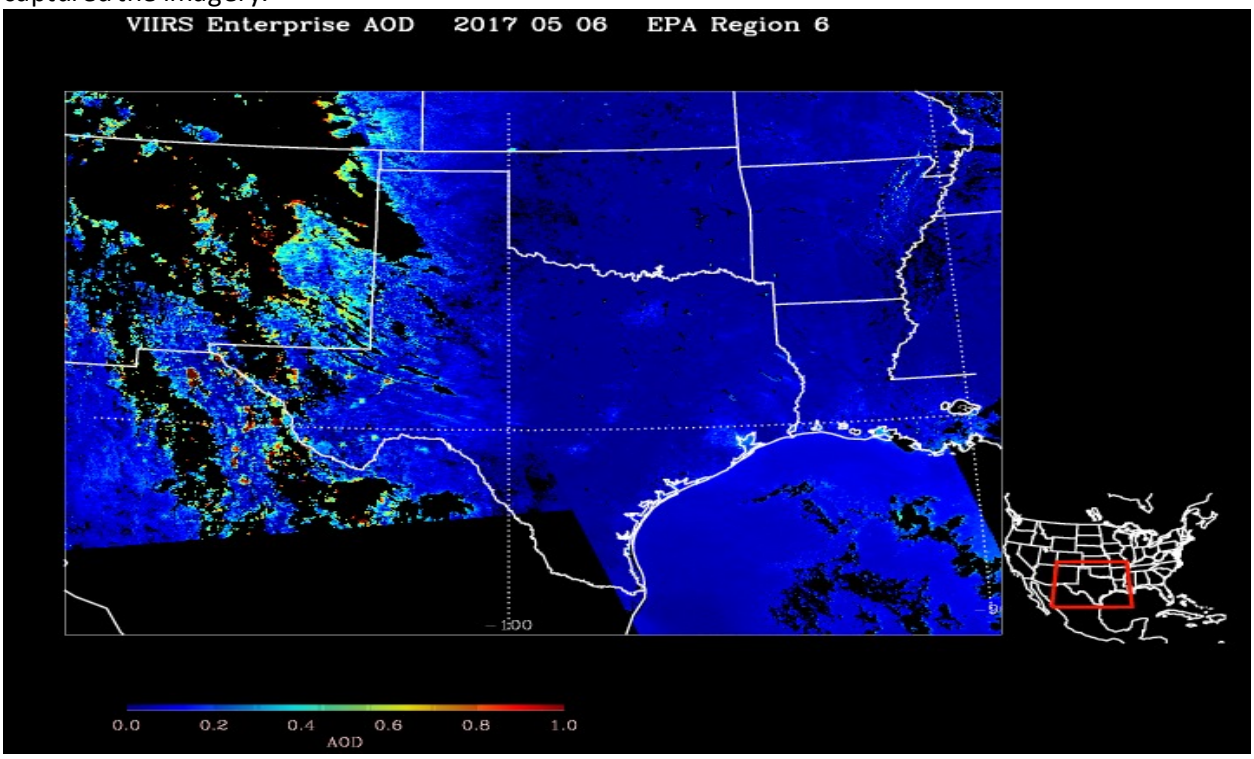
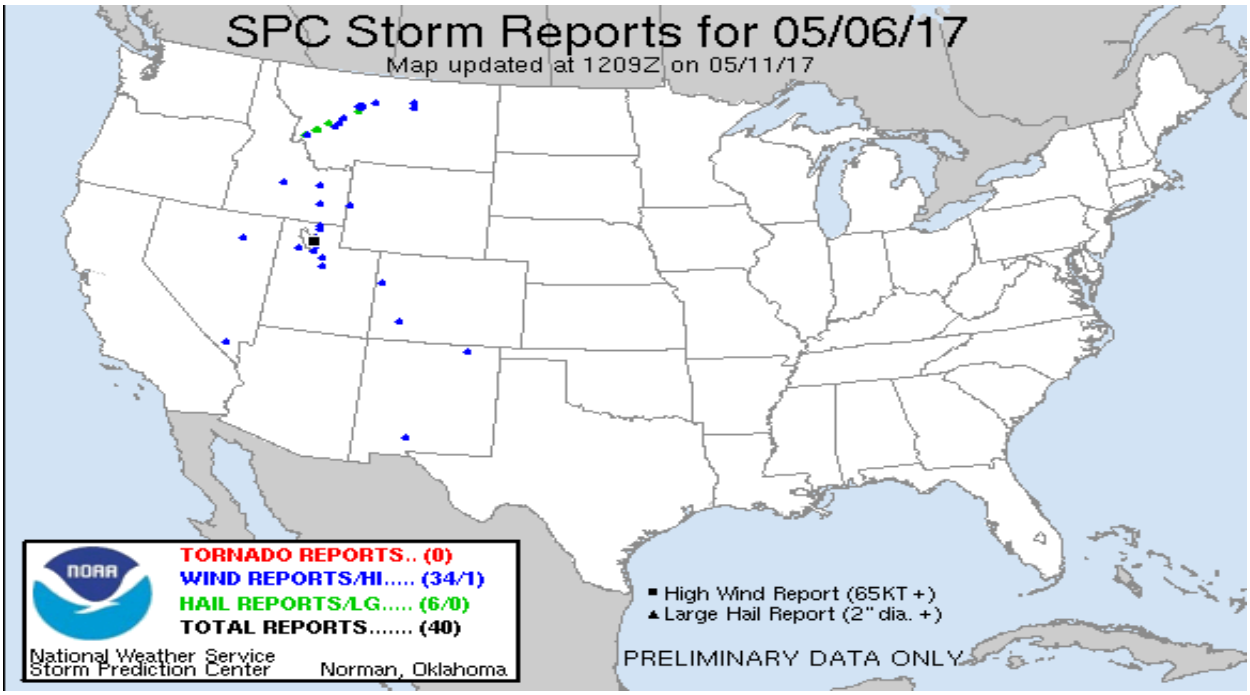


Figure 11-4. Aerosol Optical Depth imagery from the VIIRS Suomi Satellite showing southwestern New Mexico, northern Chihuahua and western Texas. Imagery obtained from NASA's EOSDIS Worldview website. Warm colors represent dust plumes.

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

The National Weather Service (NWS) issued a Storm Report which indicates that in the neighboring Dona Ana county the wind gusts had reached 63 mph at the noon hour MST (Figure 11-5). An excerpt from the NWS Area Forecast Discussion can be found below:

"Potential for some storms to produce severe weather in the form of damaging outflow wind gusts."



Wind Reports (CSV) (Raw Wind CSV)(?)

Time	Speed	Location	County	State	Lat	Lon	Comments
0016	63	JORNADA RANGE	DONA ANA	NM	3262	10674	(EPZ)

Wind Gusts in MPH

Figure 11-5. National Weather Service Storm Report indicating 63 mph wind gusts in neighboring Dona Ana county

Spatial and Transport Analysis

HYSPLiT Backtrajectory Analysis

A back-trajectory analysis using the HYSPLIT (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 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 11-6). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

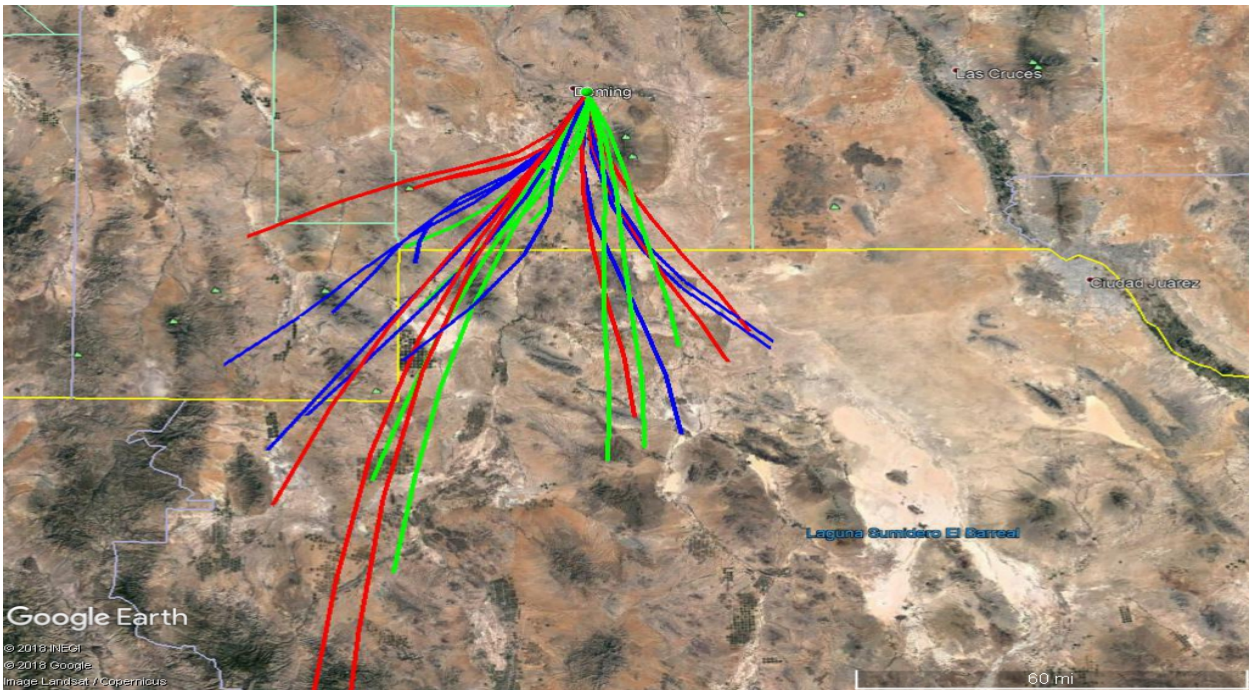


Figure 11-6. HYSPLiT back-trajectory analyses using the Ensemble mode.

Wind Direction and Elevated PM_{10} Concentrations

A pollution rose (Figure 11-7) was created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m³ (1400 -1600 hour). During the event, winds blew from the south 100% of the time coinciding with peak PM_{10} concentrations.

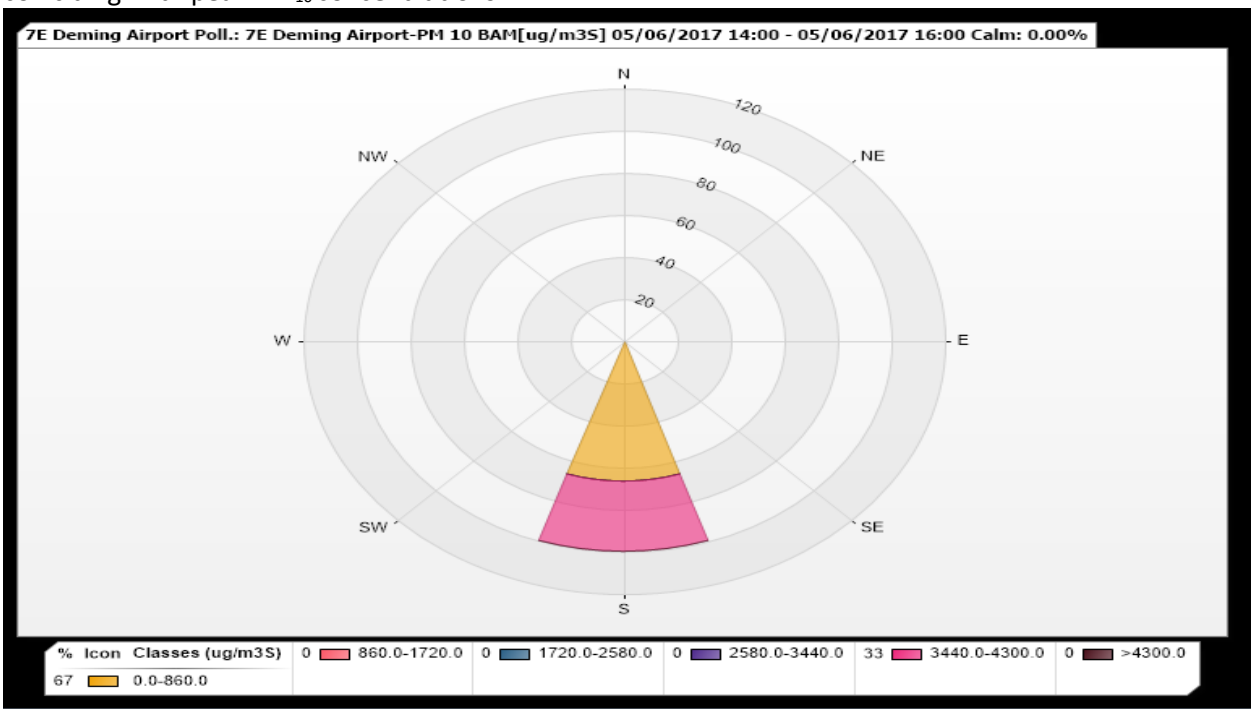


Figure 11-7. Pollution rose for the Deming monitoring site.

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

The high wind blowing dust event generated strong southerly winds for the 1500 hour. During this time, peak hourly PM_{10} concentrations ranged from 4295 to 788 µg/m^3 at NMED monitoring sites (Figure 11-8). 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 6.9 to 8.3 m/s were recorded at the Desert View and Deming monitoring sites during the peak PM_{10} concentrations of the event. The time series plot in Figure 11-9 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

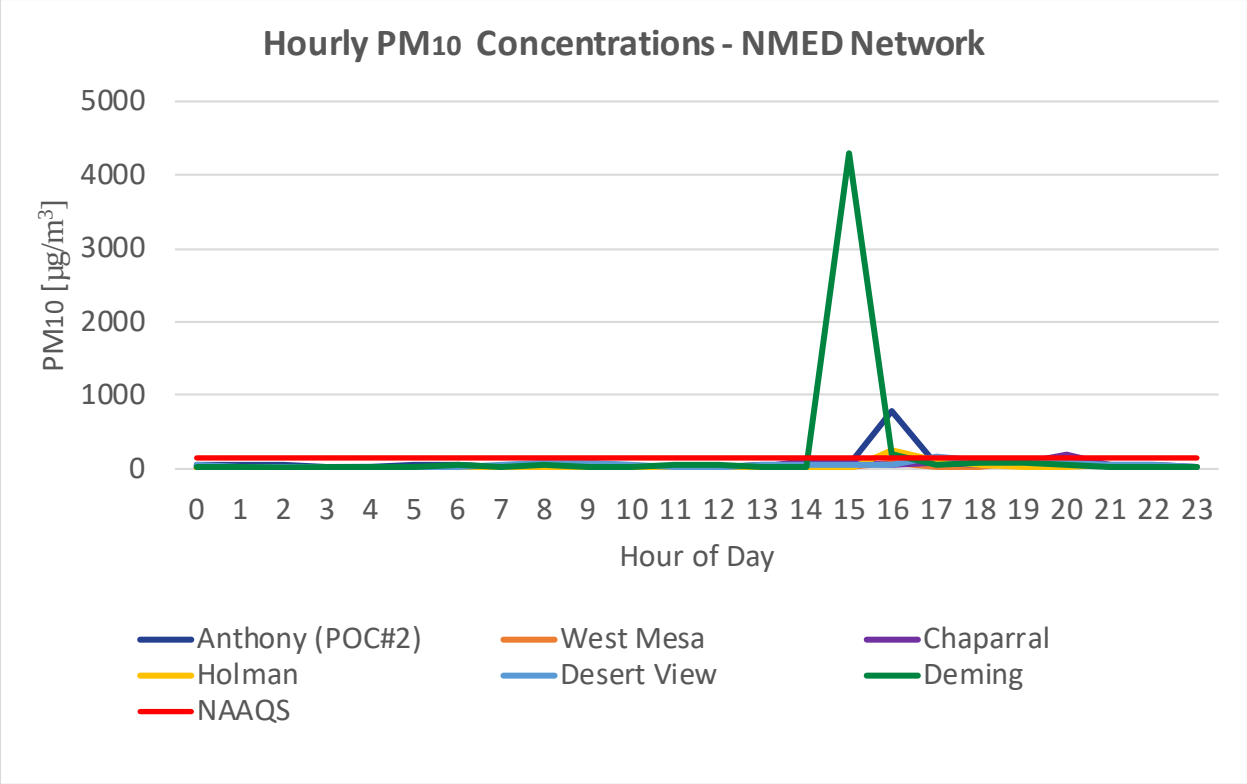


Figure 11-8. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

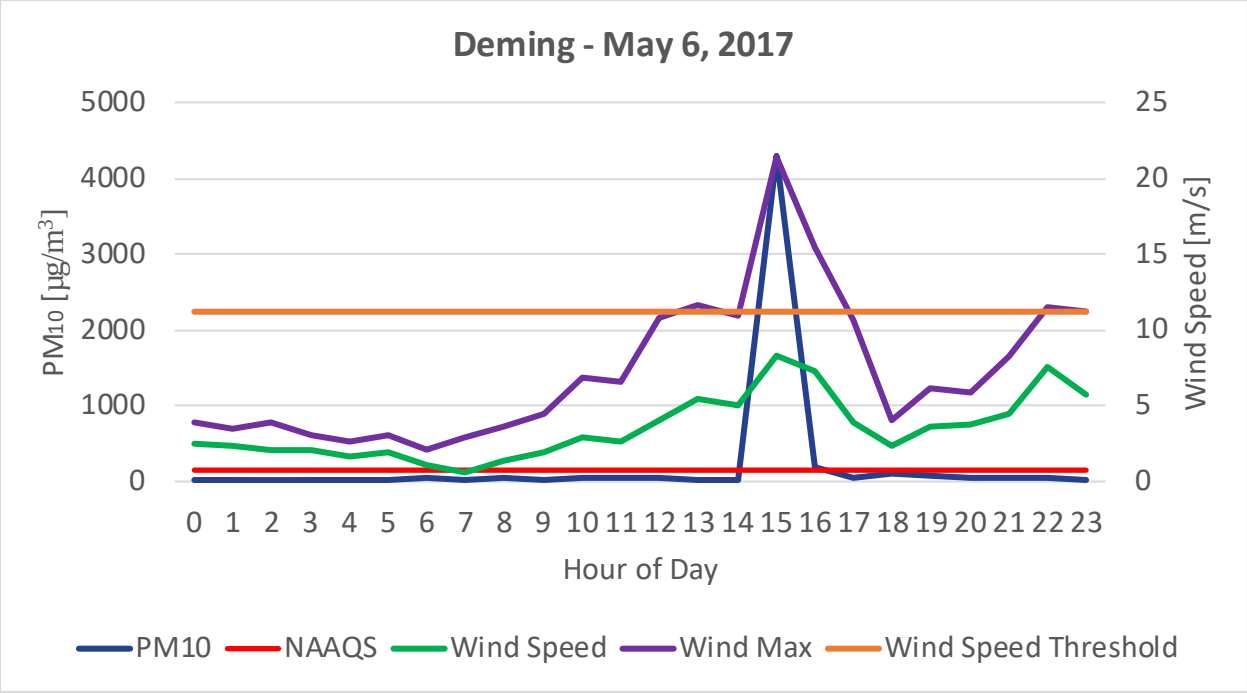


Figure 11-9. NMED monitoring network hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2012-2016, the Deming monitoring site recorded 25 exceedances of the PM_{10} NAAQS (Figure 11-10). The maximum 24-hour average PM_{10} concentration at this site was 1098 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.

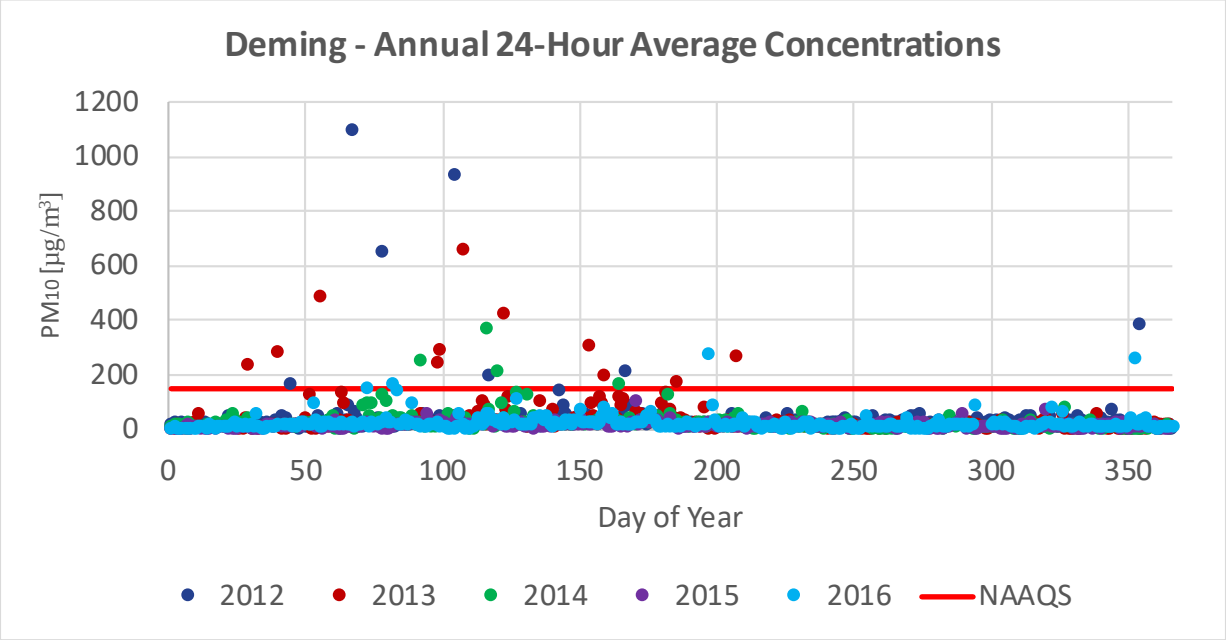


Figure 11-10. 24-hour averages by day of year from 2012-2016.

Spatial and Temporal Variability

As demonstrated in Figure 11-11, 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 80 µg/m³, demonstrating the influence high winds have on PM_{10} concentrations in the area.

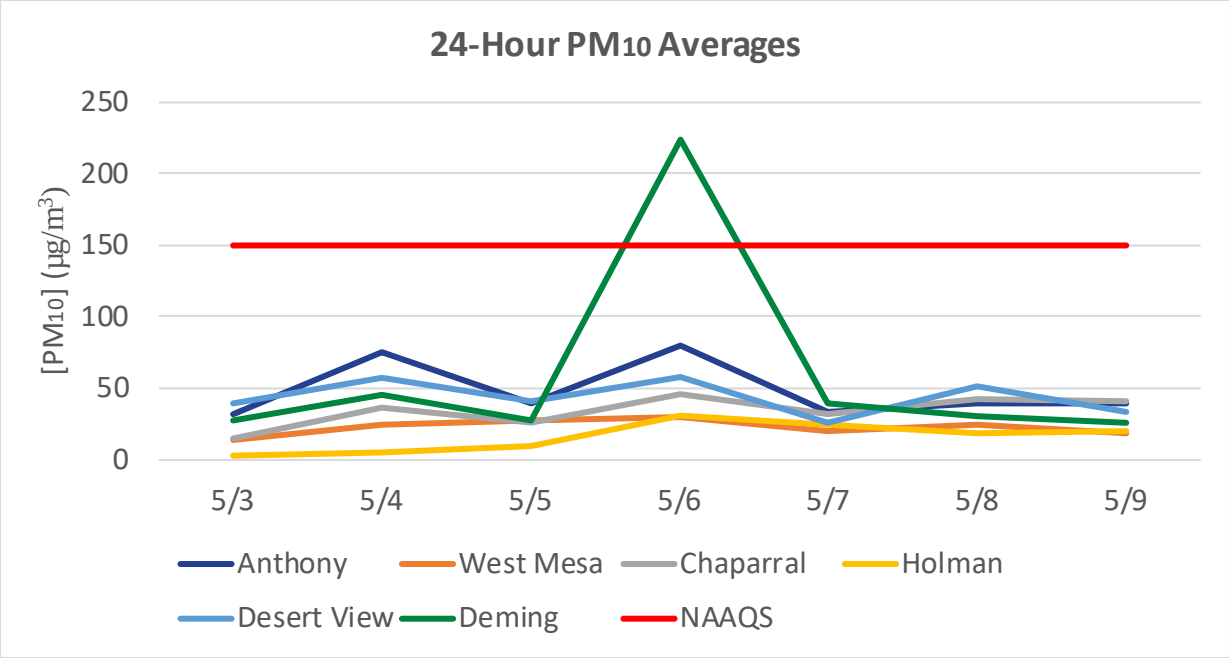


Figure 11-11. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

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 2012-2016. The recorded value for this day (224 µg/m³) is above 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	288	148	218	178	244	216
95th Percentile	95	50	79	60	95	61
75th Percentile	51	21	34	30	42	27
50th Percentile	36	14	23	20	28	19
25th Percentile	24	10	15	13	18	12
5th Percentile	13	5	6	6	8	6
Mean	46	21	32	28	39	27

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 Deming monitoring site. The monitored PM_{10} 24-Hour Average of 224 µg/m³ is above the 99th 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: May 16, 2017

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, 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 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	201 µg/m³ (POC #2)	13 m/s	21.8 m/s
RJ	35-013-0016	6CM Anthony	196 µg/m³	13 m/s	21.8 m/s
RJ	35-013-0021	6ZM Desert View	335 µg/m³	10.8 m/s	19.1 m/s

Table 12-1. 2017 PM_{10} Data flagged by NMED for exclusion pursuant to the EER.

As the storm system moved through the state, a surface pressure gradient formed over southeastern Arizona, southwestern New Mexico and northern Mexico (Figure 12-1). At the 1800 hour, an area of low pressure moved over the state line of New Mexico and Colorado. Aloft, the low-pressure center of the storm system hovered over the Great Plains. 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 providing the turbulence required for vertical mixing and entrainment of dust.

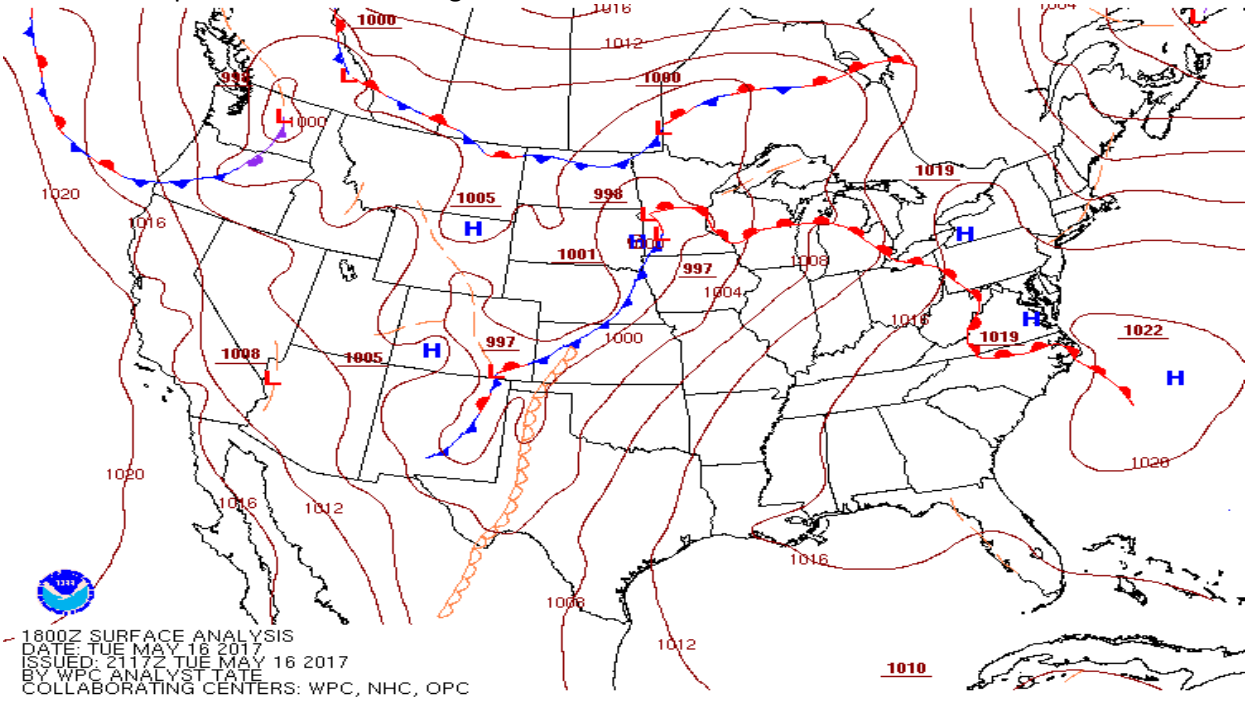


Figure 12-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

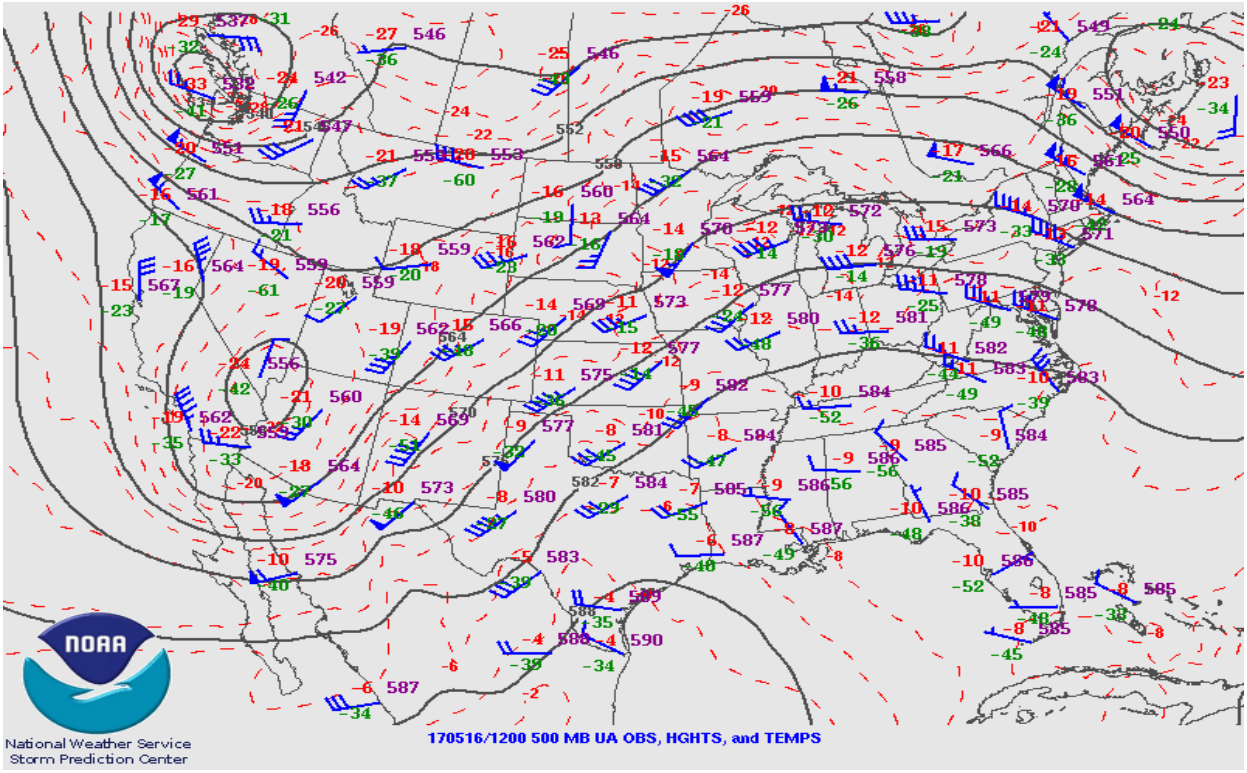


Figure 12-2. Upper air weather map for May 16, 2017 at the 1200 hour. Wind barbs depict wind speed (knots) and direction.

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. Anthropogenic sources of dust near NMED's monitoring sites include: disturbed surface areas, residential properties, vacant lots, dirt roads, and storage piles.

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, Chaparral, Holman, West Mesa and Deming monitoring sites beginning at the 1000 hour and lasted through the 2100 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 1900 hour. Table 12-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event. The 5-minute sustained wind speeds for the 1400 hour exceeded 9 m/s throughout the duration of the hour (Table 12-3).

Hour	Anthony (POC#2)			Deming			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)
1000	41	4.8	14	58	6.5	15.3	88	5.9	11
1100	149	5.9	11.7	210	11.9	18.4	36	4.5	11
1200	593	9	16.6	219	12.3	20.1	420	7.2	14.1
1300	818	11.1	19.2	351	11.4	22.4	1900	10.2	17.3

1400	1433	13	21.8	161	11.5	20.6	2114	10.8	18.6
1500	576	11.5	19.5	105	11.5	18.8	1306	10.4	19.1
1600	268	10.2	17.6	110	10.2	19.1	578	9.5	17.6
1700	171	10	16.7	66	8.3	17.3	310	8.3	15.3
1800	124	8.7	17.7	114	9.7	18.7	217	8	16.2
1900	134	8.6	18.6	31	7	13.5	434	7.8	17.4
2000	29	5.1	10.8	19	6.8	11.5	80	5.5	13
2100	31	6.4	12.5	17	6.5	11	34	3.9	9

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

Hour	Wind Speed (m/s)
1400	10.1
1405	11.1
1410	10.8
1415	11.7
1420	11.8
1425	11.7
1430	10.1
1435	11.4
1440	9
1445	11.6
1450	11.1
1455	9.7

Table 12-3. 5-Minute Wind Speeds for the Desert View monitoring site for the 1400 hour.

With the upper low over southern Nevada and enough vortex energy diving in to the base of the trough along with southwest flow over western Arizona. 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 Great Plains 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 Anthony, West Mesa, and Holman monitoring sites recorded wind speeds above this threshold for 5 hours from the 1100 to the 1600 hour (Figure 12-3). The Wind speeds at the upwind Deming monitoring site also reached the high wind threshold. The Desert View monitoring site recorded 5-minute sustained wind speeds greater than 11.2 m/s for 15 minutes during the 1415 to the 1425 hour and for two sporadic 5-minute intervals at the 1435 and 1445 hours (Table 12-3).

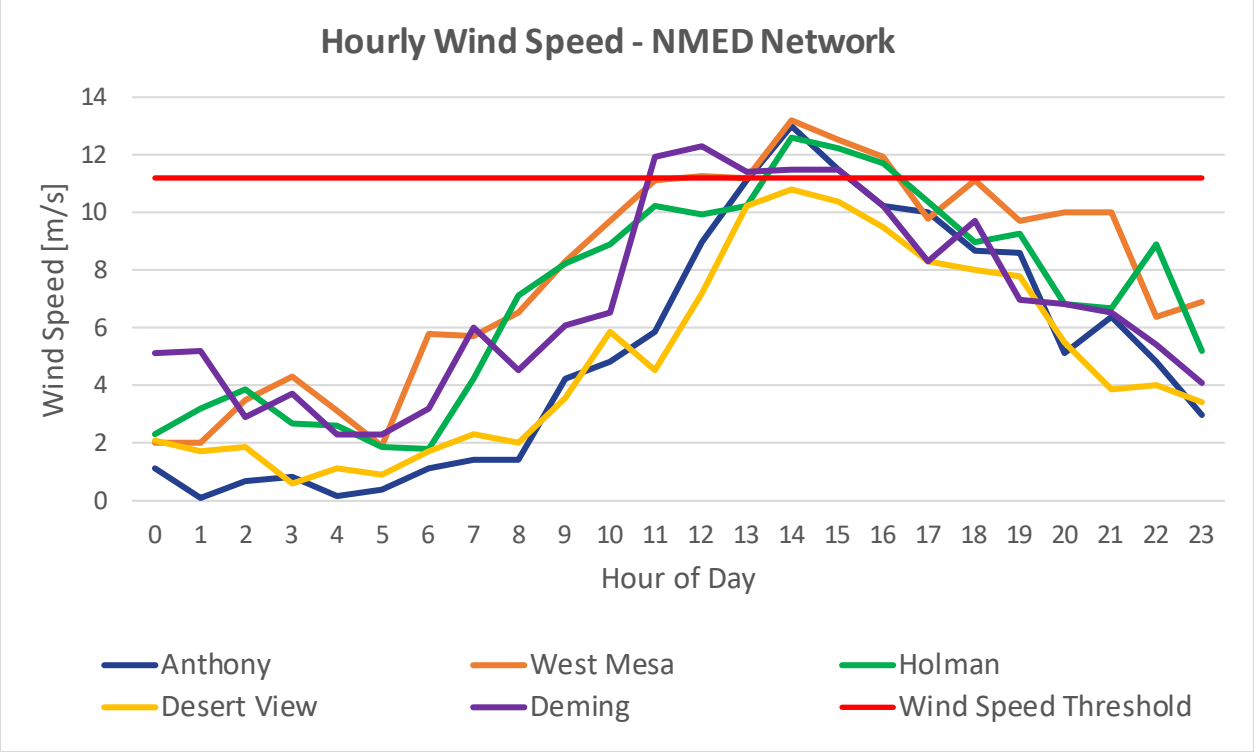


Figure 12-3. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

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 exceedances 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. which is characterized as warm colors with the VIIRS Suomi Aerosol Optical Depth product. 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 12-4). 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 (1100 hour MDT) that captured the imagery.

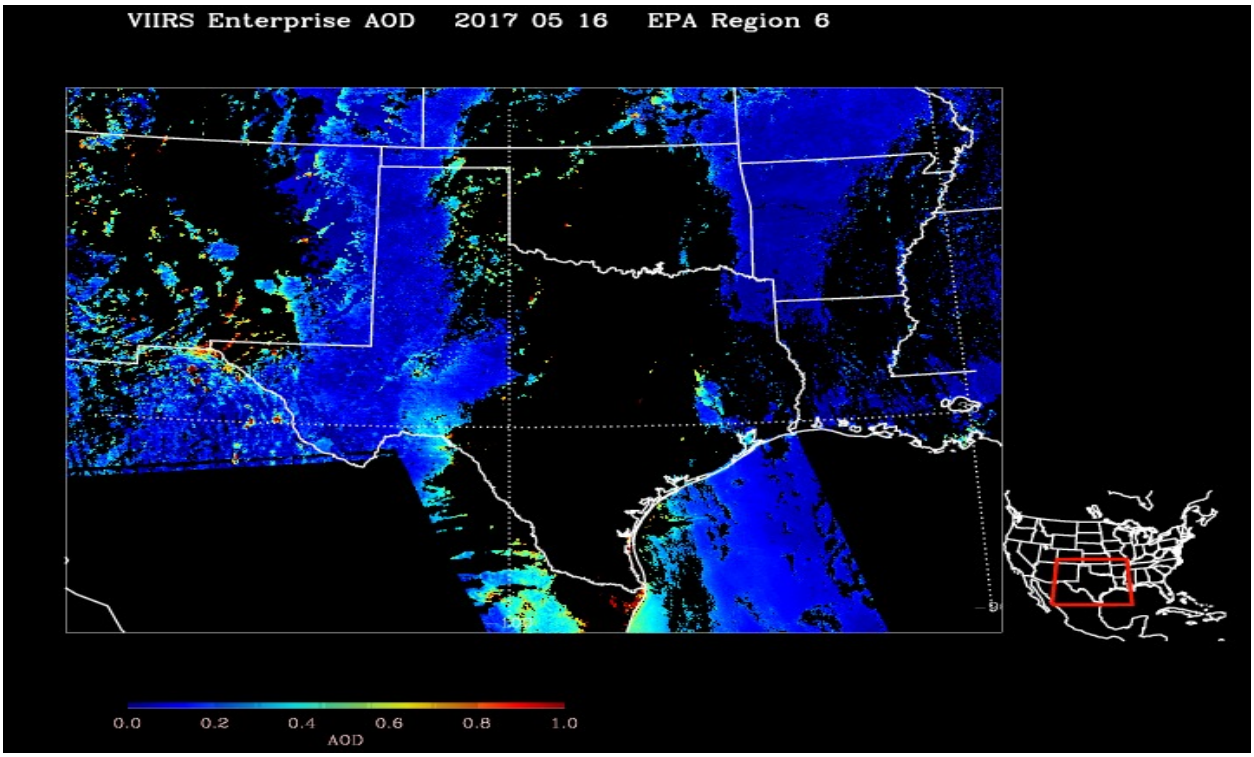


Figure 12-4. Aerosol Optical Depth imagery from the VIIRS Suomi Satellite showing southwestern New Mexico, northern Chihuahua and western Texas. Imagery obtained from NASA's EOSDIS Worldview website. Warm colors represent dust plumes.

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:

"A Wind Advisory is in effect this afternoon. Strong winds will develop through the day with west and southwest winds of 30 to 35 mph and gusts to 50mph or higher. This will result in some local blowing dust with visibilities dropping between 2 and 3 miles in spots causing hazardous driving conditions."

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 12-5 & 12-6). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

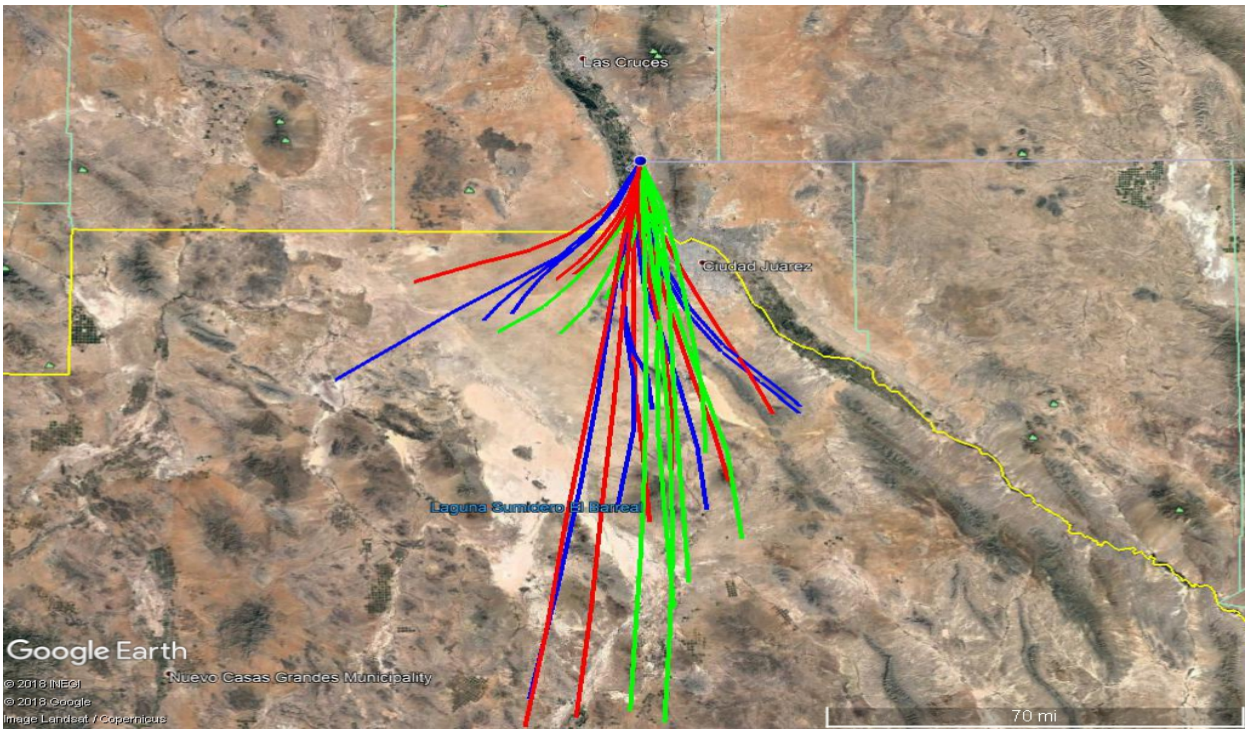


Figure 12-5. HYSPLiT back-trajectory analyses using the Ensemble mode for Anthony monitoring site.

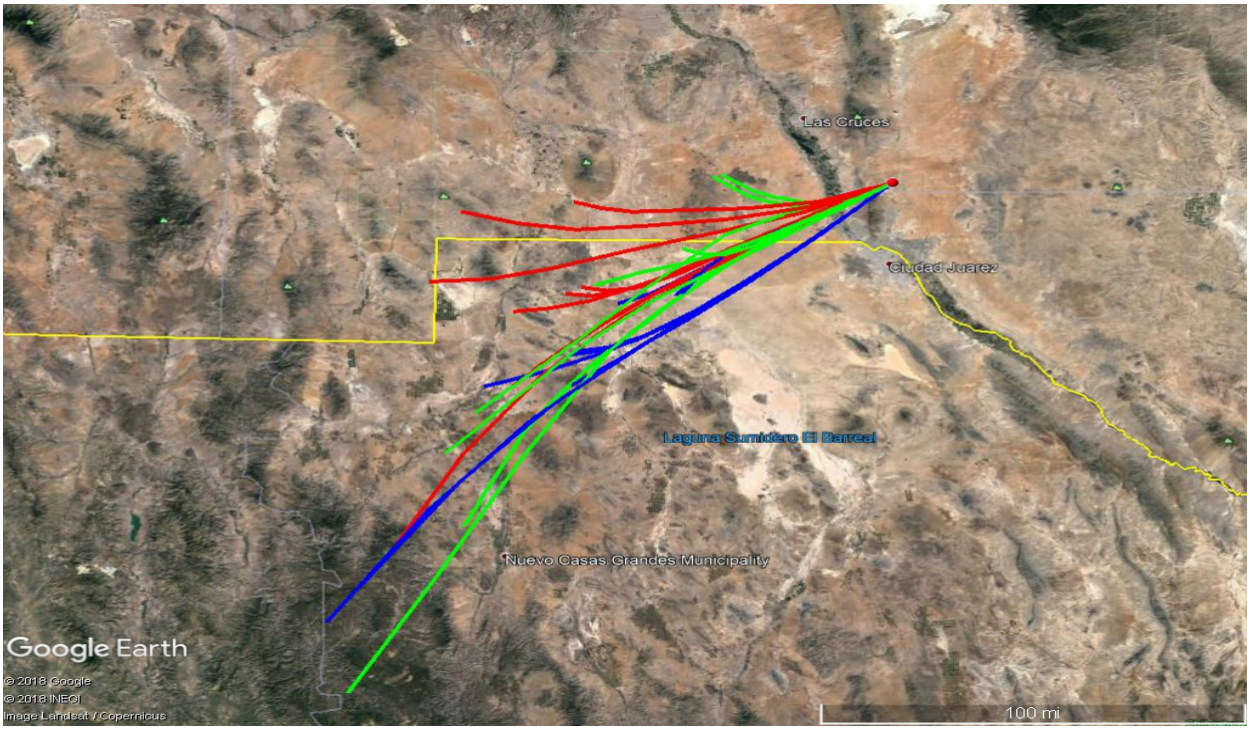


Figure 12-6. HYSPLiT back-trajectory analyses using the Ensemble mode for Chaparral monitoring site.

Wind Direction and Elevated PM_{10} Concentrations

Pollution roses (Figure 12-7 & Figure 12-8) were created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m^3 (1200 -1600 hour). During the event, winds blew from the west & southwest 100% of the time coinciding with peak PM_{10} concentrations.

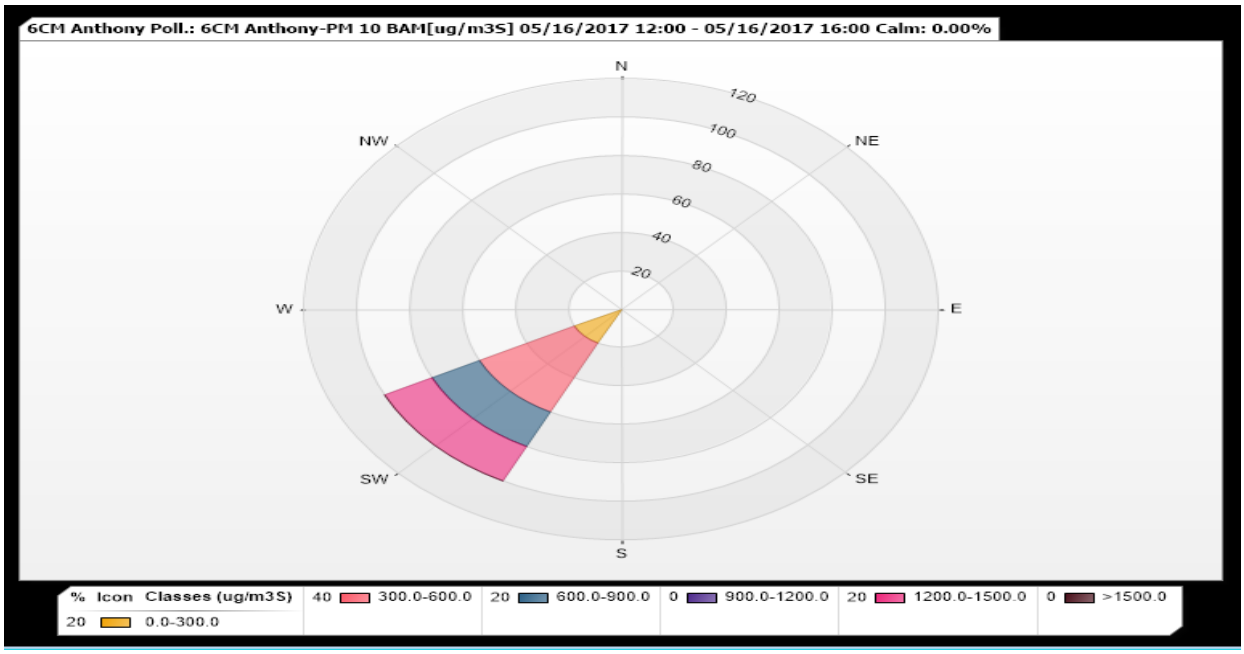


Figure 12-7. Pollution Rose for the Anthony monitoring site

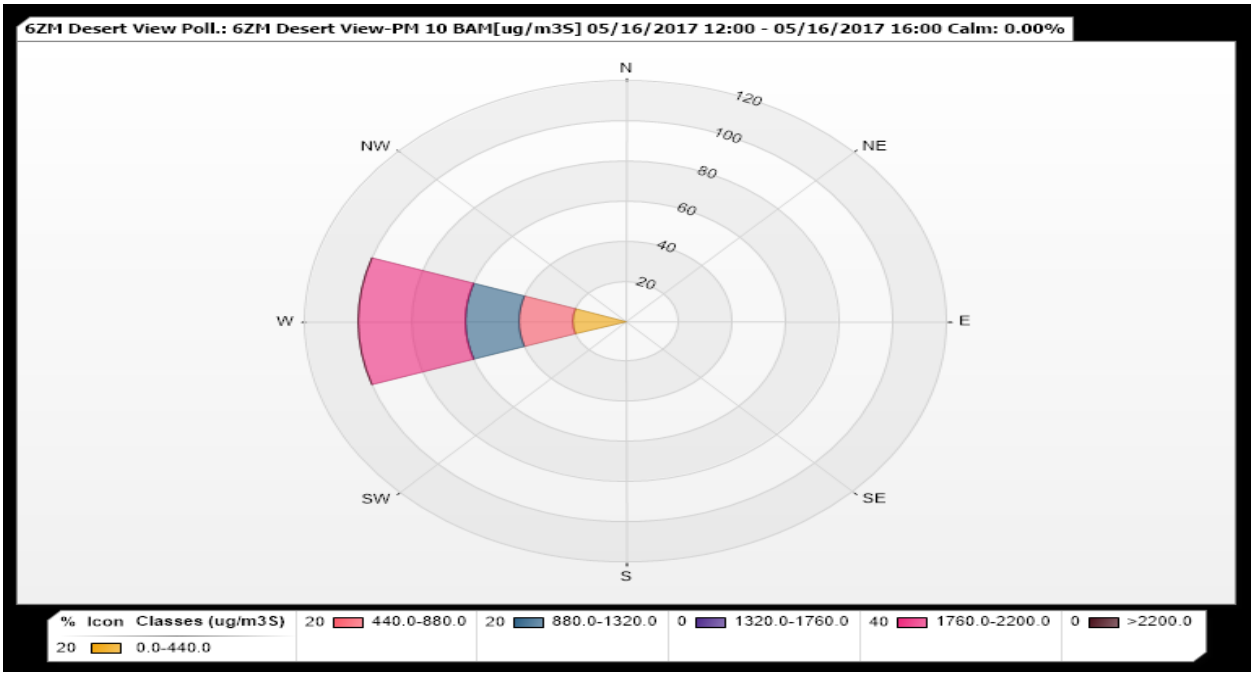


Figure 12-8. Pollution rose for the Desert View monitoring site

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

The high wind blowing dust event generated strong southwesterly winds beginning at the 1000 hour and lasting through the 2100 hour. During this time, peak hourly PM_{10} concentrations ranged from 2114 to 207 µg/m^3 at NMED monitoring sites (Figure 12-9). 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 13.2 to 10.8 m/s were recorded at the West Mesa

and Desert View monitoring sites during the peak PM_{10} concentrations of the event. The time series plots in Figures 12-10 through 12-12 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

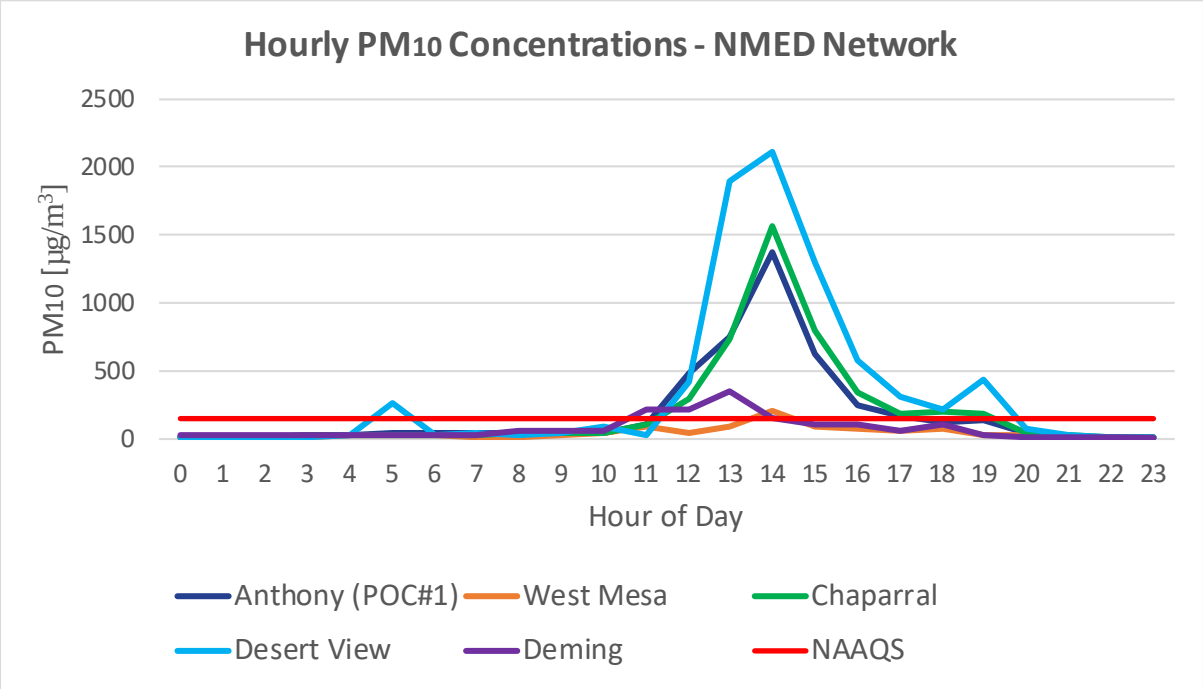


Figure 12-9. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

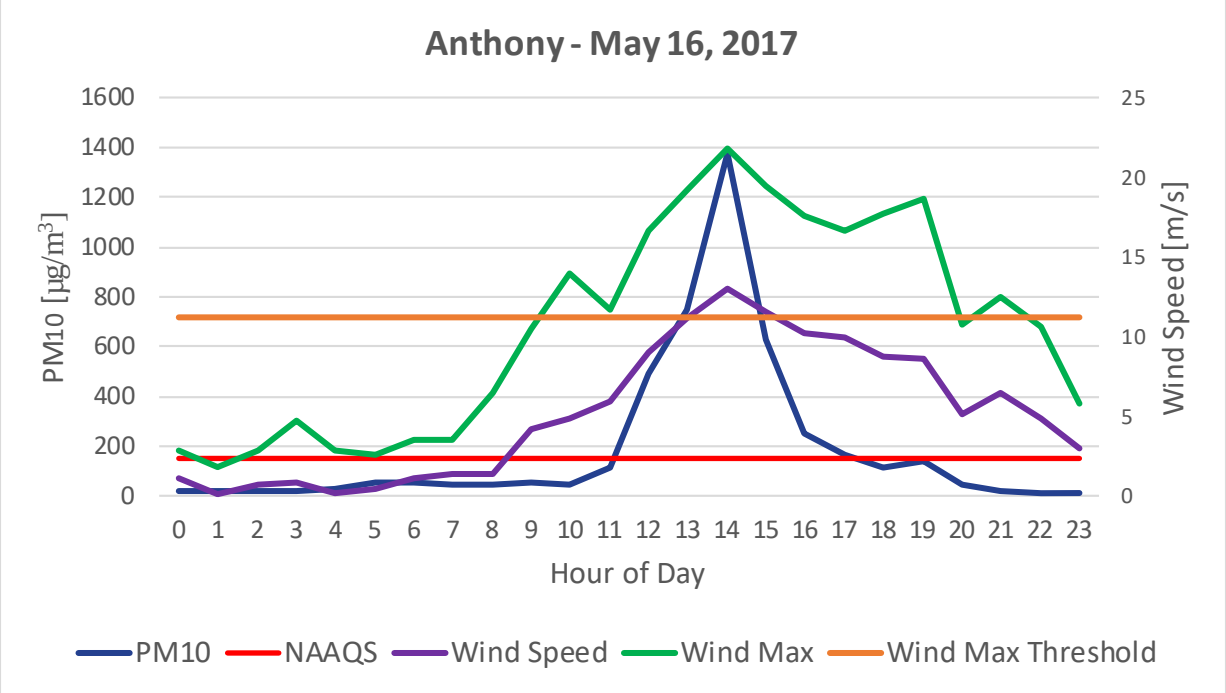


Figure 12-10. Anthony monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

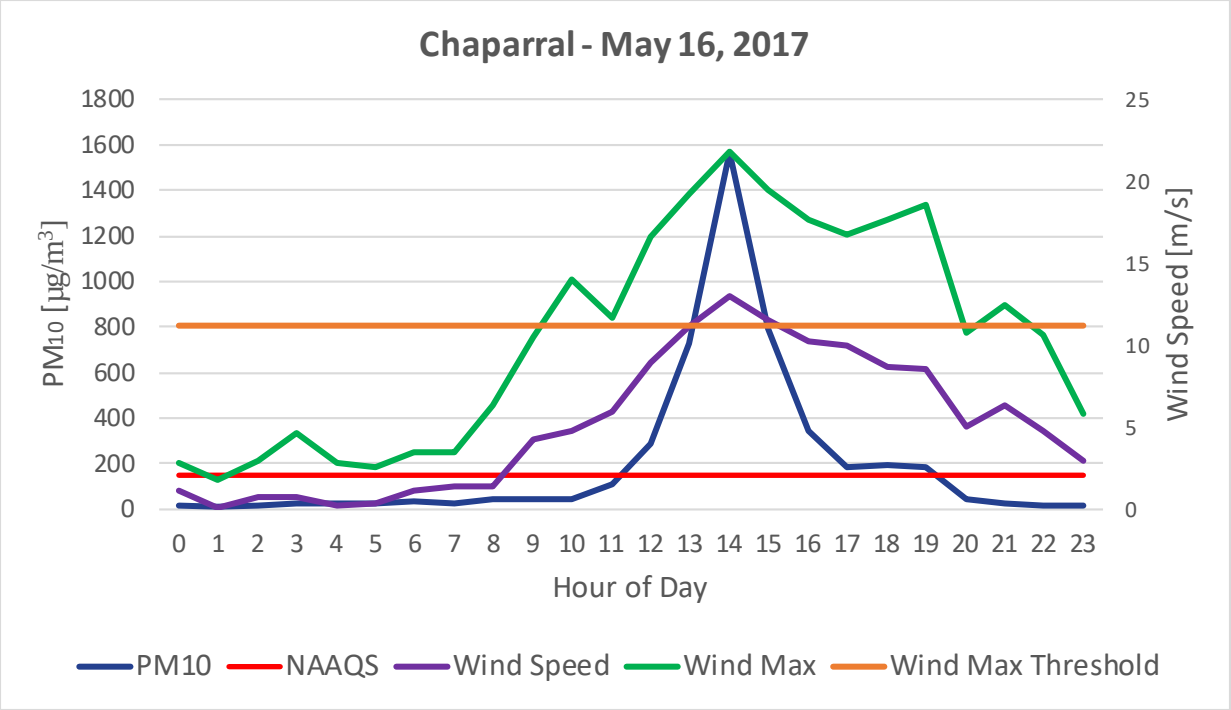


Figure 12-11. Chaparral monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

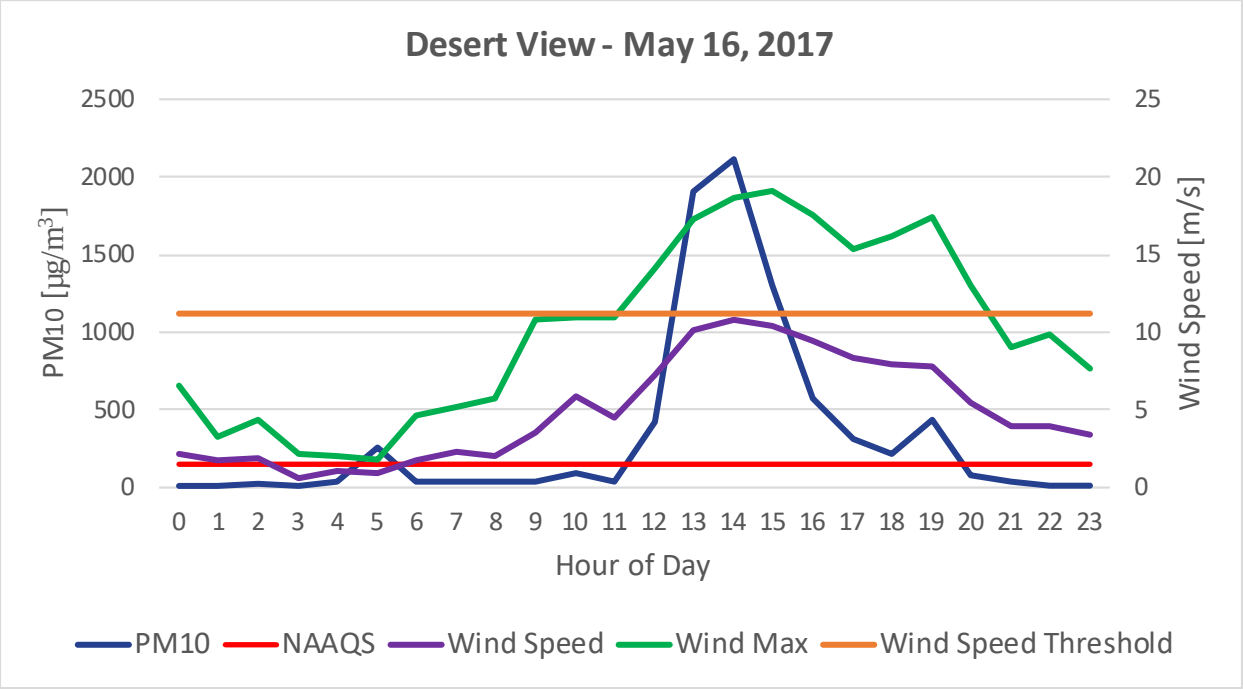


Figure 12-12. Desert View monitoring site hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2012-2016, the NMED monitoring site recorded 43 (Anthony), 35 (Chaparral), & 43(Desert View) exceedances of the PM_{10} NAAQS (Figures 12-13 through 12-15). The maximum 24-hour average PM_{10} concentrations, respectively, 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.

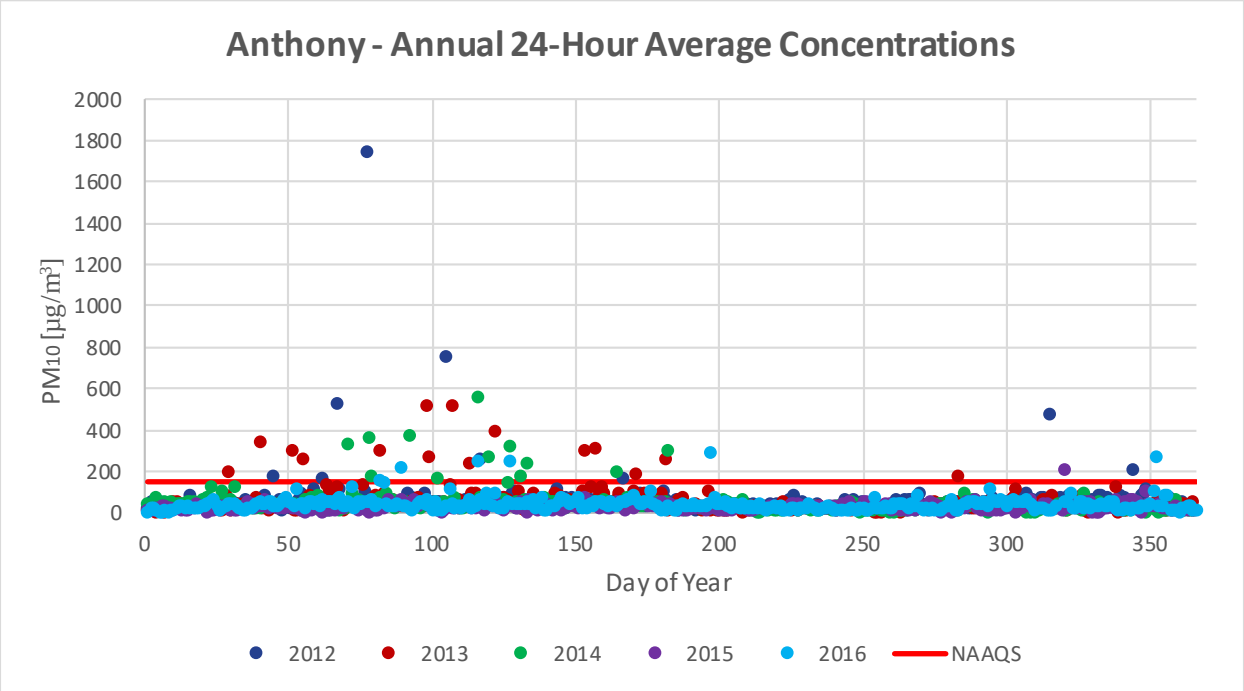


Figure 12-13. 24-hour averages by day of year from 2012-2016 for Anthony monitoring site.

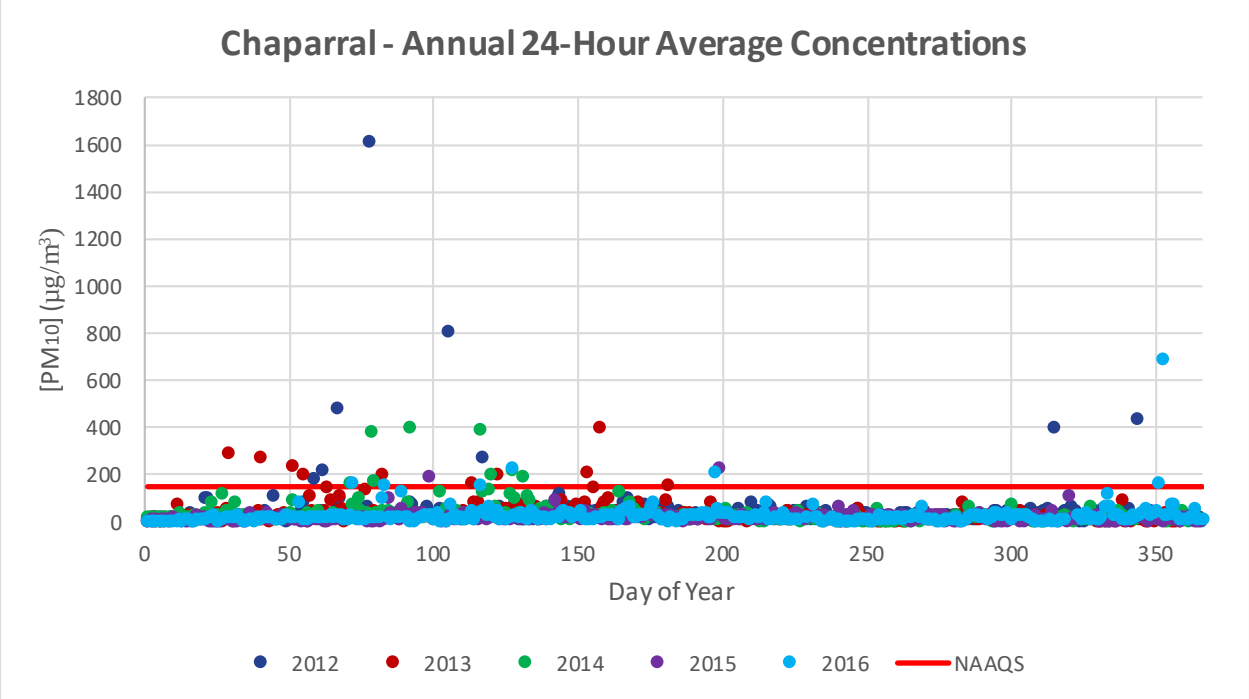


Figure 12-14. 24-hour averages by day of year from 2012-2016 for Chaparral monitoring site.

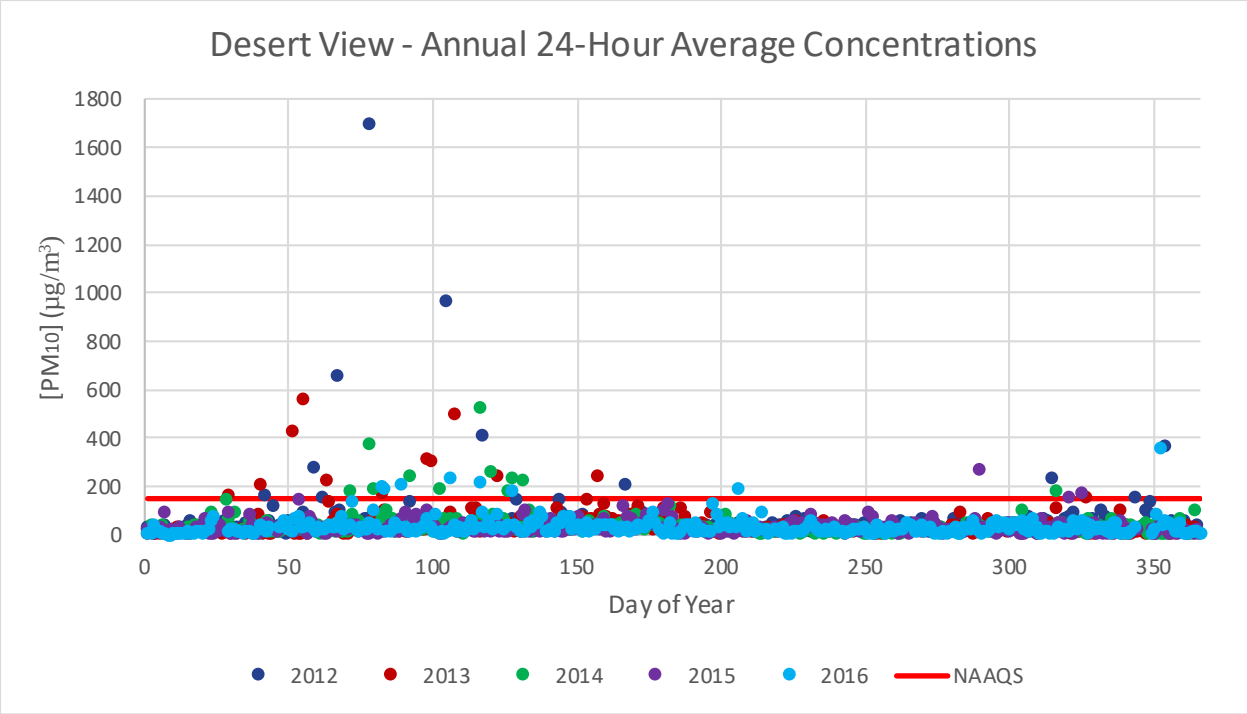


Figure 12-15. 24-hour averages by day of year from 2012-2016 for Desert View monitoring site.

Spatial and Temporal Variability

As demonstrated in Figure 12-16, 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 40 µg/m^3, demonstrating the influence high winds have on PM_{10} concentrations in the area.

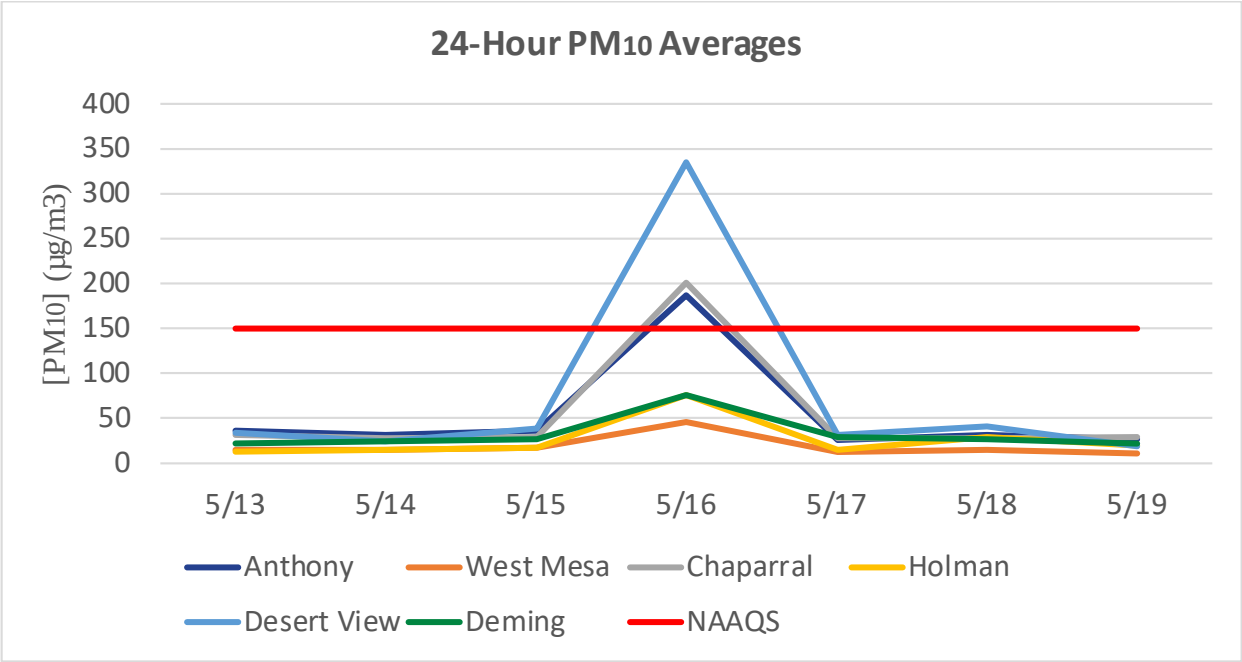


Figure 12-16. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

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 2012-2016. The recorded values for this day, 196 (Anthony), 335 (Chaparral), & 201 (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	288	148	218	178	244	216
95th Percentile	95	50	79	60	95	61
75th Percentile	51	21	34	30	42	27
50th Percentile	36	14	23	20	28	19
25th Percentile	24	10	15	13	18	12
5th Percentile	13	5	6	6	8	6
Mean	46	21	32	28	39	27

Table 12-4. 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 NMED monitoring sites. The monitored PM_{10} 24-Hour Averages of, 196 (Anthony), 335 (Chaparral), & 201 (Desert View) 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 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.

13. HIGH WIND EXCEPTIONAL EVENT: June 24, 2017

Conceptual Model

Thunderstorm outflow caused high winds and blowing dust in Luna County resulting in an exceedance of the PM_{10} NAAQS at the Deming 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 13-1).

AQS Flag	AQS ID	Site Name	24-Hour Average Concentration	Max 1-Hour Wind Speed	Max Gust
RJ	35-029-0003	7E Deming	196 µg/m^3	12.4 m/s	22.7 m/s

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

A cold front moved east to west across southern New Mexico and west Texas overnight with strong easterly winds occurring across the region early this morning. The flow was advecting cooler but much more unstable moist air into the area. Consequently, surface dewpoints were predicted to increase in moisture and destabilize the air mass. Little convective inhibition was predicted to exist so surface heating and upslope flows were expected. 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 2100 hour, an area of low pressure moved over southern Arizona. The surface radar for the 1200 hour shows the outflow boundary along south-central Texas and into Southern Arizona with southern New Mexico located in between the two boundaries. As the day progressed this low pressure traveled west and aligned itself with New Mexico and the surface wind direction (Figure 13-2). Unstable meteorological conditions that outflow boundaries create increases the surface wind velocities and provides the turbulence required for vertical mixing and entrainment of dust.

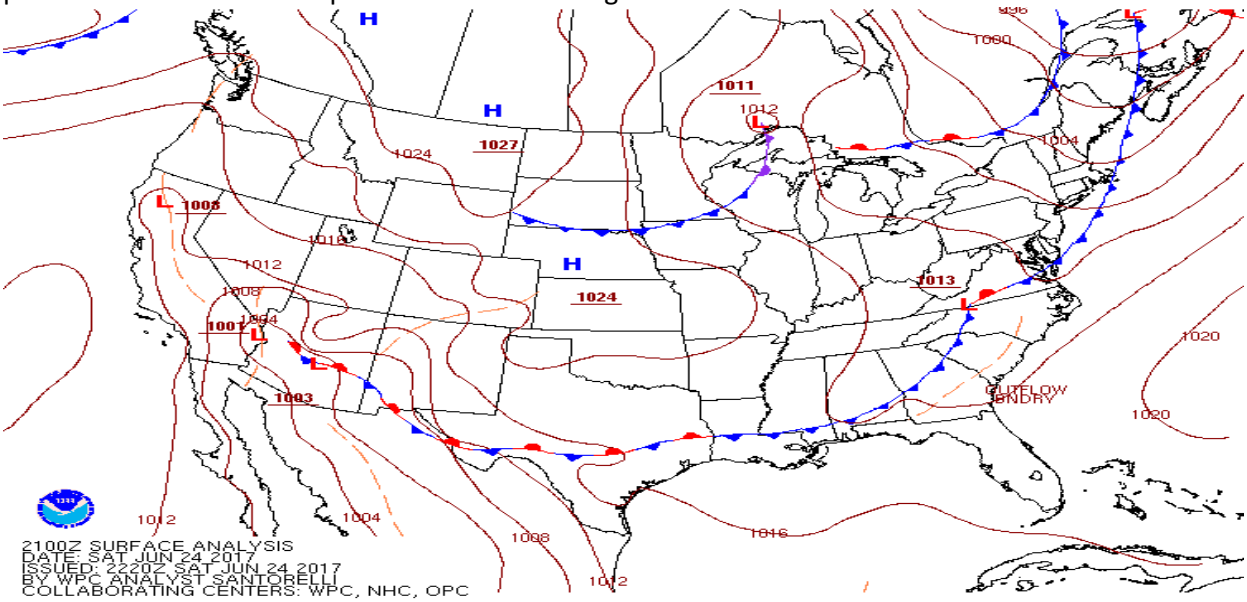


Figure 13-1. Surface weather map showing storm (surface low), cold fronts and isobars of constant pressure (red lines).

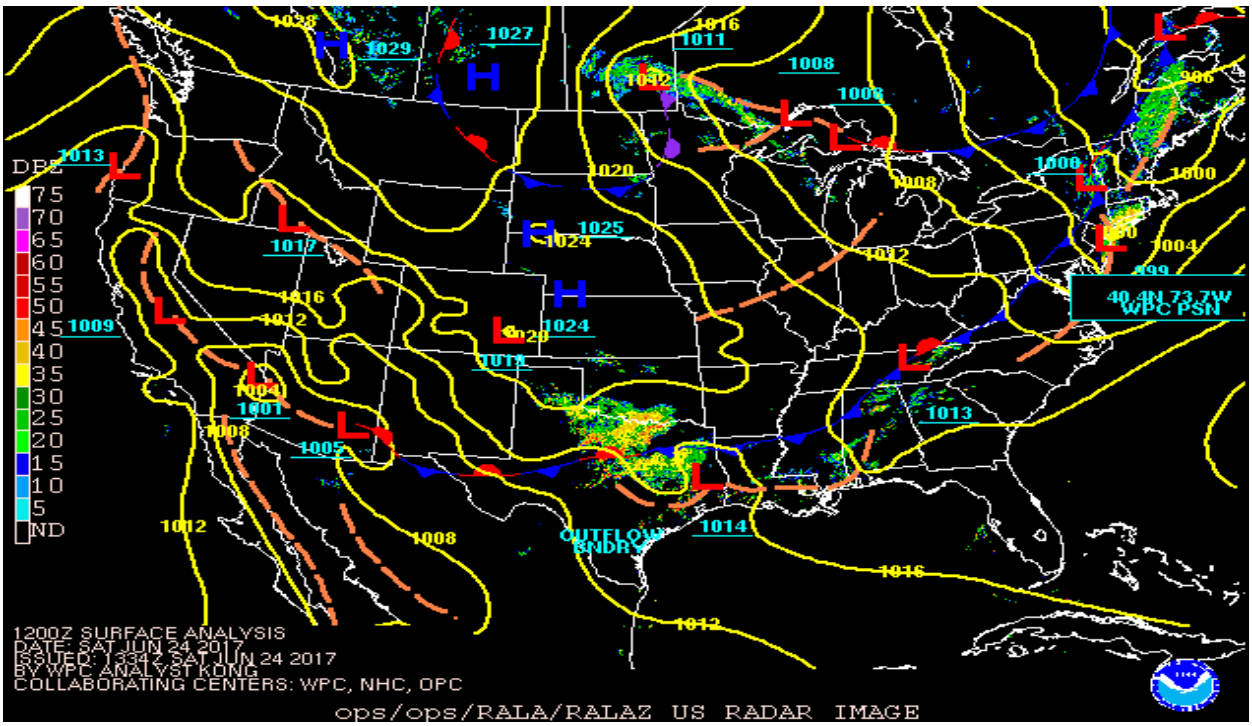


Figure 13-2. Radar weather map for June 24, 2017 at the 1200 hour. Outflow boundary depicted along south-central Texas and Arizona.

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

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, West Mesa and Deming monitoring sites beginning at the 1700 hour and lasted through the 1900 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 1700 hour. Hourly concentrations remained elevated through the 1900 hour. Table 13-2 below summarizes hourly PM_{10} concentrations, wind speeds, and wind gusts during the event.

Hour	West Mesa			Holman			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)
1600	63	7.6	13	51	7.3	13.9	105	7.5	12.3
1700	1099	10.5	21.2	1856	10.1	23.1	2954	12.4	22.7
1800	251	10.9	19.3	276	9.8	16.6	------	6.8	18
1900	141	6.8	14.8	31	7.9	12.4	85	6.5	13.9
2000	14	6.9	16.3	27	2.4	8.1	27	3	10.6

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, 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 east to west just south of the Texas panhandle 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 created by outflow boundaries 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 at the 17:00 hour (Figure 13-3).

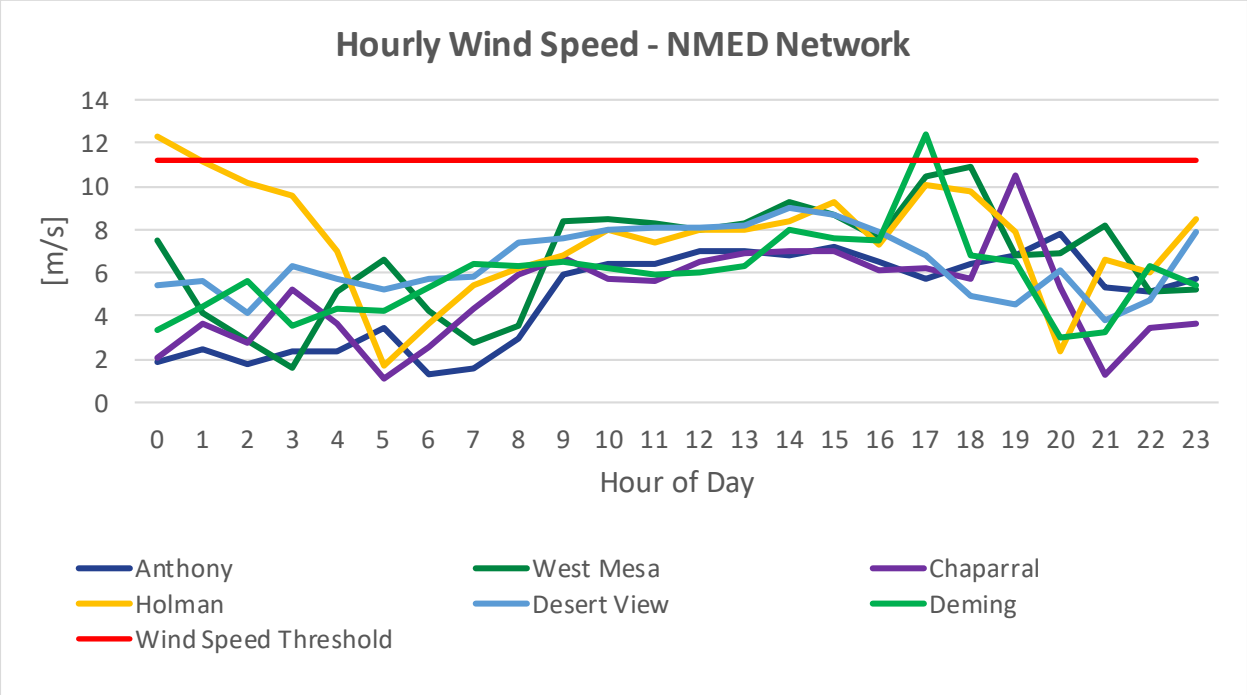


Figure 13-3. Wind speeds at NMED monitoring sites in Doña Ana and Luna Counties.

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 Luna and 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 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 the VIIRS Suomi satellite Aerosol Optical Depth product imagery with dust plumes originating upwind of NMED's monitoring site near Ascension and Janos, Chih. which is characterized by warm colors. 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 13-4). 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 site at the time of the satellite pass (1100 hour MDT) that captured the imagery.

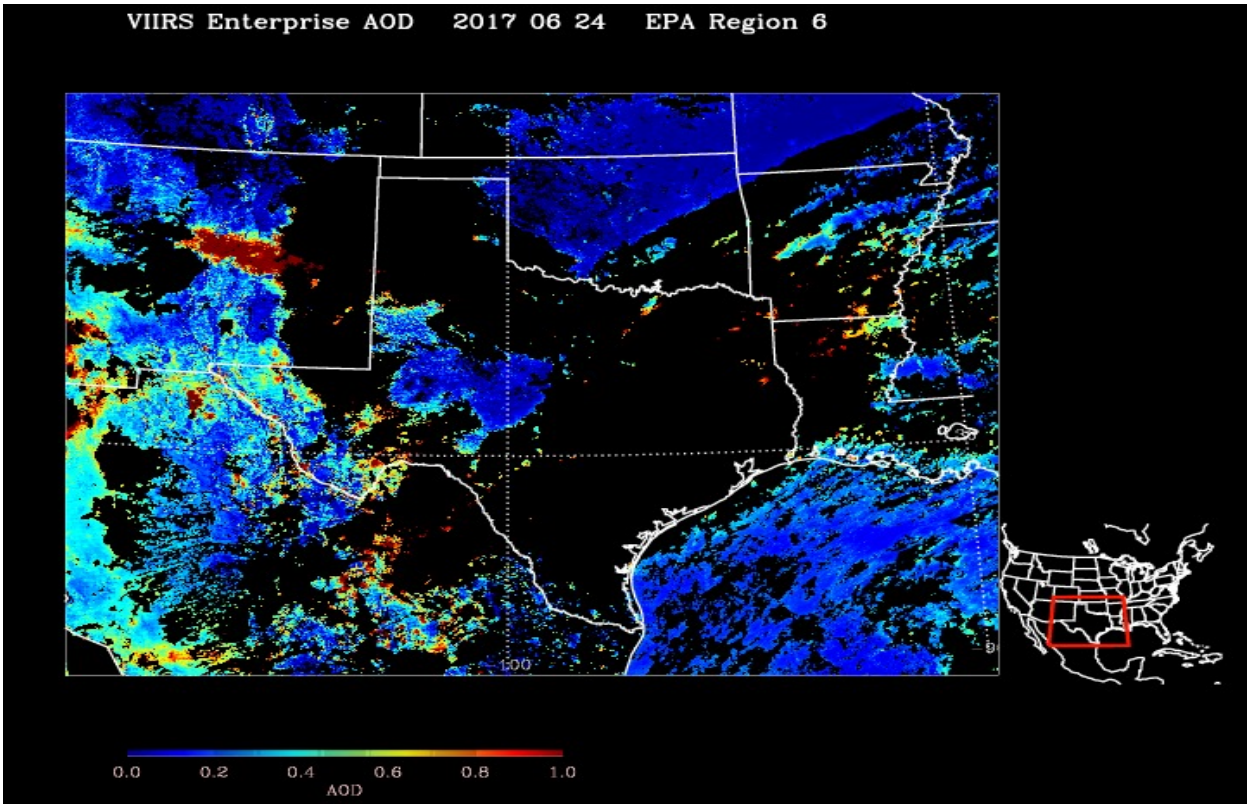


Figure 13-4. Aerosol Optical Depth product imagery from the VIIRS Suomi Satellite showing southwestern New Mexico, northern Chihuahua and western Texas. Imagery obtained from NASA's EOSDIS Worldview website. Warm colors represent dust plumes.

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

The following Las Cruces Sun News' article "Haboob sweeps over Las Cruces, goes viral", published June 26, 2017, highlights the sudden nature high intensity wind events create on a mesoscale.

Haboob sweeps over Las Cruces, goes viral

Diana Alba Soular, Las Cruces Sun-News Published 6:38 p.m. MT June 26, 2017 | Updated 7:05 p.m. MT June 26, 2017

A dust storm, or haboob begins to descend over Las Cruces on Saturday, June 24, 2017. This photo, looking toward the East Mesa, was taken from a drone launched off of Del Rey Boulevard.(Photo: Courtesy Robert Paquette)

LAS CRUCES - On Saturday, a massive wall of dust known as a haboob swept through the skies of Las Cruces, creating a spectacular visual display.

By Monday, a local drone pilot's video of the phenomenon had gone viral.

Robert Paquette, 51, marketing director for a local dentistry business, happened to be flying his drone, which is outfitted with a camera, off Del Rey Boulevard in north Las Cruces.

"I just turned around, and there was a haboob," he said. "I said, 'Oh my, gosh!' And right after that, I went, 'Oh, yeah!'"

More: Arabic weather term 'haboob' scares Texans more than dust

The wave of dust, which approached Las Cruces from the north, was dramatic. Paquette said he's seen haboobs before in the area, but this was the first time he'd viewed one from the perspective of a drone. He was only able to leave the drone in the air about 90 seconds before the fast-moving storm — and its associated winds — reached his area.

"I had to bring it down, and I almost lost it because it got so windy," he said of the drone.

Paquette's video and photos of the storm attracted a lot of interest on Facebook. His initial post garnered more than 1,000 shares. His video hit 75,000 views in one day — the most he's ever gotten for a single video.

"That's just because it's pretty amazing to look at," he said.

Weather experts said haboobs — a term that originates from the Middle East — aren't unheard of in southern New Mexico. Robert W. Endlich, a meteorologist who lives in Las Cruces and retired from White Sands Missile Range, said he sees about four or five of them per year.

"It's not that rare of an event," he said.

On May 29, 2016 the National Weather Service's Lubbock station posted on Facebook about a wall of dust that was approaching the city. The wall of dust is called a haboob, which is the same of a dust storm. USA TODAY

What's a haboob?

In fact, haboobs are relatively common in the desert areas of states such as New Mexico, Arizona, Texas and California, said David Hefner, meteorologist with the National Weather Service's Santa Teresa station.

"A haboob is generally a dust storm created either directly from a thunderstorm or the outflow that goes out ahead of it," he said.

More: A relative of the desert haboob: As the less predictable dust channel blows through Arizona, ADOT seeks solutions

Endlich said he was leaving the Walmart on Walton Boulevard just before 6:30 p.m. Saturday when he spotted the storm. He had a good vantage point to see the storm's approach and was able to snap some pictures. He described the storm as a "textbook example of a thunderstorm-produced haboob."

A combination of dry ground and tall, moisture-filled thunderstorms can set up the right conditions to spark a haboob, especially if there's a hefty layer of air between the ground and the bottom of the thunderstorm, Endlich said.

“In the Middle East, where the original name came from, the soil is a lot more fine, so you tend to get very restricted visibility.”

Robert W. Endlich, a meteorologist who lives in Las Cruces

"If they (the storms) are wet enough, then they'll lift this moisture up to 30,000 or 40,000 feet," he said. "Then you get ice crystals and snowflakes, and they start falling. Once they go below the cloud base, they evaporate, and that makes the water even cooler. That means it will accelerate. As long as it's got water, it will accelerate."

This speeding mass of cold air then strikes the ground, as if someone poured a pitcher of water on a table, Endlich said. Akin to water bouncing off a table, the wind picks up dust — if the ground is dry enough

— and propels it into the air. The finer the dust particles, the longer they'll hang around in the atmosphere.

"In the Middle East, where the original name came from, the soil is a lot more fine, so you tend to get very restricted visibility," he said. And then the stuff doesn't fall out as quickly as it does in North America. We'll have blowing dust and crummy visibility for 20, 30, 40 minutes. But with the real fine soils they have in the Middle East, it will stay real low visibility for days."

Airborne dust is a key factor contributing to poor air quality rankings in the Las Cruces and El Paso areas, climate experts have said.

A dust storm, or haboob begins to descend over Las Cruces on Saturday, June 24, 2017. This photo, looking west, was taken from a drone launched off of Del Rey Boulevard. (Photo: Courtesy Robert Paquette)

A look ahead

Saturday's storm didn't drop much rain. Gauges around the city recorded two- to three-tenths of an inch of rain.

While severe thunderstorms are in the forecast for Monday night, a 30 percent chance of scattered storms is predicted for Tuesday, according to the National Weather Service. The chances for moisture dissipate by Wednesday, with hot, dry weather expected for the remainder of the week.

Highs are expected to top 100 degrees Wednesday, Thursday and Friday, according to the weather service.

Diana Alba Soular may be reached at 575-541-5443, dalba@lcsun-news.com or @AlbaSoular on Twitter.

The National Weather Service (NWS) issued the following warning for Southern Doña Ana county.

"A few storms will be capable of producing damaging downburst winds with gusts to 60 mph."

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 west Texas 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 13-5). This analysis supports the hypothesis that dust plumes originated in MX before being transported to downwind monitoring sites.

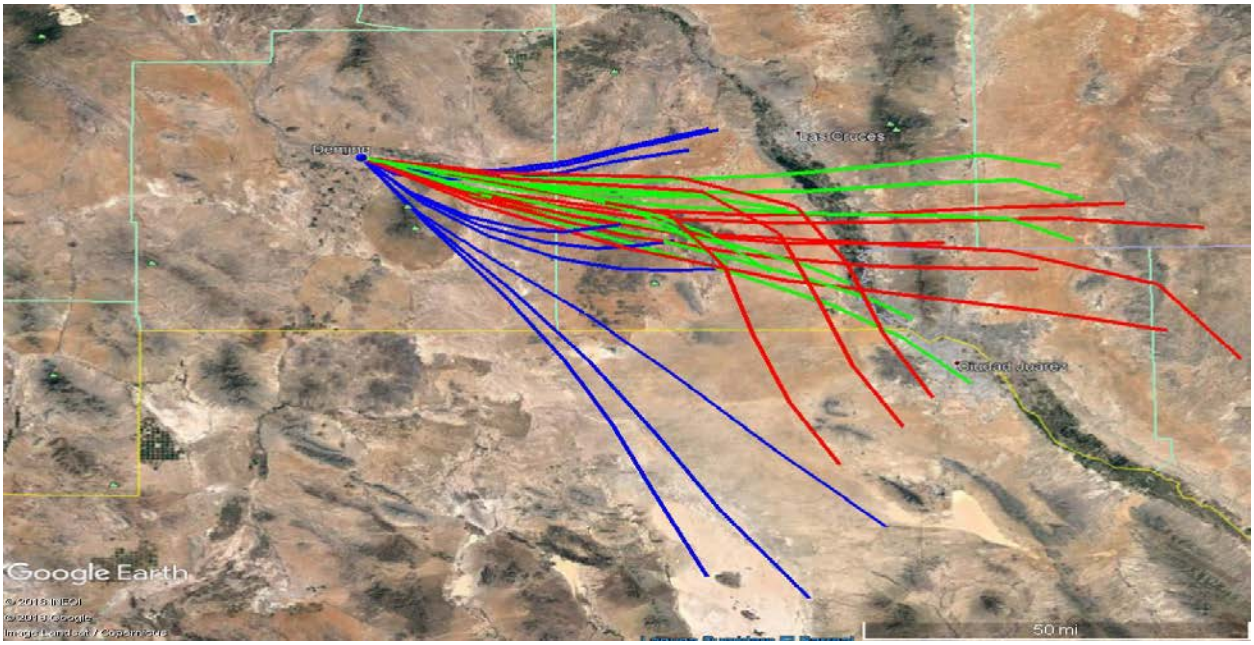


Figure 13-5. HYSPLiT back-trajectory analyses using the Ensemble mode.

Wind Direction and Elevated PM_{10} Concentrations

A pollution rose (Figure 13-6) was created for the hours of the event when PM_{10} concentrations exceeded 150 µg/m³ (1700 -1900 hour). During the event, winds blew from the northeast 100% of the time coinciding with peak PM_{10} concentrations.

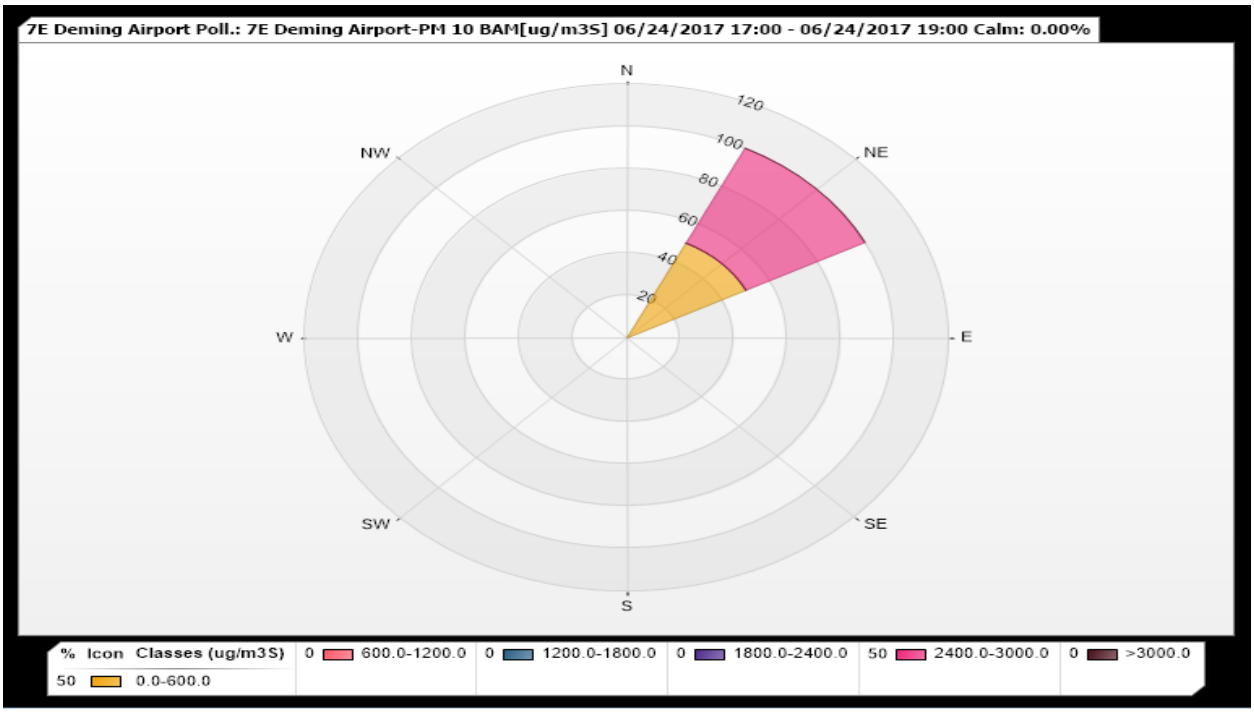


Figure 13-6. Pollution rose for the Deming monitoring site

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

The high wind blowing dust event generated strong southeasterly winds beginning at the 1700 hour and lasting through the 1900 hour. During this time, peak hourly PM_{10} concentrations ranged from 2954 to 356 µg/m³ at NMED monitoring sites (Figure 13-7). 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 hourly average wind speeds of 9 to 12.4 m/s were recorded at Desert View and Deming monitoring sites during the peak PM_{10} concentrations of the event. The time series plot in Figure 13-8 demonstrates the correlation between elevated levels of PM_{10} and high winds for this event.

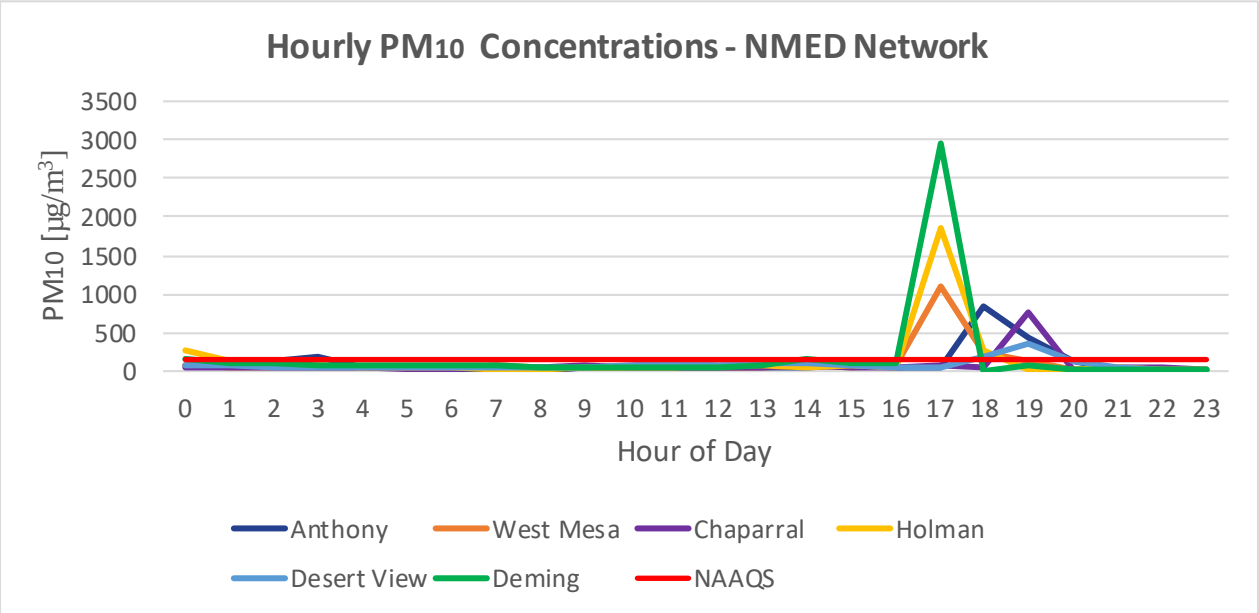


Figure 13-7. NMED monitoring network hourly PM_{10} data for the high wind blowing dust event.

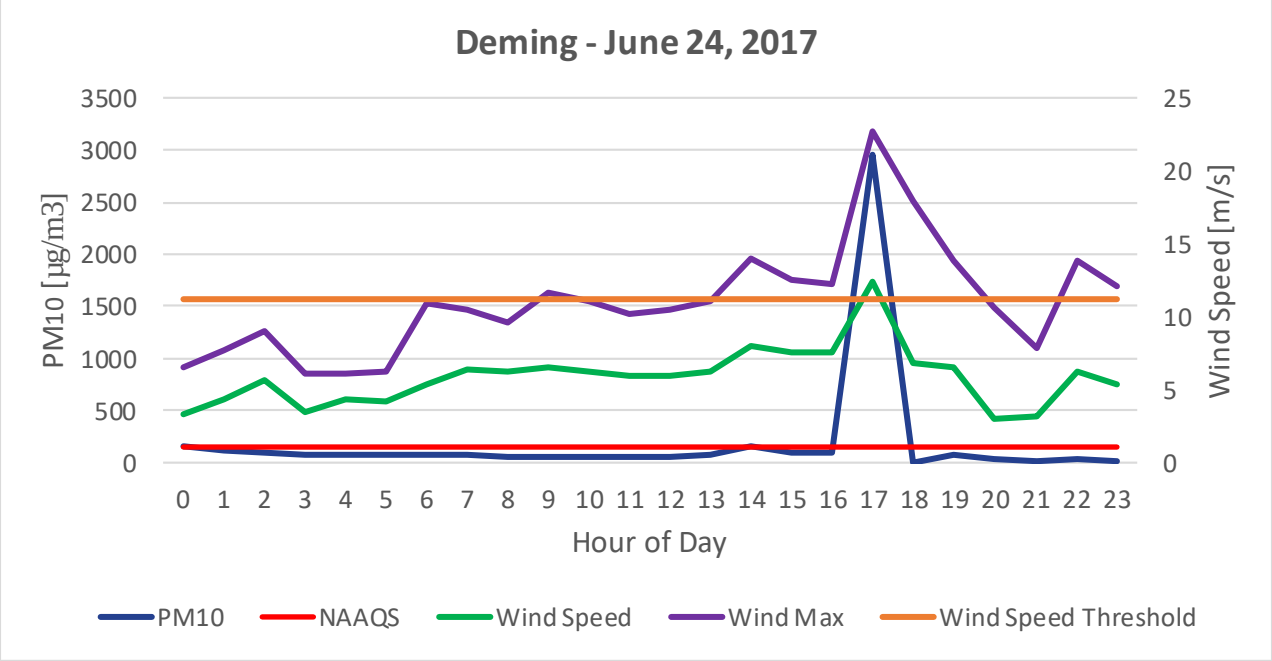


Figure 13-8. NMED monitoring network hourly PM_{10} and wind speed data for the high wind blowing dust event.

Historical Concentrations Analysis

Annual and Seasonal 24-hour Average Fluctuations

From 2012-2016, the Deming monitoring site recorded 25 exceedances of the PM_{10} NAAQS (Figure 13-9). The maximum 24-hour average PM_{10} concentration at this site was 1098 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.

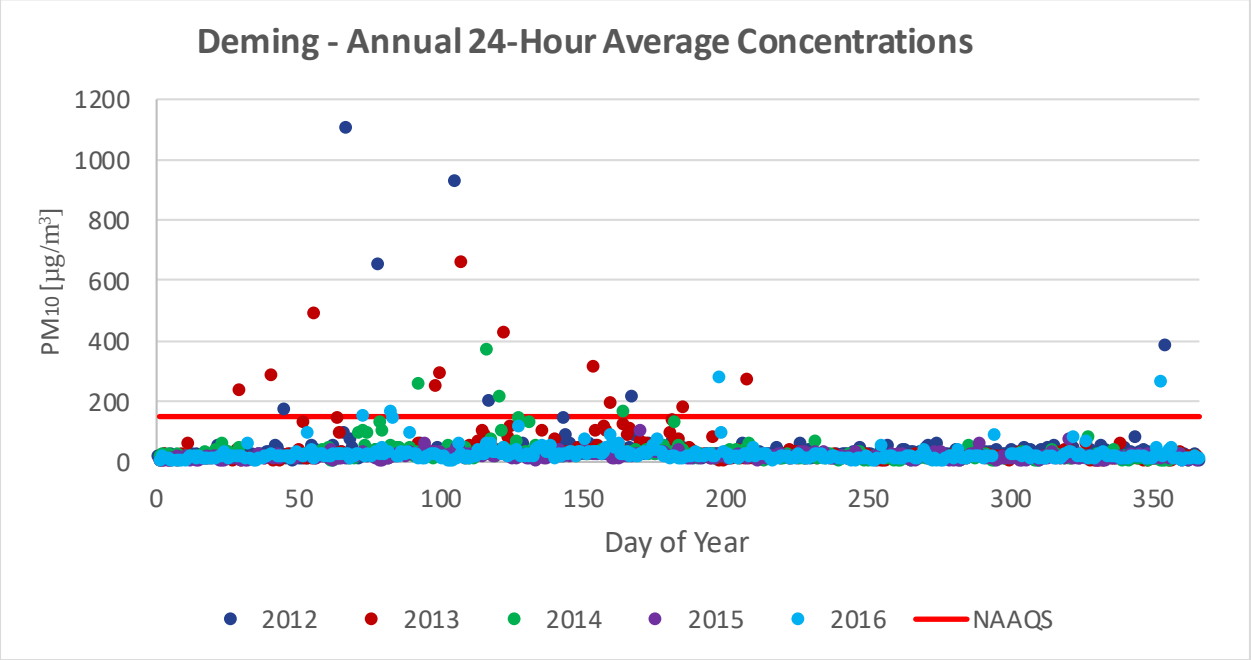


Figure 13-9. 24-hour averages by day of year from 2011-2015.

Spatial and Temporal Variability

As demonstrated in Figure 13-10, 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 60 µg/m³, demonstrating the influence high winds have on PM_{10} concentrations in the area.

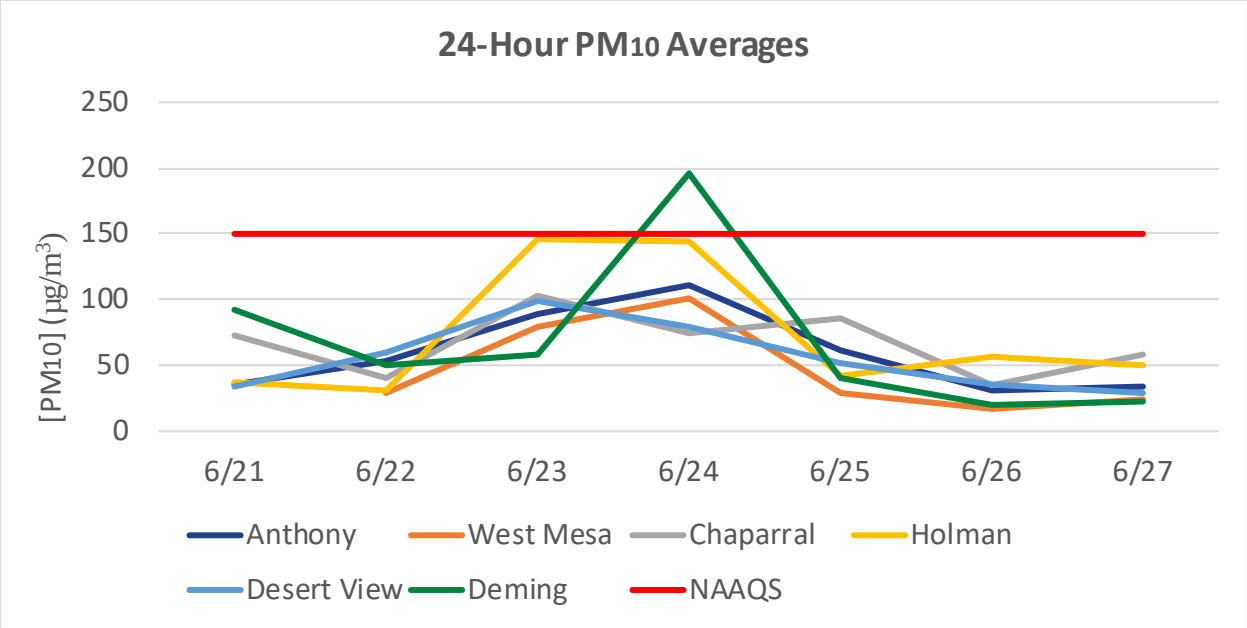


Figure 13-10. 24-Hour PM_{10} averages recorded at NMED monitoring sites for the event day and three days before and after.

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 2012-2016. The recorded value for this day (196 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	288	148	218	178	244	216
95th Percentile	95	50	79	60	95	61
75th Percentile	51	21	34	30	42	27
50th Percentile	36	14	23	20	28	19
25th Percentile	24	10	15	13	18	12
5th Percentile	13	5	6	6	8	6
Mean	46	21	32	28	39	27

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 Deming monitoring site. The monitored PM_{10} 24-Hour Average of 196 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 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.