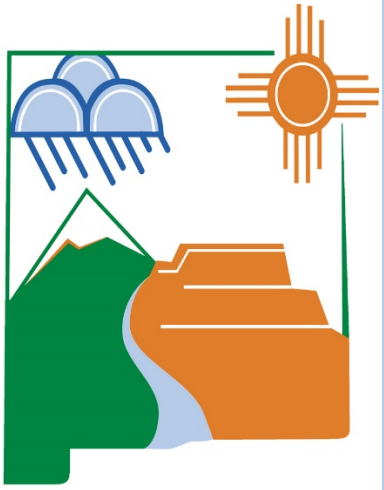
Exceptional Events Demonstration January 1-March 31, 2013

NMED
New Mexico Environment Department



Public Review Draft

Air Quality Bureau

Control Strategies Section

March 2016

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/aqb or in person at the address listed below. The Air Quality Bureau will accept public comment on this document from February 29, 2016 to March 30, 2016. For further information or to request a copy of this document, please contact the bureau by phone or in writing at:

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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 a 24-hour average of 150 $\mu g/m^3$.

From January 1-March 31, 2013, the New Mexico Environment Department (NMED) Air Quality Bureau (AQB) recorded 25 exceedances of the PM_{10} NAAQS on 6 days due to high wind dust events.

The evidence presented in this document substantiates the AQB's request to exclude exceedance data from the PM_{10} NAAQS attainment determinations for Doña Ana and Luna Counties in New Mexico. Table 1-1 lists the dates, monitoring sites and 24-hour averages of the exceedances requested for exclusion when the EPA makes a determination that a county meets the PM_{10} NAAQS. The elevated levels of PM recorded on the dates highlighted below were due to high winds entraining dust in the air and transporting it to the monitoring sites.

Monitor	**Anthony**	**Chaparral**	**Holman**	**Desert View**	**Deming**	**West Mesa**
AIRS #	**35-013-0016**	**35-013-0020**	**35-013-0019**	**35-013-0021**	**35-029-0003**	**35-013-0024**
Pollutant	**PM_{10}**	**PM_{10}**	**PM_{10}**	**PM_{10}**	**PM_{10}**	**PM_{10}**
1/29/2013	204	297	89	165	237	163
2/9/2013	348 (272 W)	276	114	212	284	95
2/20/2013	305	243	InV	429	128	91
2/24/2013	258	203	85	563	494	121
3/4/2013	140	155	65	231	142	71
3/23/2013	308 (228W)	207	203	176	ND	332

Table 1-1. 24-Hour PM_{10} concentrations requested for exclusion. ND stands for no data for that day and InV stands for insufficent hours of data collection for a valid 24-Hour concentration.

2 Background

Exceptional Events Rule

On March 22, 2007, the EPA adopted its final rule for state and local air quality management agencies regarding the review and handling of certain air quality monitoring data (72 FR 13560). The regulation, "Treatment of Data Influenced by Exceptional Events", or more commonly called the Exceptional Events Rule (EER), became effective on May 22, 2007 (40 CFR Part 50.14). The EER allows the EPA to exclude data affected by an exceptional event that caused an exceedance of a NAAQS when determining an area's ability to meet the standard for a given criteria pollutant. The rule does not include specific requirements concerning the type or level of evidence an agency must provide due to the wide range of events and circumstances covered under the rule. Hence, EPA determines data exclusion on a case-by-case basis after considering the weight of evidence provided in a demonstration. The procedural requirements of the EER are:

1. flagging of data in EPA's Air Quality System (AQS) database by air quality management agencies,
2. submission of demonstrations proving an exceptional event caused an exceedance within three years of the calendar quarter in which it was recorded, and
3. EPA placing a concurrence flag in AQS for those dates that are exceptional events.

In order for EPA to concur on a demonstration and exclude data under the EER, an agency must meet six technical elements. These elements include:

1. whether the event in question was not reasonably controllable or preventable (nRCP),
2. whether there was a clear causal relationship (CCR),
3. whether there would have been no exceedance or violation but for the event in question (NEBF),
4. whether the event affects air quality (AAQ),
5. whether the event was caused by human activity unlikely to reoccur or it was a natural event (HAURL/Natural Event), and
6. whether the event was in excess of normal historical fluctuations (HF).

This report demonstrates that NMED met the procedural and technical requirements for excluding data due to exceptional events in New Mexico for the first quarter of calendar year 2013.

2.2 Monitoring Network and Data Collection

The AQB operates a State and Local Air Monitoring Stations (SLAMS) network to measure the concentration of criteria pollutants and meteorological parameters (Table 2-1). The Bureau maintains five PM_{10} monitoring sites in Doña Ana County and one 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 (FEM) Tapered Element Oscillating

Microbalance (TEOM) PM_{10} instruments, while the Anthony (Doña Ana County) site is also equipped with a filter-based Federal Reference Method (FRM) Hi-Volume Wedding PM_{10} Monitor. The Anthony site does not have a standard 10 m wind tower and the La Union monitoring site is used for measuring meteorological parameters due to their proximity. The Santa Teresa monitoring site is included in this report because it may inform wind speeds at areas nearby, but upwind of PM_{10} monitors in southern Doña Ana County. Figure 2-2 shows the location of the monitoring sites listed in Table 2-1.

Site Name	AIRS Number	County	Sampling Frequency	Parameters
Holman	35-013-0019	Doña Ana	Continuous	PM_{10} and Meteorological
Chaparral	35-013-0020	Doña Ana	Continuous	PM_{10} and Meteorological
Anthony	35-013-0016	Doña Ana	Continuous and 1-in-6 Day	PM_{10}
Desert View	35-013-0021	Doña Ana	Continuous	PM_{10} and Meteorological
West Mesa	35-013-0024	Doña Ana	Continuous	PM_{10} and Meteorological
Deming Airport	35-029-0003	Luna	Continuous	PM_{10} and Meteorological
La Union	35-013-0008	Doña Ana	Continuous	Meteorological
Santa Teresa	35-013-0022	Doña Ana	Continuous	Meteorological

Table 2-1. SLAMS designated monitoring sites affected by exceptional events in 2013. The Anthony Site has collocated TEOM and Wedding instruments.

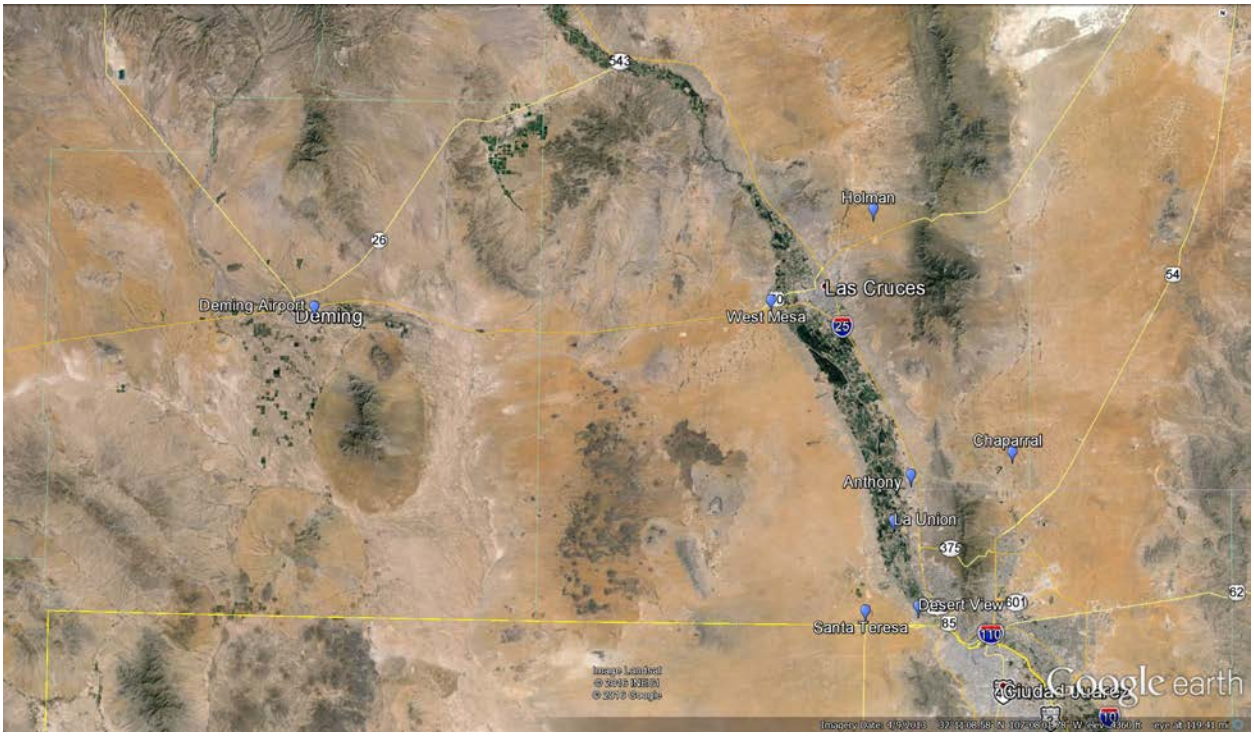


Table 2-2. PM_{10} and meteorological monitoring sites used in this demonstration.

3 Exceptional Event: January 29, 2013

Summary of the Event

The passing of a winter storm caused high winds and blowing dust in Doña Ana and Luna Counties resulting in exceedances of the PM_{10} 24-hour NAAQS at the Anthony, Chaparral, Desert View, Deming and West Mesa monitoring sites on this date. The FEM TEOM continuous monitors at these sites recorded 24-hour average concentrations of 204 $\mu g/m^3$, 297 $\mu g/m^3$, 165 $\mu g/m^3$, 237 $\mu g/m^3$, and 163 $\mu g/m^3$ respectively. This was not a sampling day for the FRM Wedding at the Anthony site. Although the Holman site did not record an exceedance on this date, elevated PM_{10} concentrations were measured during the same time period.

As the event unfolded, the wind blew from the west throughout the border region. These high velocity winds passed over large areas of desert within Arizona, Texas, New Mexico and Mexico. NMED measured strong sustained hourly wind speeds at and in areas upwind of the PM_{10} monitoring sites ranging from 10.8 m/s to 15.2 m/s. 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 an exceptional event, specifically a natural event caused by high wind and blowing dust.

Is Not Reasonably Controllable or Preventable

Suspected Source Areas and Categories Contributing to the Event

Sources of windblown dust contributing to this exceedance include portions of the Chihuahuan Desert, residential and commercial properties, agricultural land and unpaved roads upwind of the monitors. The largest and most likely sources of windblown dust is the natural desert and the playas in New Mexico and northern Mexico (see satellite imagery below).

Sustained and Instantaneous Wind Speeds

EPA uses a default entrainment threshold of sustained wind speeds at 11.2 m/s (25 mph) for natural and well controlled anthropogenic sources contributing to natural events caused by high wind and blowing dust. Under the Doña Ana and Luna County NEAPs, EPA and NMED agreed that wind gusts exceeding 18 m/s (40 mph) would overwhelm any natural and well-controlled anthropogenic sources and cause windblown dust. On January 29, sustained wind speeds exceeded EPA's default threshold at five of the six PM_{10} monitoring sites and wind gusts exceeded the NEAPs agreed upon threshold at all of these sites (Figures 3-1 and 3-2). Although the Desert View monitoring site did not record sustained wind speeds above the 11.2 m/s threshold, the nearby and upwind monitoring site of Santa Teresa did. During the 1500 hour, the Deming Airport site recorded less than 45 minutes of data due to routine maintenance and therefore did not have the requisite 75% percent of data for that hour to be valid.

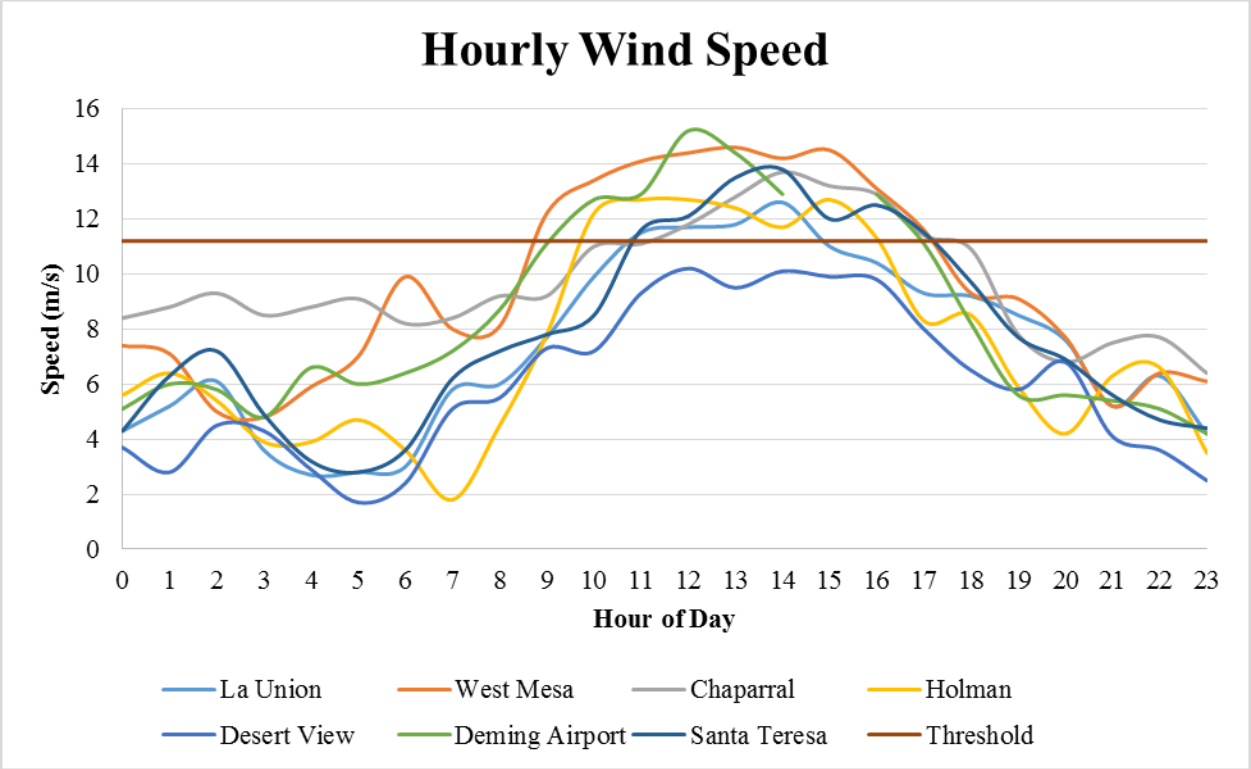


Figure 3-1. Sustained wind speeds at monitoring sites in Doña Ana and Luna Counties.

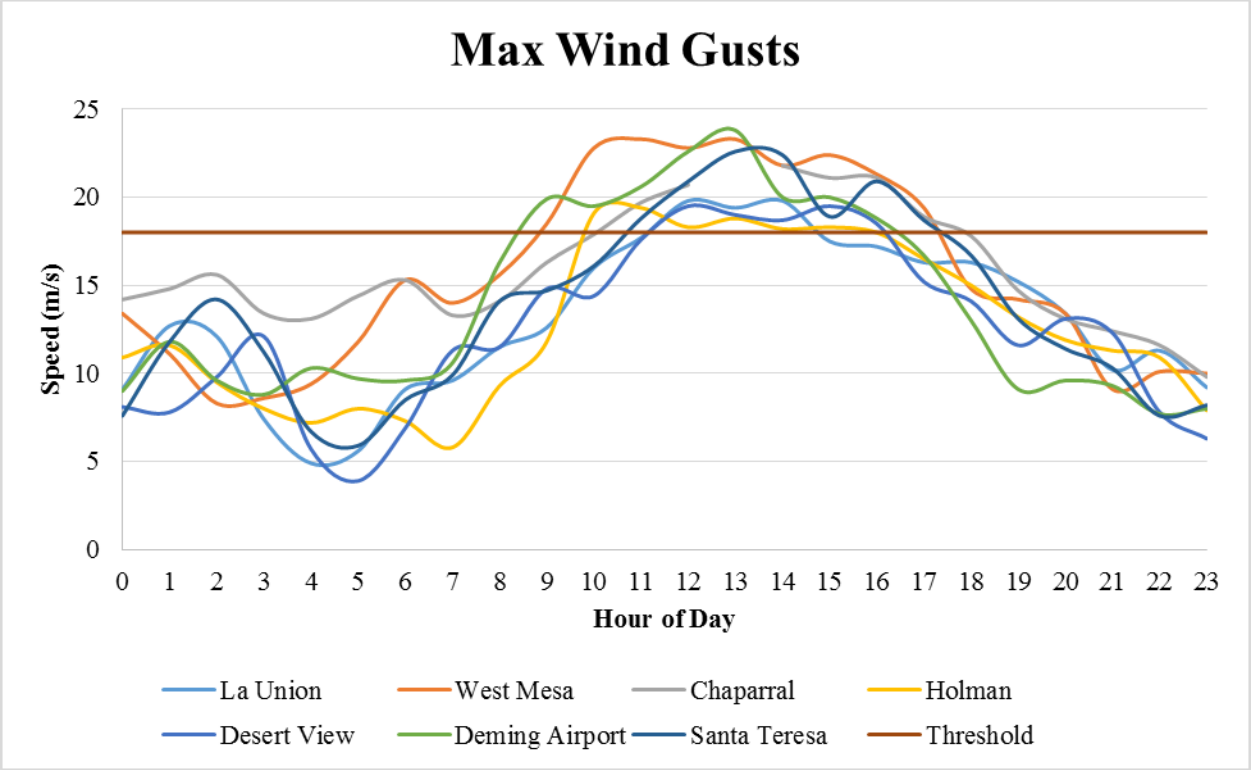


Figure 3-2. Maximum wind gusts at monitoring sites in Doña Ana and Luna Counties.

Basic Controls Analysis

Under the approved Doña Ana County and Luna County Natural Events Action Plans (NEAPs), Best Available Control Measures (BACM) are in place for anthropogenic sources based on ease and effectiveness of implementation. In addition, large land managers including New Mexico State University, Ft. Bliss Military Base, White Sands Missile Range and the New Mexico Department of Transportation, each signed a Memorandum of Understanding with NMED to control sources of windblown dust under their control. The BACM measures regulate disturbed lands, construction and demolition, vacant parking lots and materials handling and transportation. Our investigation did not identify any unusual PM_{10} producing activities on this day, and anthropogenic emissions remained constant before, during and after the event.

Soil erosion by wind or water reduces agricultural productivity and has always been a major concern for agricultural land managers. New Mexico farmers work with the local U.S. Department of Agriculture Natural Resource Conservation Service and New Mexico State Agricultural Extension Office to develop and implement soil conservation plans specifically designed for the soil types and crops of each individual farm. Most of the cropland in Doña Ana County form stable, non-erodible aggregates (clods) when tilled, protecting the surface from wind erosion even when the soil is dry and not covered with plants.

Wind speeds on this day were high enough to entrain dust from undisturbed desert areas upwind of the monitors. Emissions from these areas are not reasonably controllable because costs would prohibit applying controls and detrimental effects on the natural ecosystem could occur.

Based on Doña Ana and Luna Counties attainment designation, implementation of BACM, and the MOUs in place, NMED believes that the control measures to reduce windblown dust should suffice as reasonable controls. Additional controls would not be economically and technically feasible and would not provide additional public health protections. NMED concludes that the sources contributing to the event are not reasonably controllable.

Historical Fluctuations Analysis

Annual and Seasonal 24-hour Average Fluctuations

Since being established, the monitoring sites in Doña Ana and Luna Counties have recorded exceedances of the PM_{10} NAAQS. High winds cause these exceedances and they can occur at any time of year (Appendix-A). Most exceedances occur from late winter through early summer (February-June) and are associated with the passage of storm systems and associated cold fronts or thunderstorm outflow during the monsoon season. High winds caused all recorded exceedances from 2008-2012 and NMED submitted natural events demonstrations to EPA.

Table 3-1 shows the percentile rank of the 24-hour average PM_{10} concentration on this day relative to all measurements including days when high wind natural events caused exceedances from 2008-2012. Data for PM_{10} in this table includes FEM TEOM measurements only since they are continuous monitors that provide a large number of data points for a robust statistical analysis. The recorded values for this day are above the 95^{th} percentile of all 24-hour averages

recorded. Because NMED believes all previous exceedances were due to high wind dust events, the exceedances for this day would be the maximum values recorded if no high wind exceedances are included in the analysis.

	Anthony	Chaparral	Deming	Desert View	Holman	West Mesa
Max	1740	1607	1099	1693	1450	480
99th Percentile	268	297	300	231	212	135
95th Percentile	105	101	69	91	71	47
Event Day	204	297	237	165	89	163

Table 3-1. Percentile comparison of event day 24-hour average to 24-hour averages from 2008 to 2012.

Table 3-2 shows the percentile rank of the 24-hour average PM_{10} concentration on this day relative to all measurements during the winter season including days when high wind natural events caused exceedances from 2008-2012. For purposes of this analysis winter season was defined as the three month period from December through February. Data for PM_{10} in this table includes FEM TEOM measurements only since they are continuous monitors that provide a large number of data points for a robust statistical analysis. The recorded values for this day are above the 95th percentile of the seasonal 24-hour averages recorded. The Chaparral, Deming and West Mesa sites recorded values above the 99th percentile of data. Because NMED believes all previous exceedances were due to high wind dust events, the exceedances for this day would be the maximum values recorded if no high wind exceedances are included in the analysis.

	Anthony	Chaparral	Deming	Desert View	Holman	West Mesa
Max	775	437	525	366	398	353
99th Percentile	248	256	224	220	146	91
95th Percentile	110	105	57	100	63	45
Event Day	204	297	237	165	89	163

Table 3-2. Percentile comparison of event day 24-hour average to seasonal 24-hour averages from 2008 to 2012.

Clear Causal Relationship

A strong winter storm passed through New Mexico on January 29. An area of low pressure centered in northeastern New Mexico created a pressure gradient over southeastern Arizona, southwestern New Mexico and northern Mexico. As the storm system moved through northern New Mexico, the surface pressure gradient tightened and winds became stronger (Figure 3-3). Surface winds flow perpendicular to the isobars from high to low pressure. Diurnal heating of the surface allowed winds aloft to mix downward, increasing the surface wind velocities and provided the turbulence required for vertical mixing and horizontal transport of dust.

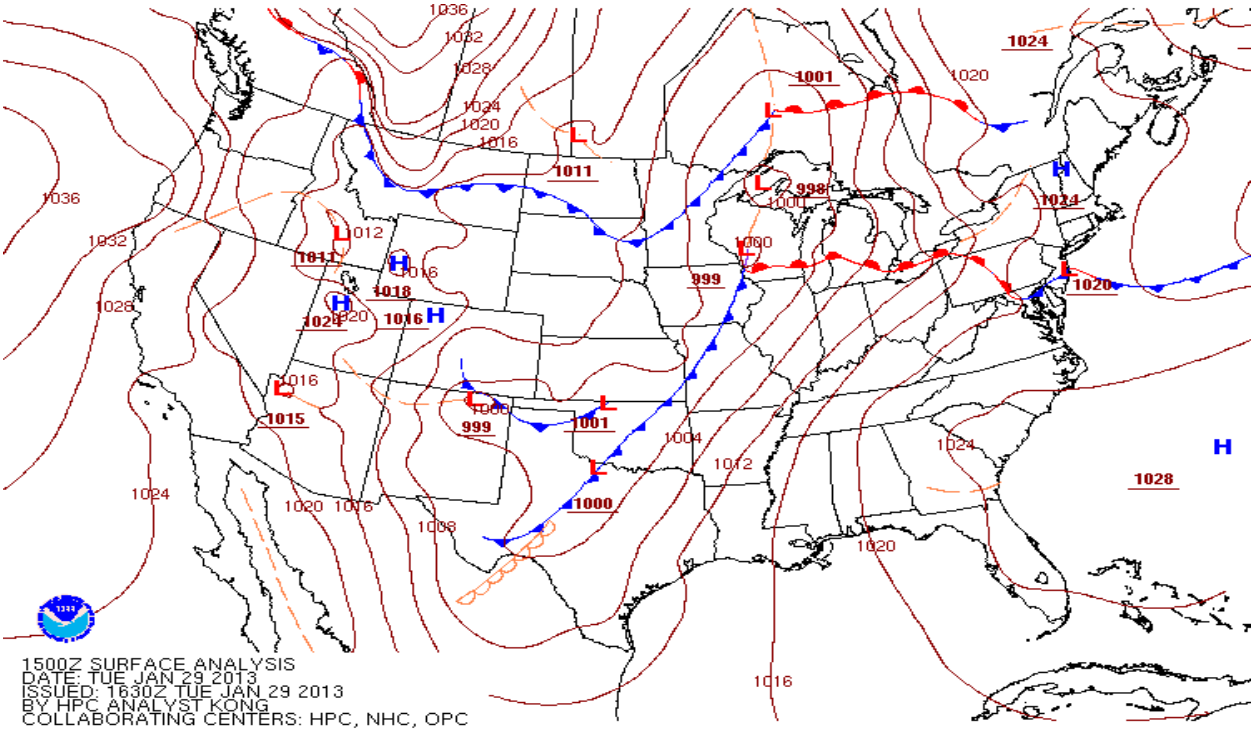
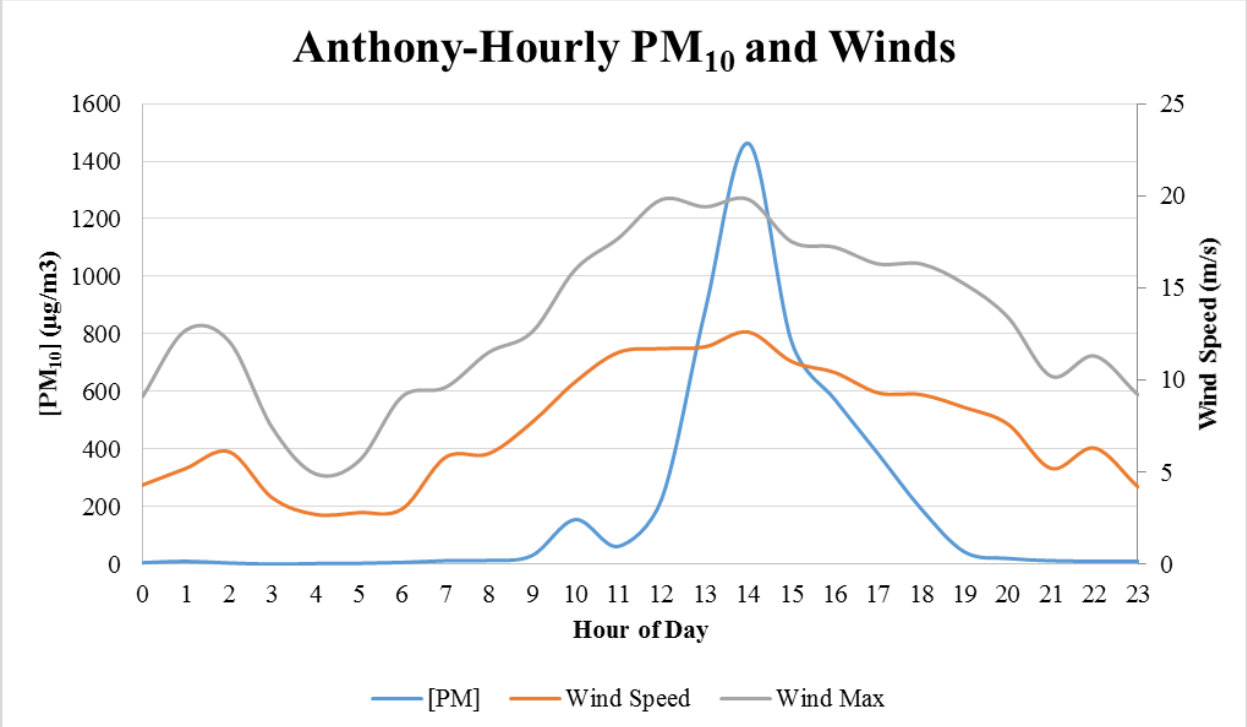
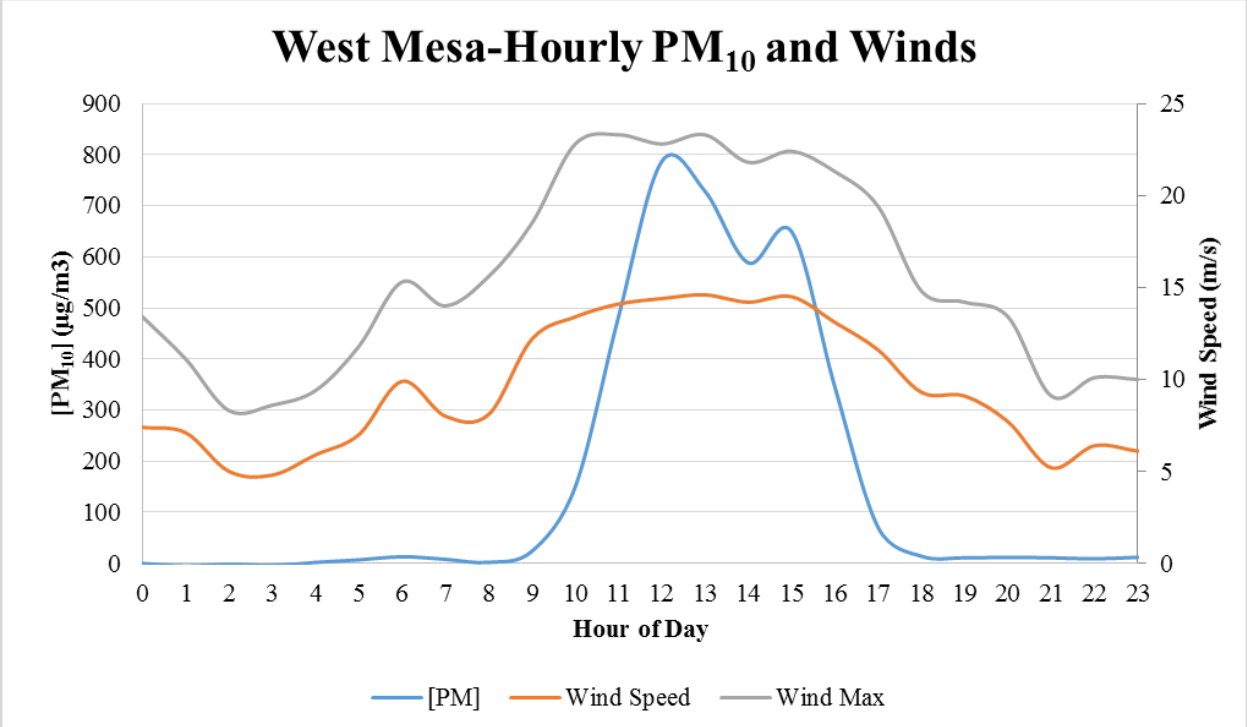
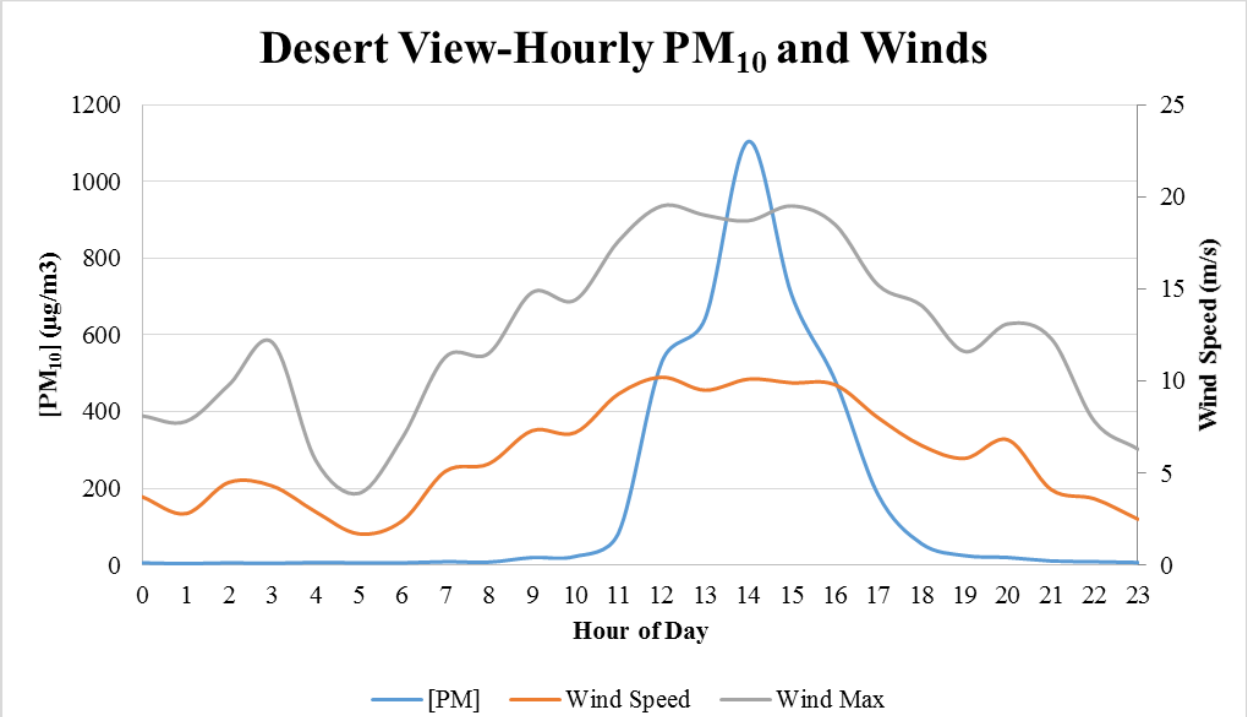


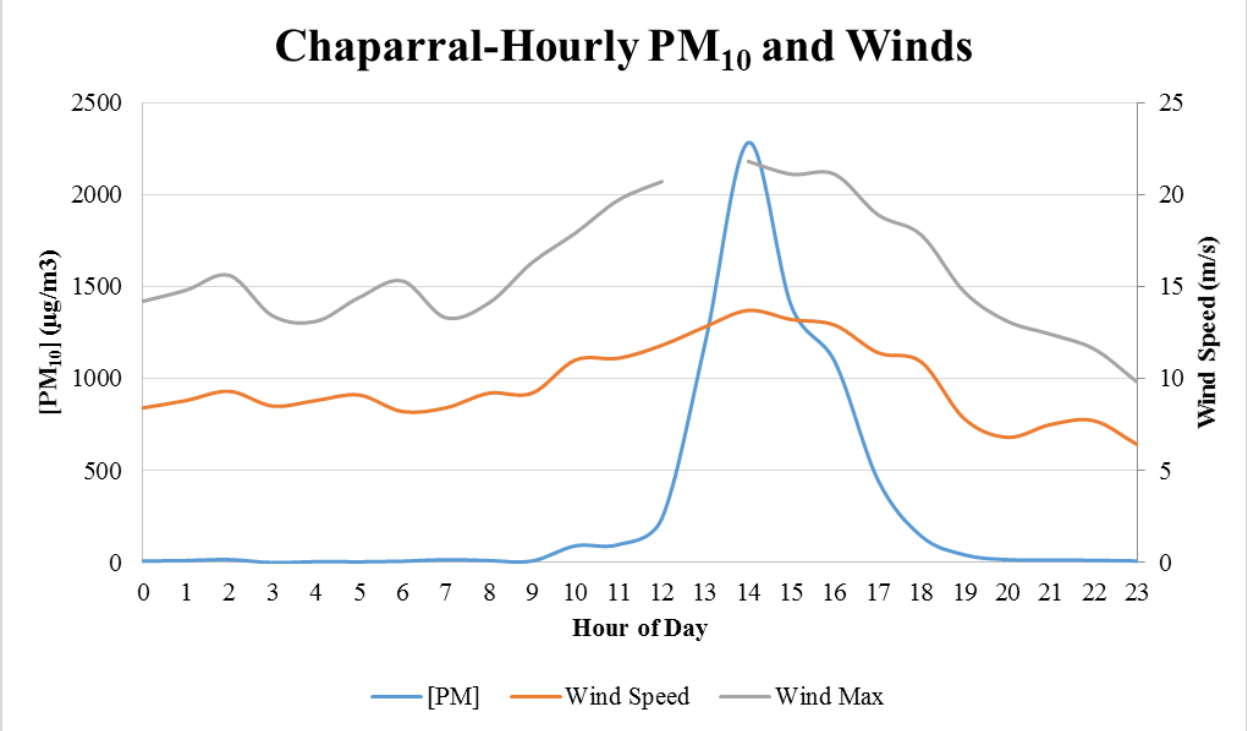
Figure 3-3. Surface weather map showing winter storm and isobars of constant pressure (red lines) for January 29 at the 800 hour.

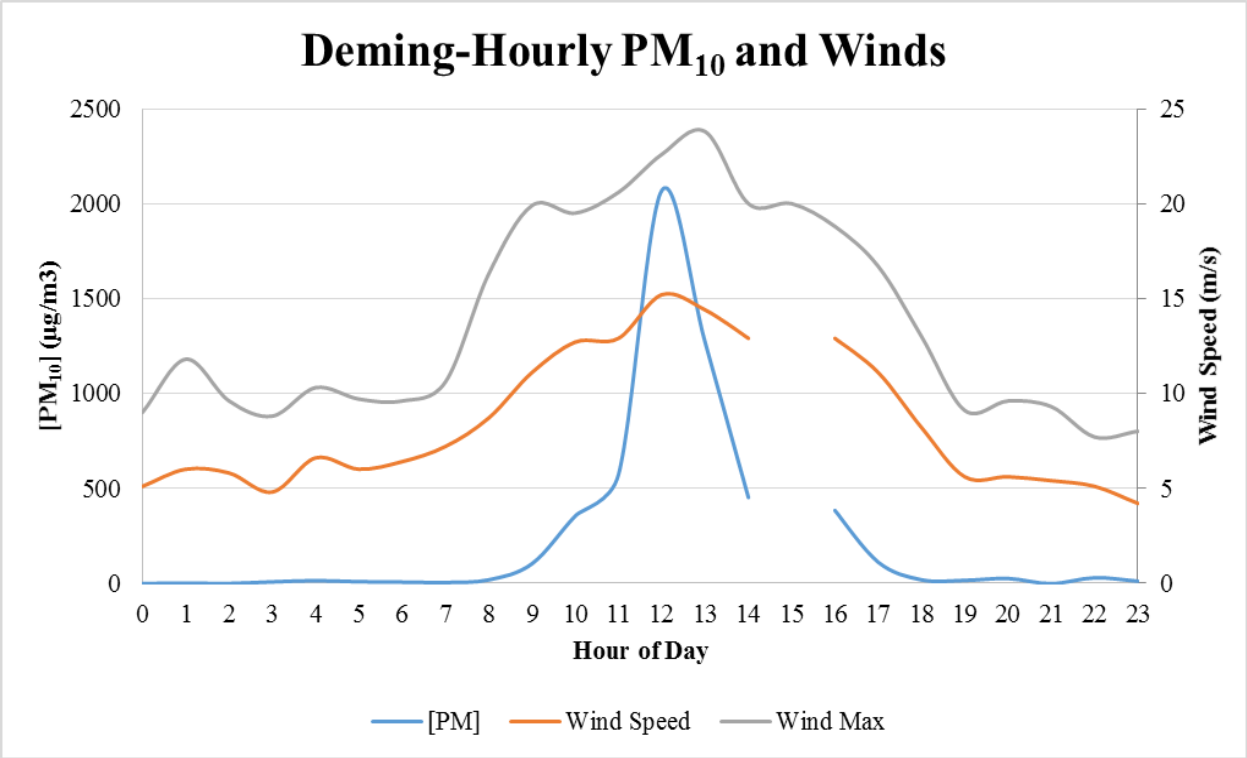
The weather pattern described above generated strong west winds beginning at the 900 hour and lasted through the 1700 hour. Beginning at the 900 hour, wind speeds exceeded 11.2 m/s at West Mesa as shown in Figure 3-1. Peak wind speeds ranged from 10.2 m/s at Desert View to 15.2 m/s at the Deming Airport (Figure 3-1). Peak wind gusts ranged from 19.4 m/s at Holman to 23.8 m/s at the Deming Airport (Figure 3-2). Blowing dust caused elevated levels of PM_{10} during the same period as high winds as demonstrated by the time series plots in Figure 3-4 a-e. During these hours, hourly PM_{10} concentrations spiked at all monitoring sites in the network (Figure 3-5).


Anthony-Hourly PM10 and Winds
[PM10] (µg/m3)
Wind Speed (m/s)
Hour of Day
[PM]
Wind Speed
Wind Max


West Mesa-Hourly PM10 and Winds
[PM10] (µg/m3)
Wind Speed (m/s)
Hour of Day
[PM]
Wind Speed
Wind Max


Desert View-Hourly PM10 and Winds
[PM10] (µg/m3)
Wind Speed (m/s)
Hour of Day
[PM]
Wind Speed
Wind Max


Chaparral-Hourly PM10 and Winds
[PM10] (µg/m3)
Wind Speed (m/s)
Hour of Day
[PM]
Wind Speed
Wind Max



Figures 3-4 a-e. Time series plot of hourly observations showing increased PM_{10} concentrations as wind speeds and gusts increase.

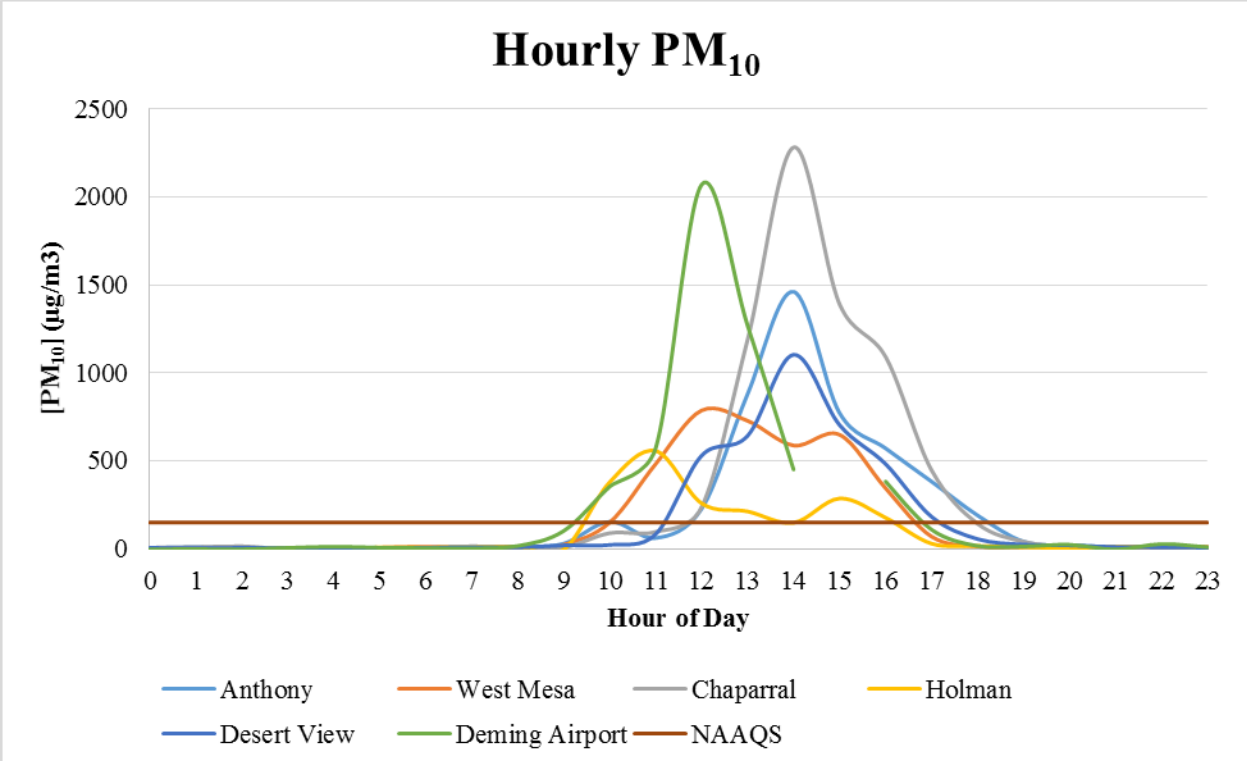


Figure 3-5. Hourly PM_{10} concentrations for Doña Ana and Luna Counties monitors.

The National Weather Service (NWS) issued a Wind Advisory and High Wind Warning (Figure 3-6) 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 High Wind Warning is issued when sustained winds of 40 mph or more are expected for 1 hour or longer, or for wind gusts of 58 mph or more with no time limit. These were in place for southwestern New Mexico and west Texas to warn the public of the high wind event.

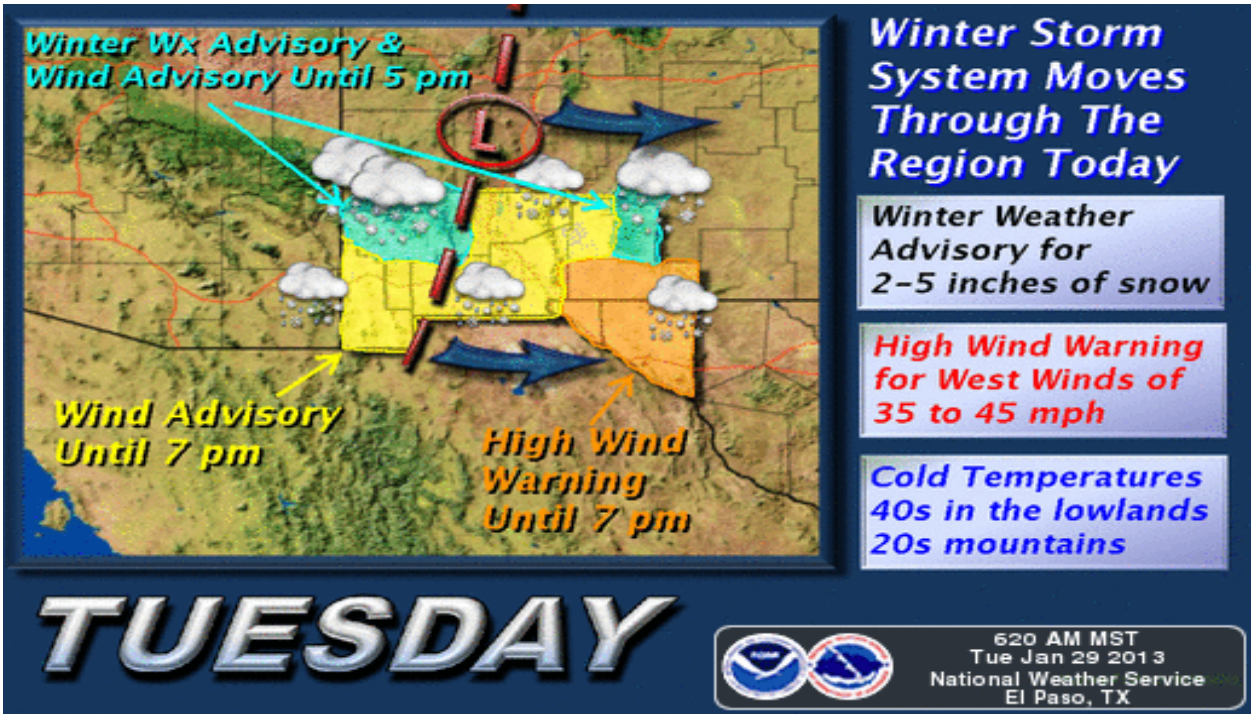


Figure 3-6. NWS graphicast showing the winter storm and advisory and warning areas.

The event was also captured on satellite imagery showing dust plumes originating along the I-10 corridor and desert areas near the East Potrillo Mountains (Figure 3-7). The event was featured on NASA's daily natural hazard blog and the Las Cruces Sun-News also reported on the event.

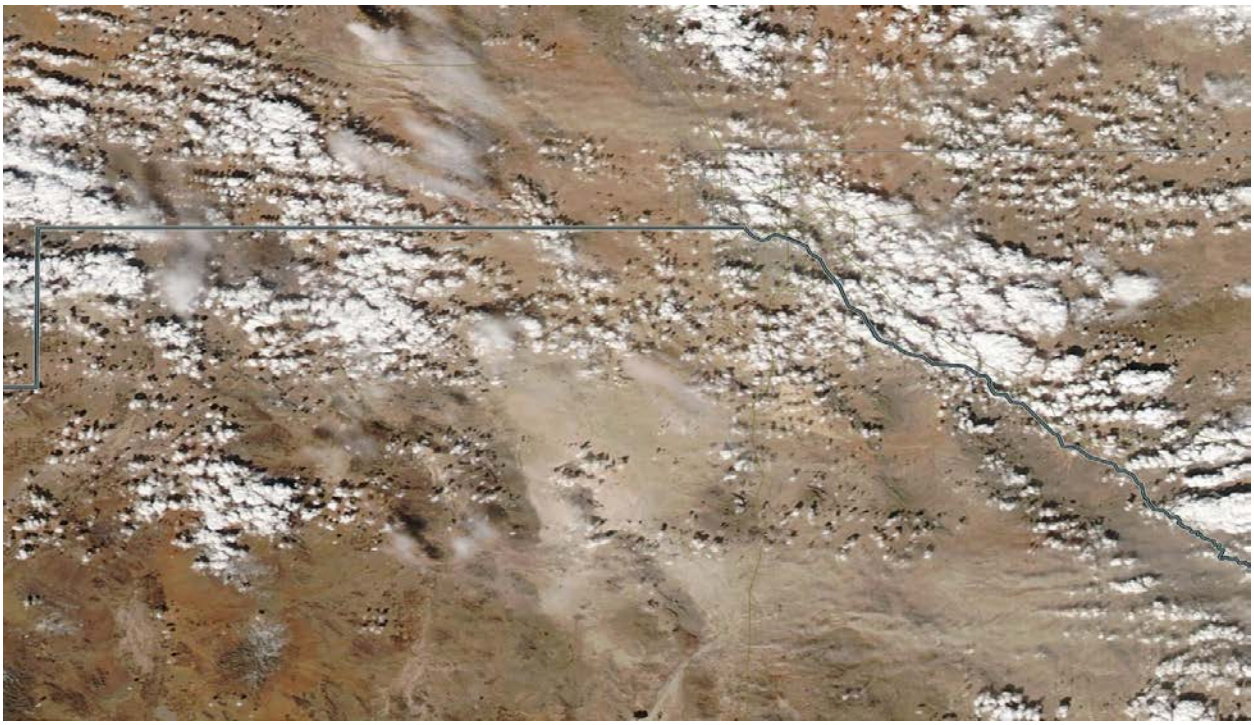


Figure 3-7. NASA Aqua satellite imagery of the border area.

Affects Air Quality

The historical fluctuations and clear causal relationship analyses prove that the event in question affected air quality on this date.

Natural Event

The Clear Causal Relationship and not Reasonably Controllable or Preventable analyses show that this was a natural event caused by high wind and blowing dust.

No Exceedance but for the Event

Looking at the 95th percentile of 24-hour averages contained in the historical fluctuation analyses, non-event pollution levels for the monitors are typically significantly below the NAAQS. Activities that generate anthropogenic PM_{10} were approximately constant immediately preceding, during and after the event. Activity levels were typical for the time of year and the BACM measures were being implemented. Vehicular traffic, cooking and residential and agricultural fires do not directly cause PM_{10} 24-Hour NAAQS exceedances in the counties. With the high winds on this day, these emissions would not contribute significantly to the PM_{10} measured.

Based on the evidence provided above, NMED concludes that without the high wind and blowing dust an exceedance would not have occurred. Even if the 95th percentile concentration

for 24-Hour averages, 105 µg/m^3 (Anthony TEOM monitor), were used as the background concentration to compare to the measured PM_{10} concentrations, the particulate contribution from the high wind event clearly caused these exceedances. The causal connection of the measured PM_{10} and the strong winds indicate that but for the high wind event these exceedances would not have occurred.

4 Exceptional Event: February 9, 2013

Summary of the Event

The passing of a winter storm caused high winds and blowing dust in Doña Ana and Luna Counties resulting in exceedances of the PM_{10} 24-hour NAAQS at the Anthony, Chaparral, Desert View, and Deming monitoring sites on this date. The FEM TEOM continuous monitors at these sites recorded 24-hour average concentrations of 348 µg/m^3, 276 µg/m^3, 212 µg/m^3, and 284 µg/m^3, respectively. The FRM Wedding at the Anthony site also recorded an exceedance of 272 µg/m^3. Although the Holman and West Mesa sites did not record an exceedance on this date, elevated PM_{10} concentrations were measured during the same time period.

As the event unfolded, the wind blew from the southwest to west throughout the border region. These high velocity winds passed over large areas of desert within Texas, New Mexico and Mexico. NMED measured strong sustained hourly wind speeds at and in areas upwind of the PM_{10} monitoring sites ranging from 10.3 m/s to 14.9 m/s. 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 an exceptional event, specifically a natural event caused by high wind and blowing dust.

Is Not Reasonably Controllable or Preventable

Suspected Source Areas and Categories Contributing to the Event

Sources of windblown dust contributing to this exceedance include portions of the Chihuahuan Desert, residential and commercial properties, agricultural land and unpaved roads upwind of the monitors. The largest and most likely sources of windblown dust is the natural desert and the playas in New Mexico and northern Mexico (see satellite imagery below).

Sustained and Instantaneous Wind Speeds

EPA uses a default entrainment threshold of sustained wind speeds at 11.2 m/s (25 mph) for natural and well controlled anthropogenic sources contributing to natural events caused by high wind and blowing dust. Under the Doña Ana and Luna County NEAPs, EPA and NMED agreed that wind gusts exceeding 18 m/s (40 mph) would overwhelm any natural and well-controlled anthropogenic sources and cause windblown dust. On February 9, sustained wind speeds exceeded EPA's default threshold at five of the six PM_{10} monitoring sites and wind gusts exceeded the NEAPs agreed upon threshold at all of these sites (Figures 4-1 and 4-2). Although

the Desert View monitoring site did not record sustained wind speeds above the 11.2 m/s threshold, the nearby and upwind monitoring site of Santa Teresa did.

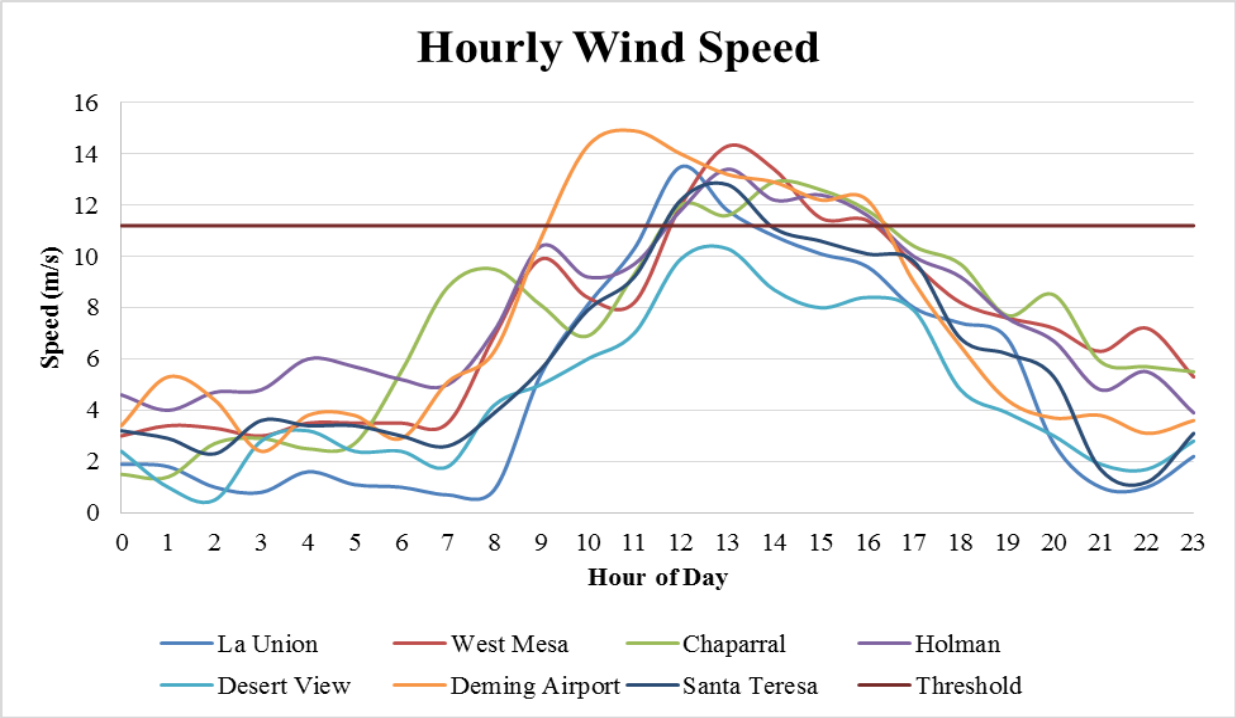
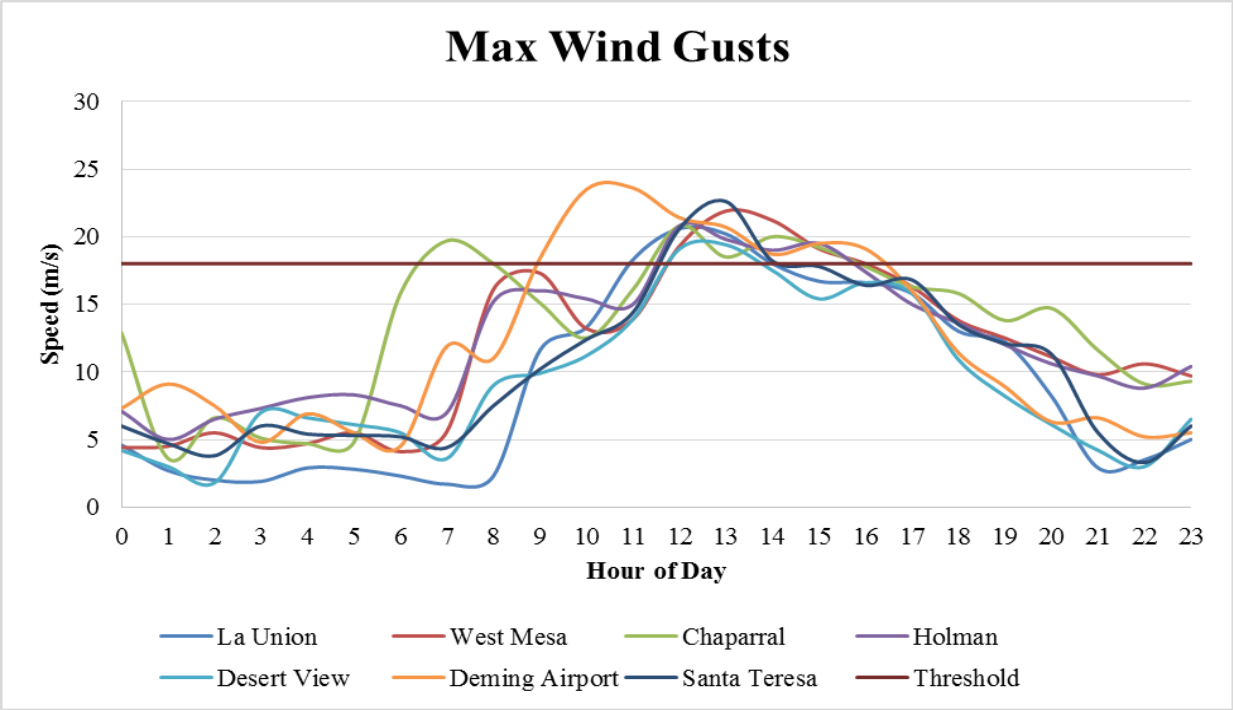


Figure 4-1. Sustained wind speeds at monitoring sites in Doña Ana and Luna Counties.



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Basic Controls Analysis

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Wind speeds on this day were high enough to entrain dust from undisturbed desert areas upwind of the monitors. Emissions from these areas are not reasonably controllable because costs would prohibit applying controls and detrimental effects on the natural ecosystem could occur.

Based on Doña Ana and Luna Counties attainment designation, implementation of BACM, and the MOUs in place, NMED believes that the control measures to reduce windblown dust should suffice as reasonable controls. Additional controls would not be economically and technically feasible and would not provide additional public health protections. NMED concludes that the sources contributing to the event are not reasonably controllable.

Historical Fluctuations Analysis

Annual and Seasonal 24-hour Average Fluctuations

Since being established, the monitoring sites in Doña Ana and Luna Counties have recorded exceedances of the PM_{10} NAAQS. High winds cause these exceedances and they can occur at any time of year (Appendix-A). Most exceedances occur from late winter through early summer (February-June) and are associated with the passage of storm systems and associated cold fronts or thunderstorm outflow during the monsoon season. High winds caused all recorded exceedances from 2008-2012 and NMED submitted natural events demonstrations to EPA.

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Event Day	348	276	284	212	114	95

Table 4-1. Percentile comparison of event day 24-hour average to 24-hour averages from 2008 to 2012.

Table 4-2 shows the percentile rank of the 24-hour average PM_{10} concentration on this day relative to all measurements during the winter season including days when high wind natural events caused exceedances from 2008-2012. For purposes of this analysis winter season was defined as the three month period from December through February. Data for PM_{10} in this table includes FEM TEOM measurements only since they are continuous monitors that provide a large number of data points for a robust statistical analysis. The recorded values for this day are above the 95th percentile of the seasonal 24-hour averages recorded. The Anthony, Chaparral, and Deming sites recorded values above the 99th percentile of data. Since NMED believes all previous exceedances were due to high wind dust events, the exceedances for this day would be the maximum values recorded if no high wind exceedances are included in the analysis.

	Anthony	Chaparral	Deming	Desert View	Holman	West Mesa
Max	775	437	525	366	398	353
99th Percentile	248	256	224	220	146	91
95th Percentile	110	105	57	100	63	45
Event Day	348	276	284	212	114	95

Table 4-2. Percentile comparison of event day 24-hour average to seasonal 24-hour averages from 2008 to 2012.

Clear Causal Relationship

A strong winter storm passed through New Mexico on February 9. An area of low pressure traveling east over northern New Mexico and associated cold front spanning the state, created a pressure gradient over southeastern Arizona, southwestern New Mexico and northern Mexico. As the storm system moved through northern New Mexico, the surface pressure gradient tightened and winds became stronger (Figure 4-3). Surface winds flow perpendicular to the isobars from high to low pressure. Diurnal heating of the surface allowed winds aloft to mix downward, increasing the surface wind velocities and provided the turbulence required for vertical mixing and horizontal transport of dust.

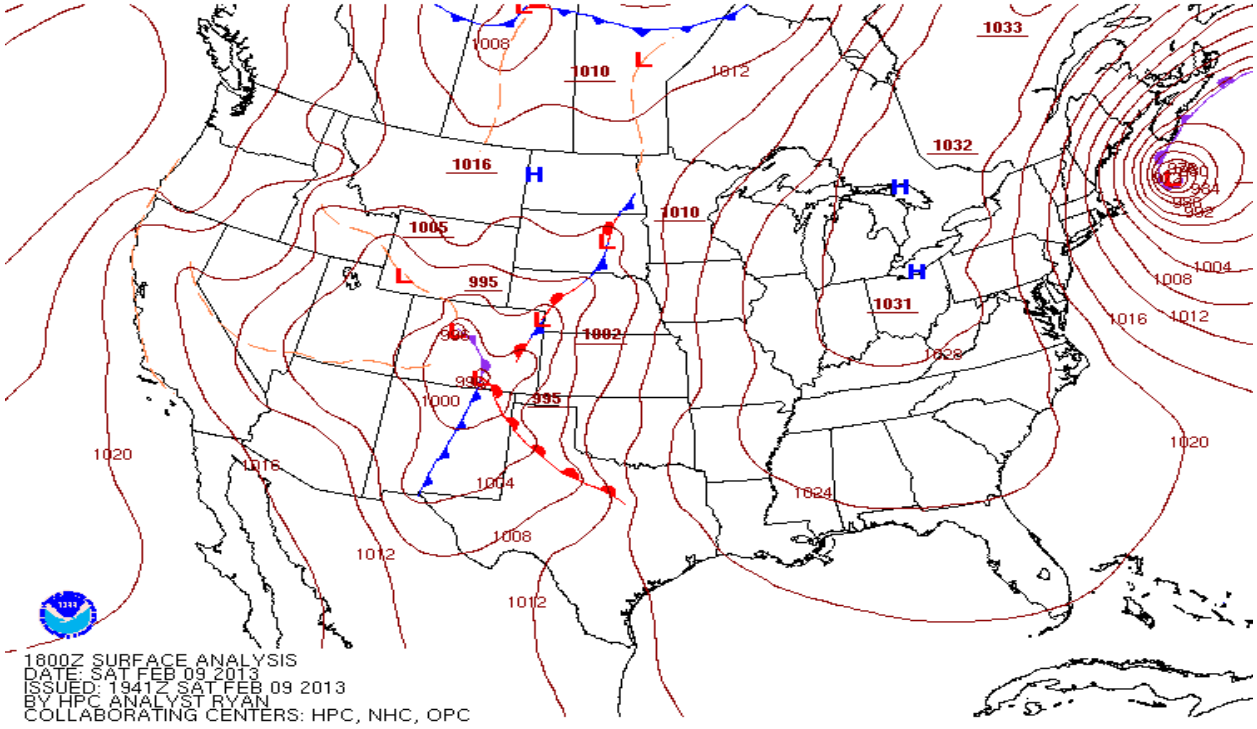
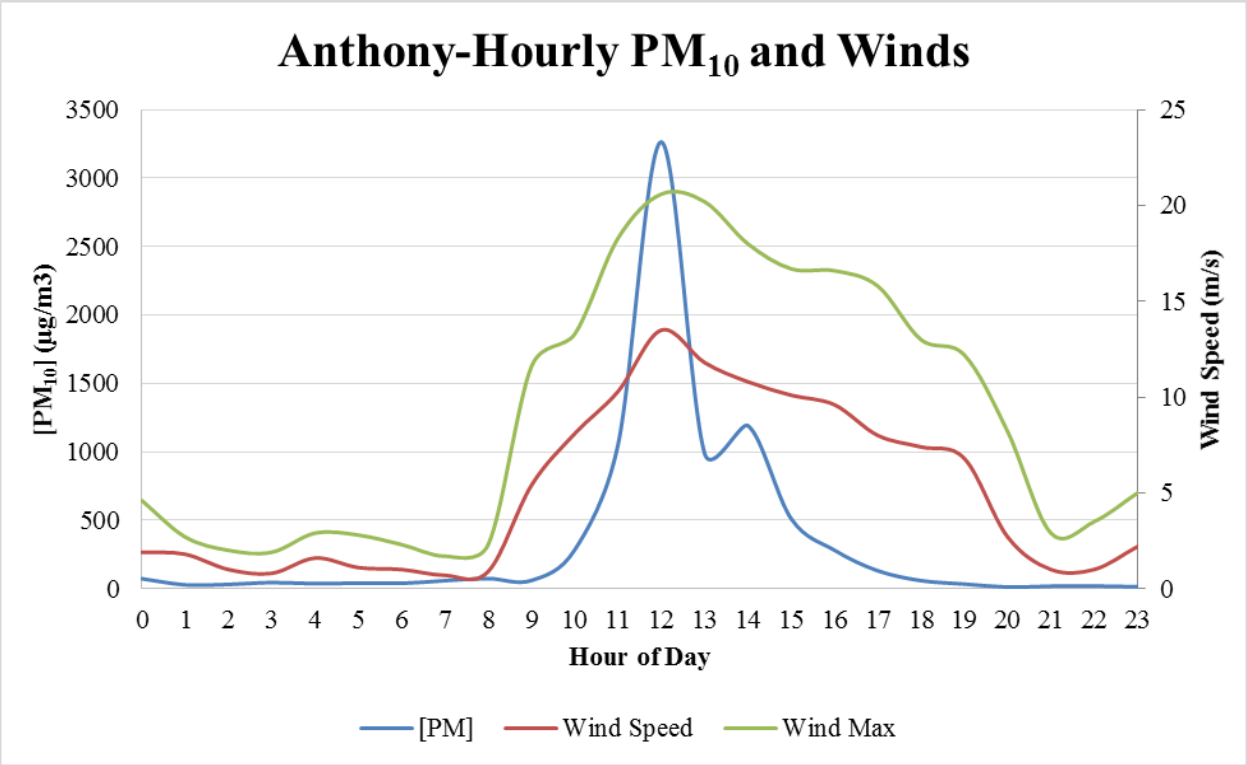
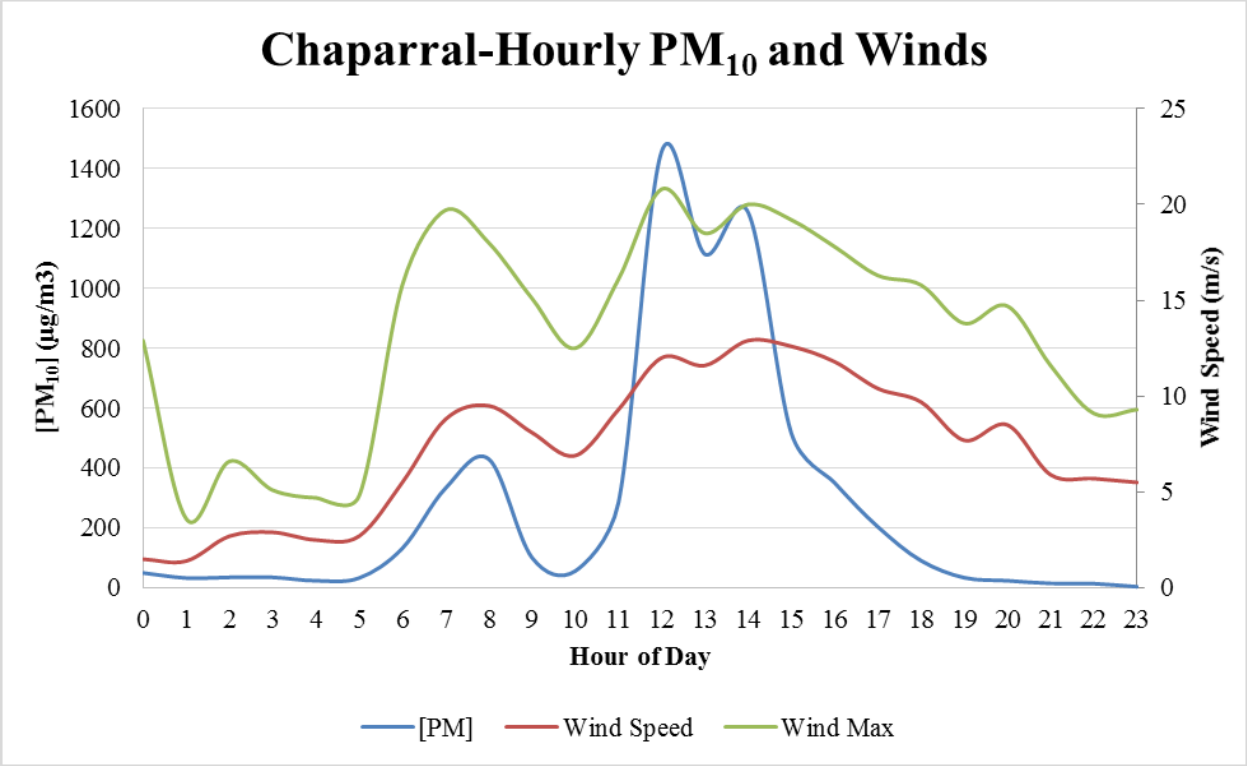
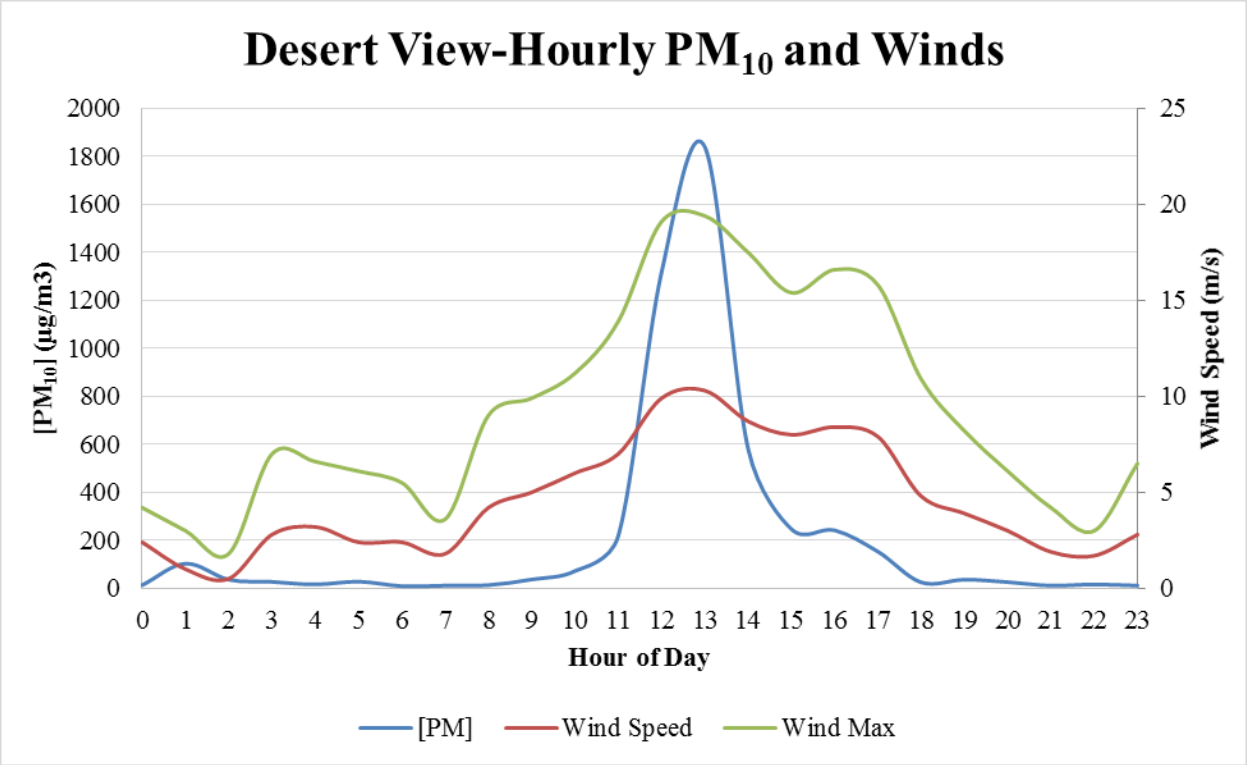


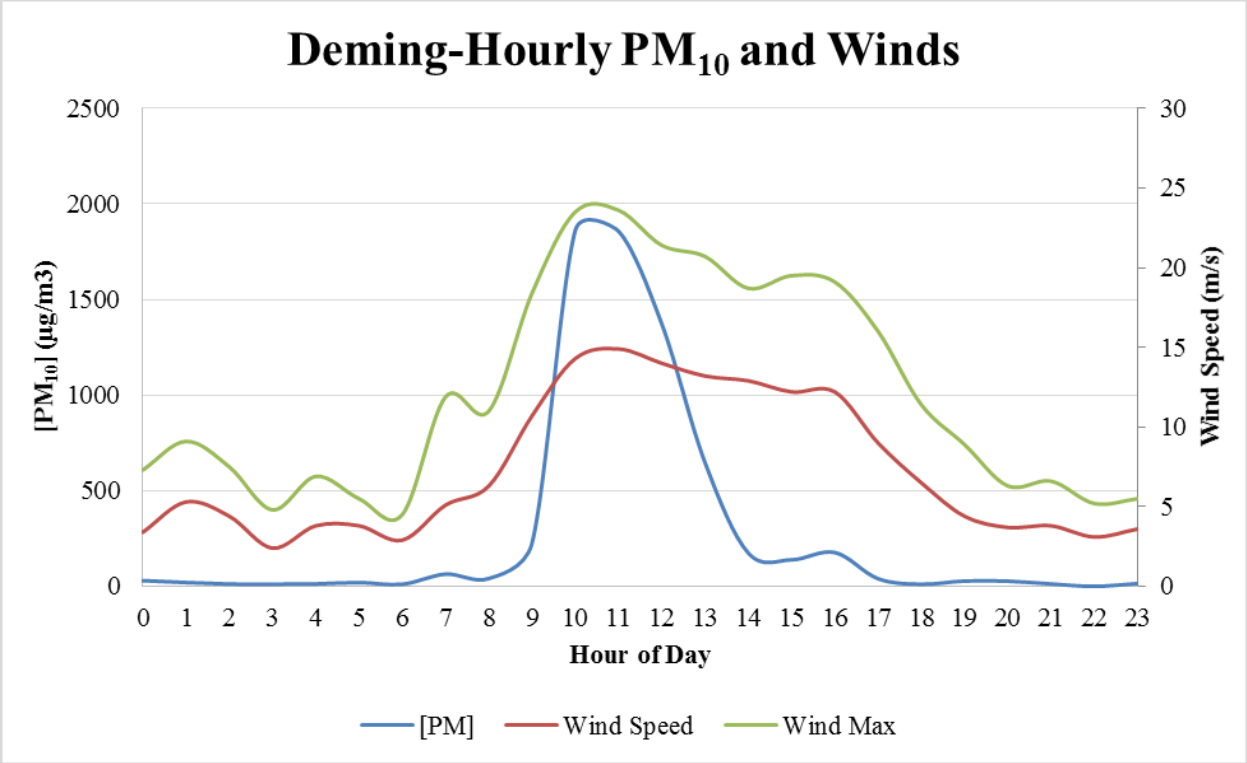
Figure 4-3. Surface weather map showing winter storm and isobars of constant pressure (red lines) for February 9 at the 1100 hour.

The weather pattern described above generated strong west winds beginning at the 1000 hour and lasted through the 1600 hour. Beginning at the 1000 hour, wind speeds exceeded 11.2 m/s at Deming as shown in Figure 4-1. Peak wind speeds ranged from 10.3 m/s at Desert View to 14.9 m/s at the Deming Airport (Figure 4-1). Peak wind gusts ranged from 19.4 m/s at Desert View to 23.6 m/s at the Deming Airport (Figure 4-2). Blowing dust caused elevated levels of PM_{10} during the same period as high winds as demonstrated by the time series plots in Figure 4-4 a-d. During these hours, hourly PM_{10} concentrations spiked at all monitoring sites in the network (Figure 4-5).


Anthony-Hourly PM10 and Winds
[PM10] (µg/m3)
Wind Speed (m/s)
Hour of Day
[PM]
Wind Speed
Wind Max


Chaparral-Hourly PM10 and Winds
[PM10] (µg/m3)
Wind Speed (m/s)
Hour of Day
[PM]
Wind Speed
Wind Max





Figures 4-4 a-e. Time series plot of hourly observations showing increased PM_{10} concentrations as wind speeds and gusts increase.

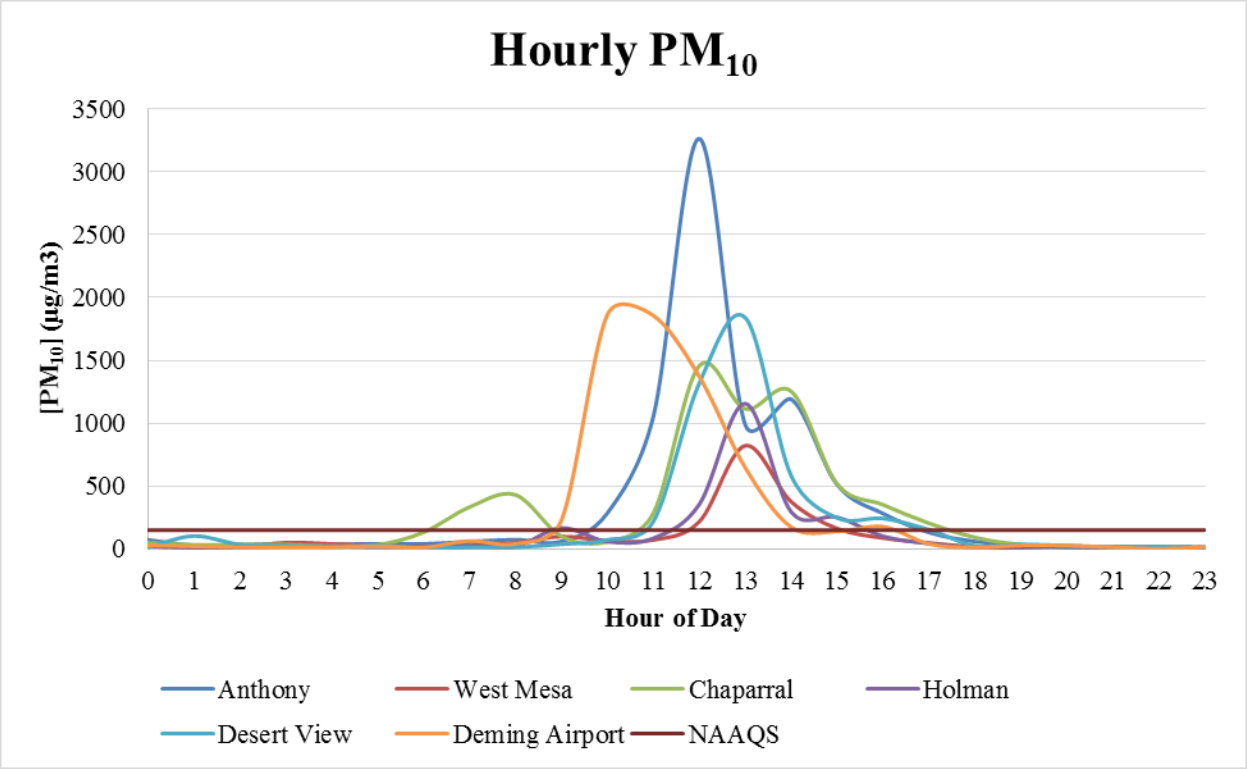


Figure 4-5. Hourly PM_{10} concentrations for Doña Ana and Luna Counties monitors.

The National Weather Service (NWS) issued a Wind Advisory and a Blowing Dust Advisory from the 900 hour to 1800 hour 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 text product can be found below.

```
A STRONG PACIFIC STORM SYSTEM WILL MOVE ACROSS FOUR CORNERS REGION TODAY.
AHEAD OF THE SYSTEM...STRONG WEST TO SOUTHWEST SURFACE WINDS WILL DEVELOP
THIS MORNING ACROSS SOUTHERN NEW MEXICO AND FAR WEST TEXAS. WINDS WILL PEAK
AS A SURFACE COLD FRONT SWEEPS EAST ACROSS SOUTHERN NEW MEXICO. THE FRONT
WILL REACH THE EL PASO AND LAS CRUCES AREAS AROUND MIDDAY AND WILL BE EAST OF
THE SACRAMENTO AND GUADALUPE MOUNTAINS BEFORE THE EVENING. SIGNIFICANT
BLOWING DUST WILL ALSO DEVELOP ACROSS THE DESERT LOWLANDS...REDUCING
VISIBILITIES TO UNDER ONE MILE IN PLACES.
```

The event was also captured on satellite imagery, showing dust plumes originating around the Florida Mountains in Luna County and with numerous plumes originating in desert areas and playas in northern Mexico (Figure 4-6). Another large plume can be seen coming off of White Sands National Monument and carrying over the Sacramento Mountains to eastern NM and the Texas panhandle.

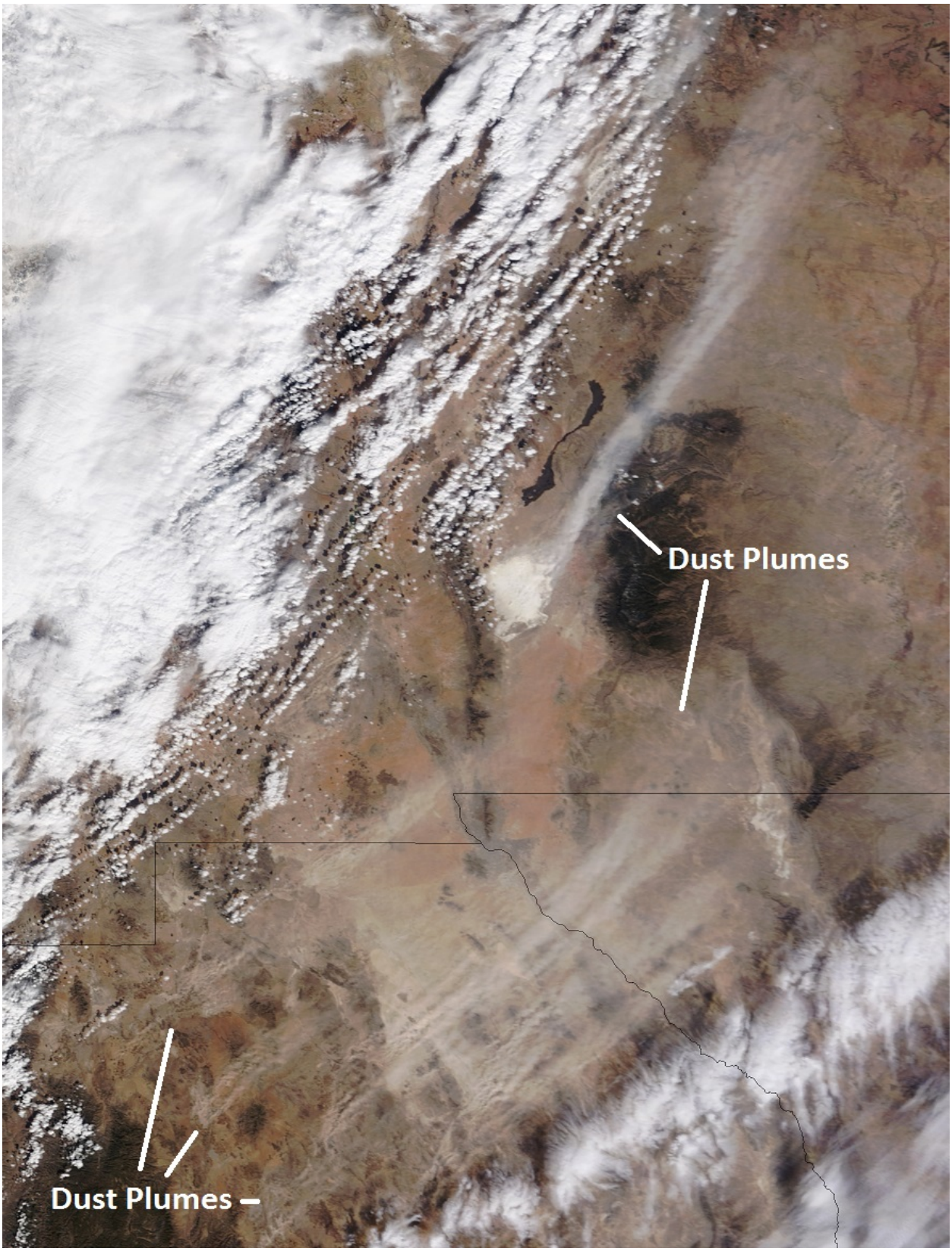


Figure 4-6. NASA satellite imagery of the border area.

Affects Air Quality

The historical fluctuations and clear causal relationship analyses prove that the event in question affected air quality on this date.

Natural Event

The Clear Causal Relationship and not Reasonably Controllable or Preventable analyses show that this was a natural event caused by high wind and blowing dust.

No Exceedance but for the Event

Looking at the 95th percentile of 24-hour averages contained in the historical fluctuation analyses, non-event pollution levels for the monitors are typically significantly below the NAAQS. Activities that generate anthropogenic PM_{10} were approximately constant immediately preceding, during and after the event. Activity levels were typical for the time of year and the BACM measures were being implemented. Vehicular traffic, cooking and residential and agricultural fires do not directly cause PM_{10} 24-Hour NAAQS exceedances in the counties. With the high winds on this day, these emissions would not contribute significantly to the PM_{10} measured.

Based on the evidence provided above, NMED concludes that without the high wind and blowing dust an exceedance would not have occurred. Even if the 95th percentile concentration for 24-Hour averages, 105 µg/m^3 (Anthony TEOM monitor), were used as the background concentration to compare to the measured PM_{10} concentrations, the particulate contribution from the high wind event clearly caused these exceedances. The causal connection of the measured PM_{10} and the strong winds indicate that but for the high wind event these exceedances would not have occurred.

5 Exceptional Event: February 20, 2013

Summary of the Event

The passing of a winter storm caused high winds and blowing dust in Doña Ana and Luna Counties resulting in exceedances of the PM_{10} 24-hour NAAQS at the Anthony, Chaparral, and Desert View monitoring sites on this date. The FEM TEOM continuous monitors at these sites recorded 24-hour average concentrations of 305 µg/m^3, 243 µg/m^3, and 429 µg/m^3 respectively. This was not a sampling day for the FRM Wedding at the Anthony site. Although the West Mesa and Deming Airport sites did not record an exceedance on this date, elevated PM_{10} concentrations were measured during the same time period. The Holman monitor did not record a valid 24-hour average concentration due to a pump failure.

As the event unfolded, the wind blew from the southwest and west throughout the border region. These high velocity winds passed over large areas of desert within Texas, New Mexico and Mexico. NMED measured strong sustained hourly wind speeds at and in areas upwind of the

PM_{10} monitoring sites ranging from 10.4 m/s to 14.7 m/s. 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 an exceptional event, specifically a natural event caused by high wind and blowing dust.

Is Not Reasonably Controllable or Preventable

Suspected Source Areas and Categories Contributing to the Event

Sources of windblown dust contributing to this exceedance include portions of the Chihuahuan Desert, residential and commercial properties, agricultural land and unpaved roads upwind of the monitors. The largest and most likely sources of windblown dust is the natural desert and the playas in New Mexico and northern Mexico (see satellite imagery below).

Sustained and Instantaneous Wind Speeds

EPA uses a default entrainment threshold of sustained wind speeds at 11.2 m/s (25 mph) for natural and well controlled anthropogenic sources contributing to natural events caused by high wind and blowing dust. Under the Doña Ana and Luna County NEAPs, EPA and NMED agreed that wind gusts exceeding 18 m/s (40 mph) would overwhelm any natural and well-controlled anthropogenic sources and cause windblown dust. On February 20, sustained wind speeds exceeded EPA's default threshold at five of the six PM_{10} monitoring sites and wind gusts exceeded the NEAPs agreed upon threshold at all of these sites (Figures 5-1 and 5-2). Although the Desert View monitoring site did not record sustained wind speeds above the 11.2 m/s threshold, the nearby and upwind monitoring site of Santa Teresa did.

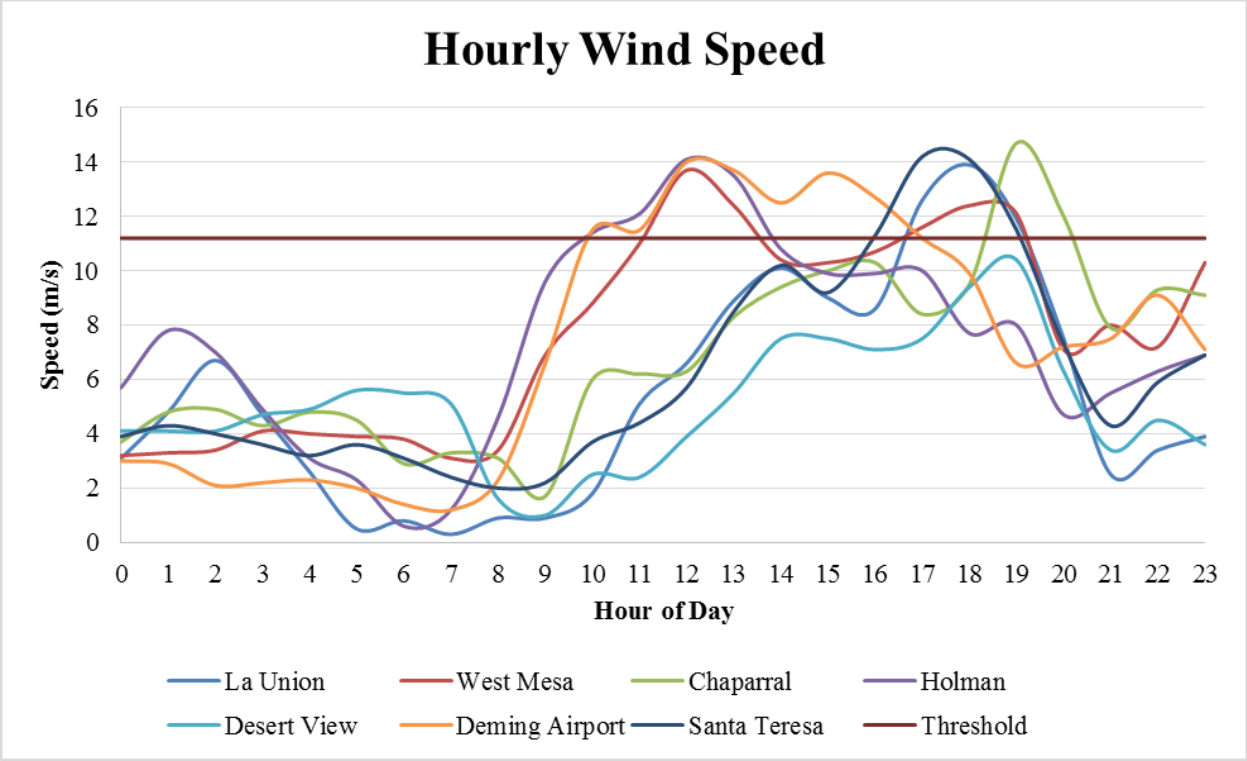


Figure 5-1. Sustained wind speeds at monitoring sites in Doña Ana and Luna Counties.

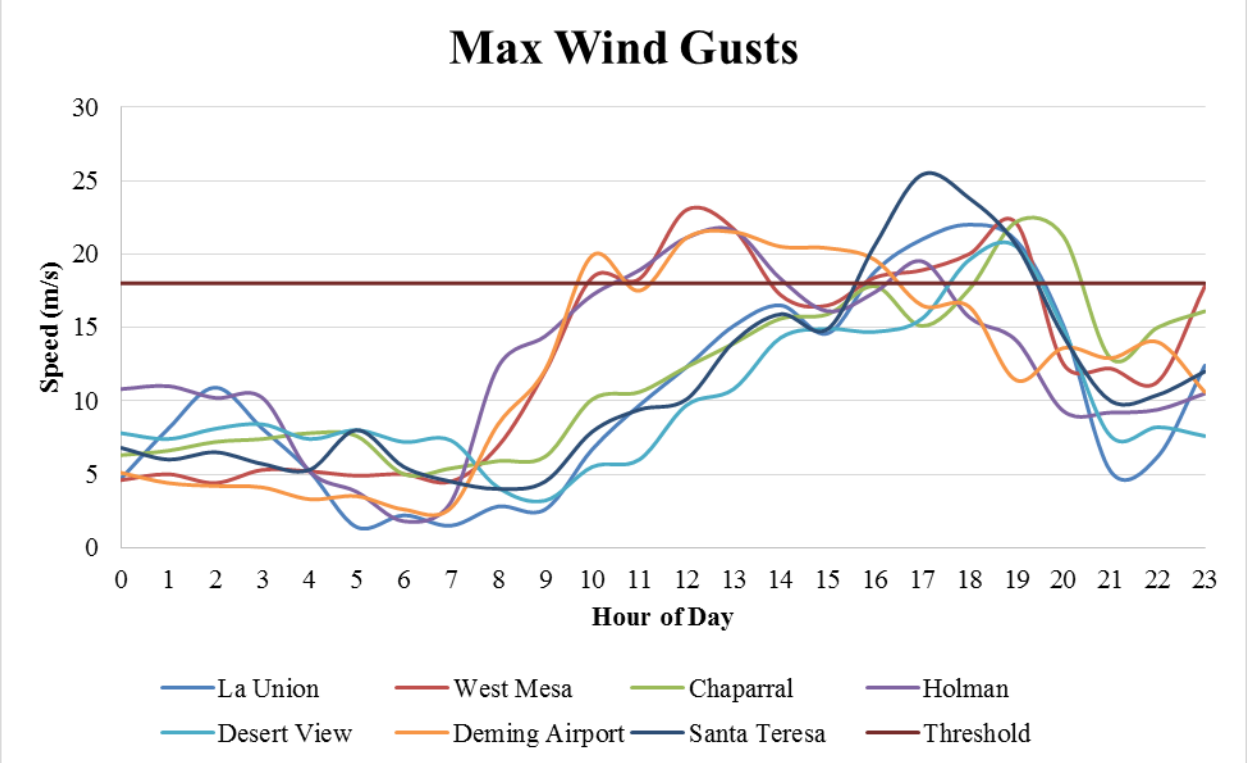


Figure 5-2. Maximum wind gusts at monitoring sites in Doña Ana and Luna Counties.

Basic Controls Analysis

Under the approved Doña Ana County and Luna County Natural Events Action Plans (NEAPs), Best Available Control Measures (BACM) are in place for anthropogenic sources based on ease and effectiveness of implementation. In addition, large land managers including New Mexico State University, Ft. Bliss Military Base, White Sands Missile Range and the New Mexico Department of Transportation, each signed a Memorandum of Understanding with NMED to control sources of windblown dust under their control. The BACM measures regulate disturbed lands, construction and demolition, vacant parking lots and materials handling and transportation. Our investigation did not identify any unusual PM_{10} producing activities on this day, and anthropogenic emissions remained constant before, during and after the event.

Soil erosion by wind or water reduces agricultural productivity and has always been a major concern for agricultural land managers. New Mexico farmers work with the local U.S. Department of Agriculture Natural Resource Conservation Service and New Mexico State Agricultural Extension Office to develop and implement soil conservation plans specifically designed for the soil types and crops of each individual farm. Most of the cropland in Doña Ana County form stable, non-erodible aggregates (clods) when tilled, protecting the surface from wind erosion even when the soil is dry and not covered with plants.

Wind speeds on this day were high enough to entrain dust from undisturbed desert areas upwind of the monitors. Emissions from these areas are not reasonably controllable because costs would prohibit applying controls and detrimental effects on the natural ecosystem could occur.

Based on Doña Ana and Luna Counties attainment designation, implementation of BACM, and the MOUs in place, NMED believes that the control measures to reduce windblown dust should suffice as reasonable controls. Additional controls would not be economically and technically feasible and would not provide additional public health protections. NMED concludes that the sources contributing to the event are not reasonably controllable.

Historical Fluctuations Analysis

Annual and Seasonal 24-hour Average Fluctuations

Since being established, the monitoring sites in Doña Ana and Luna Counties have recorded exceedances of the PM_{10} NAAQS. High winds cause these exceedances and they can occur at any time of year (Appendix-A). Most exceedances occur from late winter through early summer (February-June) and are associated with the passage of storm systems and associated cold fronts or thunderstorm outflow during the monsoon season. High winds caused all recorded exceedances from 2008-2012 and NMED submitted natural events demonstrations to EPA.

Table 5-1 shows the percentile rank of the 24-hour average PM_{10} concentration on this day relative to all measurements including days when high wind natural events caused exceedances from 2008-2012. Data for PM_{10} in this table includes FEM TEOM measurements only since they are continuous monitors that provide a large number of data points for a robust statistical analysis. The recorded values for this day are above the 95^{th} percentile of all 24-hour averages

recorded. The Anthony and Desert View sites recorded values above the 99th percentile of data. Because NMED believes all previous exceedances were due to high wind dust events, the exceedances for this day would be the maximum values recorded if no high wind exceedances are included in the analysis.

	Anthony	Chaparral	Deming	Desert View	Holman	West Mesa
Max	1740	1607	1099	1693	1450	480
99th Percentile	268	297	300	231	212	135
95th Percentile	105	101	69	91	71	47
Event Day	305	243	128	429	InV	91

Table 5-1. Percentile comparison of event day 24-hour average to 24-hour averages from 2008 to 2012.

Table 5-2 shows the percentile rank of the 24-hour average PM_{10} concentration on this day relative to all measurements during the winter season including days when high wind natural events caused exceedances from 2008-2012. For purposes of this analysis winter season was defined as the three month period from December through February. Data for PM_{10} in this table includes FEM TEOM measurements only since they are continuous monitors that provide a large number of data points for a robust statistical analysis. The recorded values for this day are above the 95th percentile of the seasonal 24-hour averages recorded. The Anthony and Desert View sites recorded values above the 99th percentile of data. Because NMED believes all previous exceedances were due to high wind dust events, the exceedances for this day would be the maximum values recorded if no high wind exceedances are included in the analysis.

	Anthony	Chaparral	Deming	Desert View	Holman	West Mesa
Max	775	437	525	366	398	353
99th Percentile	248	256	224	220	146	91
95th Percentile	110	105	57	100	63	45
Event Day	305	243	128	429	InV	91

Table 5-2. Percentile comparison of event day 24-hour average to seasonal 24-hour averages from 2008 to 2012.

Clear Causal Relationship

A strong winter storm passed through New Mexico on February 20. An area of low pressure traveling east over northern New Mexico and associated cold front spanning the state, created a pressure gradient over southeastern Arizona, southwestern New Mexico and northern Mexico. As the storm system moved through northern New Mexico, the surface pressure gradient tightened and winds became stronger (Figure 5-3). Surface winds flow perpendicular to the isobars from high to low pressure. Diurnal heating of the surface allowed winds aloft to mix downward, increasing the surface wind velocities and provided the turbulence required for vertical mixing and horizontal transport of dust.

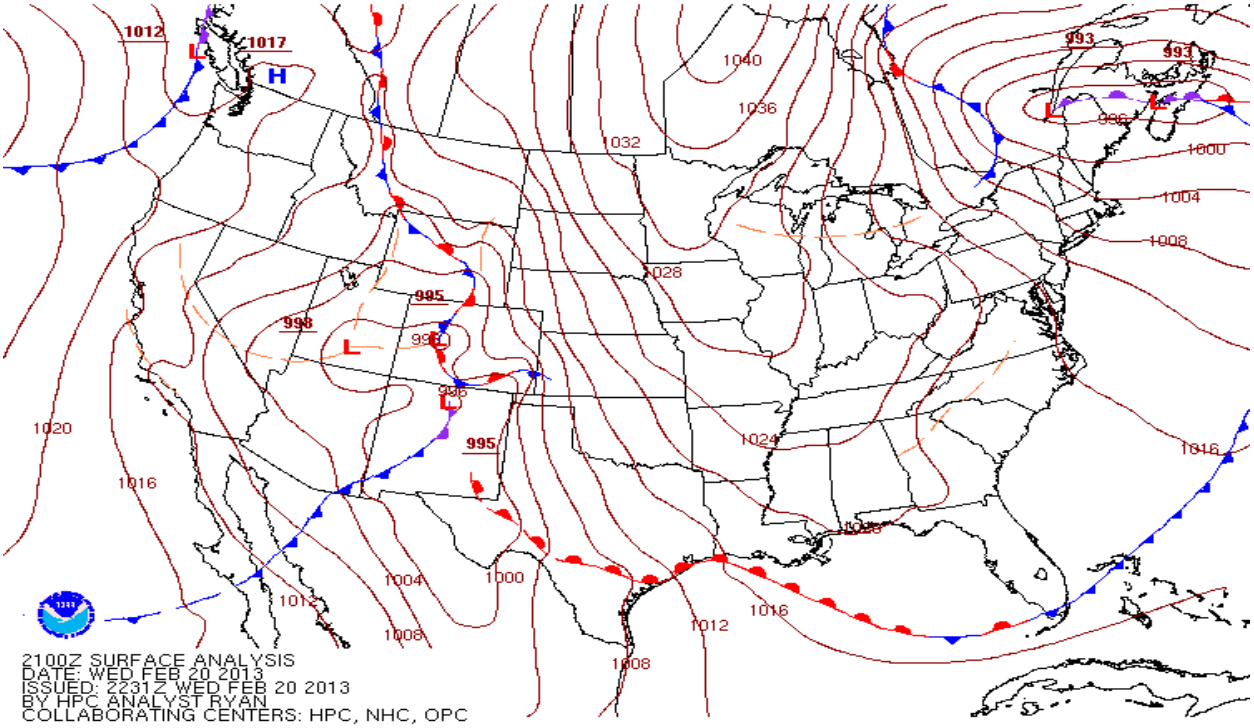
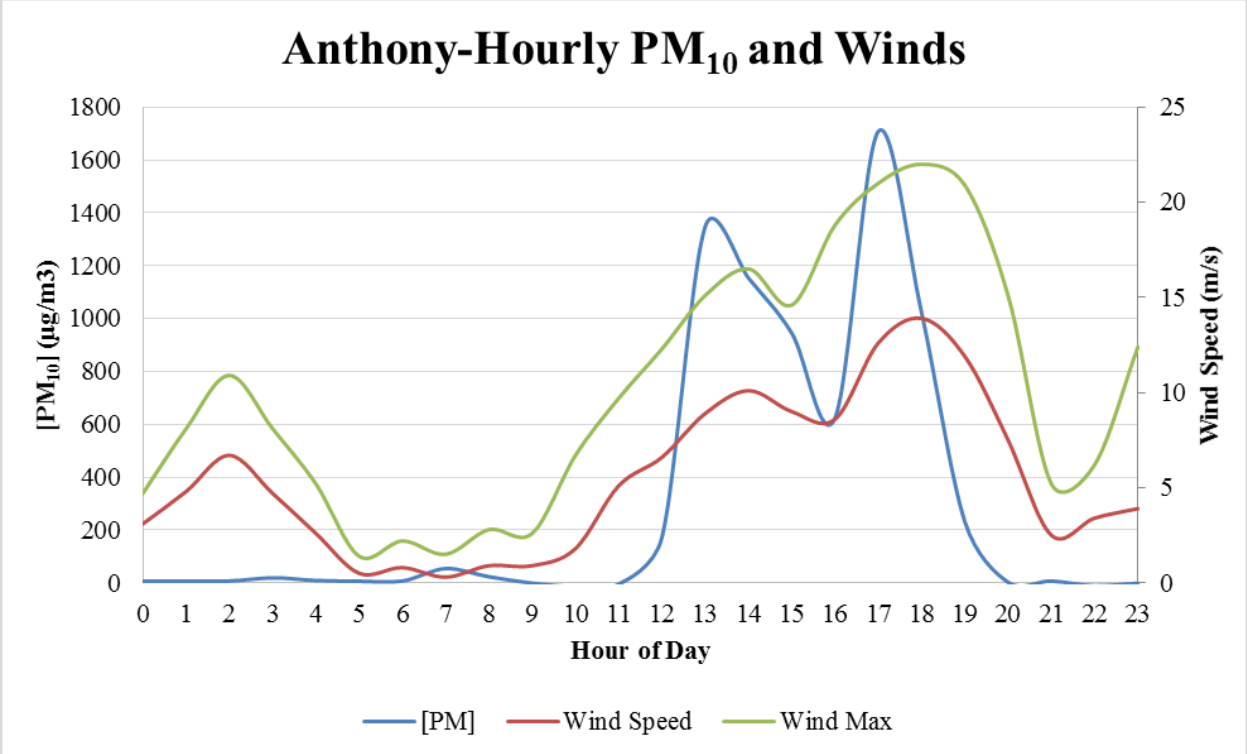
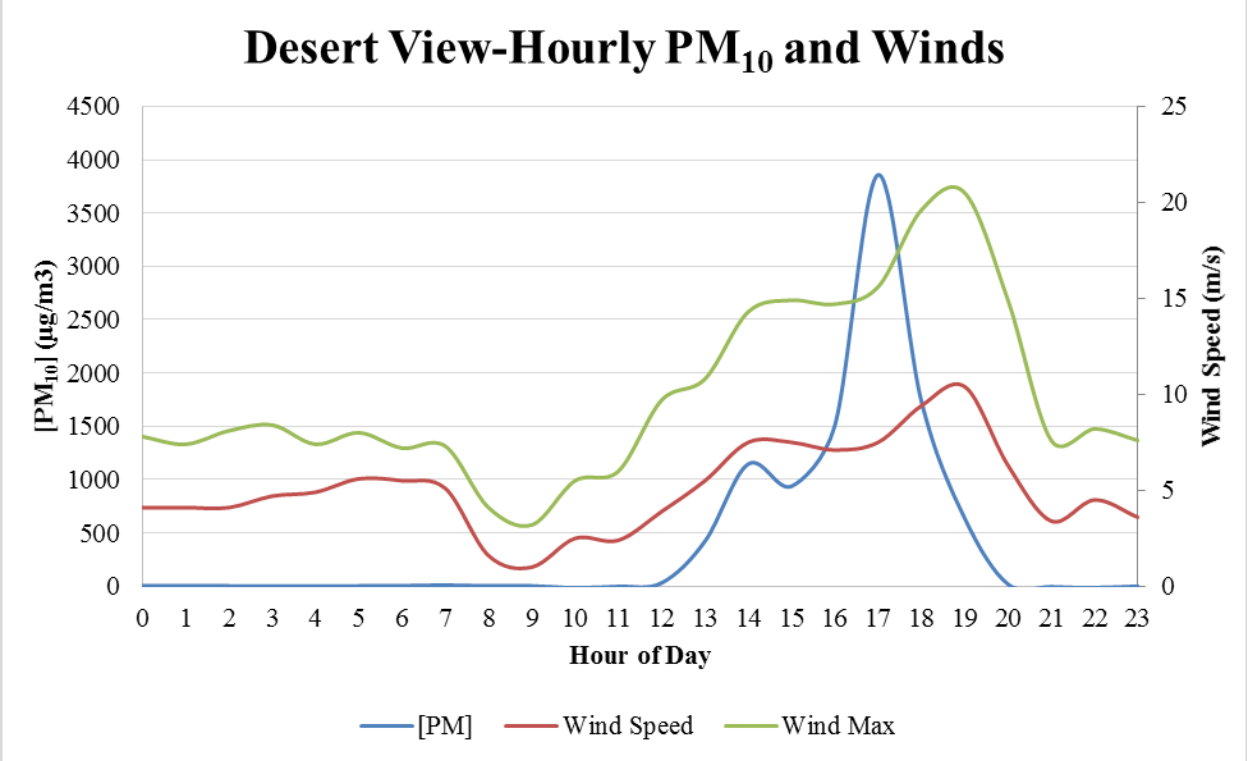
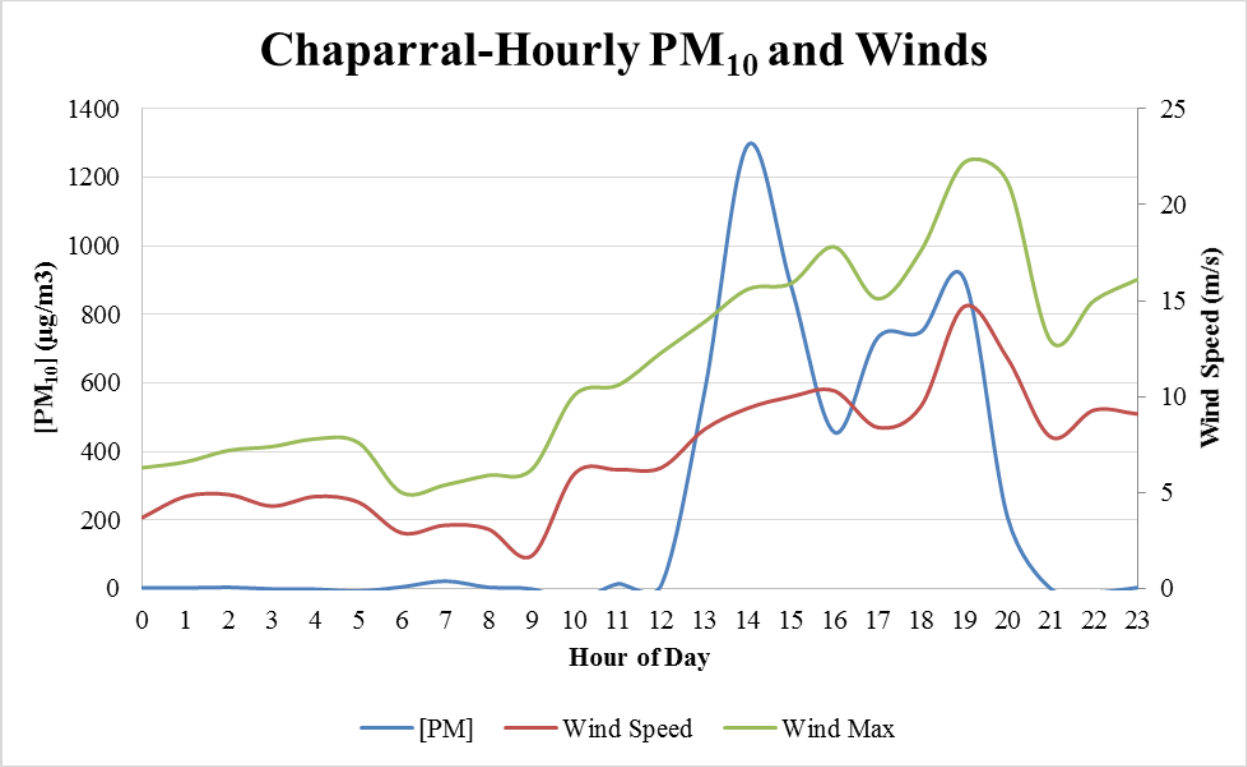


Figure 5-3. Surface weather map showing winter storm and isobars of constant pressure (red lines).

The weather pattern described above generated strong southwest winds beginning at the 1100 hour and lasted through the 2000 hour. Beginning at the 1100 hour, wind speeds exceeded 11.2 m/s at the Holman site as shown in Figure 5-1. Peak wind speeds ranged from 10.4 m/s at Desert View to 14.7 m/s at Chaparral (Figure 5-1). Peak wind gusts ranged from 20.5 m/s at Holman to 25.4 m/s at Santa Teresa (Figure 5-2). Blowing dust caused elevated levels of PM_{10} during the same period as high winds as demonstrated by the time series plots in Figure 5-4 a-c. During these hours, hourly PM_{10} concentrations spiked at all monitoring sites in the network (Figure 5-5).


Anthony-Hourly PM10 and Winds
[PM10] (µg/m3)
Wind Speed (m/s)
Hour of Day
[PM]
Wind Speed
Wind Max


Desert View-Hourly PM10 and Winds
[PM10] (µg/m3)
Wind Speed (m/s)
Hour of Day
[PM]
Wind Speed
Wind Max



Figures 5-4 a-c. Time series plot of hourly observations showing increased PM_{10} concentrations as wind speeds and gusts increase.

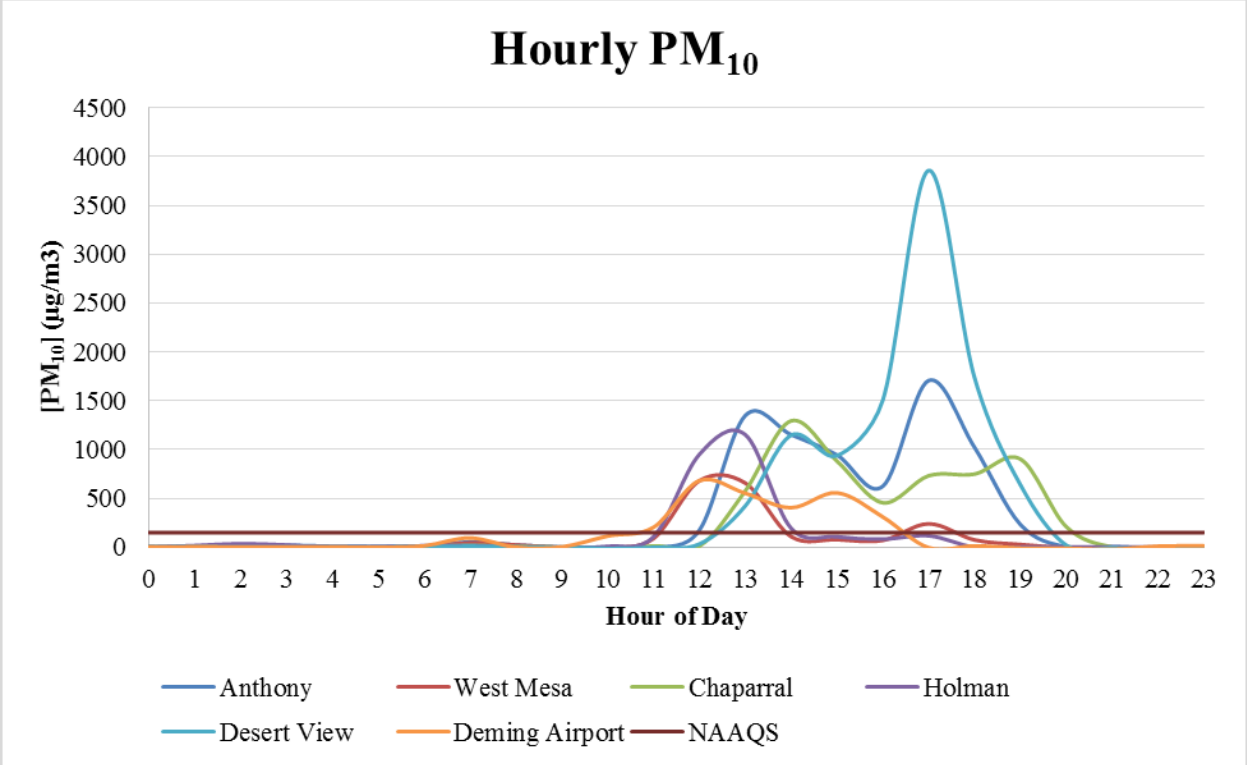


Figure 5-5. Hourly PM_{10} concentrations for Doña Ana and Luna Counties monitors.

The National Weather Service (NWS) issued a Wind Advisory and a Blowing Dust Advisory for this date (Figure 5-6). 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 text product can be found below.

```
VERY HIGH WIND SPEEDS WILL OCCUR IN THE AFTERNOON WITH SUSTAINED WIND SPEEDS
OF 35 TO 45 MPH WITH GUSTS AROUND 65 MPH ALONG THE BORDER REGION. AREAS
FURTHER NORTH OF THE BORDER WILL HAVE WIND SPEEDS THAT ARE NOT QUITE AS
STRONG IN THE 25 TO 35 MPH RANGE. WIDESPREAD BLOWING DUST WILL PRODUCE
REDUCED VISIBILITY OVER MANY LOWLAND LOCATIONS.
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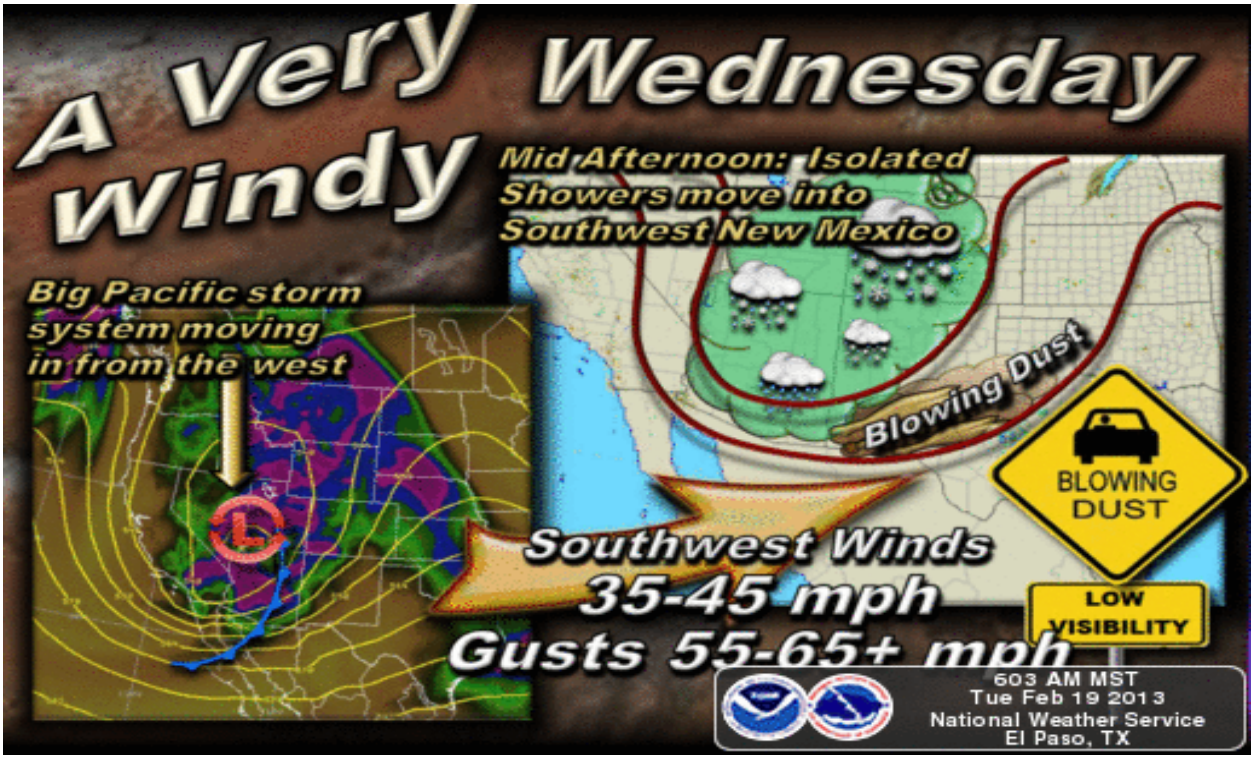


Figure 5-6. NWS graphicast showing the winter storm and advisory and warning areas.

The event was also captured on satellite imagery, showing dust plumes originating around the Florida Mountains in Luna County and with numerous plumes originating in desert areas and playas in northern Mexico (Figure 5-7). Another large plume can be seen coming off of White Sands National Monument and carrying over the Sacramento Mountains. The event was also featured on NASA's daily natural hazard blog.

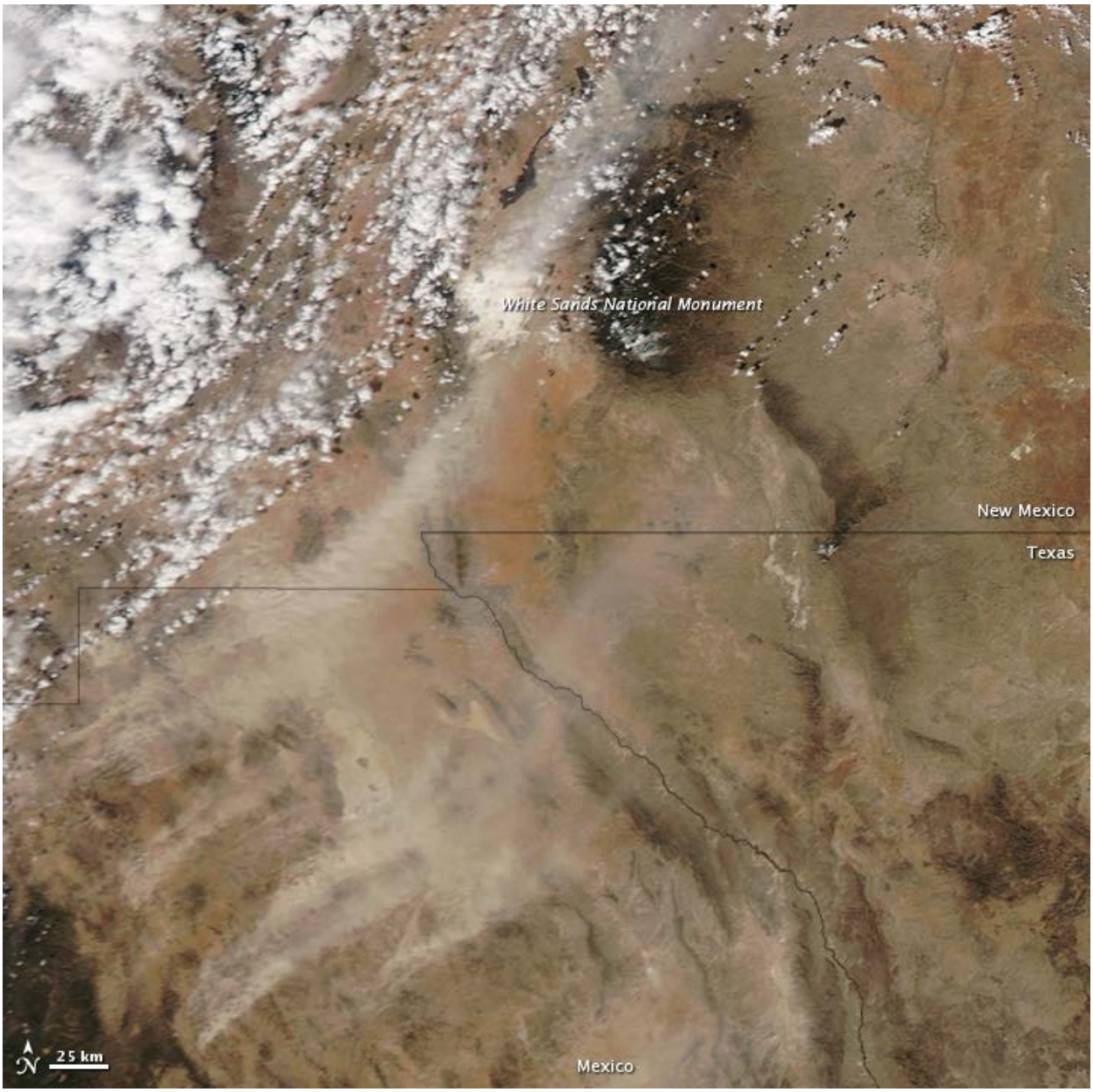


Figure 5-7. NASA satellite imagery of the border area.

Affects Air Quality

The historical fluctuations and clear causal relationship analyses prove that the event in question affected air quality on this date.

Natural Event

The Clear Causal Relationship and not Reasonably Controllable or Preventable analyses show that this was a natural event caused by high wind and blowing dust.

No Exceedance but for the Event

Looking at the 95th percentile of 24-hour averages contained in the historical fluctuation analyses, non-event pollution levels for the monitors are typically significantly below the NAAQS. Activities that generate anthropogenic PM_{10} were approximately constant immediately preceding, during and after the event. Activity levels were typical for the time of year and the BACM measures were being implemented. Vehicular traffic, cooking and residential and agricultural fires do not directly cause PM_{10} 24-Hour NAAQS exceedances in the counties. With the high winds on this day, these emissions would not contribute significantly to the PM_{10} measured.

Based on the evidence provided above, NMED concludes that without the high wind and blowing dust an exceedance would not have occurred. Even if the 95th percentile concentration for 24-Hour averages, 105 $\mu g/m^3$ (Anthony TEOM monitor), were used as the background concentration to compare to the measured PM_{10} concentrations, the particulate contribution from the high wind event clearly caused these exceedances. The causal connection of the measured PM_{10} and the strong winds indicate that but for the high wind event these exceedances would not have occurred.

6 Exceptional Event: February 24, 2013

Summary of the Event

The passing of a winter storm caused high winds and blowing dust in Doña Ana and Luna Counties resulting in exceedances of the PM_{10} 24-hour NAAQS at the Anthony, Chaparral, Desert View, and Deming monitoring sites on this date. The FEM TEOM continuous monitors at these sites recorded 24-hour average concentrations of 258 $\mu g/m^3$, 203 $\mu g/m^3$, 563 $\mu g/m^3$, and 494 $\mu g/m^3$ respectively. This was not a sampling day for the FRM Wedding at the Anthony site. Although the Holman and West Mesa sites did not record an exceedance on this date, elevated PM_{10} concentrations were measured during the same time period.

As the event unfolded, the wind blew from the west to northwest throughout the border region. These high velocity winds passed over large areas of desert within Arizona, Texas, New Mexico and Mexico. NMED measured strong sustained hourly wind speeds at and in areas upwind of the PM_{10} monitoring sites ranging from 11.2 m/s to 15.4 m/s. 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 an exceptional event, specifically a natural event caused by high wind and blowing dust.

Is Not Reasonably Controllable or Preventable

Suspected Source Areas and Categories Contributing to the Event

Sources of windblown dust contributing to this exceedance include portions of the Chihuahuan Desert, residential and commercial properties, agricultural land and unpaved roads upwind of the monitors. The largest and most likely sources of windblown dust is the natural desert and the playas in New Mexico and northern Mexico (see satellite imagery below).

Sustained and Instantaneous Wind Speeds

EPA uses a default entrainment threshold of sustained wind speeds at 11.2 m/s (25 mph) for natural and well controlled anthropogenic sources contributing to natural events caused by high wind and blowing dust. Under the Doña Ana and Luna County NEAPs, EPA and NMED agreed that wind gusts exceeding 18 m/s (40 mph) would overwhelm any natural and well-controlled anthropogenic sources and cause windblown dust. On this day, sustained wind speeds exceeded EPA's default threshold at all six PM_{10} monitoring sites and wind gusts exceeded the NEAPs agreed upon threshold at all of these sites (Figures 6-1 and 6-2).

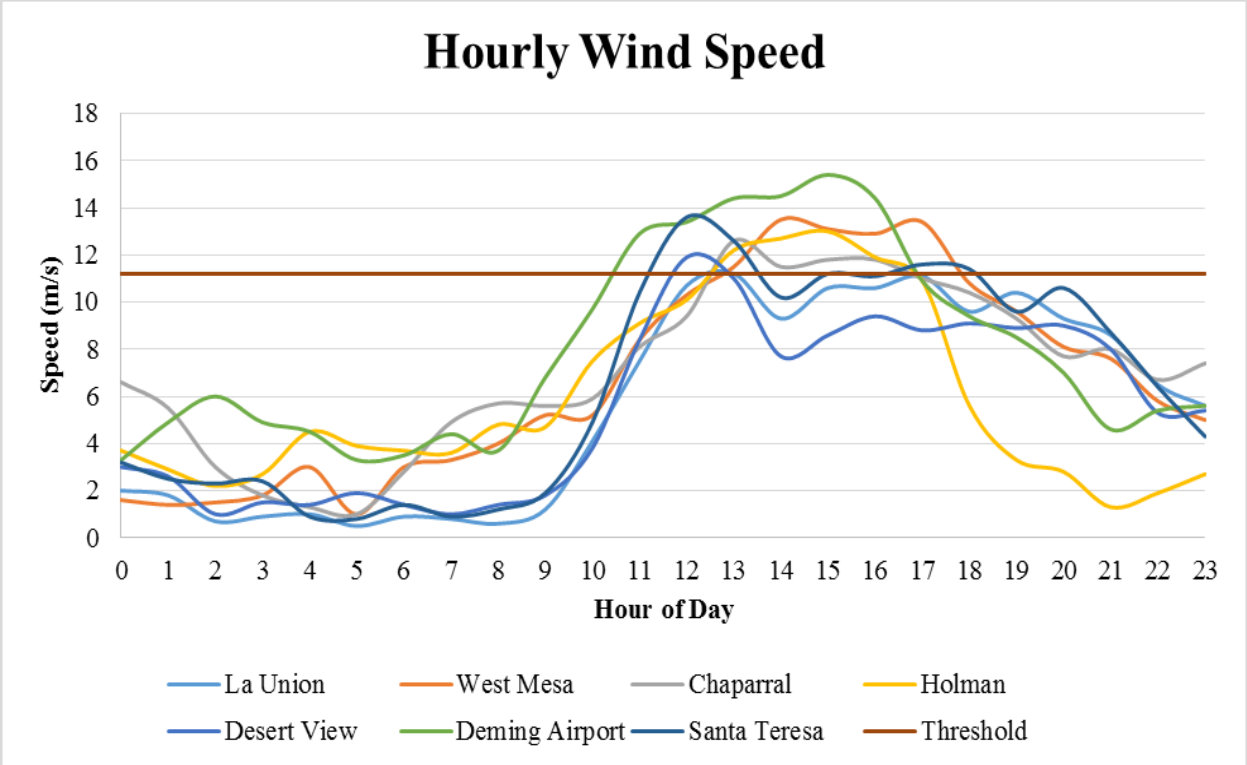


Figure 6-1. Sustained wind speeds at monitoring sites in Doña Ana and Luna Counties.

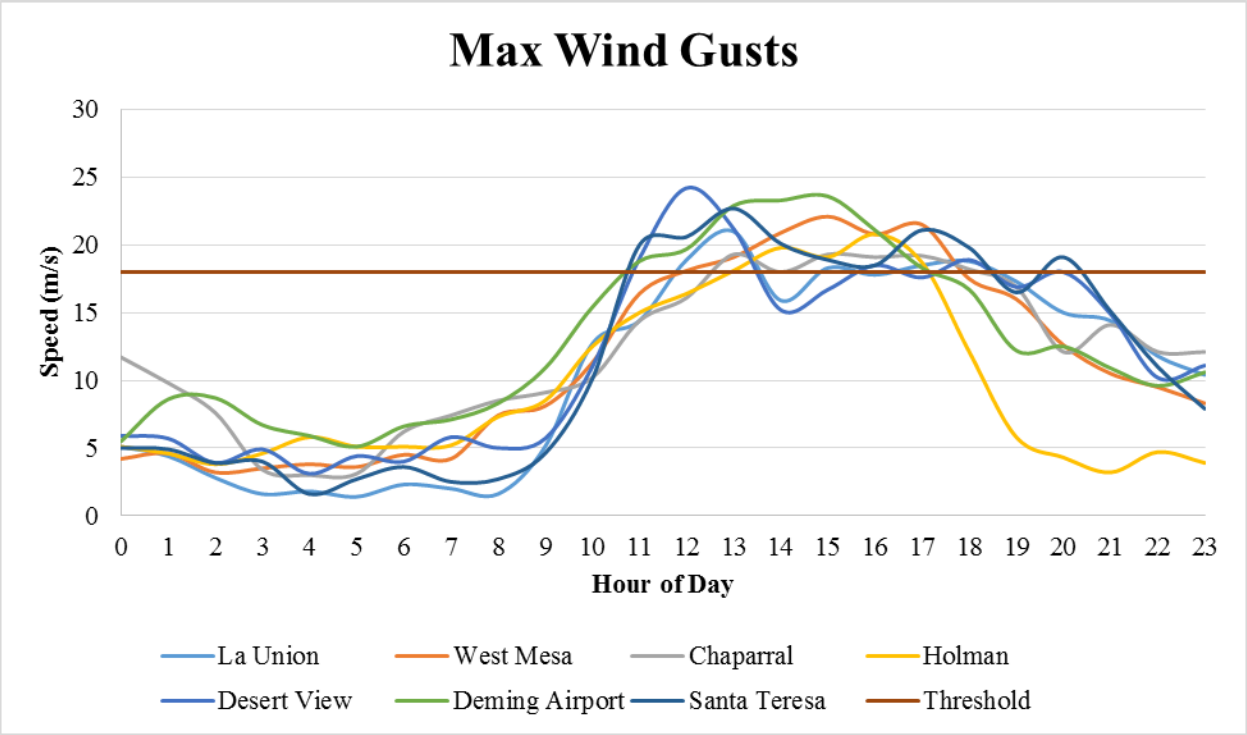


Figure 6-2. Maximum wind gusts at monitoring sites in Doña Ana and Luna Counties.

Basic Controls Analysis

Under the approved Doña Ana County and Luna County Natural Events Action Plans (NEAPs), Best Available Control Measures (BACM) are in place for anthropogenic sources based on ease and effectiveness of implementation. In addition, large land managers including New Mexico State University, Ft. Bliss Military Base, White Sands Missile Range and the New Mexico Department of Transportation, each signed a Memorandum of Understanding with NMED to control sources of windblown dust under their control. The BACM measures regulate disturbed lands, construction and demolition, vacant parking lots and materials handling and transportation. Our investigation did not identify any unusual PM_{10} producing activities on this day, and anthropogenic emissions remained constant before, during and after the event.

Soil erosion by wind or water reduces agricultural productivity and has always been a major concern for agricultural land managers. New Mexico farmers work with the local U.S. Department of Agriculture Natural Resource Conservation Service and New Mexico State Agricultural Extension Office to develop and implement soil conservation plans specifically designed for the soil types and crops of each individual farm. Most of the cropland in Doña Ana County form stable, non-erodible aggregates (clods) when tilled, protecting the surface from wind erosion even when the soil is dry and not covered with plants.

Wind speeds on this day were high enough to entrain dust from undisturbed desert areas upwind of the monitors. Emissions from these areas are not reasonably controllable because costs would prohibit applying controls and detrimental effects on the natural ecosystem could occur.

Based on Doña Ana and Luna Counties attainment designation, implementation of BACM, and the MOUs in place, NMED believes that the control measures to reduce windblown dust should suffice as reasonable controls. Additional controls would not be economically and technically feasible and would not provide additional public health protections. NMED concludes that the sources contributing to the event are not reasonably controllable.

Historical Fluctuations Analysis

Annual and Seasonal 24-hour Average Fluctuations

Since being established, the monitoring sites in Doña Ana and Luna Counties have recorded exceedances of the PM_{10} NAAQS. High winds cause these exceedances and they can occur at any time of year (Appendix-A). Most exceedances occur from late winter through early summer (February-June) and are associated with the passage of storm systems and associated cold fronts or thunderstorm outflow during the monsoon season. High winds caused all recorded exceedances from 2008-2012 and NMED submitted natural events demonstrations to EPA.

Table 6-1 shows the percentile rank of the 24-hour average PM_{10} concentration on this day relative to all measurements including days when high wind natural events caused exceedances from 2008-2012. Data for PM_{10} in this table includes FEM TEOM measurements only since they are continuous monitors that provide a large number of data points for a robust statistical analysis. The recorded values for this day are above the 95th percentile of all 24-hour averages recorded. The Desert View and Deming sites recorded values above the 99th percentile of data. Because NMED believes all previous exceedances were due to high wind dust events, the exceedances for this day would be the maximum values recorded if no high wind exceedances are included in the analysis.

	Anthony	Chaparral	Deming	Desert View	Holman	West Mesa
Max	1740	1607	1099	1693	1450	480
99th Percentile	268	297	300	231	212	135
95th Percentile	105	101	69	91	71	47
Event Day	258	203	494	563	85	121

Table 6-1. Percentile comparison of event day 24-hour average to 24-hour averages from 2008 to 2012.

Table 6-2 shows the percentile rank of the 24-hour average PM_{10} concentration on this day relative to all measurements during the winter season including days when high wind natural events caused exceedances from 2008-2012. For purposes of this analysis winter season was defined as the three month period from December through February. Data for PM_{10} in this table includes FEM TEOM measurements only since they are continuous monitors that provide a large number of data points for a robust statistical analysis. The recorded values for this day are above the 95th percentile of the seasonal 24-hour averages recorded. The Anthony, Desert View, Deming and West Mesa sites recorded values above the 99th percentile of data. Because NMED believes all previous exceedances were due to high wind dust events, the exceedances for this day would be the maximum values recorded if no high wind exceedances are included in the analysis.

	Anthony	Chaparral	Deming	Desert View	Holman	West Mesa
Max	775	437	525	366	398	353
99th Percentile	248	256	224	220	146	91
95th Percentile	110	105	57	100	63	45
Event Day	258	203	494	563	85	121

Table 6-2. Percentile comparison of event day 24-hour average to seasonal 24-hour averages from 2008 to 2012.

Clear Causal Relationship

A strong winter storm passed through New Mexico on February 24. Areas of low pressure centered in northeastern and eastern New Mexico created a pressure gradient over southeastern Arizona, southwestern New Mexico and northern Mexico. As the storm system moved through northern New Mexico, the surface pressure gradient tightened and winds became stronger (Figure 6-3). Surface winds flow perpendicular to the isobars from high to low pressure. Diurnal heating of the surface allowed winds aloft to mix downward, increasing the surface wind velocities and provided the turbulence required for vertical mixing and horizontal transport of dust.

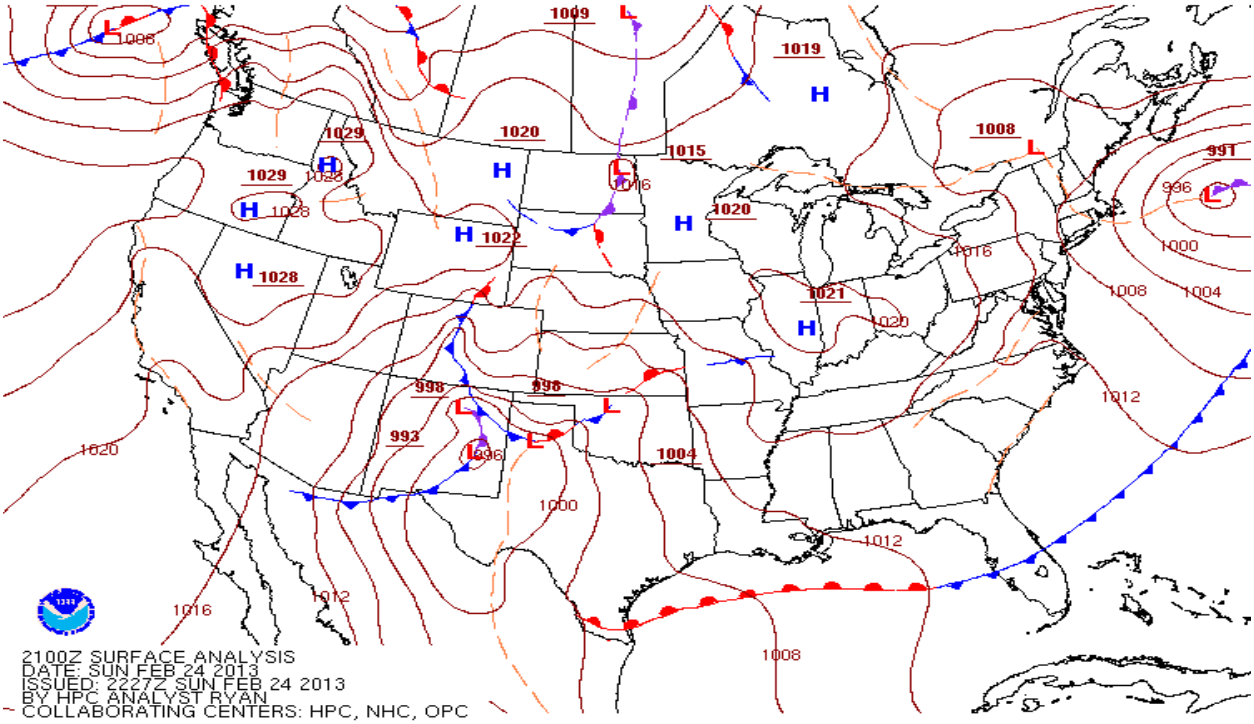
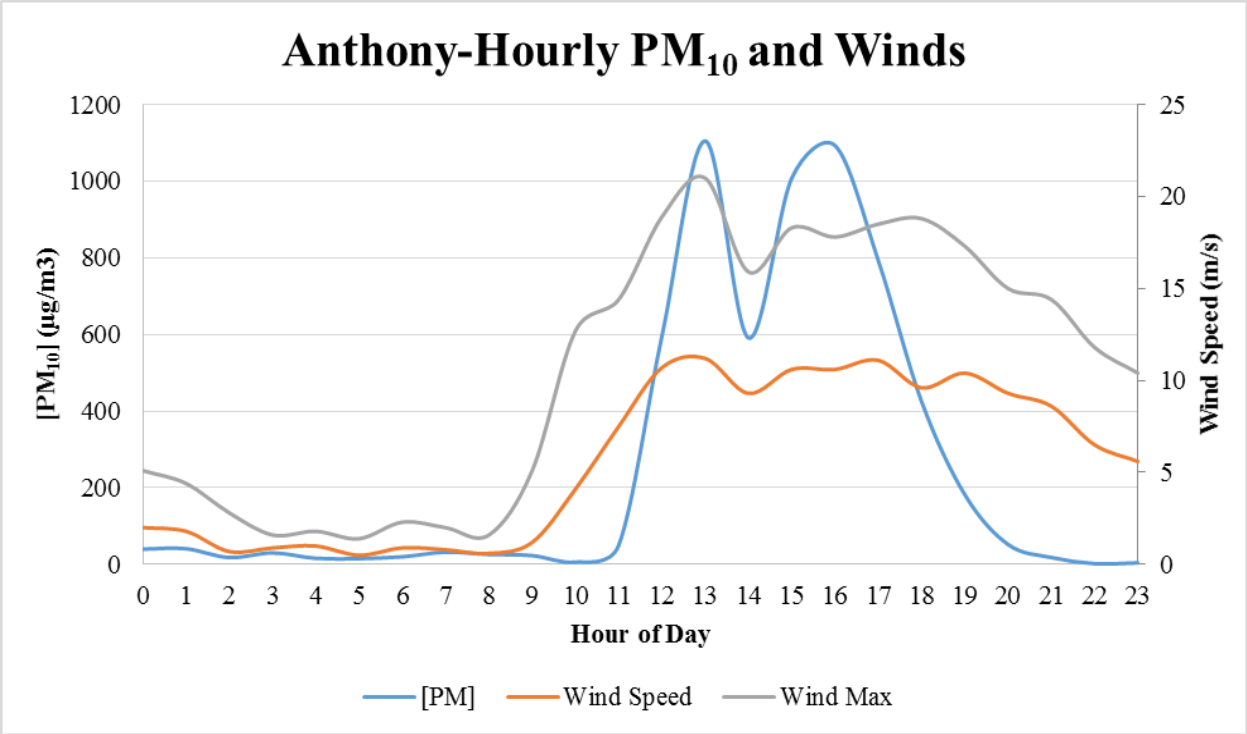
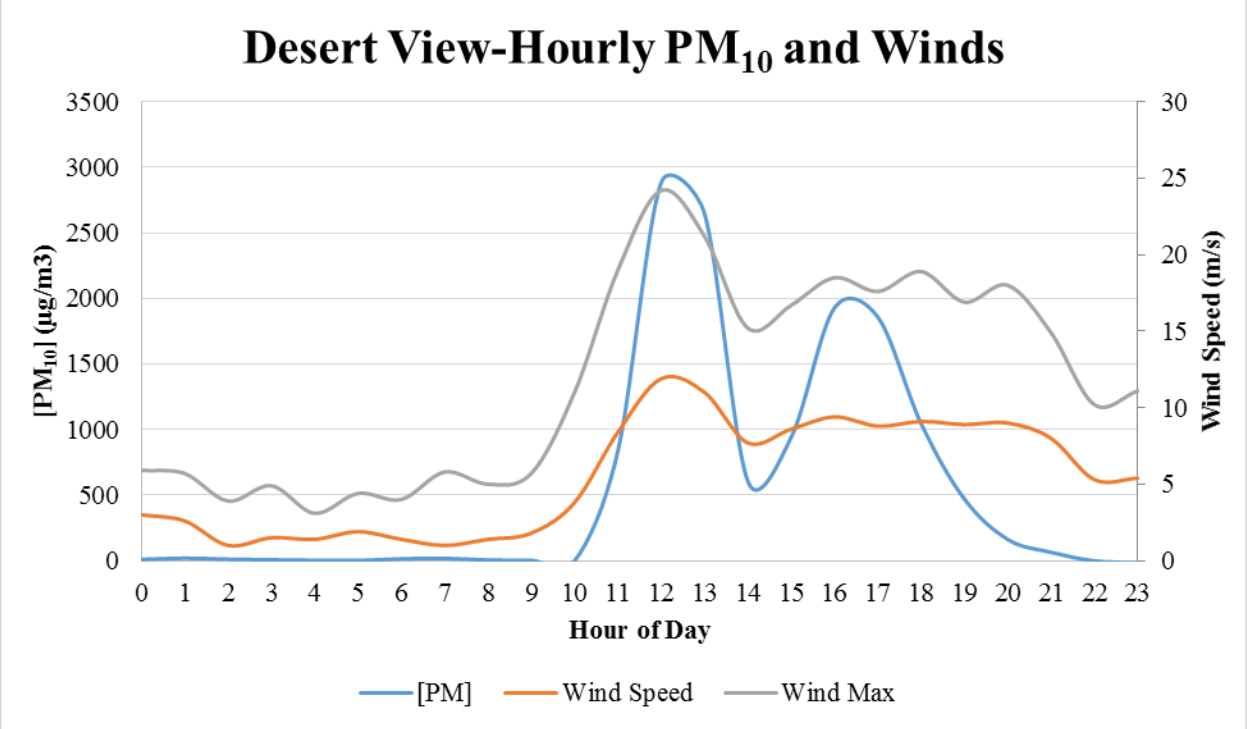


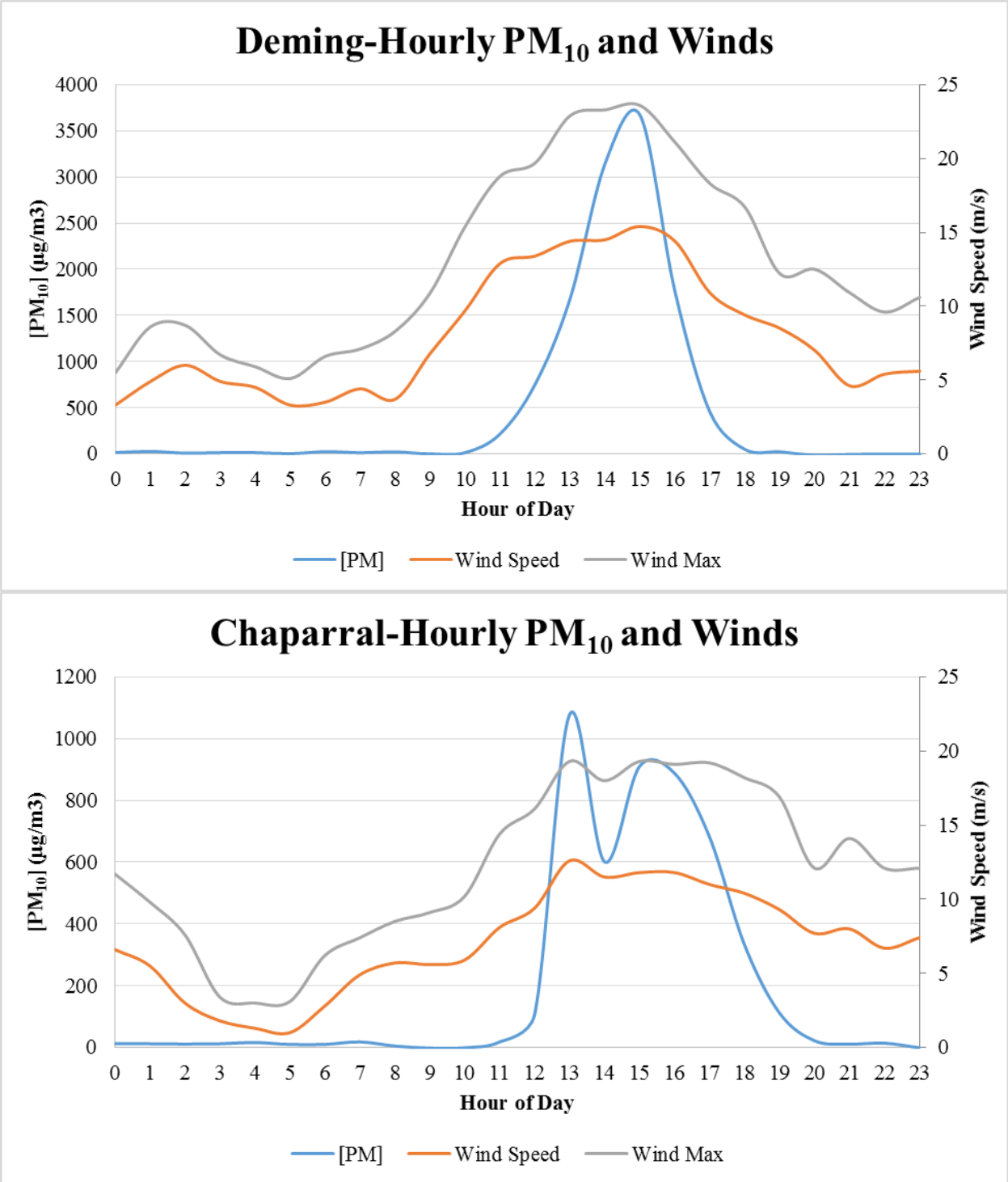
Figure 6-3. Surface weather map showing winter storm and isobars of constant pressure (red lines).

The weather pattern described above generated strong west winds beginning at the 1100 hour and lasted through the 1800 hour. Beginning at the 1100 hour, wind speeds exceeded 11.2 m/s at the Deming Airport as shown in Figure 6-1. Peak wind speeds ranged from 11.2 m/s at La Union to 15.4 m/s at the Deming Airport (Figure 6-1). Peak wind gusts ranged from 19.3 m/s at

Chaparral to 24.2 m/s at Desert View (Figure 6-2). Blowing dust caused elevated levels of PM_{10} during the same period as high winds as demonstrated by the time series plots in Figure 6-4 a-d. During these hours, hourly PM_{10} concentrations spiked at all monitoring sites in the network (Figure 6-5).







Figures 6-4 a-e. Time series plot of hourly observations showing increased PM_{10} concentrations as wind speeds and gusts increase.

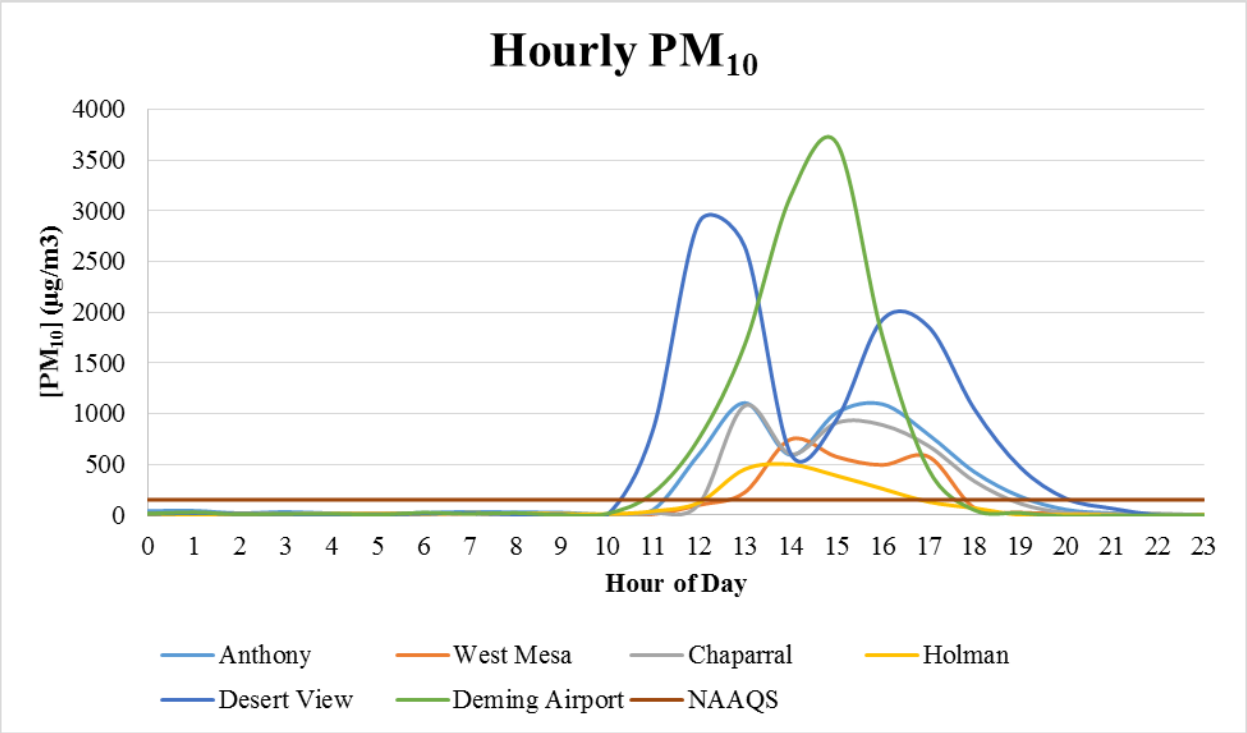


Figure 6-5. Hourly PM_{10} concentrations for Doña Ana and Luna Counties monitors.

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

```
WINDS WILL HAVE SUSTAINED SPEEDS FROM 30 TO 40 MPH WITH GUSTS TO 50 MPH.
AREAS ALONG EAST SLOPES OF MOUNTAINS COULD SEE A FEW GUSTS OVER 55 MPH.
BLOWING DUST MAY BRIEFLY LOWER VISIBILITIES TO ONE TO THREE MILES
```

The event was also captured on satellite imagery showing dust plumes originating in desert areas and playas of New Mexico and northern Mexico (Figure 6-6). In this image the clouds appear as fluffy grey areas, blowing dust appears as light gray areas, and land appears as grey and black areas.

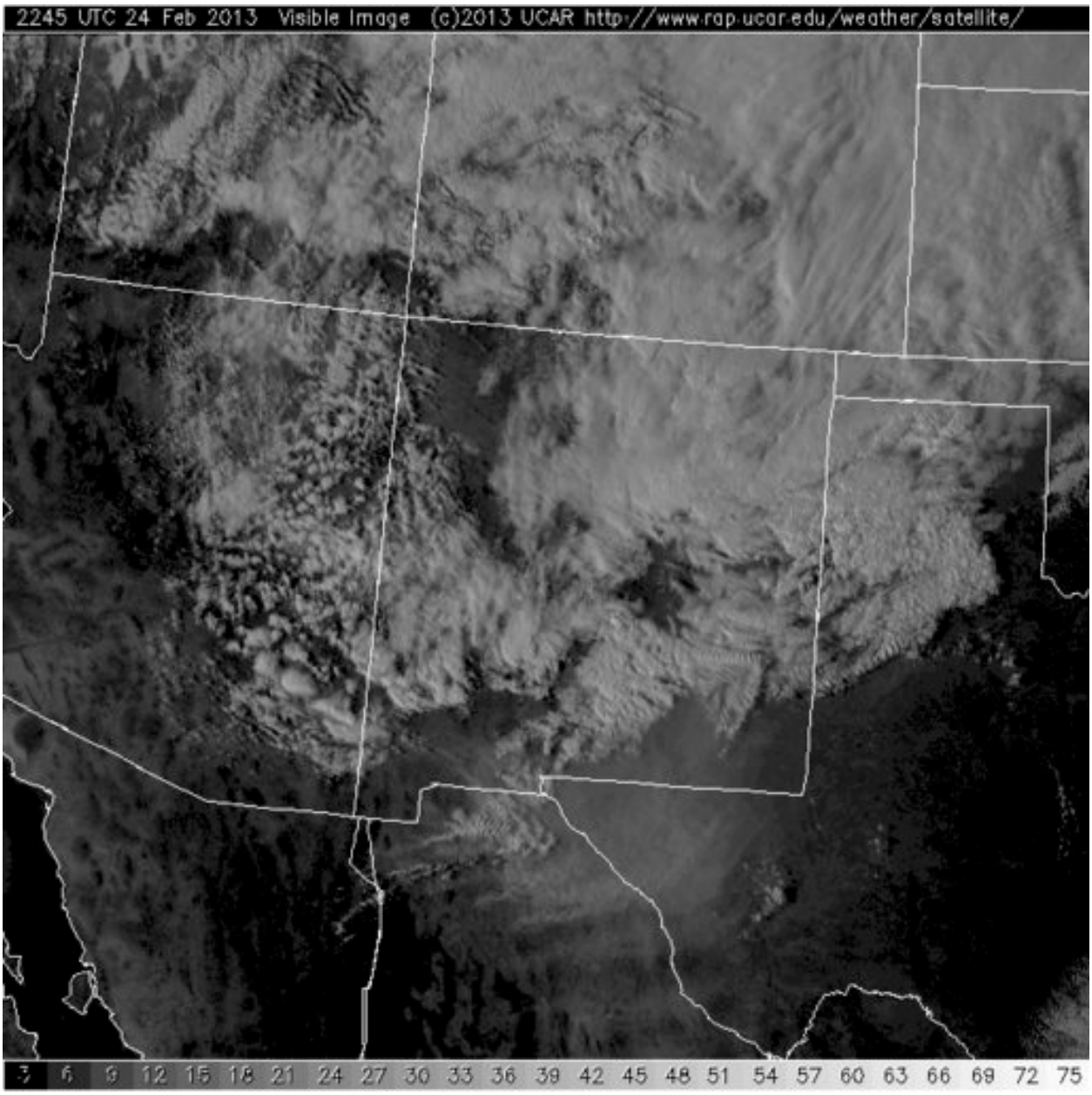


Figure 6-6. GOES satellite imagery of the border area.

Affects Air Quality

The historical fluctuations and clear causal relationship analyses prove that the event in question affected air quality on this date.

Natural Event

The Clear Causal Relationship and not Reasonably Controllable or Preventable analyses show that this was a natural event caused by high wind and blowing dust.

No Exceedance but for the Event

Looking at the 95th percentile of 24-hour averages contained in the historical fluctuation analyses, non-event pollution levels for the monitors are typically significantly below the NAAQS. Activities that generate anthropogenic PM_{10} were approximately constant immediately preceding, during and after the event. Activity levels were typical for the time of year and the BACM measures were being implemented. Vehicular traffic, cooking and residential and agricultural fires do not directly cause PM_{10} 24-Hour NAAQS exceedances in the counties. With the high winds on this day, these emissions would not contribute significantly to the PM_{10} measured.

Based on the evidence provided above, NMED concludes that without the high wind and blowing dust an exceedance would not have occurred. Even if the 95th percentile concentration for 24-Hour averages, 105 $\mu g/m^3$ (Anthony TEOM monitor), were used as the background concentration to compare to the measured PM_{10} concentrations, the particulate contribution from the high wind event clearly caused these exceedances. The causal connection of the measured PM_{10} and the strong winds indicate that but for the high wind event these exceedances would not have occurred.

7 Exceptional Event: March 4, 2013

Summary of the Event

The passing of a winter storm caused high winds and blowing dust in Doña Ana and Luna Counties resulting in exceedances of the PM_{10} 24-hour NAAQS at the Chaparral and Desert View monitoring sites on this date. The FEM TEOM continuous monitors at these sites recorded 24-hour average concentrations of 155 $\mu g/m^3$ and 231 $\mu g/m^3$ respectively. This was not a sampling day for the FRM Wedding at the Anthony site. Although the other sites did not record an exceedance on this date, elevated PM_{10} concentrations were measured during the same time period.

As the event unfolded, the wind blew from the west to northwest throughout the border region. These high velocity winds passed over large areas of desert within Arizona, Texas, New Mexico and Mexico. NMED measured strong sustained hourly wind speeds at and in areas upwind of the PM_{10} monitoring sites ranging from 11 m/s to 13.1 m/s. 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 an exceptional event, specifically a natural event caused by high wind and blowing dust.

Is Not Reasonably Controllable or Preventable

Suspected Source Areas and Categories Contributing to the Event

Sources of windblown dust contributing to this exceedance include portions of the Chihuahuan Desert, residential and commercial properties, agricultural land and unpaved roads upwind of the

monitors. The largest and most likely sources of windblown dust is the natural desert and the playas in New Mexico and northern Mexico (see satellite imagery below).

Sustained and Instantaneous Wind Speeds

EPA uses a default entrainment threshold of sustained wind speeds at 11.2 m/s (25 mph) for natural and well controlled anthropogenic sources contributing to natural events caused by high wind and blowing dust. Under the Doña Ana and Luna County NEAPs, EPA and NMED agreed that wind gusts exceeding 18 m/s (40 mph) would overwhelm any natural and well-controlled anthropogenic sources and cause windblown dust. On this day, sustained wind speeds exceeded EPA's default threshold at five of the six PM_{10} monitoring sites and wind gusts exceeded the NEAPs agreed upon threshold at all of these sites (Figures 7-1 and 7-2). The Desert View monitoring site recorded sustained wind speeds near (11m/s) the 11.2 m/s threshold and the nearby and upwind monitoring site of Santa Teresa did record wind speeds above the threshold.

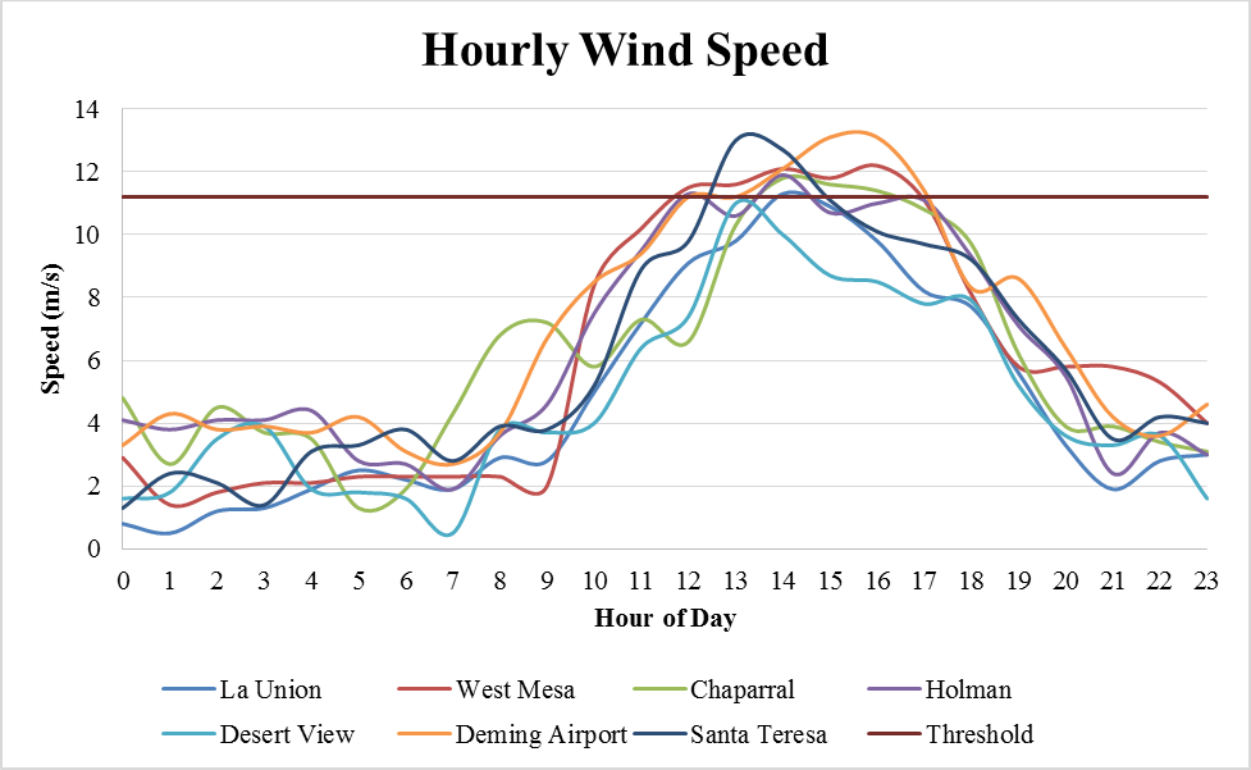


Figure 7-1. Sustained wind speeds at monitoring sites in Doña Ana and Luna Counties.

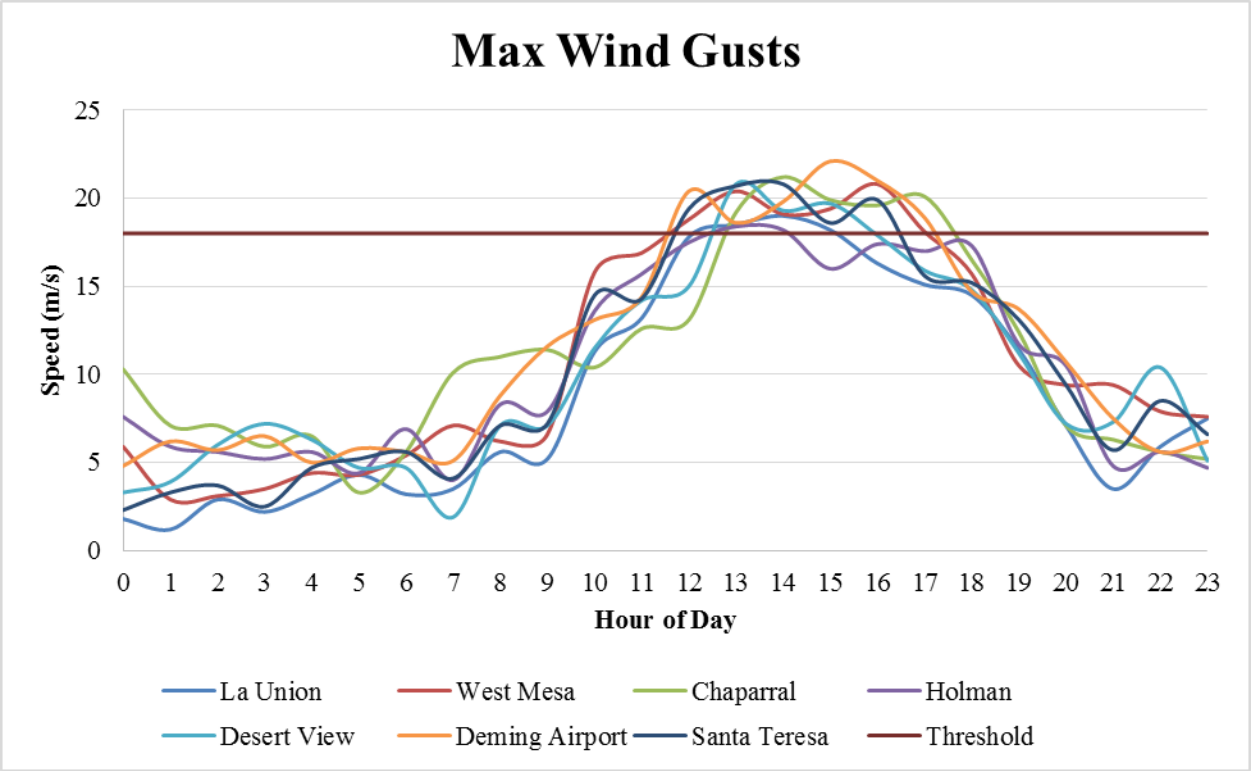


Figure 7-2. Maximum wind gusts at monitoring sites in Doña Ana and Luna Counties.

Basic Controls Analysis

Under the approved Doña Ana County and Luna County Natural Events Action Plans (NEAPs), Best Available Control Measures (BACM) are in place for anthropogenic sources based on ease and effectiveness of implementation. In addition, large land managers including New Mexico State University, Ft. Bliss Military Base, White Sands Missile Range and the New Mexico Department of Transportation, each signed a Memorandum of Understanding with NMED to control sources of windblown dust under their control. The BACM measures regulate disturbed lands, construction and demolition, vacant parking lots and materials handling and transportation. Our investigation did not identify any unusual PM_{10} producing activities on this day, and anthropogenic emissions remained constant before, during and after the event.

Soil erosion by wind or water reduces agricultural productivity and has always been a major concern for agricultural land managers. New Mexico farmers work with the local U.S. Department of Agriculture Natural Resource Conservation Service and New Mexico State Agricultural Extension Office to develop and implement soil conservation plans specifically designed for the soil types and crops of each individual farm. Most of the cropland in Doña Ana County form stable, non-erodible aggregates (clods) when tilled, protecting the surface from wind erosion even when the soil is dry and not covered with plants.

Wind speeds on this day were high enough to entrain dust from undisturbed desert areas upwind of the monitors. Emissions from these areas are not reasonably controllable because costs would prohibit applying controls and detrimental effects on the natural ecosystem could occur.

Based on Doña Ana and Luna Counties attainment designation, implementation of BACM, and the MOUs in place, NMED believes that the control measures to reduce windblown dust should suffice as reasonable controls. Additional controls would not be economically and technically feasible and would not provide additional public health protections. NMED concludes that the sources contributing to the event are not reasonably controllable.

Historical Fluctuations Analysis

Annual and Seasonal 24-hour Average Fluctuations

Since being established, the monitoring sites in Doña Ana and Luna Counties have recorded exceedances of the PM_{10} NAAQS. High winds cause these exceedances and they can occur at any time of year (Appendix-A). Most exceedances occur from late winter through early summer (February-June) and are associated with the passage of storm systems and associated cold fronts or thunderstorm outflow during the monsoon season. High winds caused all recorded exceedances from 2008-2012 and NMED submitted natural events demonstrations to EPA.

Table 7-1 shows the percentile rank of the 24-hour average PM_{10} concentration on this day relative to all measurements including days when high wind natural events caused exceedances from 2008-2012. Data for PM_{10} in this table includes FEM TEOM measurements only since they are continuous monitors that provide a large number of data points for a robust statistical analysis. The recorded values for this day are above the 95th percentile of all 24-hour averages recorded, except at the Holman site where the recorded value is near this level. Because NMED believes all previous exceedances were due to high wind dust events, the exceedances for this day would be the maximum values recorded if no high wind exceedances are included in the analysis.

	Anthony	Chaparral	Deming	Desert View	Holman	West Mesa
Max	1740	1607	1099	1693	1450	480
99th Percentile	268	297	300	231	212	135
95th Percentile	105	101	69	91	71	47
Event Day	140	155	142	231	65	71

Table 7-1. Percentile comparison of event day 24-hour average to 24-hour averages from 2008 to 2012.

Table 7-2 shows the percentile rank of the 24-hour average PM_{10} concentration on this day relative to all measurements during the spring season including days when high wind natural events caused exceedances from 2008-2012. For purposes of this analysis spring season was defined as the three month period from March through May. Data for PM_{10} in this table includes FEM TEOM measurements only since they are continuous monitors that provide a large number of data points for a robust statistical analysis. The recorded value at Desert View for this day is above the 95th percentile of the seasonal 24-hour averages recorded. Spring is considered the windy season with the highest blowing dust activity, as reflected in the increased 99th and 95th

percentiles compared to the annual values. Because NMED believes all previous exceedances were due to high wind dust events, the exceedances for this day would be the maximum values recorded if no high wind exceedances are included in the analysis.

	Anthony	Chaparral	Deming	Desert View	Holman	West Mesa
Max	1740	1607	1099	1693	1450	480
99th Percentile	505	527	774	411	467	263
95th Percentile	176	200	176	144	172	86
Event Day	140	155	142	231	65	71

Table 7-2. Percentile comparison of event day 24-hour average to seasonal 24-hour averages from 2008 to 2012.

Clear Causal Relationship

An upper level trough and cold front brought a late winter storm to New Mexico on March 4. An area of low pressure centered in Colorado created a pressure gradient over southeastern Arizona, southwestern New Mexico and northern Mexico. As the storm system moved eastward and the cool air approached the area, the surface pressure gradient tightened and winds became stronger (Figure 7-3). Surface winds flow perpendicular to the isobars from high to low pressure. Diurnal heating of the surface allowed winds aloft to mix downward, increasing the surface wind velocities and provided the turbulence required for vertical mixing and horizontal transport of dust.

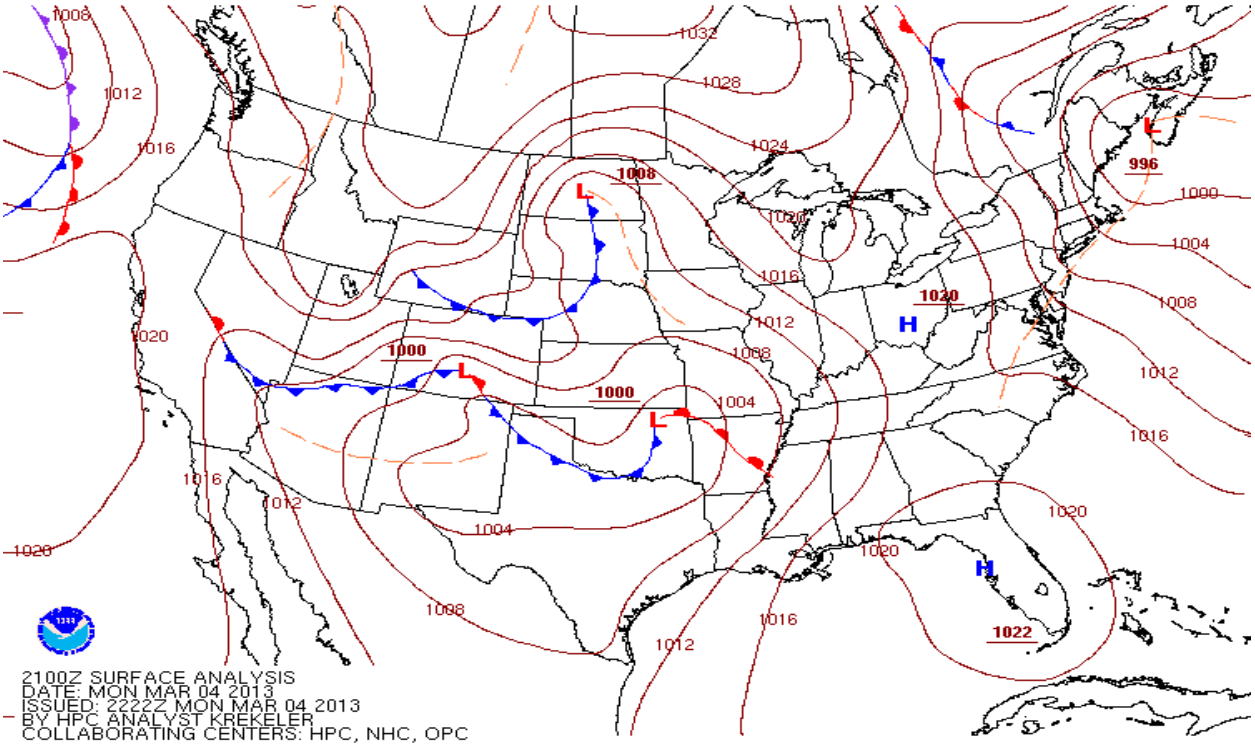
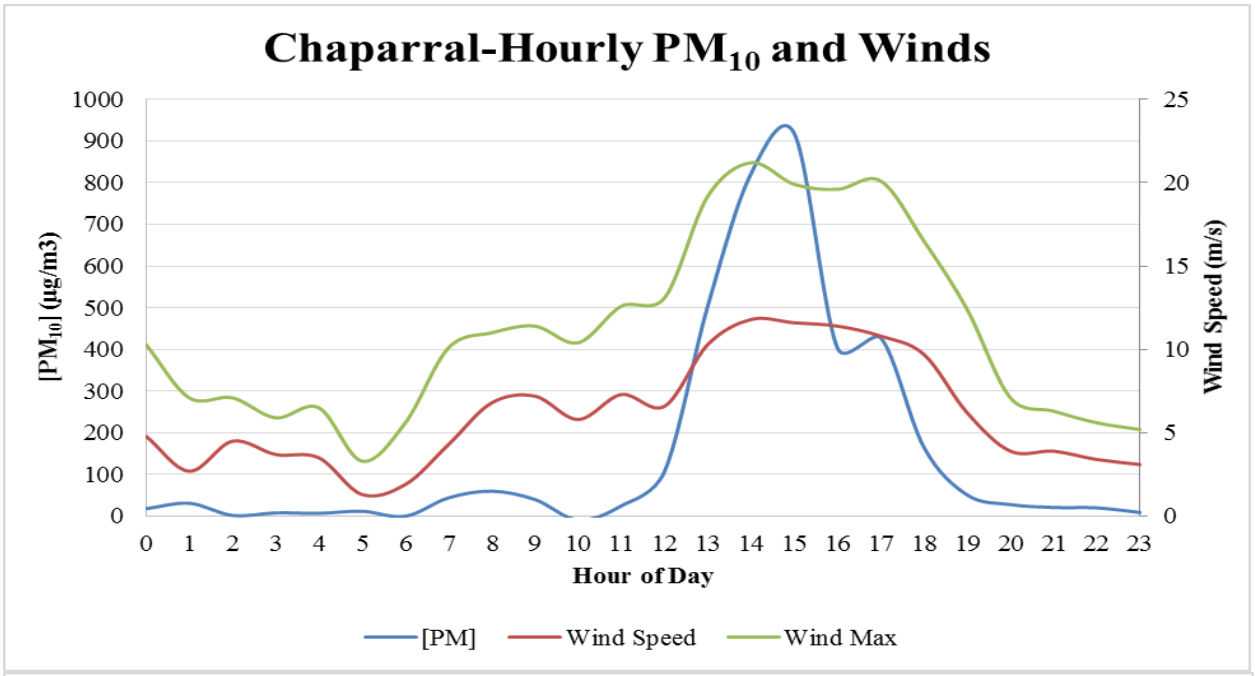
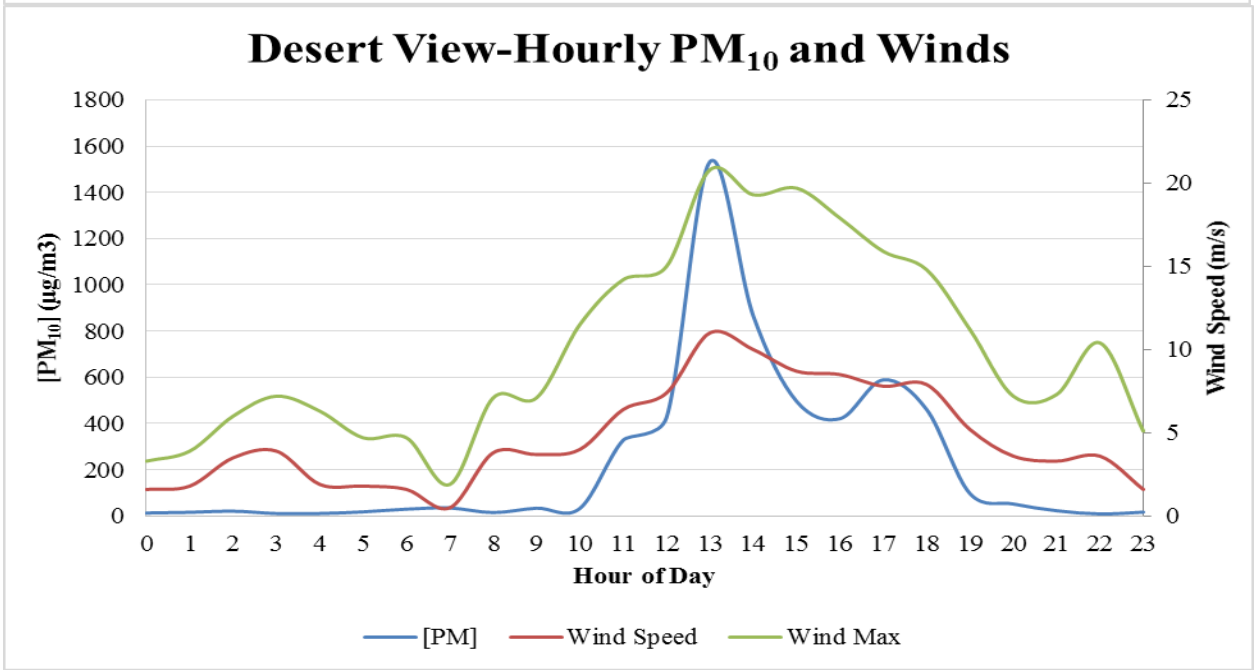


Figure 7-3. Surface weather map showing winter storm and isobars of constant pressure (red lines).

The weather pattern described above generated strong west winds beginning at the 1200 hour and lasted through the 1700 hour. Beginning at the 1200 hour, wind speeds exceeded 11.2 m/s at West Mesa as shown in Figure 7-1. Peak wind speeds ranged from 11 m/s at Desert View to 15.2 m/s at the Deming Airport (Figure 7-1). Peak wind gusts ranged from 18.4 m/s at Holman to 22.1 m/s at the Deming Airport (Figure 7-2). Blowing dust caused elevated levels of PM_{10} during the same period as high winds as demonstrated by the time series plots in Figure 7-4 a-b. During these hours, hourly PM_{10} concentrations spiked at all monitoring sites in the network (Figure 7-5).





Figures 7-4 a-b. Time series plot of hourly observations showing increased PM_{10} concentrations as wind speeds and gusts increase.

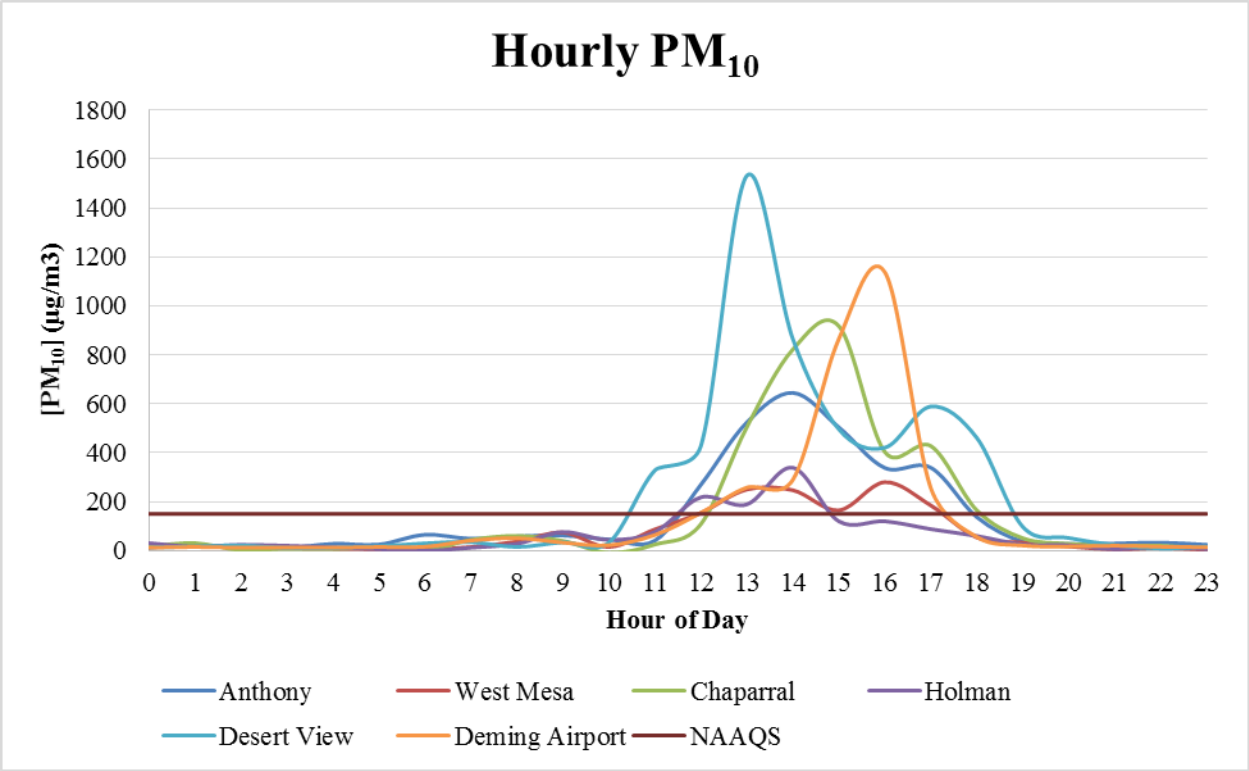


Figure 7-5. Hourly PM_{10} concentrations for Doña Ana and Luna Counties monitors.

The National Weather Service (NWS) issued a Wind 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. 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 text product can be found below.

```
...WINDS AND DUST ON THE INCREASE MONDAY ACROSS SOUTHERN NEW
MEXICO AND WEST TEXAS...

THIS SYSTEM WILL CAUSE WINDS TO STRENGTHEN ACROSS THE AREA AS WINDS ALOFT
INCREASE AND MIX DOWN TO THE SURFACE. WESTERLY WINDS WILL INCREASE BY MID DAY
WITH SPEEDS EXPECTED AT 25 TO 35 MPH WITH GUSTS UP TO 50 MPH. BLOWING DUST
WILL REDUCE VISIBILITIES IN DUST PRONE AREAS.
```

The event was also captured on satellite imagery showing patchy blowing dust south of the I-10 corridor and large dust plumes originating in northern Mexico (Figure 7-6).

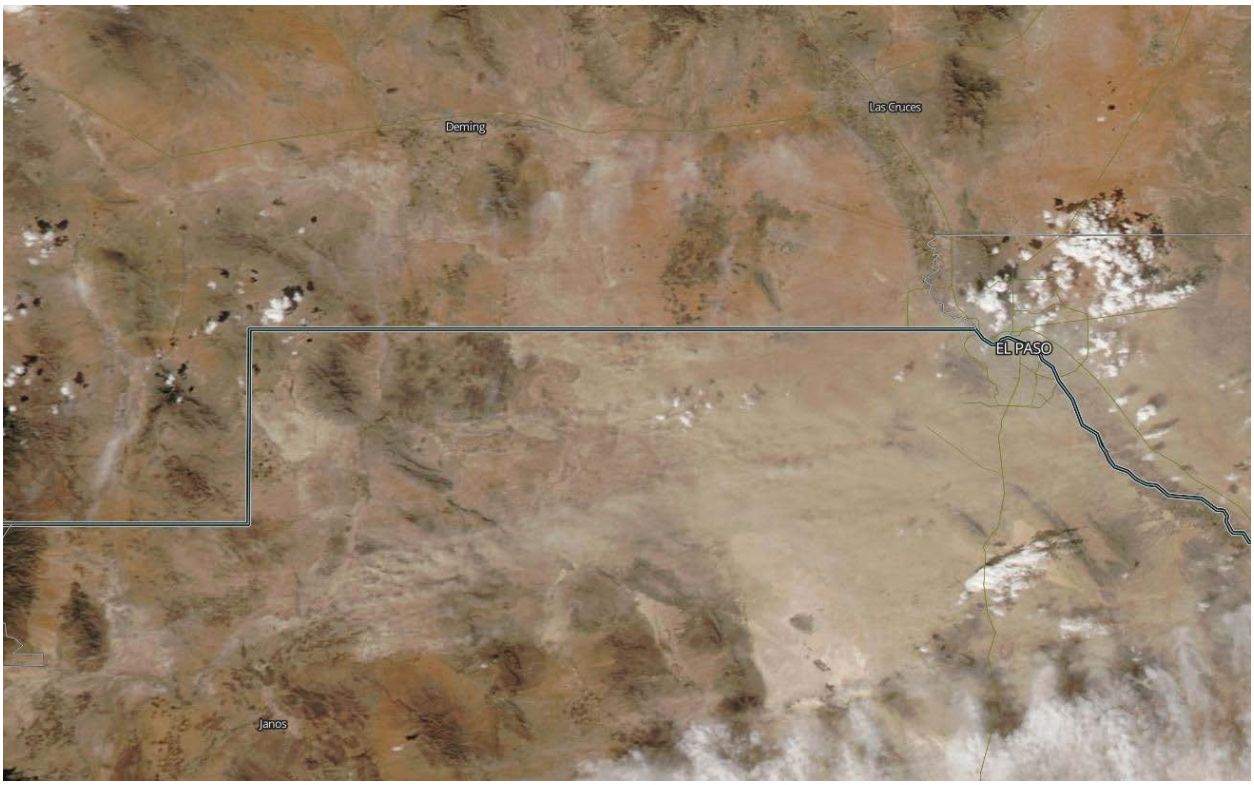


Figure 7-6. NASA satellite imagery of the border area.

Affects Air Quality

The historical fluctuations and clear causal relationship analyses prove that the event in question affected air quality on this date.

Natural Event

The Clear Causal Relationship and not Reasonably Controllable or Preventable analyses show that this was a natural event caused by high wind and blowing dust.

No Exceedance but for the Event

Looking at the 95th percentile of 24-hour averages contained in the historical fluctuation analyses, non-event pollution levels for the monitors are typically significantly below the NAAQS. Activities that generate anthropogenic PM_{10} were approximately constant immediately preceding, during and after the event. Activity levels were typical for the time of year and the BACM measures were being implemented. Vehicular traffic, cooking and residential and agricultural fires do not directly cause PM_{10} 24-Hour NAAQS exceedances in the counties. With the high winds on this day, these emissions would not contribute significantly to the PM_{10} measured.

Based on the evidence provided above, NMED concludes that without the high wind and blowing dust an exceedance would not have occurred. Even if the 95th percentile concentration for 24-Hour averages, 105 µg/m^3 (Anthony TEOM monitor), were used as the background concentration to compare to the measured PM_{10} concentrations, the particulate contribution from the high wind event clearly caused these exceedances. The causal connection of the measured PM_{10} and the strong winds indicate that but for the high wind event these exceedances would not have occurred.

8 Exceptional Event: March 23, 2013

Summary of the Event

The passing of an early spring storm caused high winds and blowing dust in Doña Ana and Luna Counties resulting in exceedances of the PM_{10} 24-hour NAAQS at the Anthony, Chaparral, Desert View, Holman and West Mesa monitoring sites on this date. The FEM TEOM continuous monitors at these sites recorded 24-hour average concentrations of 308 µg/m^3, 207 µg/m^3, 176 µg/m^3, 203 µg/m^3, and 332 µg/m^3 respectively. The FRM Wedding at the Anthony site also recorded an exceedance of 228 µg/m^3. The Deming Airport monitor did not record a 24-hour average concentration due to an issue with the air flow into the machine.

As the event unfolded, the wind blew from the west throughout the border region. These high velocity winds passed over large areas of desert within Arizona, Texas, New Mexico and Mexico. NMED measured strong sustained hourly wind speeds at and in areas upwind of the PM_{10} monitoring sites ranging from 10.1 m/s to 15 m/s. 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 an exceptional event, specifically a natural event caused by high wind and blowing dust.

Is Not Reasonably Controllable or Preventable

Suspected Source Areas and Categories Contributing to the Event

Sources of windblown dust contributing to this exceedance include portions of the Chihuahuan Desert, residential and commercial properties, agricultural land and unpaved roads upwind of the monitors. The largest and most likely sources of windblown dust is the natural desert and the playas in New Mexico and northern Mexico (see satellite imagery below).

Sustained and Instantaneous Wind Speeds

EPA uses a default entrainment threshold of sustained wind speeds at 11.2 m/s (25 mph) for natural and well controlled anthropogenic sources contributing to natural events caused by high wind and blowing dust. Under the Doña Ana and Luna County NEAPs, EPA and NMED agreed that wind gusts exceeding 18 m/s (40 mph) would overwhelm any natural and well-controlled anthropogenic sources and cause windblown dust. On this day, sustained wind speeds exceeded EPA's default threshold at five of the six PM_{10} monitoring sites and wind gusts exceeded the

NEAPs agreed upon threshold at all of these sites (Figures 8-1 and 8-2). Although the Desert View monitoring site did not record sustained wind speeds above the 11.2 m/s threshold, the nearby and upwind monitoring site of Santa Teresa did.

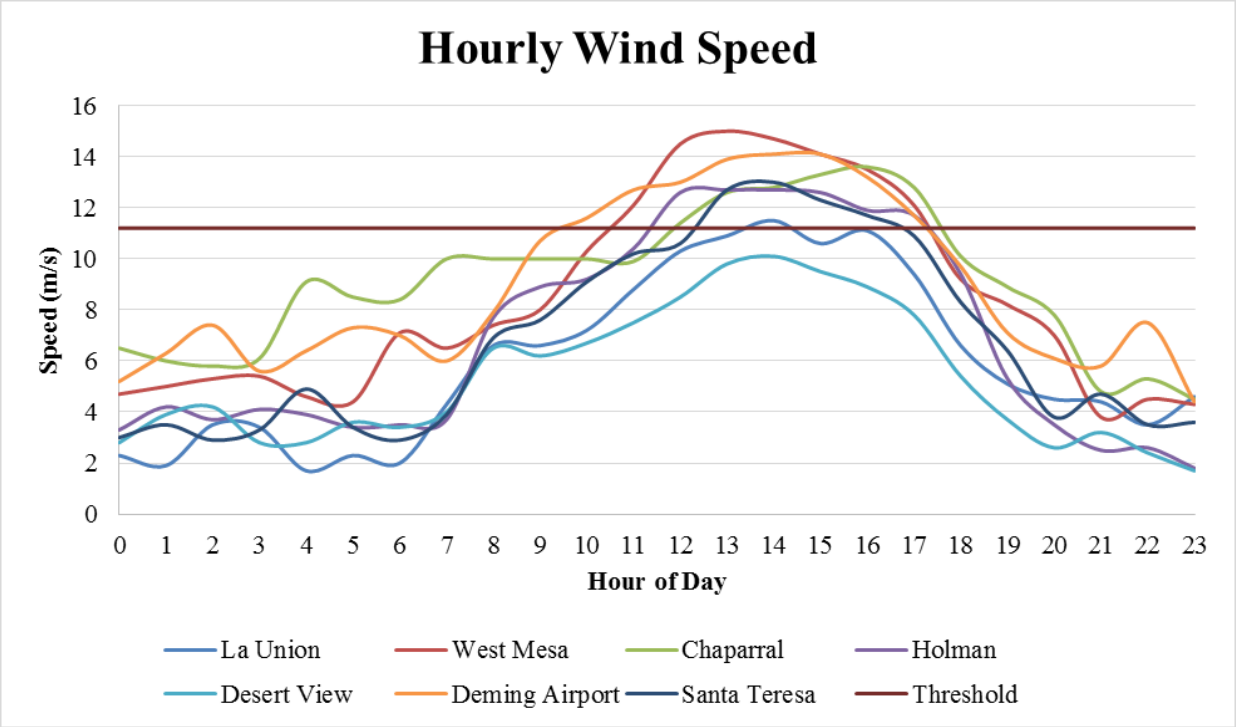


Figure 8-1. Sustained wind speeds at monitoring sites in Doña Ana and Luna Counties.

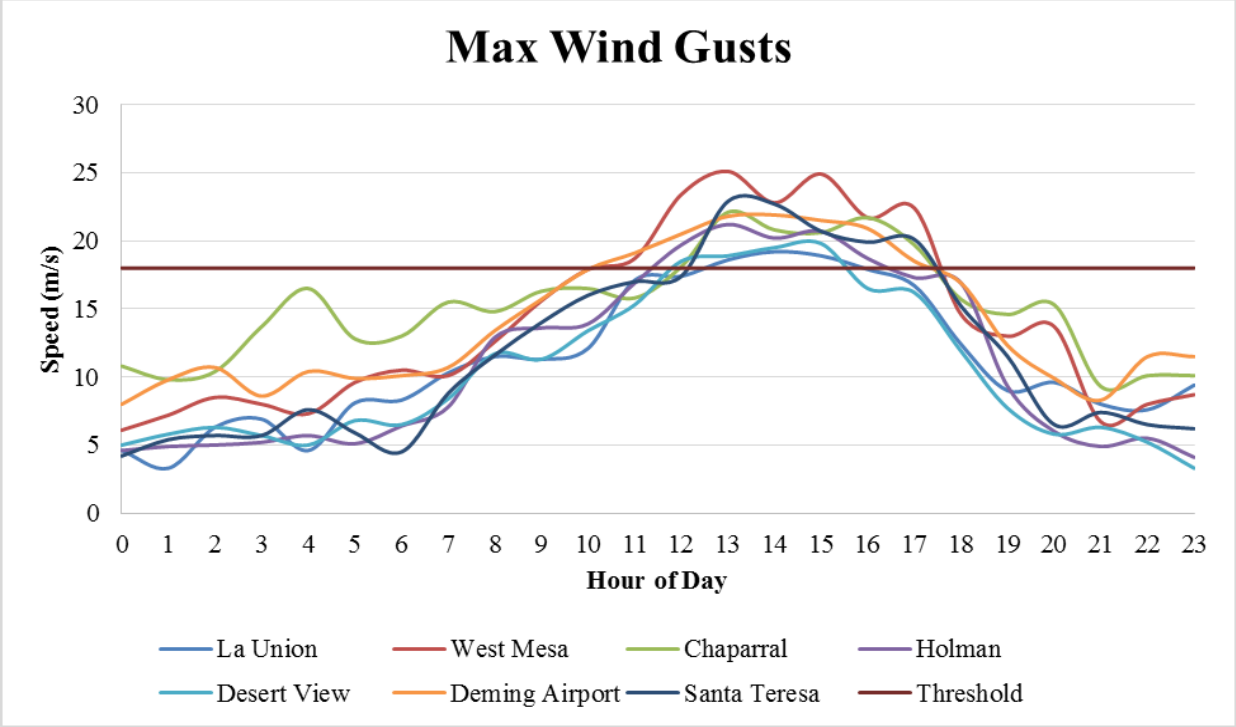


Figure 8-2. Maximum wind gusts at monitoring sites in Doña Ana and Luna Counties.

Basic Controls Analysis

Under the approved Doña Ana County and Luna County Natural Events Action Plans (NEAPs), Best Available Control Measures (BACM) are in place for anthropogenic sources based on ease and effectiveness of implementation. In addition, large land managers including New Mexico State University, Ft. Bliss Military Base, White Sands Missile Range and the New Mexico Department of Transportation, each signed a Memorandum of Understanding with NMED to control sources of windblown dust under their control. The BACM measures regulate disturbed lands, construction and demolition, vacant parking lots and materials handling and transportation. Our investigation did not identify any unusual PM_{10} producing activities on this day, and anthropogenic emissions remained constant before, during and after the event.

Soil erosion by wind or water reduces agricultural productivity and has always been a major concern for agricultural land managers. New Mexico farmers work with the local U.S. Department of Agriculture Natural Resource Conservation Service and New Mexico State Agricultural Extension Office to develop and implement soil conservation plans specifically designed for the soil types and crops of each individual farm. Most of the cropland in Doña Ana County form stable, non-erodible aggregates (clods) when tilled, protecting the surface from wind erosion even when the soil is dry and not covered with plants. In addition, most crop planting in the area would have been completed and the land irrigated by this time of year.

Wind speeds on this day were high enough to entrain dust from undisturbed desert areas upwind of the monitors. Emissions from these areas are not reasonably controllable because costs would prohibit applying controls and detrimental effects on the natural ecosystem could occur.

Based on Doña Ana and Luna Counties attainment designation, implementation of BACM, and the MOUs in place, NMED believes that the control measures to reduce windblown dust should suffice as reasonable controls. Additional controls would not be economically and technically feasible and would not provide additional public health protections. NMED concludes that the sources contributing to the event are not reasonably controllable.

Historical Fluctuations Analysis

Annual and Seasonal 24-hour Average Fluctuations

Since being established, the monitoring sites in Doña Ana and Luna Counties have recorded exceedances of the PM_{10} NAAQS. High winds cause these exceedances and they can occur at any time of year (Appendix-A). Most exceedances occur from late winter through early summer (February-June) and are associated with the passage of storm systems and associated cold fronts or thunderstorm outflow during the monsoon season. High winds caused all recorded exceedances from 2008-2012 and NMED submitted natural events demonstrations to EPA.

Table 8-1 shows the percentile rank of the 24-hour average PM_{10} concentration on this day relative to all measurements including days when high wind natural events caused exceedances from 2008-2012. Data for PM_{10} in this table includes FEM TEOM measurements only since

they are continuous monitors that provide a large number of data points for a robust statistical analysis. The recorded values for this day are above the 95th percentile of all 24-hour averages recorded. The Anthony and West Mesa sites recorded values above the 99th percentile of data. Because NMED believes all previous exceedances were due to high wind dust events, the exceedances for this day would be the maximum values recorded if no high wind exceedances are included in the analysis.

	Anthony	Chaparral	Deming	Desert View	Holman	West Mesa
Max	1740	1607	1099	1693	1450	480
99th Percentile	268	297	300	231	212	135
95th Percentile	105	101	69	91	71	47
Event Day	308	207	ND	176	203	332

Table 8-1. Percentile comparison of event day 24-hour average to 24-hour averages from 2008 to 2012.

Table 8-2 shows the percentile rank of the 24-hour average PM_{10} concentration on this day relative to all measurements during the spring season including days when high wind natural events caused exceedances from 2008-2012 For purposes of this analysis spring season was defined as the three month period from March through May. Data for PM_{10} in this table includes FEM TEOM measurements only since they are continuous monitors that provide a large number of data points for a robust statistical analysis. Spring is considered the windy season with the highest blowing dust activity, as reflected in the increased 99th and 95th percentiles compared to the annual values. The recorded values for this day are above the 95th percentile of the seasonal 24-hour averages recorded. The West Mesa site recorded values above the 99th percentile of data. Because NMED believes all previous exceedances were due to high wind dust events, the exceedances for this day would be the maximum values recorded if no high wind exceedances are included in the analysis.

	Anthony	Chaparral	Deming	Desert View	Holman	West Mesa
Max	1740	1607	1099	1693	1450	480
99th Percentile	505	527	774	411	467	263
95th Percentile	176	200	176	144	172	86
Event Day	308	207	ND	176	203	332

Table 8-2. Percentile comparison of event day 24-hour average to seasonal 24-hour averages from 2008 to 2012.

Clear Causal Relationship

A strong winter storm passed through New Mexico on March 23. An area of low pressure centered in northeastern New Mexico and an upper level trough created a pressure gradient over southeastern Arizona, southwestern New Mexico and northern Mexico. As the storm system moved through northern New Mexico, the surface pressure gradient tightened and winds became stronger (Figure 8-3). Surface winds flow perpendicular to the isobars from high to low pressure. Diurnal heating of the surface allowed winds aloft to mix downward, increasing the surface wind velocities and provided the turbulence required for vertical mixing and horizontal transport of dust.

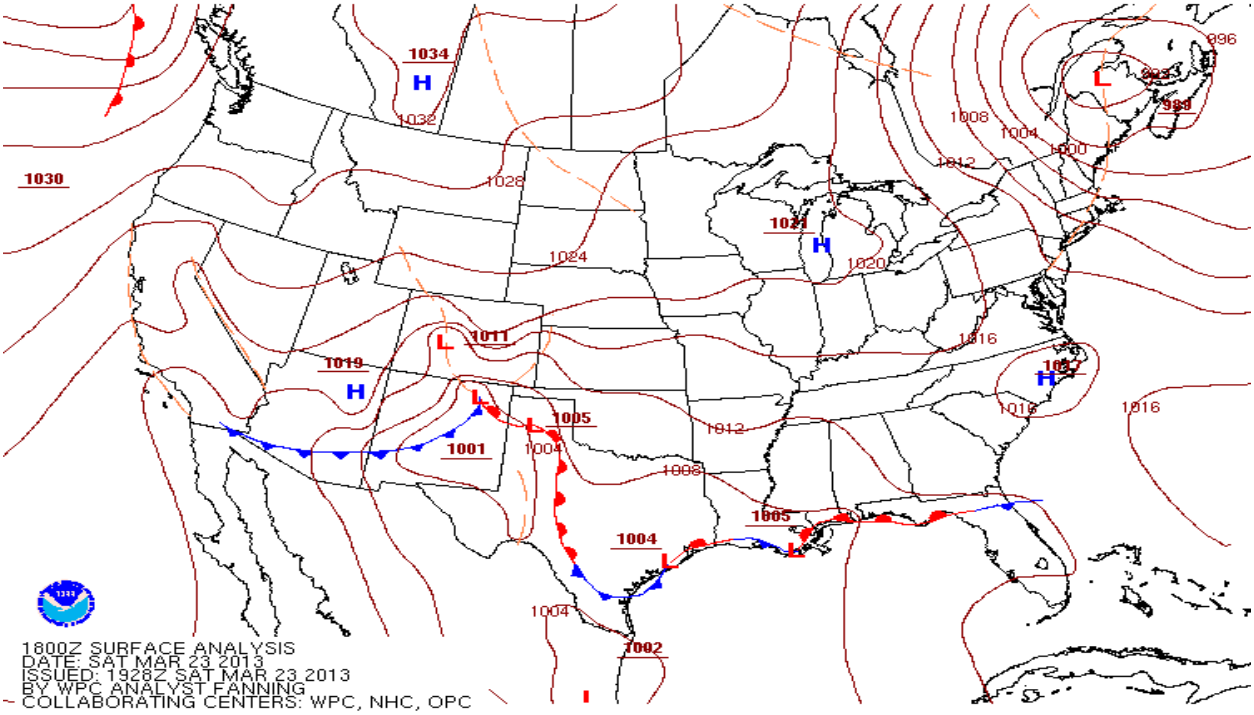
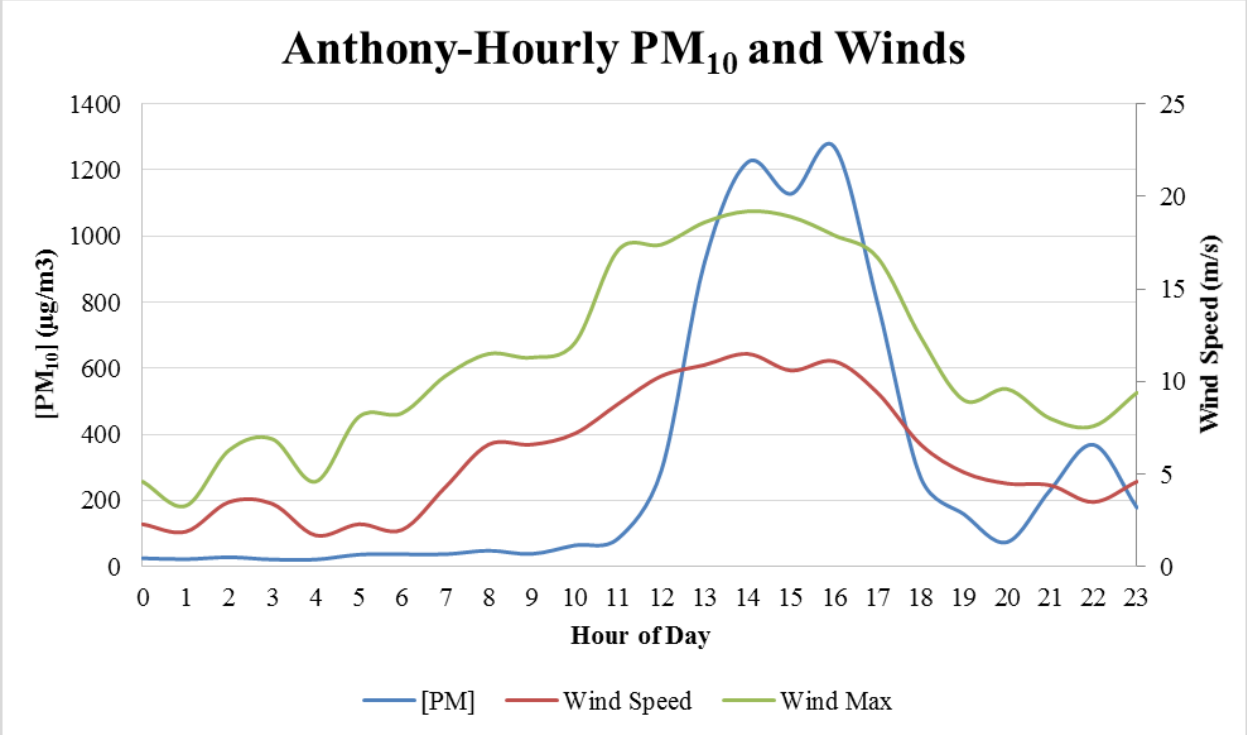
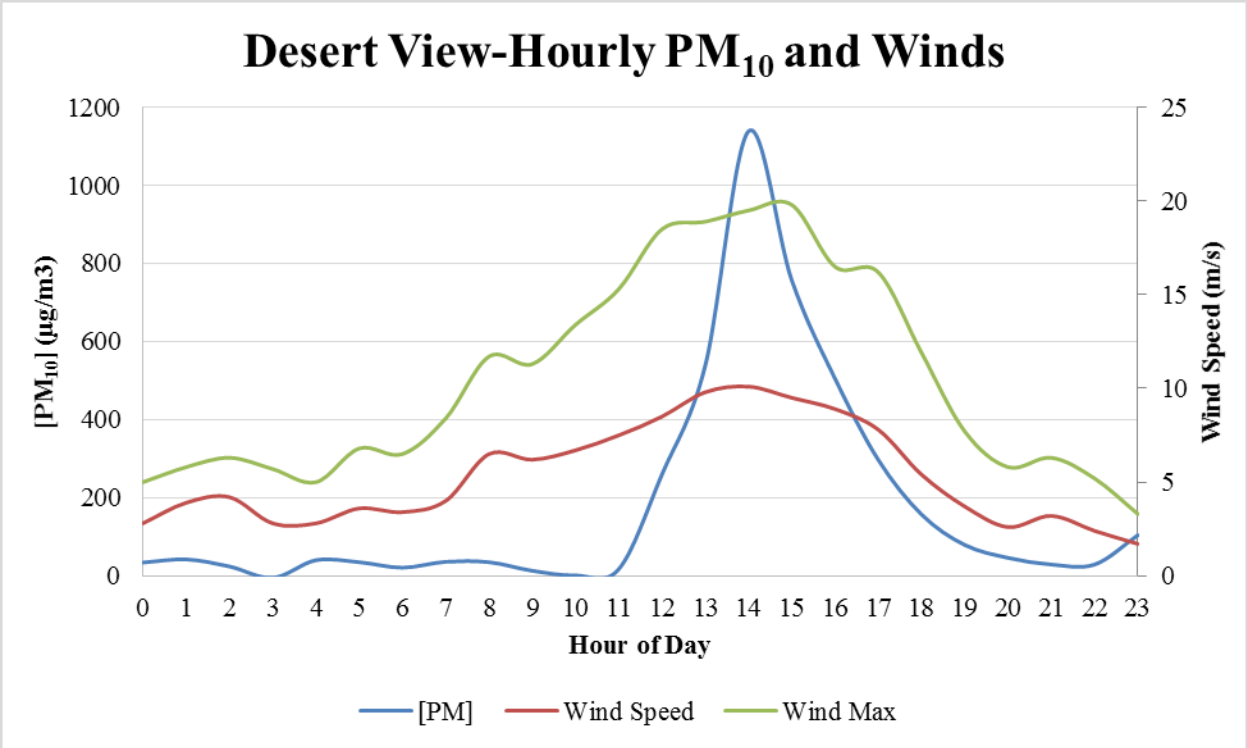
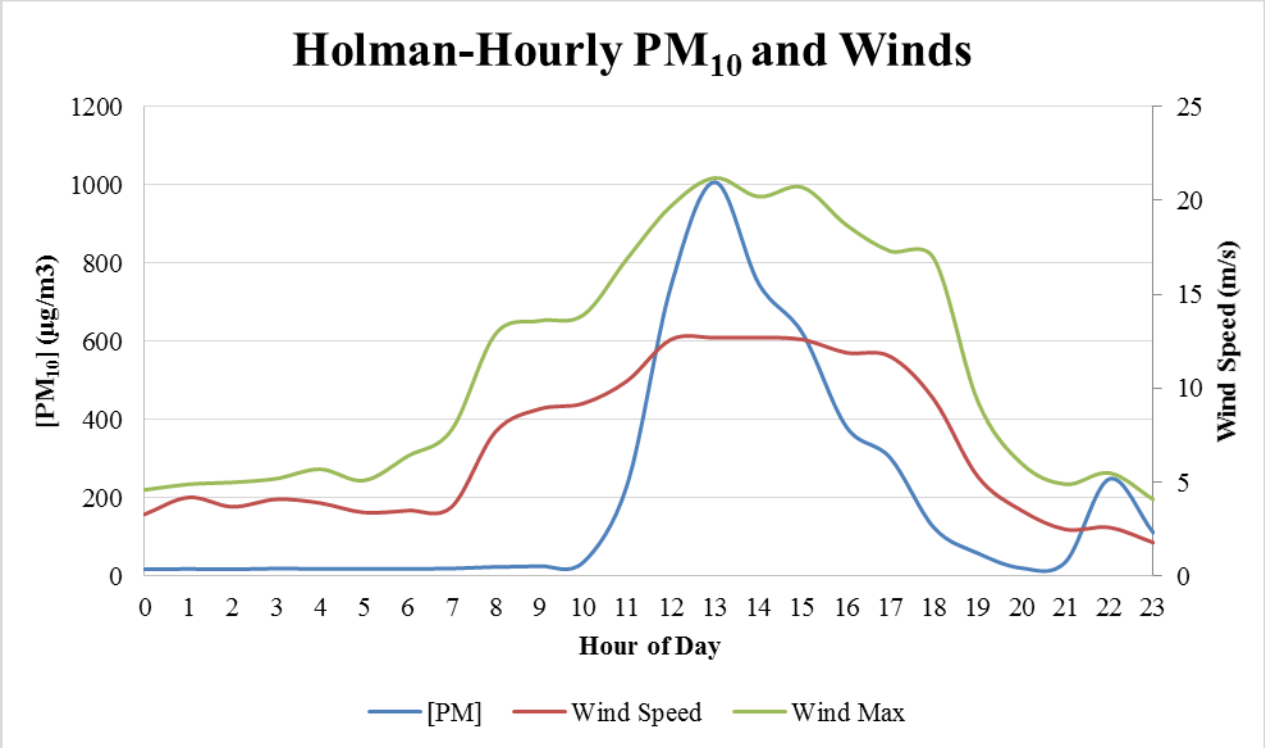


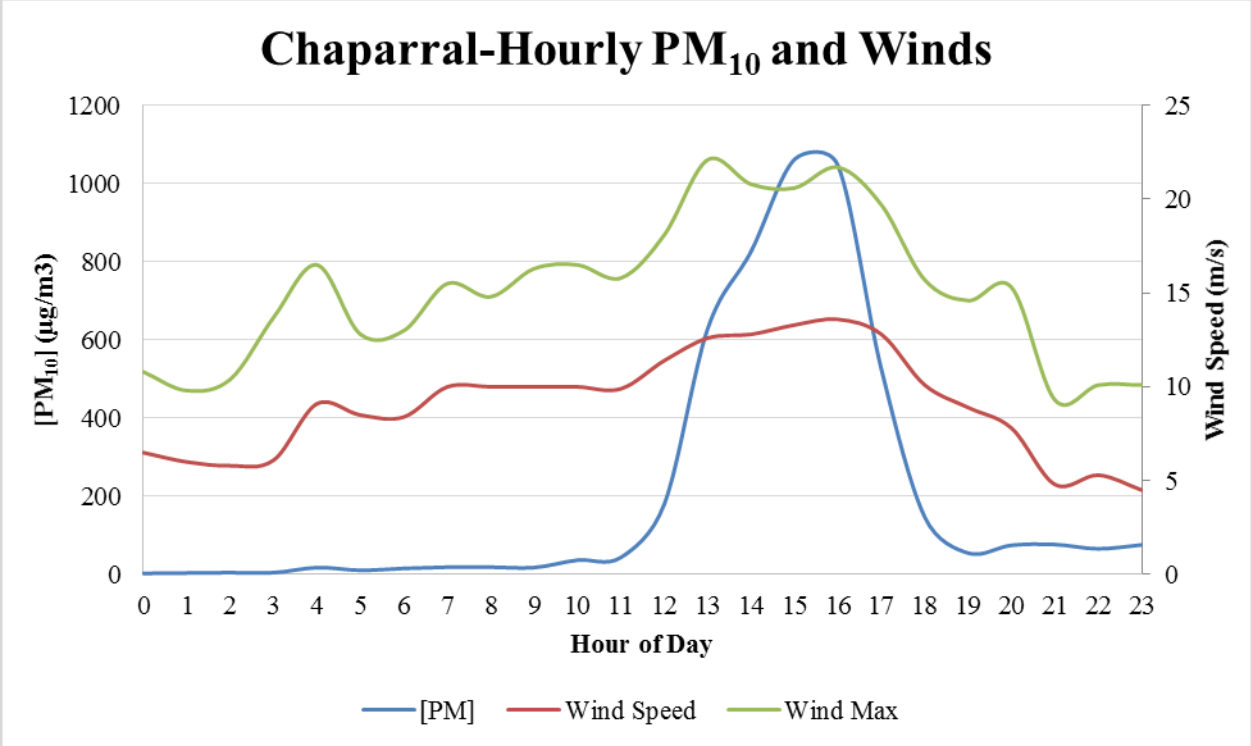
Figure 8-3. Surface weather map showing winter storm and isobars of constant pressure (red lines).

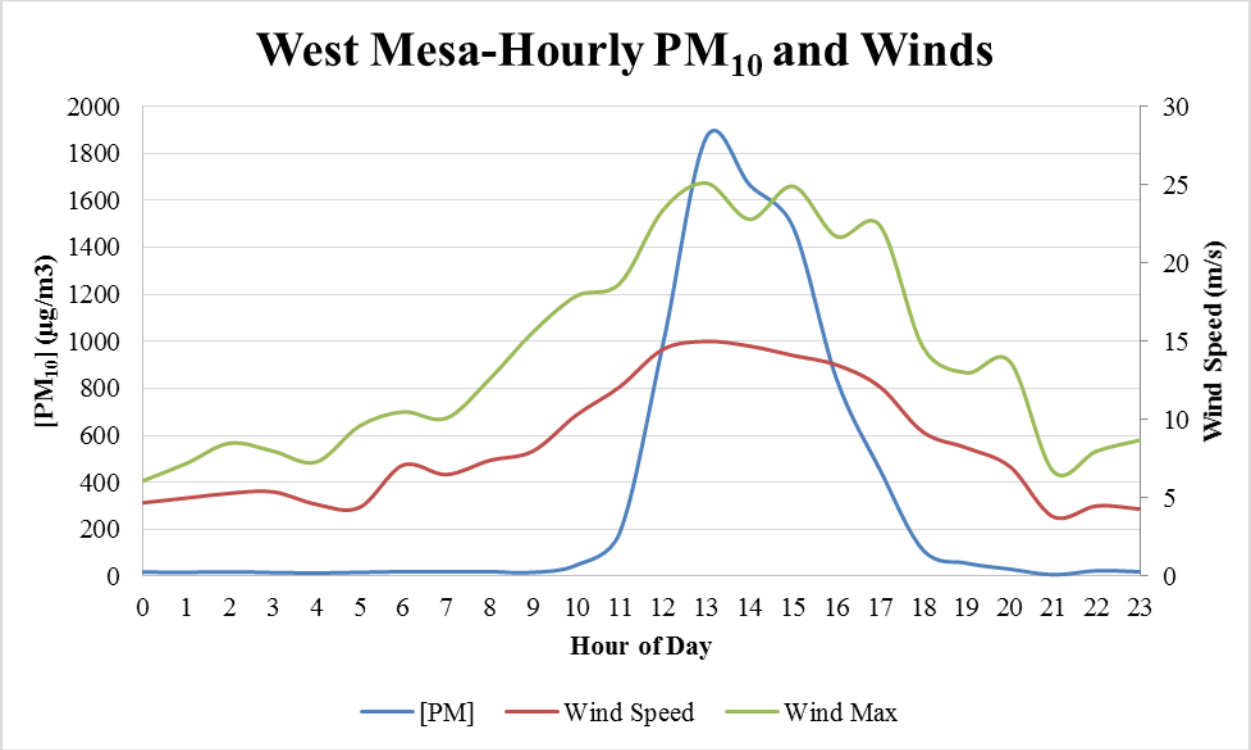
The weather pattern described above generated strong west winds beginning at the 1000 hour and lasted through the 1700 hour. Beginning at the 1000 hour, wind speeds exceeded 11.2 m/s at the Deming Airport as shown in Figure 8-1. Peak wind speeds ranged from 10.1 m/s at Desert View to 15 m/s at West Mesa (Figure 8-1). Peak wind gusts ranged from 19.2 m/s at La Union to 25.1 m/s at West Mesa (Figure 8-2). Blowing dust caused elevated levels of PM_{10} during the same period as high winds as demonstrated by the time series plots in Figure 8-4 a-e. During these hours, hourly PM_{10} concentrations spiked at all monitoring sites in the network (Figure 8-5).


Anthony-Hourly PM10 and Winds
[PM10] (µg/m3)
Wind Speed (m/s)
Hour of Day
[PM]
Wind Speed
Wind Max


Desert View-Hourly PM10 and Winds
[PM10] (µg/m3)
Wind Speed (m/s)
Hour of Day
[PM]
Wind Speed
Wind Max


Holman-Hourly PM10 and Winds
[PM10] (µg/m3)
Wind Speed (m/s)
Hour of Day
[PM]
Wind Speed
Wind Max


Chaparral-Hourly PM10 and Winds
[PM10] (µg/m3)
Wind Speed (m/s)
Hour of Day
[PM]
Wind Speed
Wind Max



Figures 8-4 a-e. Time series plot of hourly observations showing increased PM_{10} concentrations as wind speeds and gusts increase.

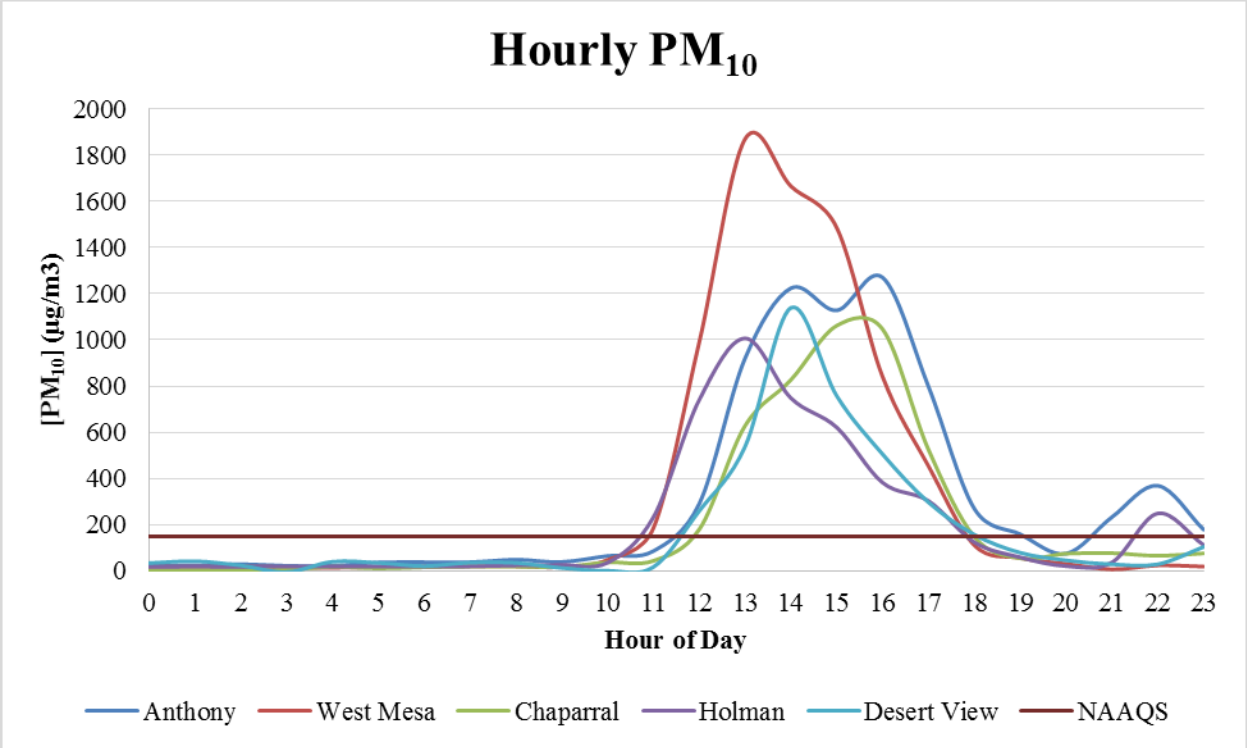


Figure 8-5. Hourly PM_{10} concentrations for Doña Ana and Luna Counties monitors.

The National Weather Service (NWS) issued a Wind 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. 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 text product can be found below.

```
THIS UPPER TROUGH WILL BRING STRONG WINDS ALOFT DOWN TO THE SURFACE...WHICH
WILL COMBINE WITH A SURFACE LOW PRESSURE SYSTEM TO PRODUCE WINDY CONDITIONS
ACROSS FAR WEST TEXAS AND SOUTHERN NEW MEXICO THIS AFTERNOON AND EARLY
EVENING. WEST WINDS WILL HAVE SUSTAINED SPEEDS AROUND 25 TO 35 MPH WITH GUSTS
FROM 45 TO 55 MPH ACROSS THE REGION. BLOWING DUST COULD REDUCE VISIBILITIES
TO UNDER A MILE OVER ISOLATED LOCATIONS.
```

The event was also captured on satellite imagery showing dust plumes originating along the I-10 corridor, near the Florida and Potrillo Mountains in New Mexico and desert and playa areas in northern Mexico (Figure 8-6).

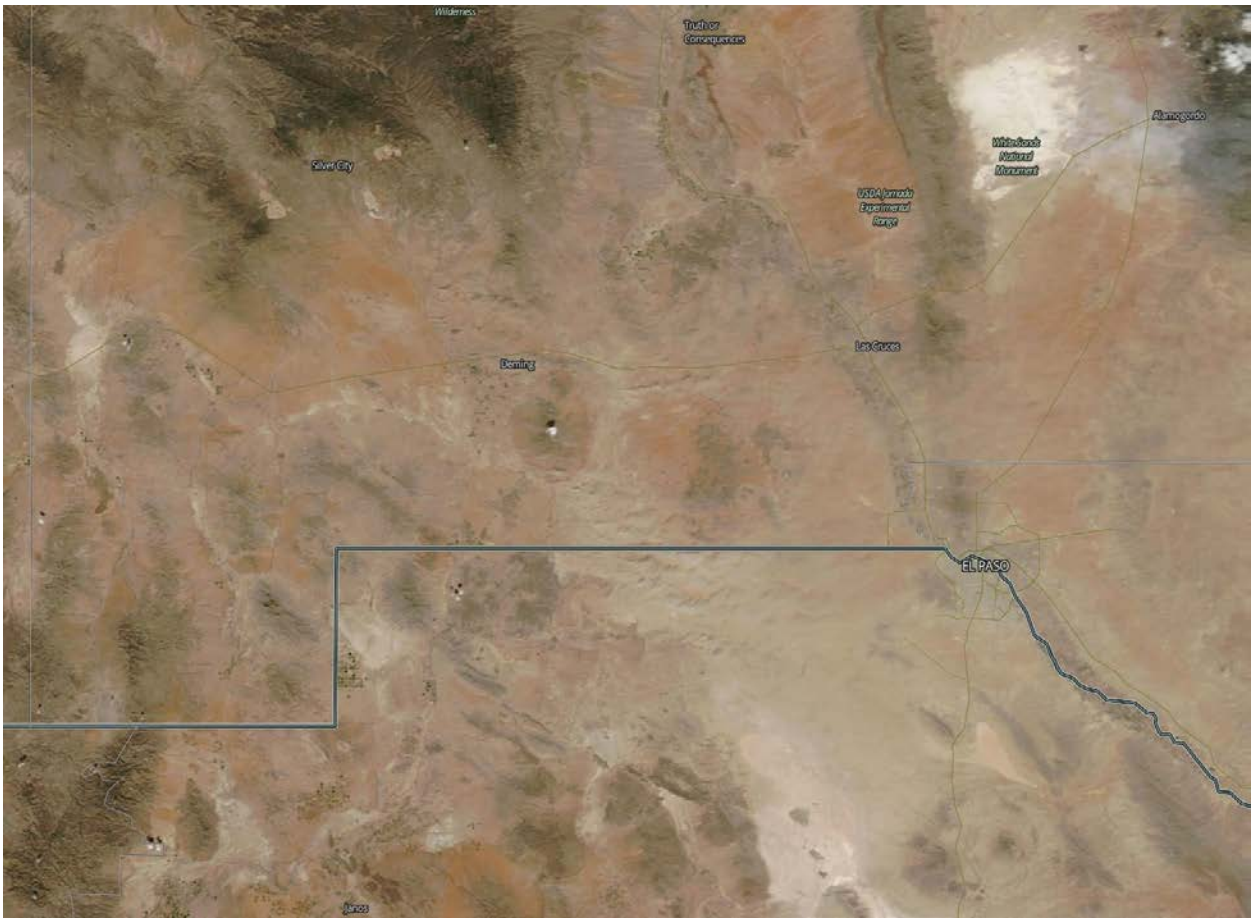


Figure 8-6. NASA satellite imagery of the border area.

Affects Air Quality

The historical fluctuations and clear causal relationship analyses prove that the event in question affected air quality on this date.

Natural Event

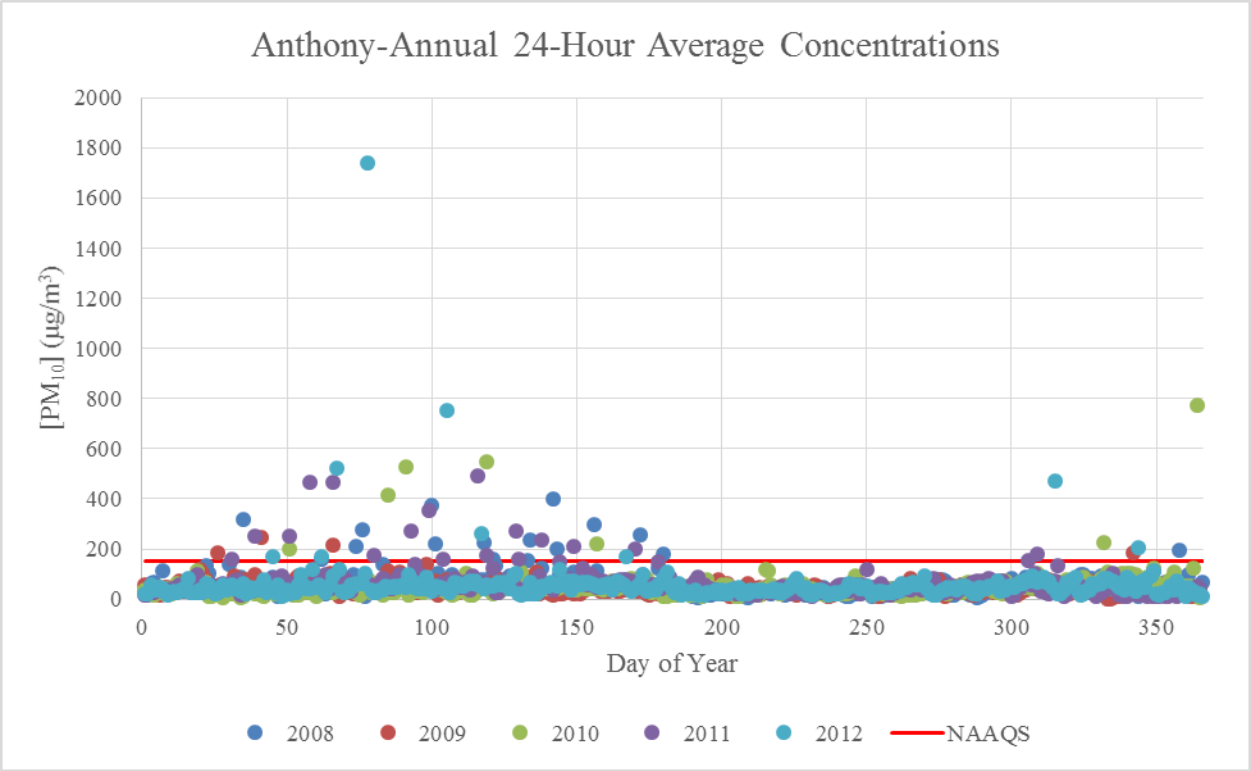
The Clear Causal Relationship and not Reasonably Controllable or Preventable analyses show that this was a natural event caused by high wind and blowing dust.

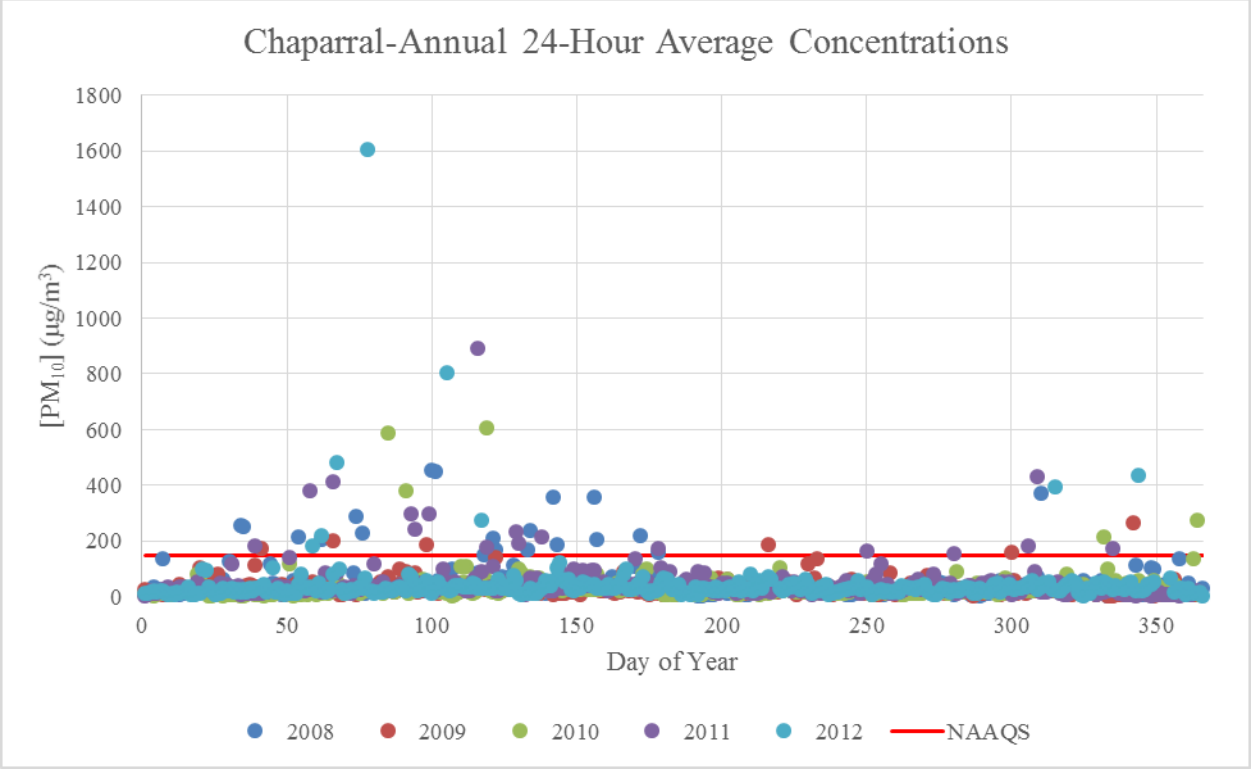
No Exceedance but for the Event

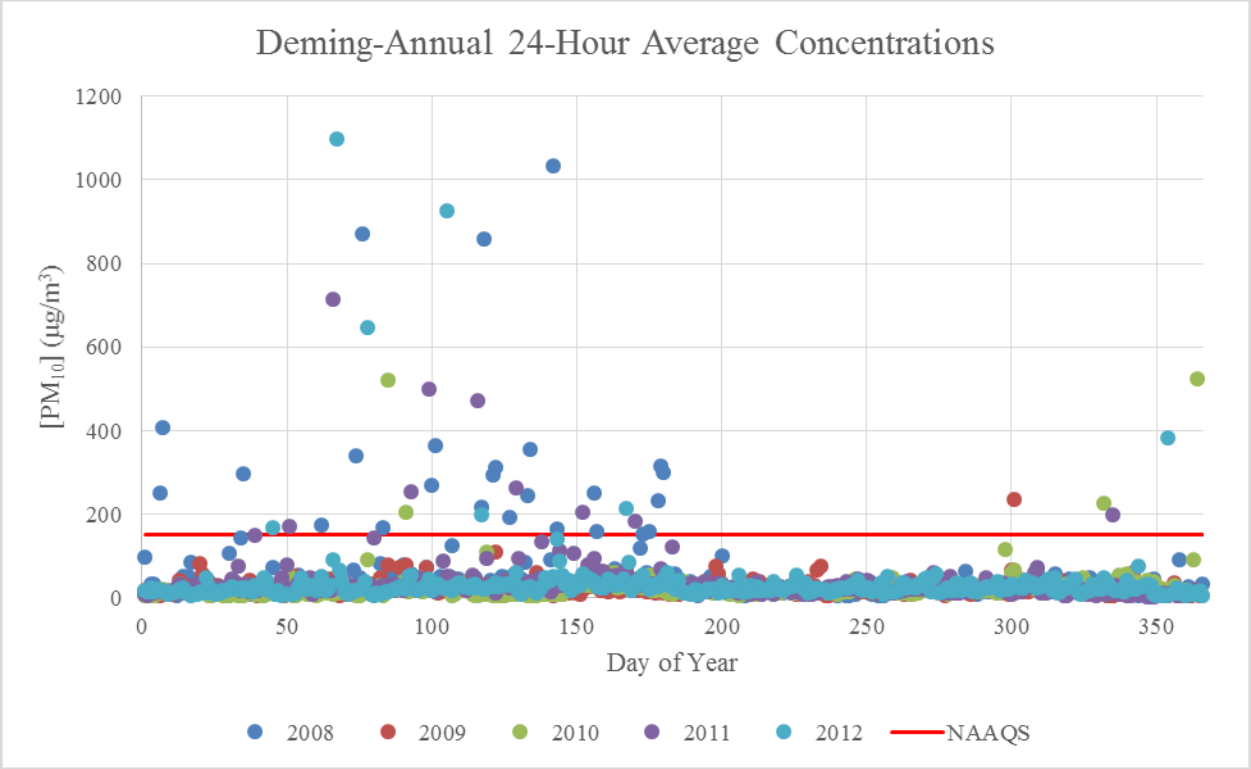
Looking at the 95th percentile of 24-hour averages contained in the historical fluctuation analyses, non-event pollution levels for the monitors are typically significantly below the NAAQS. Activities that generate anthropogenic PM_{10} were approximately constant immediately preceding, during and after the event. Activity levels were typical for the time of year and the BACM measures were being implemented. Vehicular traffic, cooking and residential and agricultural fires do not directly cause PM_{10} 24-Hour NAAQS exceedances in the counties. With the high winds on this day, these emissions would not contribute significantly to the PM_{10} measured.

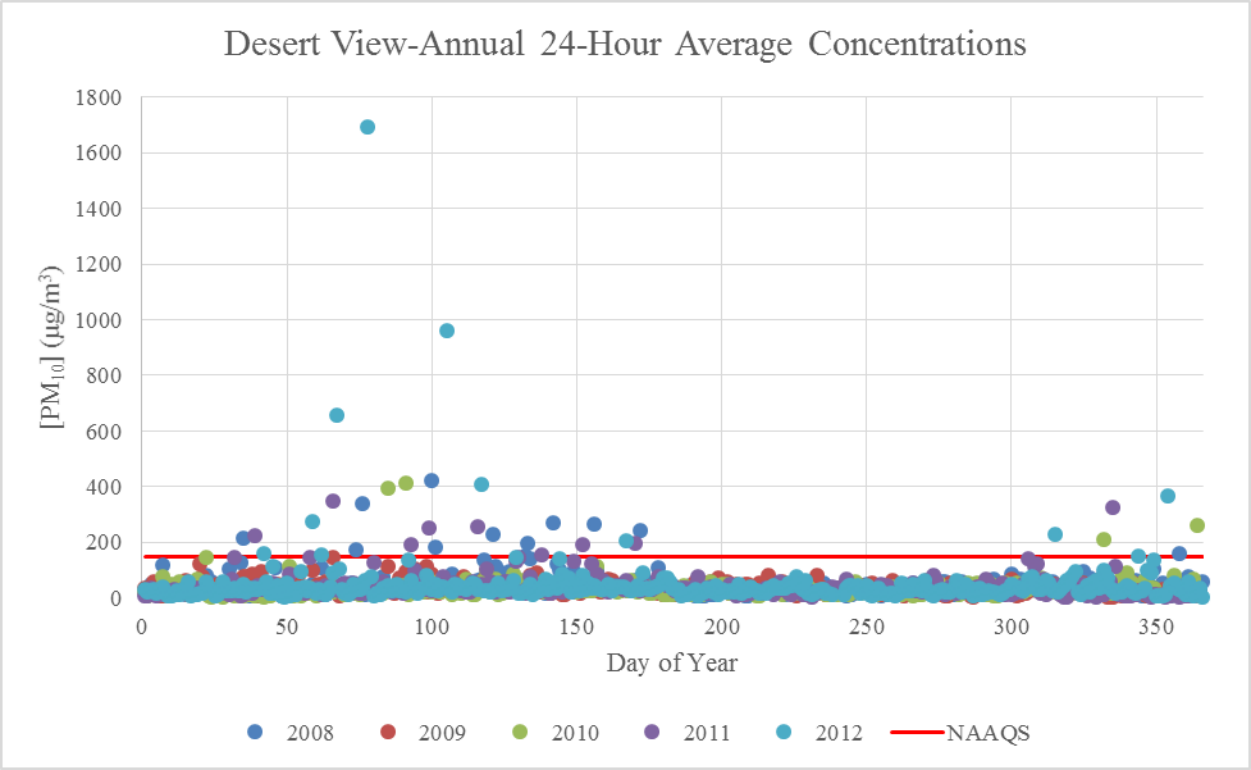
Based on the evidence provided above, NMED concludes that without the high wind and blowing dust an exceedance would not have occurred. Even if the 95th percentile concentration for 24-Hour averages, 105 µg/m^3 (Anthony TEOM monitor), were used as the background concentration to compare to the measured PM_{10} concentrations, the particulate contribution from the high wind event clearly caused these exceedances. The causal connection of the measured PM_{10} and the strong winds indicate that but for the high wind event these exceedances would not have occurred.

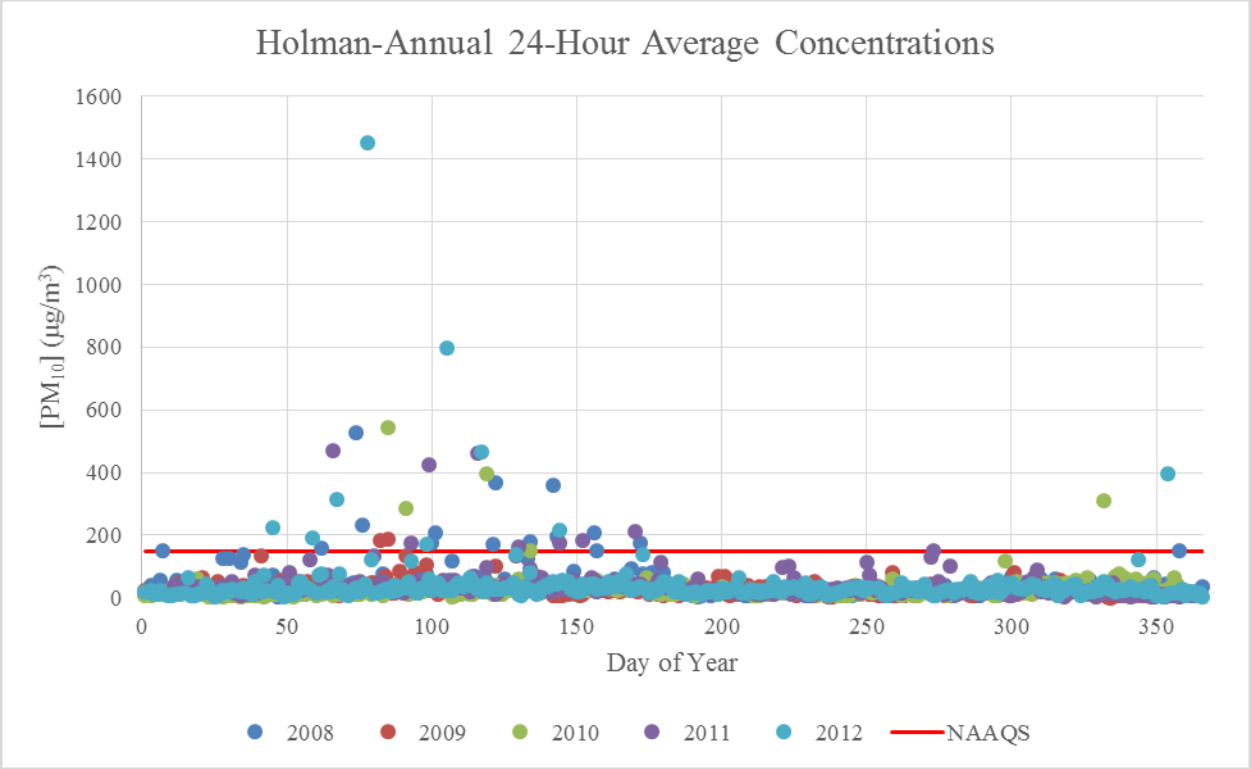
9 Appendix A-Historical Fluctuations 2008-2012

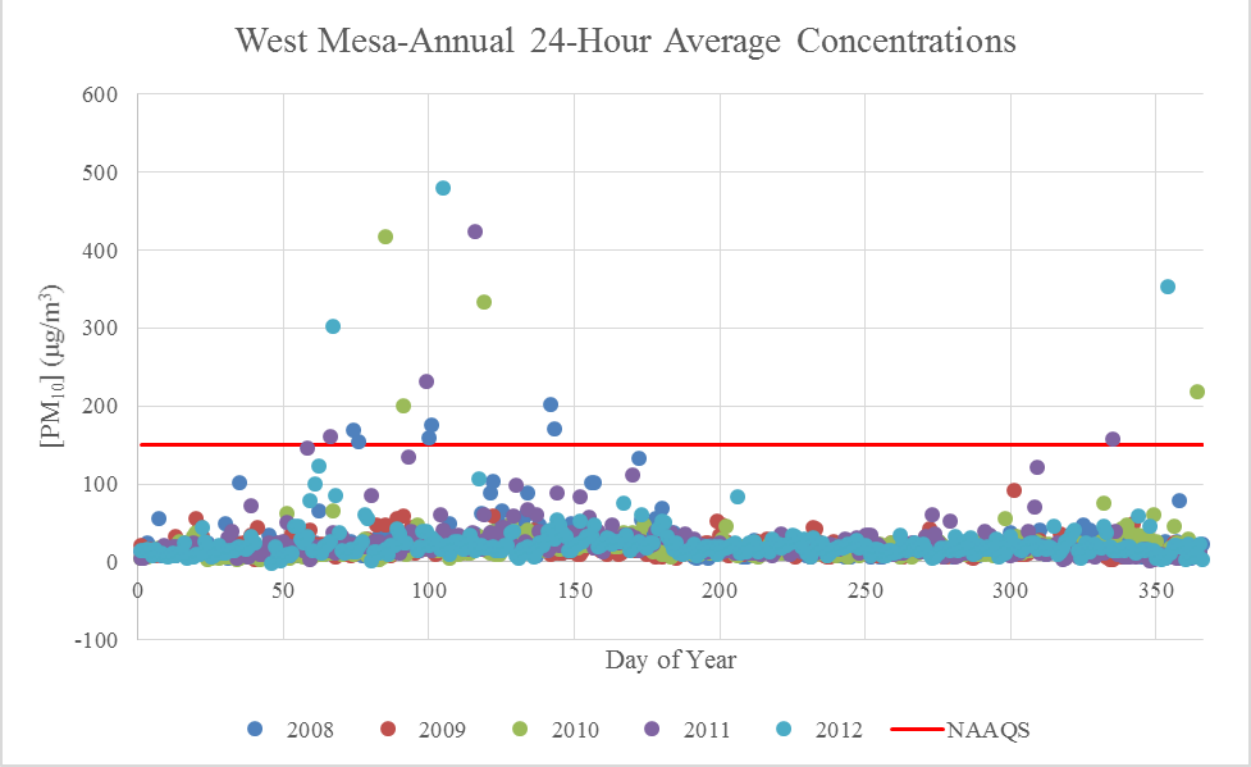





Deming-Annual 24-Hour Average Concentrations
[PM10] (µg/m3)
1200
1000
800
600
400
200
0
0
50
100
150
200
250
300
350
Day of Year
2008
2009
2010
2011
2012
NAAQS


Desert View-Annual 24-Hour Average Concentrations
[PM10] (µg/m3)
1800
1600
1400
1200
1000
800
600
400
200
0
0
50
100
150
200
250
300
350
Day of Year
2008
2009
2010
2011
2012
NAAQS


Holman-Annual 24-Hour Average Concentrations
[PM10] (µg/m3)
1600
1400
1200
1000
800
600
400
200
0
0
50
100
150
200
250
300
350
Day of Year
2008
2009
2010
2011
2012
NAAQS


West Mesa-Annual 24-Hour Average Concentrations
[PM10] (µg/m3)
600
500
400
300
200
100
0
-100
0
50
100
150
200
250
300
350
Day of Year
2008
2009
2010
2011
2012
NAAQS