

**Analysis of Particulate Matter (PM₁₀) Exceedances
Caused by High Winds
July 2001 – September 2001
Doña Ana County, New Mexico**

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INTRODUCTION

In a memorandum dated May 30, 1996, the Environmental Protection Agency (EPA) set forth a policy, entitled the Natural Events Policy (NEP), for violations of the PM₁₀ ambient air quality standard that are caused by natural events such as high winds. This policy allows for ambient air quality monitoring data affected by natural events to be excluded from determinations of attainment status, if certain requirements are met.

One requirement is that the state or local air quality agency provide adequate documentation to show that the exceedances were caused by natural events and are therefore to be noted as such in the EPA Aerometric Information Retrieval System (AIRS). The state or local air quality agency must also document that Best Available Control Measures (BACM) were required for anthropogenic sources of wind-generated dust, and that the sources were in compliance with BACM requirements at the time of the event. The primary purpose of this report is to meet these requirements for documentation of PM₁₀ exceedances, which occurred during the period July 2001 through September 2001.

BACKGROUND

Doña Ana County is located in south-central New Mexico, bordering El Paso County, Texas, and the state of Chihuahua, Mexico to the south. Of Doña Ana County's 3804 square miles, approximately 75% is federal land and 12% is state land, with the remainder privately held. The area within the county's boundaries is topographically diverse and includes mountain ranges, hills, valleys and deserts (see figure 1). The elevation range for the county is 3730 feet to 9012 feet. The Rio Grande runs the length of the county from the northwest corner to the south-central border where New Mexico, Texas and Mexico come together. The Rio Grande meanders through the fertile soils of the Rincon (northern) and Mesilla (southern) Valleys. The primary population areas are located within the Mesilla Valley, with the Las Cruces City limits extending to the east plateau below the Organ Mountains. The Organ Mountains toward the eastern side of the county separate the Mesilla Valley from White Sands Missile Range and White Sands National Monument. The western edge of the county tops out of the valley on a wide-open desert plateau.

The climate is generally mild and semiarid, averaging 350 days of clear weather annually. Annual precipitation averages 8.5 inches of rainfall and 3 inches of snowfall. Prevailing winds are generally southwesterly. Windstorms are common during the late winter and through the spring months. It is due to these high velocity winds that Doña Ana County experiences most of the particulate matter exceedances for the area. A handful of the windstorms encountered over the years in Doña Ana County have been associated with the entire southwestern U.S. region.

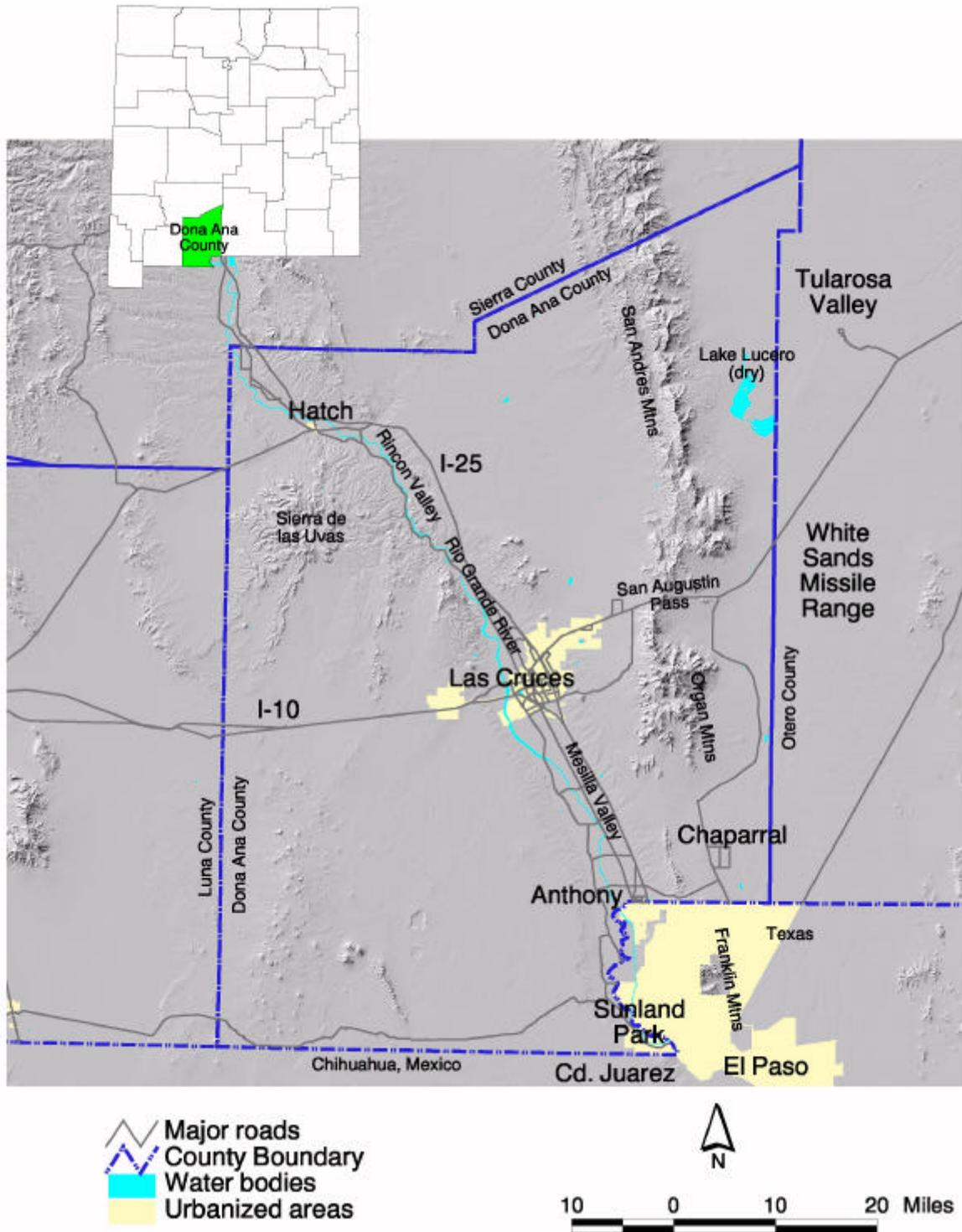


Figure 1. Doña Ana County with major landmarks, mountains and towns.

The primary areas of growth have been and continue to be in the Las Cruces metropolitan area and the southern portion of the county. While rapid population growth has occurred around the city of Las Cruces (central) and in the southern section of the county, the northern portion of the county remains primarily rural.

Doña Ana County is the second most populated county in the state of New Mexico. The county seat, Las Cruces, has been ranked as one of the fastest growing communities in the United States for the past decade. Between the years 1990 and 2000, the population in Doña Ana County increased by 28.9%. Population growth is expected to continue at a rapid pace (4-6%) during the next 20 years, and the county is anticipated to have more than 300,000 people by 2015.

BEST AVAILABLE CONTROL MEASURES

Doña Ana County, New Mexico, experienced numerous exceedances of the 24-hour National Ambient Air Quality Standard for Particulate Matter 10 microns or less (PM₁₀), recorded during 1994-1997 by monitors operated by the Air Quality Bureau (AQB) of the New Mexico Environment Department (NMED). Since the number of days with exceedances was more than the number allowed by the standard, the county is in violation of the PM₁₀ National Ambient Air Quality Standard (NAAQS). The Air Quality Bureau's analysis of wind data and other information regarding conditions during the exceedances indicated that all but a few were caused by high winds, which lift and carry dust from exposed dry soil. In response to Doña Ana County's exceedances of the PM₁₀ NAAQS, the New Mexico Air Quality Bureau, in conjunction with the City of Las Cruces Planning Department, the Doña Ana County Community Development Department, community stakeholders, and other agencies developed a Natural Events Action Plan (NEAP) for the Doña Ana County area.

The NEP set forward procedures for the development of a Natural Events Action Plan (NEAP) for protecting public health in areas where the PM₁₀ standard may be violated due to uncontrollable natural events. The policy requires that NMED provide documentation to demonstrate that exceedances of the standard were caused by high-wind events. As part of this documentation, for those exceedances that were caused by high-wind events where the sources of dust are anthropogenic, NMED must document that BACM were required for those types of sources and in place at the time of the recorded exceedance.

One of the requirements of the NEP is to abate or minimize appropriate contributing controllable sources of PM₁₀. Programs to minimize PM₁₀ emissions from high winds include the application of BACM to any sources of soil that have been disturbed by anthropogenic activities. To ensure the use of BACM by anthropogenic sources during high-wind events, the City of Las Cruces and Doña Ana County both passed erosion/dust control ordinances, which require the use of BACM. The goal of both the local and county ordinances is to prevent, limit, or mitigate the effects of activities that create fugitive dust or have a tendency to make land more vulnerable to natural erosion that creates fugitive dust.

Along with the use of local and county ordinances, the NMED worked with identified primary stakeholders to take voluntary steps to reduce PM₁₀ from property and facilities that they control.

These primary stakeholders, due to federal ruling, must comply with local applicable ordinances. However, enforceability is ambiguous on federal and state owned installations, therefore reassurance was sought through stakeholder agreements.

To ensure that BACM was required and in place for anthropogenic sources during the recorded PM₁₀ exceedances from high-wind events during the period of July 2001 through September 2001, the City of Las Cruces and Doña Ana County have submitted letters to NMED stating that code enforcement officers have been informed of the local ordinances, and are currently enforcing those ordinances. Primary stakeholders with agreements with NMED have also submitted letters stating that control measures have been implemented as stated in their stakeholder agreement (see Appendix 1).

DOCUMENTATION AND ANALYSIS OF EXCEEDANCES

The state Air Quality Bureau operates a network of monitoring stations to measure the concentration of criteria pollutants, one of which is particulate matter. The Bureau maintains seven PM₁₀ monitors and five PM_{2.5} monitors throughout the County (see figure 2 for monitor locations). Monitoring sites are selected according to a variety of factors. Many are set up in population centers, where many people could be exposed should high levels of pollution occur. Others are in areas where pollutant levels are likely to be high. Monitoring data is tracked and the reasons investigated behind any exceedance that occurs. This monitoring data is then compiled and submitted to EPA.

In New Mexico, the state Environment Department's Air Quality Bureau is responsible for identifying exceedances of the NAAQS caused by high winds. The Bureau must first mark the exceedances due to high winds with a special notation (called a "flag") in EPA's national database of ambient air monitoring data. Then the Bureau must prepare a document clearly showing, by analysis of weather data and other information, that the exceedances would not have occurred if not for the high wind events. The state's documentation of these high wind events and their impact on air quality must be made available to the public. The public may review and comment on whether the documentation convincingly shows a causal relationship between the high wind events and the exceedances.

Analysis and documentation of high-wind events should show a clear causal relationship between the measured exceedance and the natural event. The type and amount of documentation provided should be sufficient to demonstrate that the natural event occurred, and that it impacted a particular monitoring site in such a way as to cause the PM₁₀ concentrations measured.

DOCUMENTATION FROM JULY 2001-SEPTEMBER 2001

PM₁₀ and PM_{2.5} monitoring sites in Doña Ana County are listed in Table 1. A list of the PM₁₀ exceedances documented in this report as having been caused by high wind is given in Table 2. There were no exceedances of the 24-hr PM_{2.5} standard during July 2001 - September 2001.

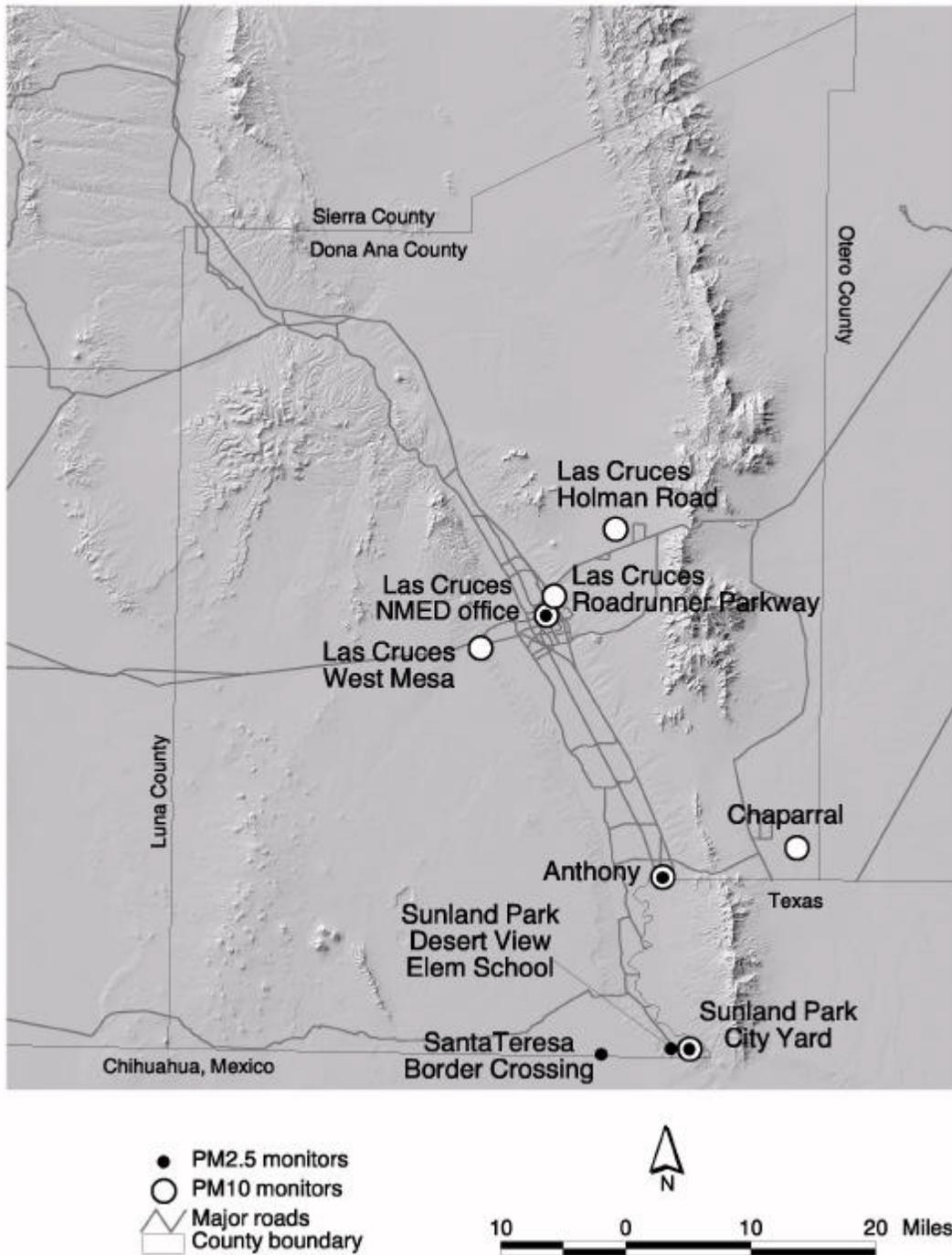


Figure 2. PM₁₀ and PM_{2.5} monitors operated by the NMED Air Quality Bureau. Note that PM₁₀ monitoring ended in 1998 at the Santa Teresa Border Crossing and Sunland Park Desert View Elementary School sites.

Table 1. PM₁₀ and PM_{2.5} monitoring sites in Doña Ana County; only Wedding monitor at Las Cruces, all others with continuous (TEOM) monitor.

Site Name	PM ₁₀	PM _{2.5}	AIRS Number	Lat (d-m-s)	Long (d-m-s)
Roadrunner	✓	...	35-013-0018	32-20-30.64	106-45-37.07
Holman*	✓	...	35-013-0019	32-25-29.69	106-40-26.62
Chaparral*	✓	...	35-013-0020	32-02-27.48	106.24-33.09
Anthony	✓	✓	35-013-0016	32-00-11.54	106-35-57.67
Sunland Park*	✓	...	35-013-0017	31-47-49.91	106-33-24.17
Desert View*	...	✓	35-013-0021	31-47-46.32	106-35-02.13
Santa Teresa*	...	✓	35-013-0022	31-47-15.77	106-40-58.36
La Union**	35-013-0008	31-55-06.03	106-37-58.99
West Mesa*	✓	...	35-013-0024	32-16-39.9	106-51-49.68
Las Cruces	✓	...	35-013-1006	32-19-08	106-46-16

* meteorological monitoring at these sites

** meteorological monitoring data is used for comparison with Anthony PM₁₀

The Las Cruces site (AIRS number 35-013-1006) is not listed in Table 2 because it did not record any exceedances during the period covered by this report. The Las Cruces site is the only site in the county which uses only a Wedding-type monitor instead of a continuous TEOM-type monitor, and monitoring is usually on an every-sixth-day schedule.

Table 2. PM₁₀ exceedances documented in this report as resulting from high wind. Values are 24-hour average PM₁₀ concentrations in micrograms per cubic meter. Values greater than 150 (after rounding to the nearest 10) micrograms per cubic meter are exceedances of the standard.

DATE	SITE					
	Roadrunner	Holman	West Mesa	Chaparral	Anthony	Sunland Park
2001						
9-Jul	254	159	206			
10-Jul	217	170	239	191	237	213
16-Jul	180					

Where necessary and feasible, hourly and 24-hr average PM₁₀ values have been corrected for errors caused by short-term saturation of the data logger recording system. Short-term periods of high PM₁₀ concentration sometimes exceed the maximum recordable value of the data logger which stores and reports the data from TEOM-type monitors. The monitor's own recording system, which is independent of the data logger, has a capacity for greater short-term values and is not affected by this problem. When hourly and daily averages were found to be derived from data affected by this problem, corrected averages were calculated by substituting hourly average data from the monitor's own recording system for the affected hourly data.

Features of Doña Ana County's natural environment that are conducive to wind erosion and windblown dust generation when high winds occur are: aridity, sparse vegetation cover, and large areas of highly wind-erodible soil. In previous documentation (Aaboe, 1997), these factors were discussed in detail and a variety of evidence was presented to support the conclusion that PM₁₀ exceedances were caused by high winds: wind roses, newspaper reports, time-lapse video photography, and time series plots of hourly PM₁₀ concentration and wind speed (Aaboe, 1997).

Typical high-wind exceedances

Most of the high-wind exceedances in this region occur in late winter and spring during regional-scale high wind events associated with the passage of cold fronts. For such events, the most compelling evidence that exceedances are caused by high wind is the co-occurrence in time of high winds and high PM₁₀ concentrations as demonstrated by time series plots of PM₁₀ and wind speed as hourly average and peak gust. The typical pattern for these regional-scale high wind events is: an abrupt rise in PM₁₀ concentrations when wind speed rises above some threshold value, an equally abrupt fall in PM₁₀ when wind speed falls below the apparent threshold, and maximum hourly PM₁₀ concentration usually occurring in the same hour as maximum wind speed.

In the summer months covered by this report, regional-scale high wind events are rare, and high levels of windblown dust are more often caused by strong downdrafts and outflow from convective thunderstorms. Dust-generating high winds are therefore more localized and variable over the region, and dust clouds generated in one area can be carried to other areas by lower-speed winds. The temporal and spatial correlation of high winds and high PM₁₀ levels is therefore often not as strong as in the regional-scale wind storms typical of the cool half of the year.

The July 16th exceedance at the Roadrunner site follows the typical pattern (see Appendix 2), with high PM₁₀ levels occurring at the same time as high winds (hourly average greater than 6 meters per second).

Dust episodes of July 9-10, 2001

On July 9 and 10, the relation between wind and PM₁₀ is more complex. Because high PM₁₀ levels extended from the late evening of July 9th into the morning hours of July 10th, wind speed and PM₁₀ are plotted for the continuous 48 hours beginning midnight July 9th (see Appendix 2).

There were two episodes of high PM₁₀ during the 48 hours of July 9-10. The first occurred during the late afternoon (1500-1700 hrs) of July 9th, and was associated with high winds at most sites. The second episode began around 1900-2300 hrs on July 9th, peaked soon thereafter, and continued with high but generally decreasing values until around noon on July 10th. Windspeeds during this second episode were not high enough to raise windblown dust in the vicinity of the monitoring sites. The second episode was of sufficient magnitude and duration to cause exceedances at all sites on July 10th. The exceedances recorded at some sites on July 9th resulted from the combination of the late-afternoon peak and the early hours of the second episode.

We have concluded that the high PM₁₀ levels of the late evening of July 9th and the morning of July 10th were caused by windblown dust raised by thunderstorm-generated winds earlier in the evening and primarily in areas of adjacent Mexico. In support of this conclusion, we cite the following statement by Max Blood, Meteorologist in Charge at the El Paso Area office of the National Weather Service. In response to our inquiry about possible causes of the high PM₁₀ levels of the morning of July 10th, Mr. Blood wrote:

"The dust clouds experienced in southern Dona Ana County on the evening of July 9 through midday on July 10 had their origins in northern Mexico. There were several thunderstorms in northern Mexico that created local high winds due to evaporative cooling referred to as dry microbursts. These microbursts in northern Mexico created large areas of dust which drifted into southern Dona Ana County. Northern Mexico has had very little rain this year so that the amount of wind needed to fill the air with dust is not great. The dust was suspended in the air for a longer than usual time due to the general instability of the air mass on those days.

A haze covered the Mesilla Valley in southern New Mexico starting on July 9. On July 10 in the early morning, the visibility was only three miles. By 11 am, it had improved to 5-7 miles. The local wind gusts in southern Dona Ana County were in the 10-meter per second range, much lower than what usually accompanies dust storms where the dust is picked up locally."

Other supporting data are given in Appendix 2. A GOES visible-wavelength image taken on the afternoon of July 9th (1400 hrs MST) shows a large area of thunderstorms south of Doña Ana County, extending from south of the western boundary of New Mexico eastward to extreme western Texas. Several other large individual storm cells are visible in the vicinity. Also included in Appendix 2 is a National Weather Service area forecast discussion for July 9th indicating the probability of scattered thunderstorms.

REFERENCES

Aaboe, Erik. 1997. Analysis of PM₁₀ Exceedances, January 1995 – March 1997, Doña Ana County, New Mexico. Report published by Air Quality Bureau, New Mexico Environment Department.