Technical Support Document
For the
March 30, 2014
Alamosa Exceptional Event

Prepared by the Technical Services Program
Air Pollution Control Division
Colorado Department of Public Health and Environment

May 5, 2016

Executive Summary

In 2005, Congress identified a need to account for events that result in exceedances of the National Ambient Air Quality Standards (NAAQS) that are exceptional in nature[1] (e.g., not expected to reoccur or caused by acts of nature beyond man-made controls). In response, EPA promulgated the Exceptional Events Rule (EER) to address exceptional events in 40 CFR Parts 50 and 51 on March 22, 2007 (72 FR 13560). On May 2, 2011, in an attempt to clarify this rule, EPA released draft guidance documents on the implementation of the EER to State, tribal and local air agencies for review. The EER allows for states and tribes to "flag" air quality monitoring data as an exceptional event and exclude those data from use in determinations with respect to exceedances or violations of the NAAQS, if EPA concurs with the demonstration submitted by the flagging agency.

Due to the semi-arid nature of parts of the state, Colorado is highly susceptible to windblown dust events. These events are often captured by various air quality monitoring equipment throughout the state, sometimes resulting in exceedances or violations of the 24-hour PM_{10} NAAQS. This document contains detailed information about the large regional windblown dust event that occurred on March 30, 2014. The Colorado Department of Public Health and Environment (CDPHE) Air Pollution Control Division (APCD) has prepared this report for the U.S. Environmental Protection Agency (EPA) to demonstrate that the elevated PM_{10} concentrations were caused by a natural event.

EPA's June 2012 draft Guidance on the Preparation of Demonstrations in Support of Requests to Exclude Ambient Air Quality Data Affected by High Winds under the Exceptional Events Rule states "the EPA will accept a threshold of a sustained wind of 25 mph for areas in the west provided the agencies support this as the level at which they expect stable surfaces (i.e., controlled anthropogenic and undisturbed natural surfaces) to be overwhelmed…". In addition, in both eastern and western Colorado it has been shown that wind speeds of 30 mph or greater and gusts of 40 mph or greater can cause blowing dust (see the Lamar, Colorado, Blowing Dust Climatology at http://www.colorado.gov/airquality/tech_doc_repository.aspx). For these blowing dust events, it has been assumed that sustained winds of 30 mph and higher or wind gusts of 40 mph and higher can cause blowing dust in Colorado and the surrounding states.

The PM_{10} exceedance in Alamosa on March 30, 2014, would not have occurred if not for the following: a) dry soil conditions over source regions with 30-day precipitation totals below the threshold identified as a precondition for blowing dust; and (b) meteorological conditions that caused strong surface winds over the area of concern. This PM_{10} exceedance was due to an exceptional event associated with regional windstorm-caused emissions from erodible soil sources outside the monitored areas. These sources are not reasonably controllable during significant windstorms under abnormally dry or moderate drought conditions.

APCD is requesting concurrence on exclusion of the PM_{10} values from the Alamosa Adams State College (08-003-0001) and Alamosa Municipal Building (08-003-0003) monitors on March 30, 2014.

[1] Section 319 of the Clear Air Act (CAA), as amended by section 6013 of the Safe Accountable Flexible Efficient-Transportation Equity Act: A Legacy for Users (SAFE-TEA-LU of 2005, required EPA to propose the Federal Exceptional Events Rule (EER) no later than March 1, 2006.

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1.0 Exceptional Events Rule Requirements

In addition to the technical requirements that are contained within the EER, procedural requirements must also be met in order for EPA to concur with the flagged air quality monitoring data. This section of the report lays out the requirements of the EER and discusses how the APCD addressed those requirements.

1.1 Procedural Criteria

This section presents a review of the procedural requirements of the EER as required by 40 CFR 50.14 (Treatment of Air Quality Monitoring Data Influenced by Exceptional Events) and explains how APCD fulfills them.

The Federal EER requirements include public notification that an event was occurring, the placement of informational flags on data in EPA's Air Quality System (AQS), submission of initial event description, the documentation that the public comment process was followed, and the submittal of a demonstration supporting the exceptional events flag. APCD has addressed all of these procedural and documentation requirements.

Public notification that event was occurring (40 CFR 50.14(c)(1)(i))
APCD issued a Blowing Dust Advisory for southwestern, southern and southeastern Colorado advising citizens of the potential for high wind/dust on March 30, 2014. The cities impacted included: Grand Junction, Montrose, Delta, Durango, Pagosa Springs, Cortez, Alamosa, Colorado Springs, Pueblo, Ordway, La Junta, Las Animas, and Springfield. The advisory that was issued on March 30, 2014 can be viewed at: http://www.colorado.gov/airquality/report.aspx and is described further in Section 2.

Place informational flag on data in AQS (40 CFR 50.14(c)(2)(ii))
APCD and other applicable agencies in Colorado submit data into EPA's AQS. Data from both filter-based and continuous monitors operated in Colorado are submitted to AQS.

When APCD and/or the Primary Quality Assurance Organization operating monitors in Colorado suspects that data may be influenced by an exceptional event, APCD and/or the other operating agency expedites analysis of the filters collected from the potentially-affected filter-based air monitoring instruments, quality assures the results and submits the data into AQS. APCD and/or other operating agencies also submit data from continuous monitors into AQS after quality assurance is complete.

If APCD and/or the applicable operating agency have determined a potential exists that the sample value has been influenced by an exceptional event, a preliminary flag is submitted with the measurement when the data are uploaded to AQS. The data are not official until they are certified by May 1st of the year following the calendar year in which the data were collected (40 CFR 58.15(a)(2)). The presence of the flag with a date/time stamp can be confirmed in AQS.

Notify EPA of intent to flag through submission of initial event description by July 1 of calendar year following event (40 CFR 50.14(c)(2)(iii))
In early 2011, APCD and EPA Region 8 staff agreed that the notification of the intent to flag data as an exceptional event would be done by submitting data to AQS with the proper flags and the initial event descriptions. This was deemed acceptable, since Region 8 staff routinely pull the data to review for completeness and other analyses.

On March 30, 2014, sample values greater than 150 µg/m^3 were taken in Alamosa, Colorado during the high wind event that occurred on that day. These high values were taken at the monitors located in Alamosa at Adams State College (SLAMS) and the Municipal Building (SLAMS). Both of these monitors are operated by APCD in partnership with local operators.

Document that the public comment process was followed for event documentation (40 CFR 50.14(c)(3)(iv))
APCD posted this report on the Air Pollution Control Division's webpage for public review. APCD opened a 30-day public comment period on May 5, 2016 and closed comments on June 6, 2016. A copy of the public notice certification (in cover letter), along with any comments received, will be submitted to EPA, consistent with the requirements of 40 CFR 50.14(c)(3)(iv).

Submit demonstration supporting exceptional event flag (40 CFR 50.14(a)(1-2))
At the close of the comment period, and after APCD has had the opportunity to consider any comments submitted on this document, APCD will submit this document, along with any comments received (if applicable), and APCD's responses to those comments to EPA Region VIII headquarters in Denver, Colorado.

1.2 Documentation Requirements

Section 50.14(c)(3)(iv) of the EER states that in order to justify excluding air quality monitoring data, evidence must be provided for the following elements:

a. The event satisfies the criteria set forth in 40 CFR 501(j) that:
   (1) the event affected air quality,
   (2) the event was not reasonably controllable or preventable, and
   (3) the event was caused by human activity unlikely to recur in a particular location or was a natural event;
b. There is a clear causal relationship between the measurement under consideration and the event;
c. The event is associated with a measured concentration in excess of normal historical fluctuations; and
d. There would have been no exceedance or violation but for the event.

2.0 Meteorological analysis of the March 30, 2014, blowing dust event and PM_{10} exceedances – Conceptual Model and Wind Statistics

On March 30, 2014, a powerful spring storm system caused an exceedance of the 24-hour PM_{10} standard in Alamosa, Colorado at the Municipal Building (08-003-0003) monitor with a concentration of 201 $\mu g/m^3$ and at the Adams State College (08-003-0001) monitor with a concentration of 172 $\mu g/m^3$. These elevated readings and the location of the monitors are plotted on a map of the Greater Alamosa area in Figure 1. The exceedance in Alamosa was the result of intense surface winds in advance of an approaching cold front. The surface features were associated with a strong upper-level trough that was moving across the western United States. The surface winds were predominantly out of a southwesterly direction which moved over dry soils in southern Colorado and northern New Mexico, producing significant blowing dust.

EPA's June 2012, Draft Guidance on the Preparation of Demonstrations in Support of Requests to Exclude Ambient Air Quality Data Affected by High Winds under the Exceptional Events Rule states, "the EPA will accept a threshold of a sustained wind of 25 mph for areas in the west provided the agencies support this as the level at which they expect stable surfaces (i.e., controlled anthropogenic and undisturbed natural surfaces) to be overwhelmed…". In addition, in Colorado it has been shown that wind speeds of 30 mph or greater and gusts of 40 mph or greater can cause blowing dust (see the Lamar, Colorado, Blowing Dust Climatology at http://www.colorado.gov/airquality/tech_doc_repository.aspx). For this blowing dust event, it has been assumed that sustained winds of 30 mph and higher or wind gusts of 40 mph and higher can cause blowing dust in the San Luis Valley of south-central Colorado.

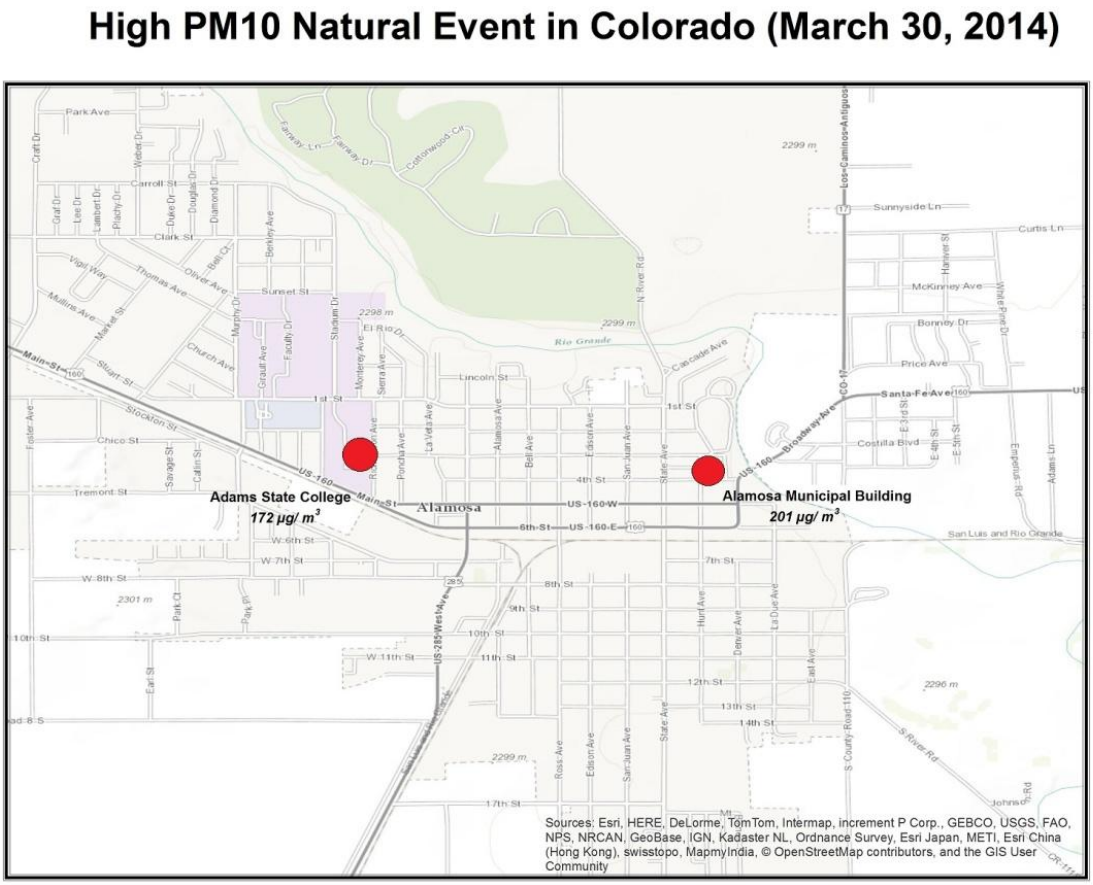


Figure 1: 24-hour PM_{10} concentrations for March 30, 2014.
(Source: http://webapps.datafed.net/datafed.aspx?dataset=AQS_D&parameter=pm10)

The upper-level trough associated with this storm system is shown on the 700 mb and 500 mb height analysis maps at 5:00 AM MST, March 30, 2014 in Figure 2 and Figure 3, respectively. The 700 mb level is located roughly 3 kilometers (km) above mean sea level (MSL) while the 500 mb level is approximately 6 km above MSL. These two charts show that a deep trough of low pressure was present at both the 700 and 500 mb level in the hours preceding the blowing dust event on March 30 and that it was moving over the western United States. This is a typical upper-air pattern for blowing dust events in Colorado (see the Technical Support Document for the April 3, 2011 Alamosa and Lamar Exceptional Event at http://www.colorado.gov/airquality/tech_doc_repository.aspx).

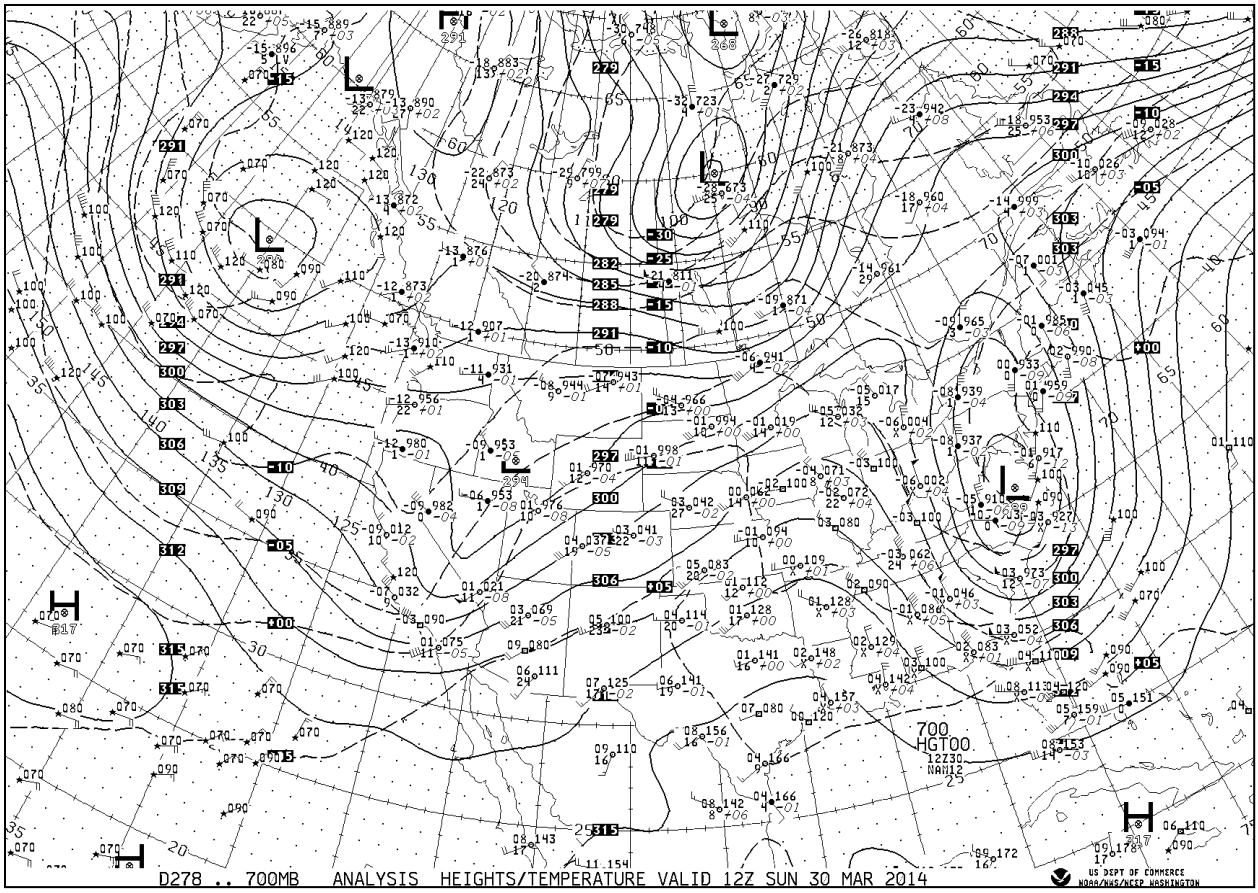


Figure 2: 700 mb (about 3 kilometers above mean sea level) analysis for 12Z March 30, 2014, or 5:00 AM MST March 30, 2014.
(Source: http://nomads.ncdc.noaa.gov/ncep/NCEP)

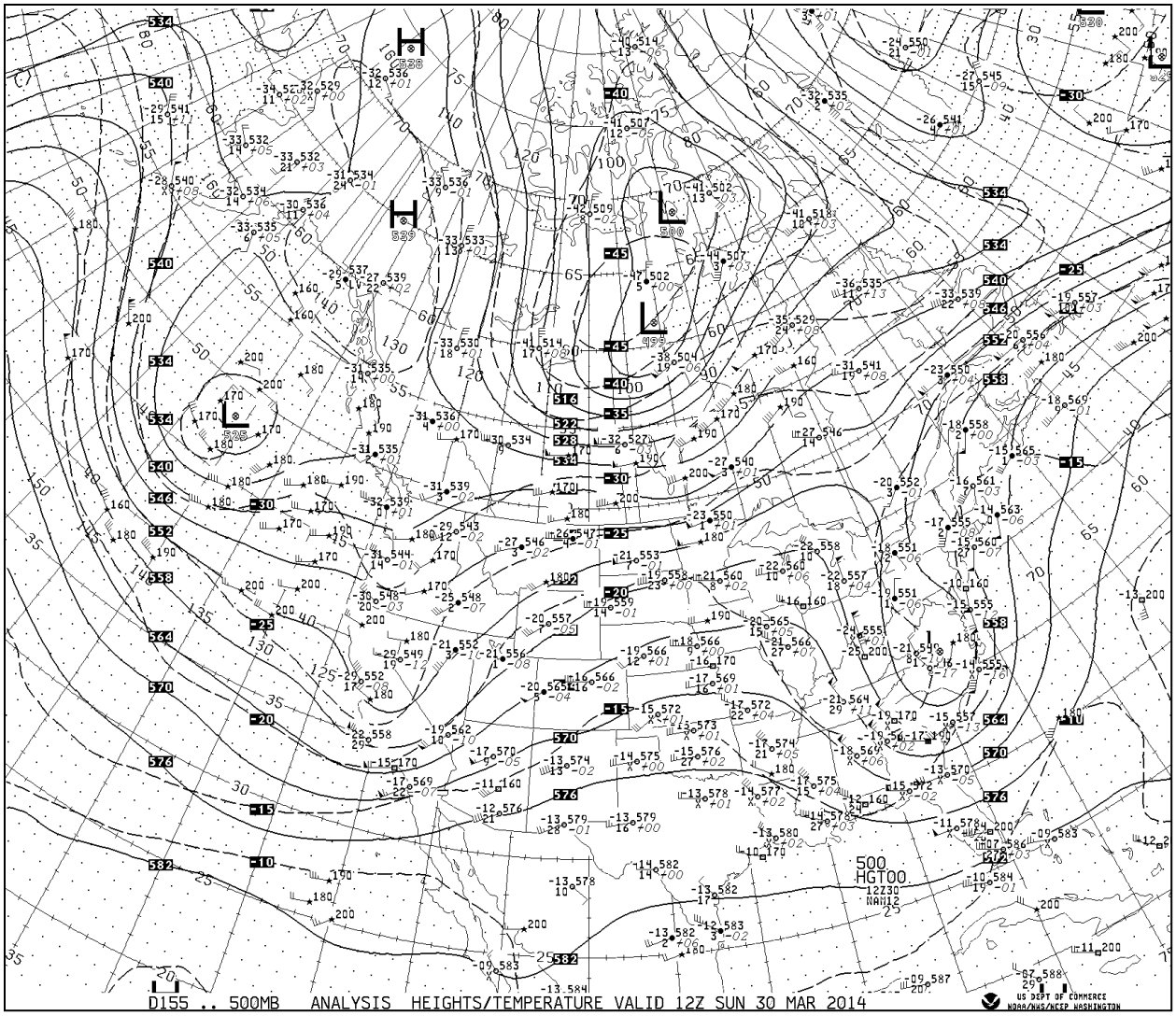


Figure 3: 500 mb (about 6 kilometers above mean sea level) analysis for 12Z March 30, 2014, or 5:00 AM MST March 30, 2014.
(Source: http://nomads.ncdc.noaa.gov/ncep/NCEP)

The surface weather associated with the storm system of March 30, 2014, is presented in Figure 4. Significant surface features impacting southern Colorado at 2:00 PM MST (21Z) included a cold front in Utah and Arizona moving eastward toward Colorado and New Mexico. This front was associated with a strengthening area of surface low pressure that was located over the central Rockies. The winds in southern Colorado and northern New Mexico out ahead of this system were mainly out of a west to southwesterly direction and intensifying in speed during the afternoon hours of March 30, 2014.

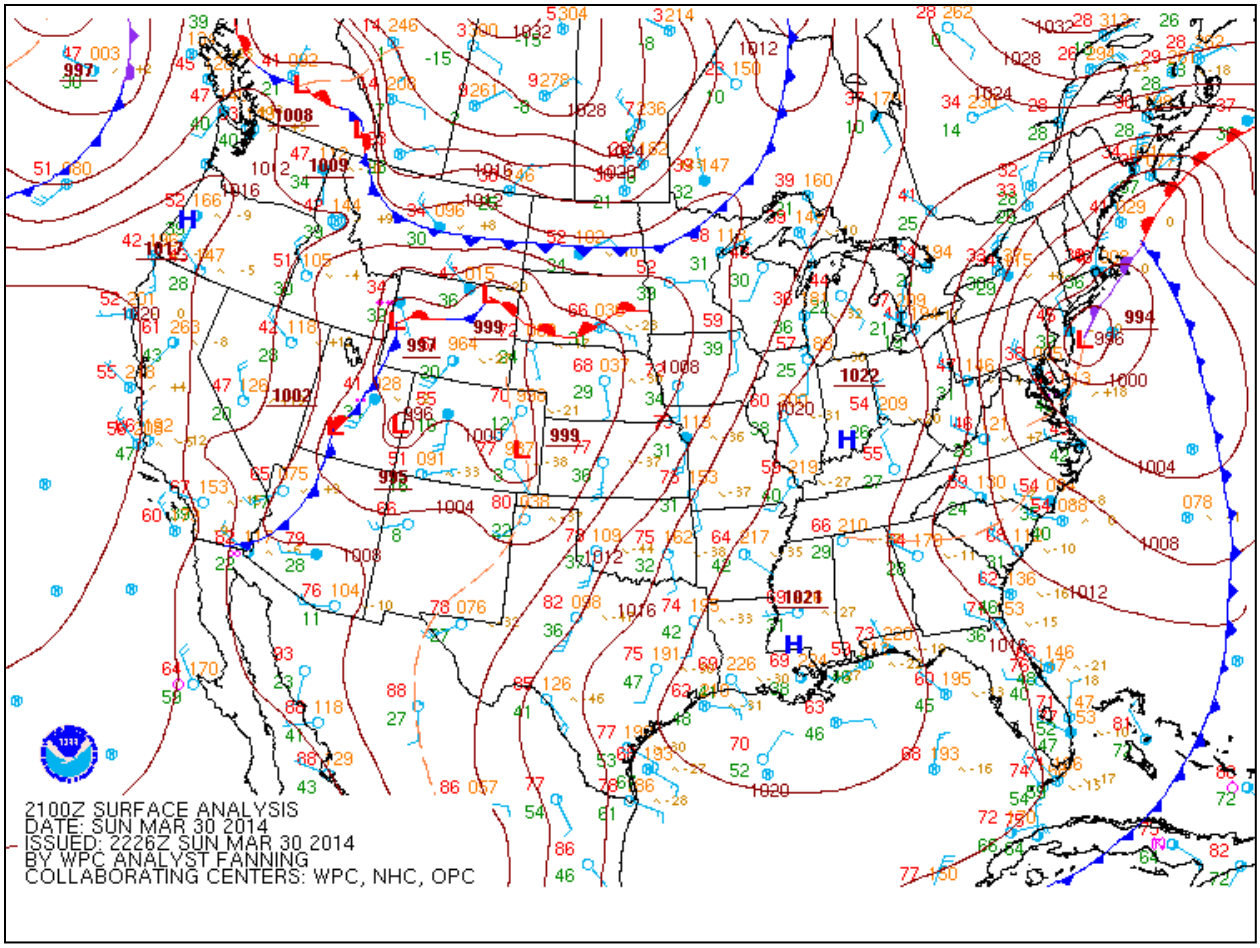


Figure 4: Surface analysis for 21Z March 30, 2014, or 2:00 PM MST March 30, 2014. (Source: http://nomads.ncdc.noaa.gov/ncep/NCEP)

In order to fully evaluate the synoptic meteorological scenario of March 30, 2014, a regional surface weather map is provided showing individual station observations during the height of the event in question. Figure 5 presents weather observations for southern Colorado and northern New Mexico at 5:00 PM MST on March 30. The station observation for Alamosa (ALS) shows three full flags indicating sustained winds of 30 knots (35 mph). Additionally, the observation includes the weather symbol of infinity (∞). The infinity sign is the weather symbol for haze. Haze is often reported during dust storms, and in dry and windy conditions haze typically refers to blowing dust (see the following link for the description of haze published by the National Oceanic and Atmospheric Administration (NOAA): http://www.erh.noaa.gov/er/box/glossary.htm). To the south of Alamosa in Albuquerque, New Mexico (ABQ), high winds were also being reported along with the weather symbol of the dollar sign ($). The dollar sign in meteorological observations is defined as "dust or sand raised by the wind at the time of the observation" (Source: http://oceanservice.noaa.gov/education/yos/resource/JetStream/synoptic/ww_symbols.htm). Reports of haze and blowing dust in both southern Colorado and northern New Mexico suggest that the dust storm of March 30 was regional in scale.

Hourly surface observations, in table form, from Alamosa and Albuquerque provide additional evidence that there was an extended period of high winds, reduced visibility, haze and

blowing dust within the region. Table 1 lists observations for the PM_{10} exceedance location of Alamosa while Albuquerque observations can be found in Table 2. Observations that are climatologically consistent with blowing dust conditions (see the Lamar Blowing Dust Climatology at http://www.colorado.gov/airquality/tech_doc_repository.aspx) are highlighted in yellow.

Surface weather maps and hourly observations show that a regional dust storm occurred under west to southwesterly flow in advance of a cold front. This data provides clear evidence of blowing dust and winds near or above the threshold speeds for blowing dust on March 30, 2014.

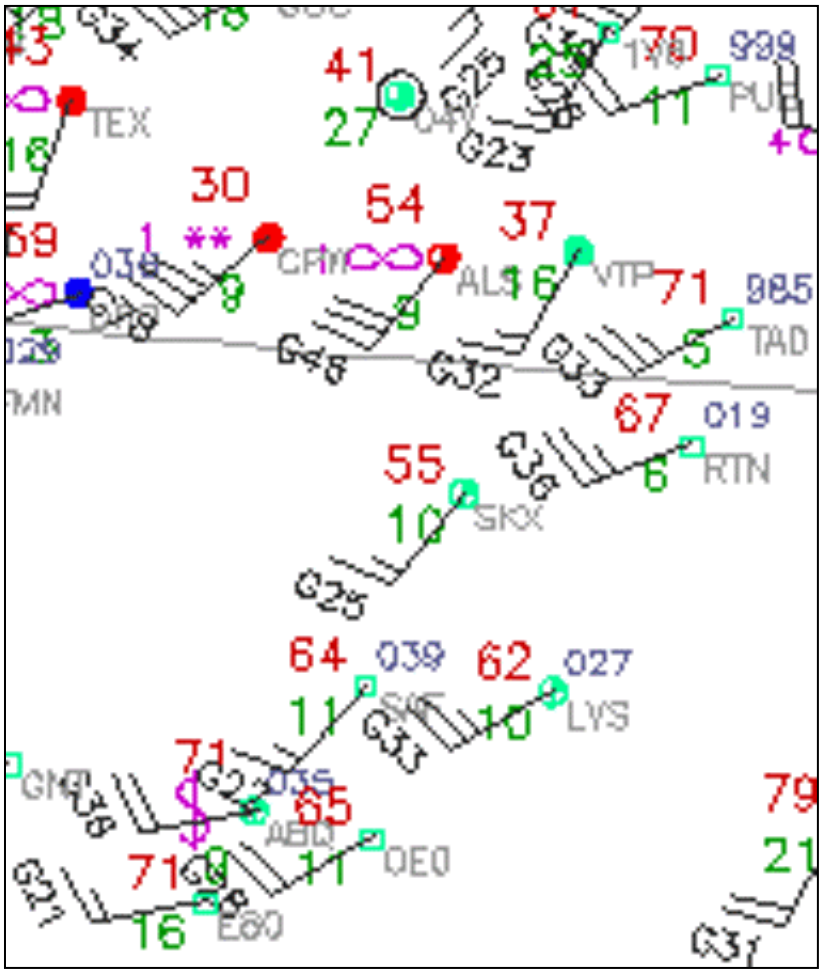


Figure 5: Regional surface analysis of southern Colorado and northern New Mexico at 5:43 PM MST, March 30, 2014.
(Source: http://weather.rap.ucar.edu/surface/)

Table 1: Weather observations for Alamosa, Colorado, on March 30, 2014. (Source: http://mesowest.utah.edu/)

Time MST March 30, 2014	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
7:52	40	36	4		20		10
8:52	53	18	21		190		10
9:52	55	15	18		180		10
10:52	59	12	22	30	220		10
11:06	60	11	22	29	210		10
11:52	61	11	24	41	230		10
12:12	61	11	29	52	240	haze	4
12:35	59	13	36	51	230	haze	1.75
12:42	58	13	32	46	240	haze	3
12:52	58	13	32	45	230	haze	5
13:52	55	17	25	38	230		10
14:52	56	14	22	31	200		10
15:34	54	18	31	48	220	haze	3
15:44	53	20	40	56	230	haze	1.5
15:52	52	22				haze	0.5
16:02	51	24	36	47	220	haze	2
16:10	51	24	24	41	220	haze	5
16:52	53	21	24	36	200		10
17:26	55	16				haze	1.5
17:36	54	16	35	53	220	haze	1
17:46	54	16	37	52	220	haze	3
17:52	54	15	31	52	230	haze	3
18:03	53	14	41	50	240	haze	2
18:09	53	14	32	50	230	haze	1.5
18:13	53	15	33	45	230	haze	3
18:52	51	15	36	45	210		8
19:52	49	13	22	36	240		10
20:52	47	22	35	48	230	haze	3
21:52	42	27	28	37	250		10
22:52	39	26	17		250		10

Table 2: Weather observations for Albuquerque, New Mexico, on March 30, 2014. (Source: http://mesowest.utah.edu/)

Time MST March 30, 2014	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
0:52	52	24	13		180		10
1:52	50	25	4		160		10
2:52	45	30	8		130		10
3:52	47	30	8		110		10
4:52	44	35	8		130		10
5:52	45	35	6		120		10
6:52	46	35	8		130		10
7:52	51	29	4		290		10
8:52	53	27	4		310		10
9:52	57	22	6		200		10
10:52	65	18	14	20	200		10
11:52	68	14	10		190		10
12:52	69	14	12	16	190		10
13:52	71	13	18	27	200		10
14:52	71	12	14	25	190		10
15:52	72	9	23	32	240		10
16:52	71	9	25	41	260	blowing dust	10
17:52	68	10	24	37	270		10
18:52	65	12	27	39	260		10
19:52	63	11	22	37	240		10
20:52	60	12	21		250		10
21:52	57	12	14		270		10
22:52	56	16	15		280		10
23:52	54	19	18	28	290		10

Unfortunately, extensive cloud cover hindered any type of satellite detection of blowing dust in the San Luis Valley on March 30, 2014. However, web cam imagery from Great Sand Dunes National Park (about 25 miles northeast of Alamosa) does appear to have captured blowing dust during the late afternoon hours of March 30. Figure 6(a) shows a considerable amount of airborne dust with the horizon highly obscured at 5:57 PM MST. By referring back to Table 1, at this time period Alamosa was reporting sustained winds of 31-41 mph, gusts of 50-52 mph with haze and visibility highly reduced at 2-3 statute miles. This strongly suggests that a dust storm was taking place in the San Luis Valley at this time. For comparison purposes, a webcam image of Great Sand Dunes National Park is provided in Figure 6(b) during relatively calm weather (sustained winds of 16 mph, gusts to 22 mph and visibility of 10 statute miles) at approximately the same time of day and year (6:07 PM MST, March 29, 2013).

The National Oceanic and Atmospheric Administration (NOAA) Satellite Services Division was in agreement with the conclusion that a regional blowing dust event was occurring, including in southwest Colorado, on March 30. The text product also suggested that the blowing dust may have been located even further to the east, which would have included the San Luis Valley. The Smoke Text Product from NOAA at 7:15 PM MST stated:

> "A large amount of blowing dust could be seen in GOES imagery this evening over northwest Mexico, southern California, Arizona, northwest New Mexico, southeast Utah, and southwest Colorado before the dust disappeared beneath clouds along the Continental Divide." (Source: http://www.ssd.noaa.gov/PS/FIRE/DATA/SMOKE/2014/2014C310220.html)

The Colorado Department of Public Health and Environment (CDPHE) and National Weather Service (NWS) office in Pueblo both anticipated high winds and blowing dust on March 30, 2014. The CDPHE issued a Blowing Dust Advisory for most of southern Colorado, including the San Luis Valley. Text from the 2:00 PM MST advisory included:

> "Strong gusty winds will bring a threat for blowing dust to portions of southwestern, southern and southeastern Colorado." (Source: http://www.colorado.gov/airquality/forecast_archive.aspx?seeddate=03%2f30%2f2014)

The Pueblo NWS Aviation Forecast at 1:50 PM MST stated:

> "VFR conditions are expected tonight and Monday at KCOS…KPUB and KALS (Alamosa METAR station)…however gusty westerly winds could at times cause blowing dust to reduce the vsby." (Source: http://mesonet.agron.iastate.edu/wx/afos/)

Webcam imagery combined with reports and advisories from government agencies on March 30, 2014 clearly reveal that a dust storm was taking place in the San Luis Valley of south-central Colorado.

a)

b)

Figure 6: Great Sand Dunes National Park webcam image at a) 5:57 PM MST March 30, 2014, and b) 6:07 PM MST March 29, 2013.
(Source: http://www.wunderground.com/webcams/shauntanner/23/show.html#cal)

In order to definitively attribute at least a portion of the dust deposition in Alamosa to long-range transport and establish that the March 30, 2014 storm was a regional event, a NOAA HYSPLIT backward trajectory analysis (Draxler and Rolph, 2012) was conducted (Figure 7). The analysis includes 7-hour duration back trajectories from Alamosa for the time period of 12:00 PM MST to 9:00 PM MST. This encompasses the time period of the highest winds and reduced visibility observations recorded in Alamosa on March 30 (Table 1, also see the following link for more information on HYSPLIT from the NOAA Air Resources Laboratory: http://www.arl.noaa.gov/HYSPLIT_info.php). The trajectory analysis clearly shows the transport of air from south-central Colorado, but also much further southwestward from northwest New Mexico and northeast Arizona.

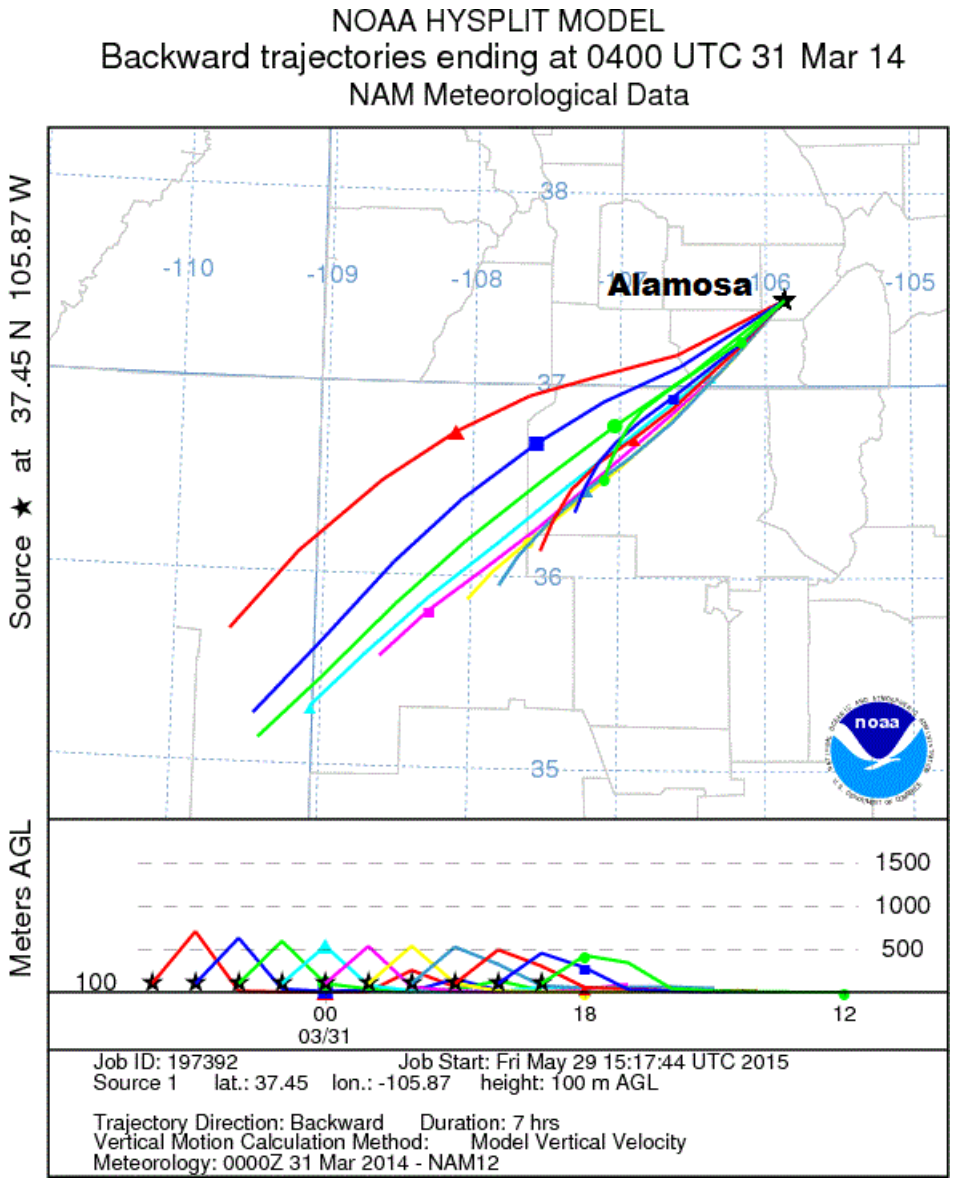


Figure 7: NOAA HYSPLIT NAM12 7-hour back-trajectories for Alamosa, CO for 12:00 PM MST (19Z) March 30, 2014, to 9:00 PM MST (4Z March 31) March 30, 2014. (Source: http://ready.arl.noaa.gov/HYSPLIT.php)

The synoptic weather conditions described above impacted a region that was experiencing abnormally dry weather, with moderate to severe drought conditions reported for those areas upwind of Alamosa in northwest New Mexico and northeast Arizona (Figure 8). Sustained drought conditions are known to make topsoil susceptible to high winds and produce blowing dust (see the following link from the National Climatic Data Center for more information: https://www.ncdc.noaa.gov/paleo/drought/drght_history.html). Figure 9 shows the total precipitation in inches from February 28, 2014 to March 29, 2014 for southern Colorado and northern New Mexico. Based on previous research 0.5 to 0.6 inches of precipitation over a 30-day period has been found to be the approximate threshold, below which, blowing dust exceedances are more likely to occur in Colorado when combined with high winds (see the Lamar Blowing Dust Climatology at http://www.colorado.gov/airquality/tech_doc_repository.aspx). Note that the vast majority of the San Luis Valley surrounding Alamosa, including in the upwind direction to the southwest, received less than 0.51 inches of precipitation during the 30-day period leading up to the March 30, 2014 dust event.

The U.S. Drought Monitor and 30-day precipitation totals indicate that soils in southern Colorado and northern New Mexico were dry enough to produce blowing dust when winds were at or above the thresholds for blowing dust. This information, combined with other evidence provided in this report, proves that this dust storm was a natural, regional event that was not reasonably controllable or preventable.

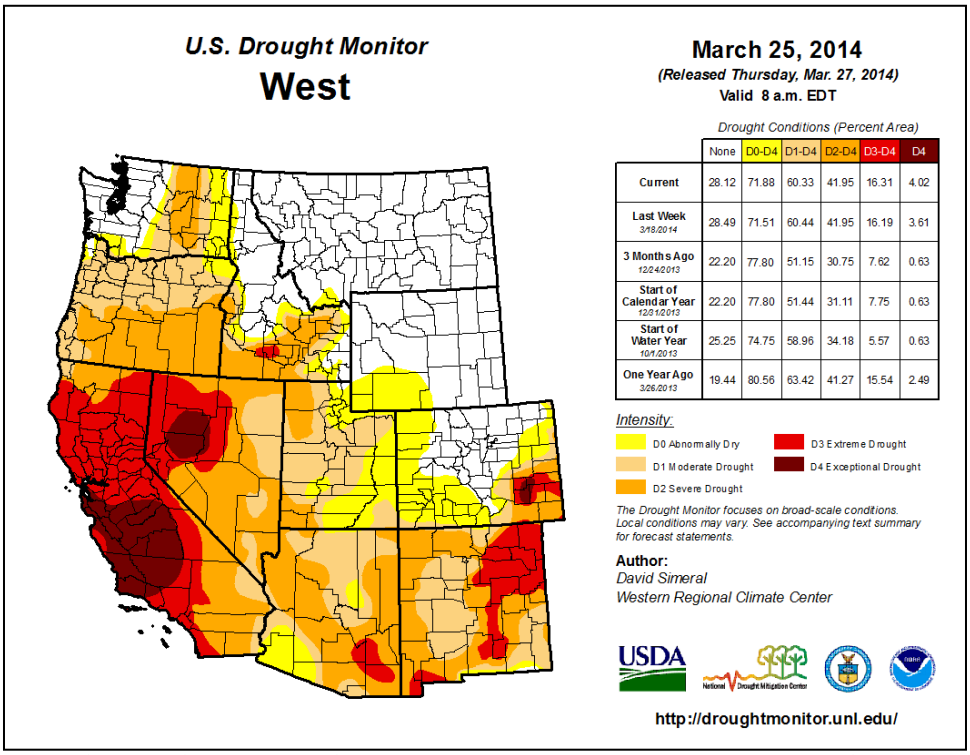


Figure 8: Drought conditions for the Western U.S. at 5:00 AM MST March 25, 2014. (Source: http://droughtmonitor.unl.edu/MapsAndData/MapArchive.aspx)

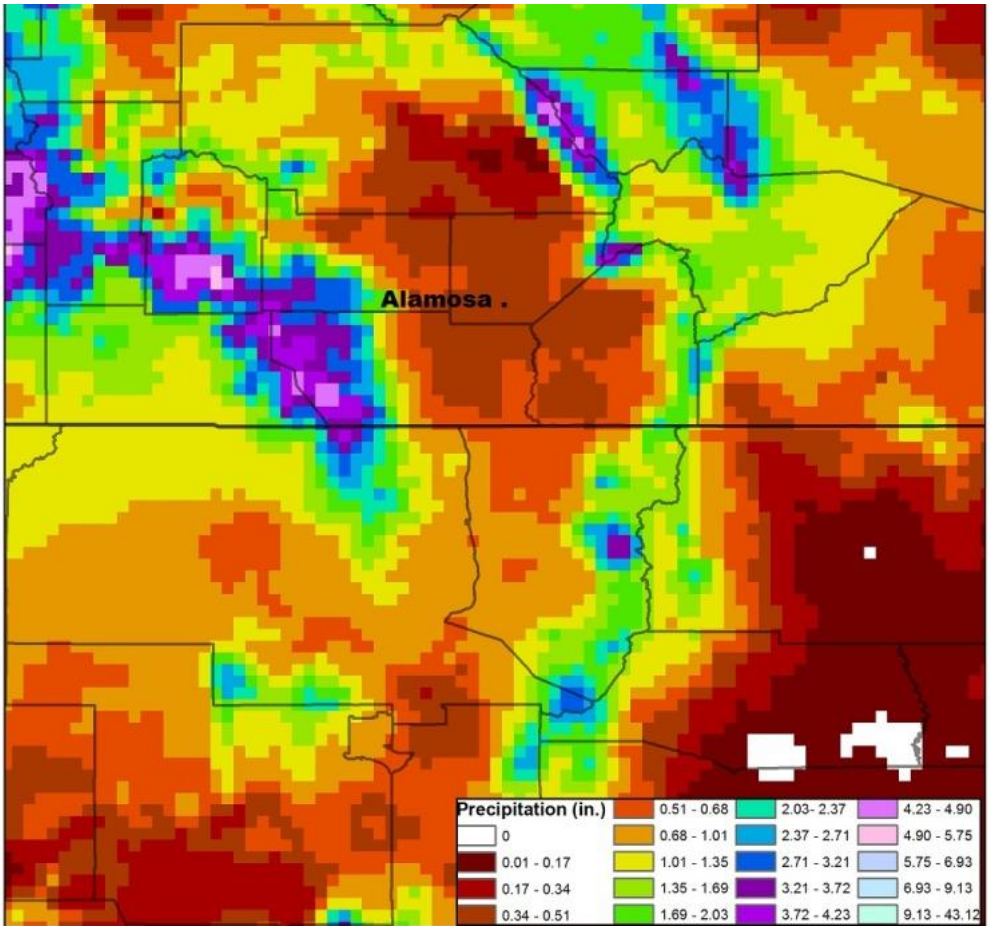


Figure 9: Total precipitation in inches for southern Colorado and northern New Mexico, February 28, 2013 – March 29, 2014.
(Source: http://prism.nacse.org/recent/)

3.0 Evidence - Ambient Air Monitoring Data and Statistics

On March 30, 2014, a powerful spring storm moved across southeast Colorado. The storm generated strong surface winds moving over dry soils affected PM_{10} samples at multiple sites across southern Colorado. During this event samples in excess of 150 $\mu g/m^3$ were recorded at Alamosa Adams State College (Alamosa ASC, 229 $\mu g/m^3$) and Alamosa Municipal (Alamosa Muni, 246 $\mu g/m^3$).

3.1 Historical Fluctuations of PM_{10} Concentrations in Alamosa

This evaluation of PM_{10} monitoring data for sites affected by the March 30, 2014, event was made using valid samples from PM_{10} samplers in Alamosa from 2009 through August of 2014; APCD has been monitoring PM_{10} concentrations in Alamosa since 1985. The overall data summary for the affected sites is presented in Table 3 , with all data values presented in $\mu g/m^3$:

Table 3: March 30, 2014, Event Data Summary

	Alamosa ASC	*Alamosa Muni*
03/30/2014	**172**	**201**
Mean	23.9	28.8
Median	19	23
Mode	20	18
St. Dev	26.7	28.0
Var.	710.2	782.4
Minimum	1	1
Maximum	440	635
Percentile	99.6%	99.9%
Count	1,897	1,795

Alamosa ASC – 080030001

The PM_{10} sample on March 30, 2014 at Alamosa ASC of 172 $\mu g/m^3$ is the 15th largest sample in the entire data set and exceeds 99% of all samples from 2009 through August 2014. The fourteen samples greater than the event sample are all associated with high wind events. There are 1,897 samples in this dataset. The sample of March 30, 2014 clearly exceeds the typical samples for this site.

Figure 10 and Figure 11 graphically characterize the Alamosa ASC PM_{10} data. The first, Figure 10, is a simple time series; every sample in this dataset (2009 – 2014) greater than 150 $\mu g/m^3$ is identified. Note the overwhelming number of samples occupying the lower end of the graph; an interested reader can count the number of samples greater than 100 $\mu g/m^3$. Of the 1,897 samples in this data set less than 1% is greater than 100 $\mu g/m^3$.

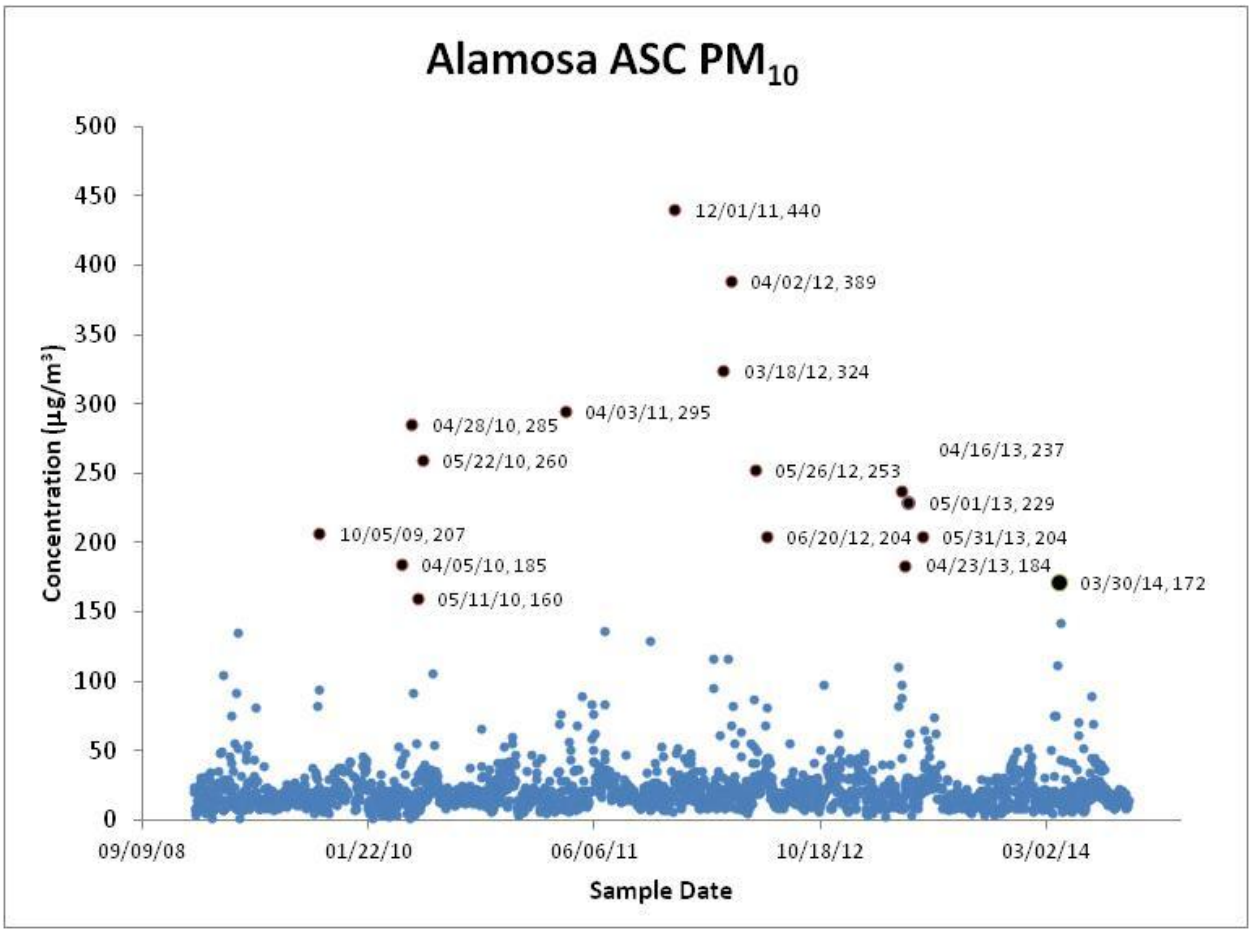


Figure 10: Alamosa Adams State College PM_{10} Time Series, 2009-2014

The monthly box-whisker plot in Figure 11 highlights the consistency of the majority of data from month to month. Note the greater variability (wider inner-quartile range) and greater range of the data through the winter and early spring months that are accompanied by typically greater monthly maxima. Recall, this time period experiences a greater number of days with meteorological conditions similar to those experienced on March 30, 2014. Although these high values affect the variability and central tendency (average) of the dataset they aren't representative of what is typical at the site.

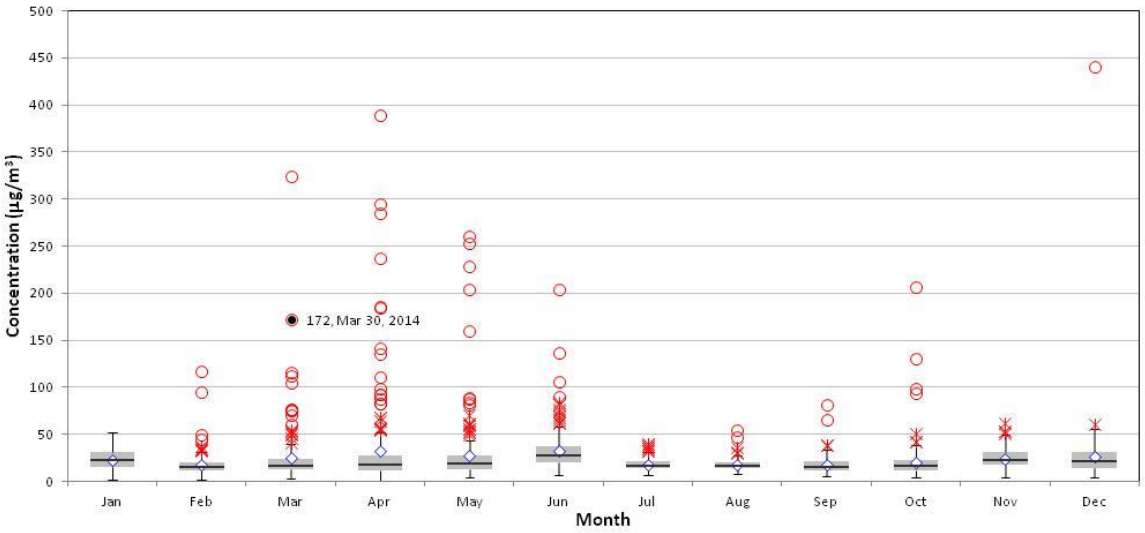


Figure 11: Alamosa Adams State College PM_{10} Box-whisper Plot, 2009-2014

The box-whisper plots graphically represent the overall distribution of each data set including the mean (◊), the inner quartile range (IQR, defined to be the distance between the 75th% and 25th%), the median (represented by the horizontal black line) and two types of outliers identifed in these plots: outliers greater than 75th% +1.5*IQR (✳)and outliers greater than 75th% + 3*IQR (○). At Alamosa ASC every sample greater than 150 µg/m^3 are associated with a known high-wind event similar to that of March 30.

Note the degree to which the data in the months of winter and spring, including March, is skewed. The March mean (24.7 µg/m^3) is greater than the March 75th percentile value. This is due to the presence of a handful of extreme values and can create the perception that those months experiencing these high wind events are somehow 'dirtier' than other months of the year. This data exposes that perception as flawed as the typical data is similar to every other month of the year. The sample of March 30, 2014 clearly exceeds the typical data at this site.

Alamosa Municipal – 080030003

The PM_{10} sample on March 30, 2014 at Alamosa Muni of 201 µg/m^3 exceeds the 99th percentile value for all evaluation criteria and is the 8th largest sample of all samples from 2009 through August, 2014. All seven samples greater than the event sample are both associated with high wind events. There are 1,795 samples in this dataset. The sample of March 30, 2014 clearly exceeds the typical samples for this site.

Figure 12 and Figure 13 graphically characterize the Alamosa Muni PM_{10} data. The first, Figure 12, is a simple time series, every sample in excess of 150 µg/m^3 is identified. Note the overwhelming number of samples occupying the lower end of the graph; an interested reader can count the number of samples greater than 100 µg/m^3. Of the 1,795 samples in this data set less than 1% are greater than 80 µg/m^3.

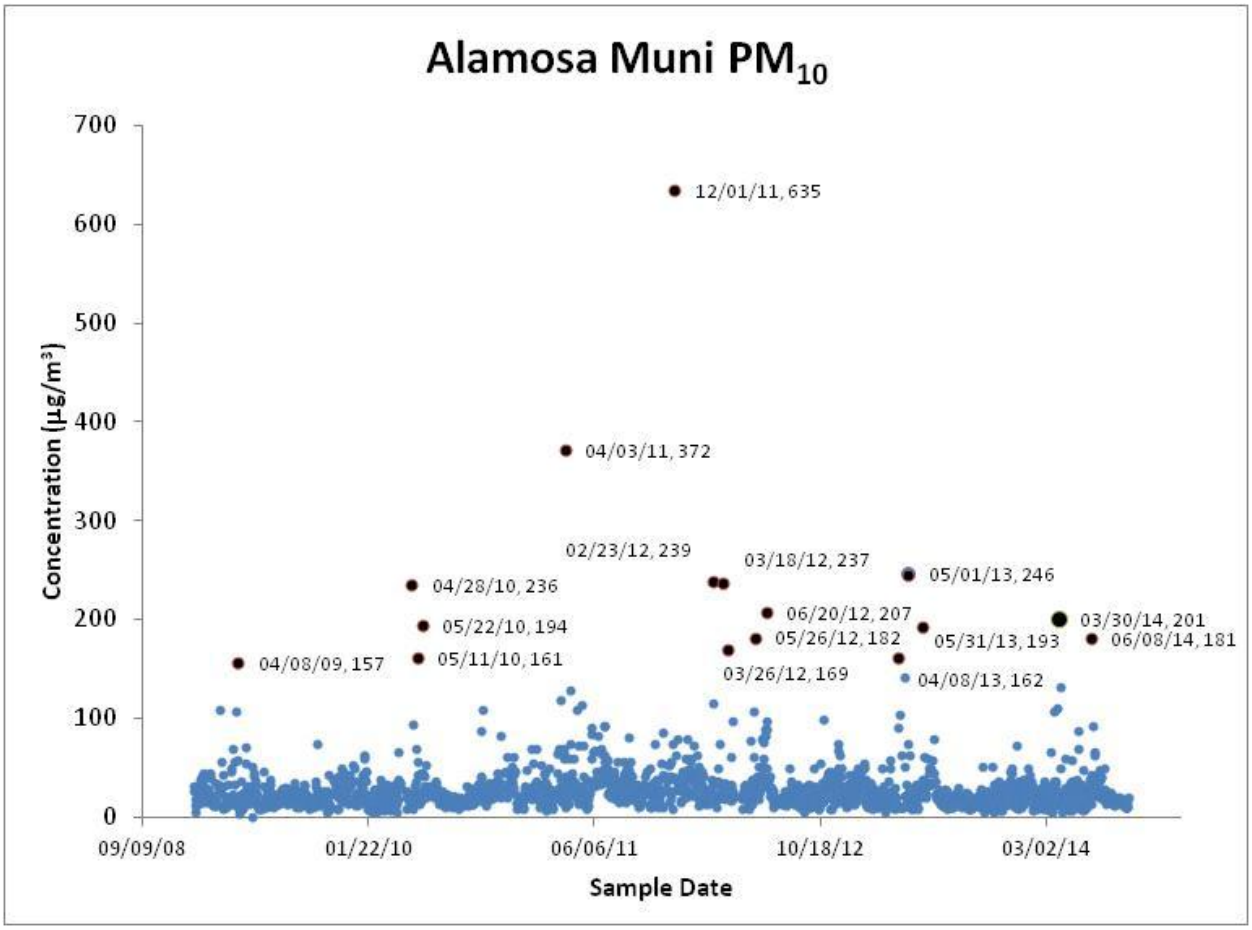


Figure 12: Alamosa Municipal PM_{10} Time Series, 2009-2014

The monthly box-whisker plot in Figure 13 highlights the consistency of the majority of data from month to month. Note the greater variability (wider inner-quartile range) and greater range of the data through the winter and early spring months that are accompanied by typically greater monthly maxima. Recall, this time period experiences a greater number of days with meteorological conditions similar to those experienced on March 30. Although these high values affect the variability and central tendency (average) of the dataset they aren't representative of what is typical at the site.

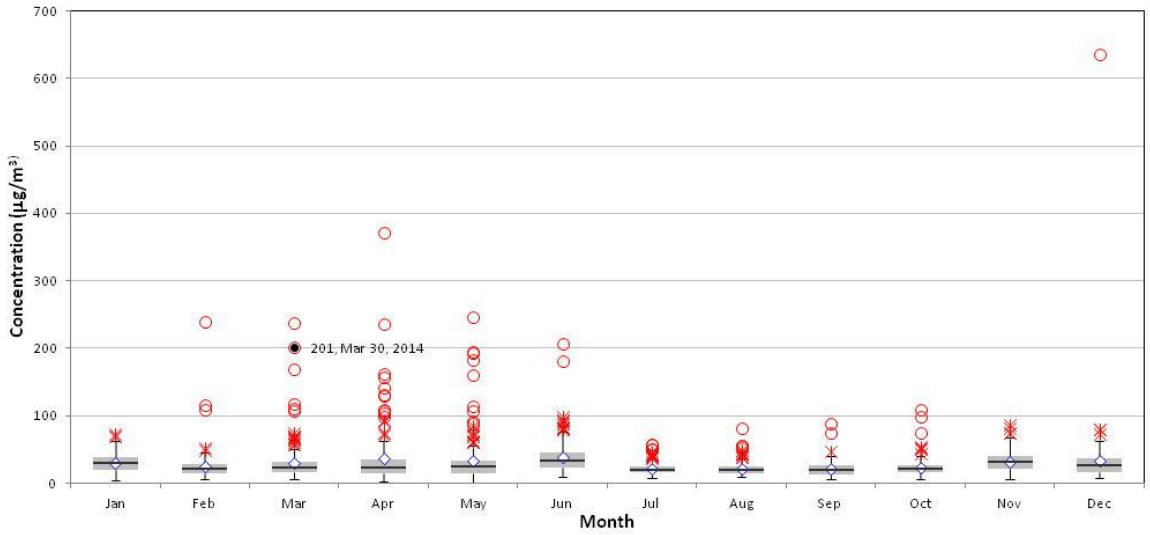


Figure 13: Alamosa Municipal PM_{10} Box-whisper Plot, 2009-2014

Note the degree to which the data from the months of winter/spring, including March, is skewed. The March mean (30.5 µg/m^3) is only slightly less than the 75th percentile value (32 µg/m^3). This is due to the presence of a handful of extreme values and can create the perception that those months experiencing these high wind events are somehow 'dirtier' than other months of the year. This data exposes that perception as flawed as the typical data is similar to every other month of the year. The sample of March 30, 2014 clearly exceeds the typical data at this site.

3.2 Wind Speed Correlations

Wind speeds in southeast Colorado increased late in the evening of May 30, 2014, and stayed elevated through the late morning of March 30, 2014, gusting to speeds in excess of 40 mph. Figure 14 displays wind speed (mph) as a function of date from meteorological sites within the affected areas for a number of days before and after the event.

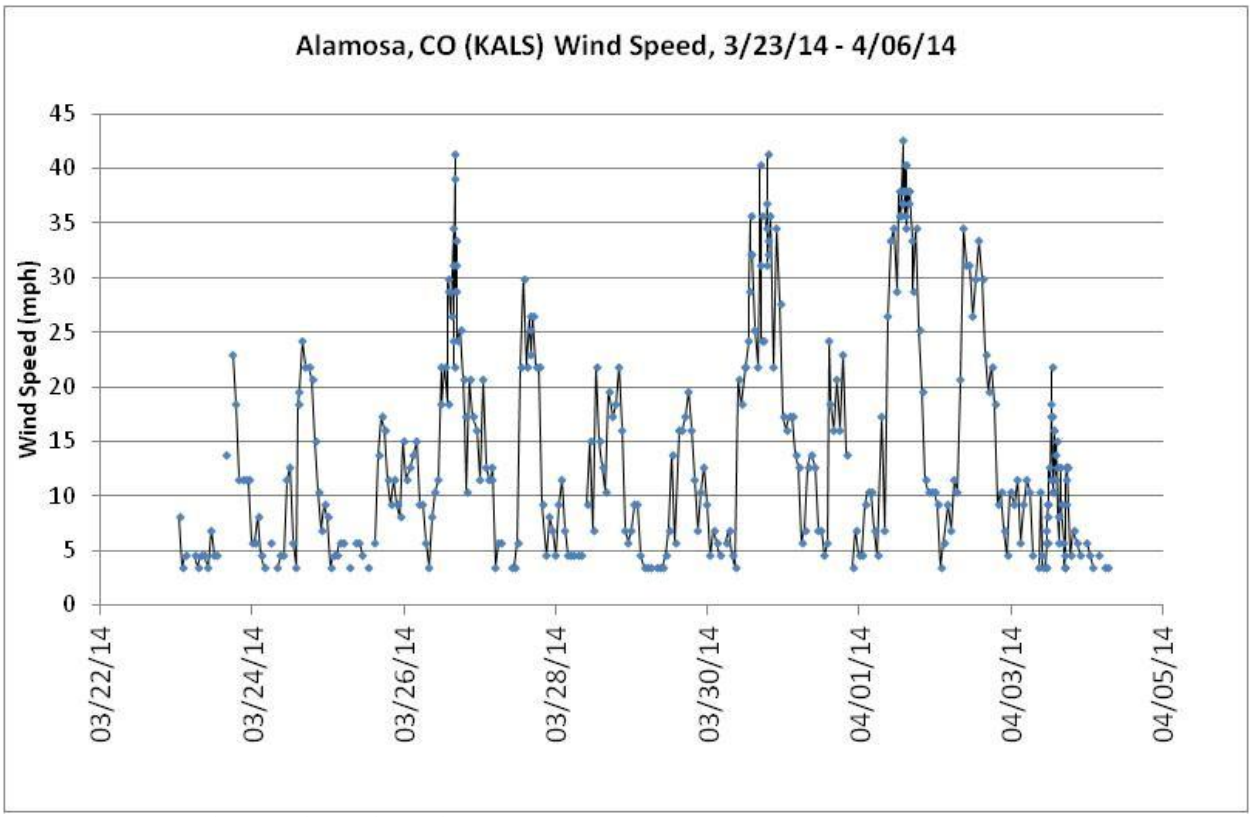


Figure 14: Wind Speed (mph), Alamosa, CO, 4/24/2013 – 5/08/2013

Figure 15 plots PM_{10} concentrations from the affected sites for the period for seven days prior to and following the samples of March 30, 2014.

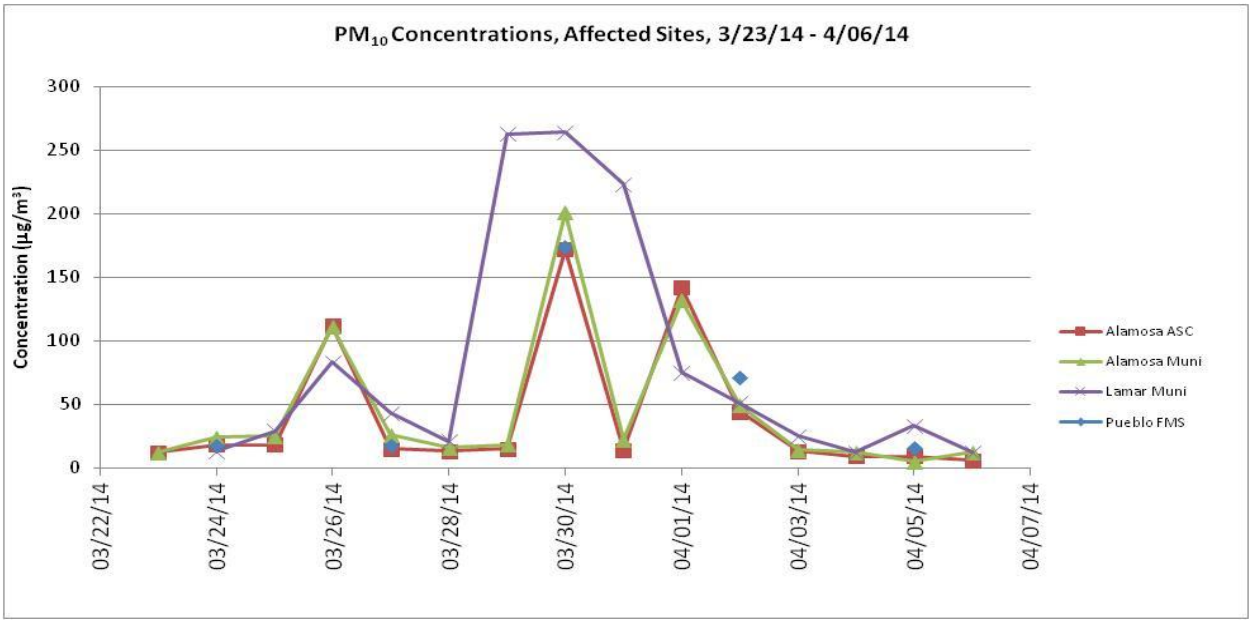


Figure 15: PM_{10} Concentrations, Alamosa, CO, 4/24/2013 – 05/08/2013

Figure 15 mimics the plots for wind speed, suggesting an association between the regional high winds and PM_{10} concentrations at the affected sites. Sites in Lamar and Pueblo also experienced high winds and high PM_{10} values on March 30, 2014. Although the samples were affected to differing degrees by the event (possibly reflecting the variation in contribution from local sources) the elevated concentrations are clearly associated with the elevated wind speeds. Given the spatial dislocation of the sites, the relationship between the data sets would suggest that the regional high winds had an effect on PM_{10} samples in Alamosa on March 30, 2014.

3.3 Percentiles

Monthly percentile plots for Alamosa sites in Figure 16 demonstrate a high degree of association between monthly median values and relatively high monthly percentile values, e.g. the Pearson's r value between the monthly 90th percentile value at Alamosa Muni and the monthly median is 0.57. As the percentile value decreases (i.e. 85%, 75%, etc) the correlation between those values and the monthly median values increases sharply.

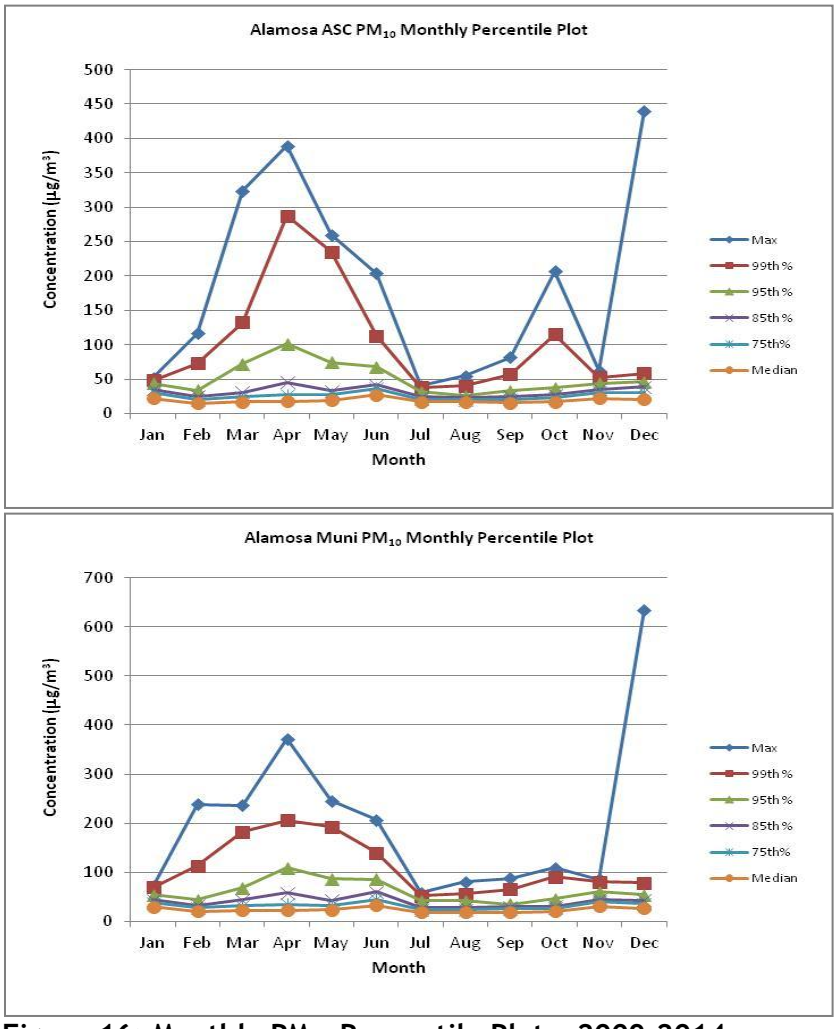


Figure 16: Monthly PM_{10} Percentile Plots, 2009-2014

It is certainly the case that monthly median values are indicative of typical, day to day concentrations. Additionally, there is a range of samples that are a product of normal variation subject to typical, day to day local effects. This range may be restricted to percentile values that are well correlated with the median. For the data sets of concern (Alamosa ASC, Alamosa Muni,) a conservative estimate of the percentile value that is reflective of typical, day to day variation is the 75th percentile value. Nearly all of the variation in the monthly 75th percentile values of these data sets can be explained by the variation in monthly medians; for these two sites the correlation between the median and monthly 75th percentile values vary from an r^2 = 0.97 (Alamosa Muni) to an r^2 = 0.94 (Alamosa ASC). A reasonable estimate of the contribution to the event from local sources for these data sets may be the monthly 85th percentile values; for these two sites the correlation between the median and the monthly 85th percentile values vary from an r^2 = 0.68 (Alamosa ASC) to an r^2 = 0.66 (Alamosa ASC). If these percentile values are taken as an estimate of event PM_{10} due to local variation then the portion of the sample concentration remaining from these monthly percentile values would be the sample contribution due to the event.

Table 4 identifies various percentile values that are representative of the maximum contribution due to local sources for each site from all March data for the sample date. In Table 4 the range estimate in the 'Est. Conc. Above Typical' column is derived using the difference between the actual sample value and the 85th percentile as the minimum (reasonable) event contribution estimate and the difference between the actual sample value and the 75th percentile as the maximum (conservative) event contribution estimate. This column represents the range of estimated contribution to the March 30, 2014 samples at the sites listed in the table due to the high wind event.

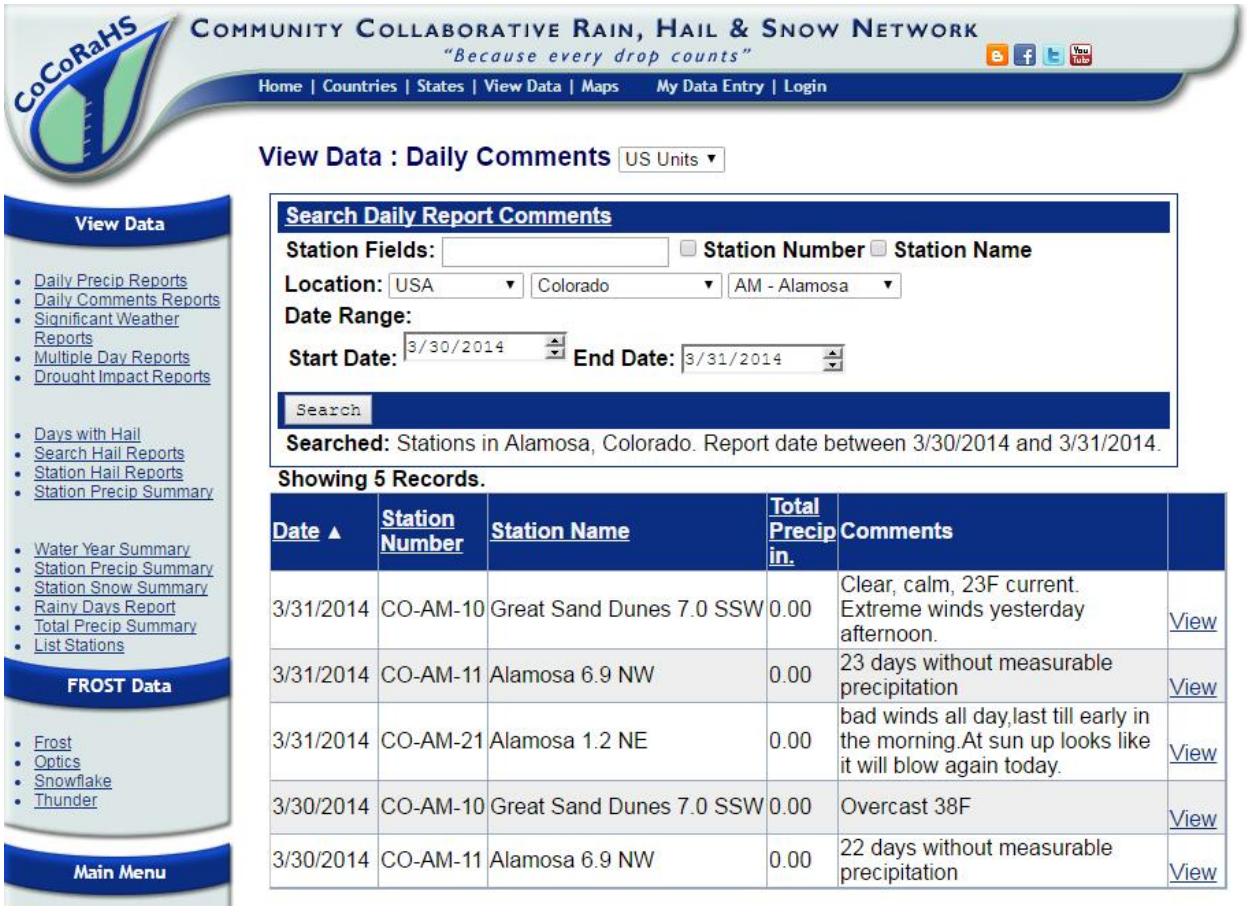
Table 4: Estimated Maximum Event PM_{10} Contribution, 3/30/2014

Site	Event Day Concentration (µg/m^3)	March Median (µg/m^3)	March Average (µg/m^3)	March 75th % (µg/m^3)	March 85th % (µg/m^3)	Est. Conc. Above Typical (µg/m^3)
Alamosa ASC	172	17	24.7	24	30.5	**141 - 148**
Alamosa Muni	201	23	30.5	32	44.6	**156 – 169**

Clearly, there would have been no exceedance but for the additional contribution to the PM_{10} sample provided by the event.

4.0 News and Credible Evidence

Community Collaborative Rain, Hail, & Snow Network reports (www.cocorahs.org):



COMMUNITY COLLABORATIVE RAIN, HAIL & SNOW NETWORK

"Because every drop counts"

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View Data

- Daily Precip Reports
- Daily Comments Reports
- Significant Weather Reports
- Multiple Day Reports
- Drought Impact Reports
- Days with Hail
- Search Hail Reports
- Station Hail Reports
- Station Precip Summary
- Water Year Summary
- Station Precip Summary
- Station Snow Summary
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- Total Precip Summary
- List Stations

FROST Data

- Frost
- Optics
- Snowflake
- Thunder

Main Menu

Search Daily Report Comments

Station Fields: Station Number Station Name

Location: USA Colorado AM - Alamosa

Date Range:

Start Date: 3/30/2014 End Date: 3/31/2014

Search

Searched: Stations in Alamosa, Colorado. Report date between 3/30/2014 and 3/31/2014.

Showing 5 Records.

Date ▲	Station Number	Station Name	Total Precip in.	Comments	
3/31/2014	CO-AM-10	Great Sand Dunes 7.0 SSW	0.00	Clear, calm, 23F current. Extreme winds yesterday afternoon.	View
3/31/2014	CO-AM-11	Alamosa 6.9 NW	0.00	23 days without measurable precipitation	View
3/31/2014	CO-AM-21	Alamosa 1.2 NE	0.00	bad winds all day,last till early in the morning.At sun up looks like it will blow again today.	View
3/30/2014	CO-AM-10	Great Sand Dunes 7.0 SSW	0.00	Overcast 38F	View
3/30/2014	CO-AM-11	Alamosa 6.9 NW	0.00	22 days without measurable precipitation	View

5.0 Not Reasonably Controllable or Preventable: Local Particulate Matter Control Measures

While it is likely that some dust was generated within the local communities as gusts from the regional dust storms passed through the area, the amount of dust generated locally was easily overwhelmed by, and largely unnoticeable as compared to the dust transported in from surrounding area. The following sections will describe in detail the regulations and programs in place designed to control PM_{10} in the affected communities. These sections will demonstrate that the event was not reasonably controllable, as laid out in Section 50.1(j) of Title 40 CFR 50, within the context of reasonable local particulate matter control measures. As shown from the meteorological and monitoring analyses (Sections 2 and 3), the source regions for the associated dust that occurred during the March 30, 2014 event originated outside of the monitored areas.

The APCD conducted thorough analyses and outreach with local governments to confirm that no unusual anthropogenic PM_{10} producing activities occurred in these areas and that despite reasonable control measures in place, high wind conditions overwhelmed all reasonably available controls. The following subsections describe in detail Best Available Control Measures (BACM), other reasonable control measures, applicable federal, state, and local regulations, appropriate land use management, and an in-depth analysis of potential areas of local soil disturbance for each affected community during the March 30, 2014 event. This information shall confirm that no unusual anthropogenic actions occurred in the local areas of Alamosa on this date.

Regulatory Measures - State
The APCDs regulations on PM_{10} emissions are summarized in Table 5.

Table 5: State Regulations Regulating Particulate Matter Emissions

Rule/Ordinance	Description
Colorado Department of Public Health and Environment Regulation 1- Emission Control For Particulate Matter, Smoke, Carbon Monoxide, And Sulfur Oxides	Applicable sections include but are not limited to: Everyone who manages a source or activity that is subject to controlling fugitive particulate emissions must employ such control measures and operating procedures through the use of all available practical methods which are technologically feasible and economically reasonable and which reduce, prevent and control emissions so as to facilitate the achievement of the maximum practical degree of air purity in every portion of the State. Section III.D.1.a) Anyone clearing or leveling of land greater than five acres in attainment areas or one acre in non-attainment areas from which fugitive particulate emissions will be emitted are required to use all available and practical methods which are technologically feasible and economically reasonable in order to minimize fugitive particulate emissions.(Section III.D.2.b)

	Control measures or operational procedures for fugitive particulate emissions to be employed may include planting vegetation cover, providing synthetic cover, watering, chemical stabilization, furrows, compacting, minimizing disturbed area in the winter, wind breaks and other methods or techniques approved by the APCD. (Section III.D.2.b) Any owner or operator responsible for the construction or maintenance of any existing or new unpaved roadway which has vehicle traffic exceeding 200 vehicles per day in the attainment/maintenance area and surrounding areas must stabilize the roadway in order to minimize fugitive dust emissions (Section III.D.2.a.(i))
Colorado Department of Public Health and Environment Regulation 3- Stationary Source Permitting and Air Pollutant Emission Notice Requirements	Construction Permit required if a land development project exceeds 25 acres and spans longer than 6 months in duration (Section II.D.1.j) All sources with uncontrolled actual PM_{10} emissions equal to or exceeding five (5) tons per year, must obtain a permit. The new source review provisions require all new and modified major stationary sources in non-attainment areas to apply emission control equipment that achieves the "lowest achievable emission rate" and to obtain emission offsets from other stationary sources of PM_{10}.
Colorado Department of Public Health and Environment Regulation 4- New Wood Stoves and the Use of Certain Woodburning Appliances During High Pollution Days	Regulates wood stoves, conventional fireplaces and woodburning on high pollution days. Prohibits the sale and installation a wood-burning stove in Colorado unless it has been tested, certified, and labeled for emission performance in accordance with criteria and procedures specified in the Federal Regulations and meets emission standards. (Section II) Section III regulates pellet stoves. Section IV regulates masonry heaters. Section VII limits the use of stoves on high pollution days.
Colorado Department of Public Health and Environment Regulation 6- Standards of Performance for New Stationary Sources	Implements federal standards of performance for new stationary sources including ones that have particulate matter emissions. (Section I)
Colorado Department of Public Health and Environment Regulation 9- Open Burning, Prescribed Fire, and Permitting	Prohibits open burning throughout the state unless a permit has been obtained from the appropriate air pollution control authority. In granting or denying any such permit, the authority will base its action on the potential contribution to air pollution in the area, climatic conditions on the day or days of such burning, and the authority's satisfaction that

	there is no practical alternate method for the disposal of the material to be burned. Among other permit conditions, the authority granting the permit may impose conditions on wind speed at the time of the burn to minimize smoke impacts on smoke-sensitive areas. (Section III)
Colorado Department of Public Health and Environment-Common Provisions Regulation	Applies to all emissions sources in Colorado When emissions generated from sources in Colorado cross the state boundary line, such emissions shall not cause the air quality standards of the receiving state to be exceeded, provided reciprocal action is taken by the receiving state. (Section II A)
Federal Motor Vehicle Emission Control Program	The federal motor vehicle emission control program has reduced PM_{10} emissions through a continuing process of requiring diesel engine manufacturers to produce new vehicles that meet tighter and tighter emission standards. As older, higher emitting diesel vehicles are replaced with newer vehicles; the PM_{10} emissions in areas will be reduced.

5.1 Alamosa Regulatory Measures and Other Programs

Natural Events Action Plan (NEAP)

The Final NEAP for High Wind Events in Alamosa, Colorado was completed in May 2003. The NEAP addresses public education programs, public notification and health advisory programs, and determines and implements Best Available Control Measures (BACM) for anthropogenic sources in the Alamosa area. The APCD followed up with the City and County of Alamosa in January 2007 and in the spring of 2013 on whether the NEAP mitigation measures and commitments were satisfied, the results of which are detailed below. The City of Alamosa, Alamosa County, the APCD, and participating federal agencies worked diligently to identify contributing sources and to develop appropriate BACM as required by the Natural Events Policy.

Please refer to the Final Natural Events Action Plan for High Wind Events, Alamosa, Colorado at http://www.colorado.gov/airquality/tech_doc_repository.aspx?action=open&file=AlamosaNaturalEventsActionPlan2003.pdf for more detail if needed.

Regulatory Measures - City and County

The APCD, the City of Alamosa, and Alamosa County are responsible for implementing regulatory measures to control emissions from agricultural sources, stationary sources, fugitive dust sources, and open burning within Alamosa. Alamosa's ordinances of PM_{10} emissions are summarized in Table 6.

Table 6: Rules and Ordinances Regulating Particulate Matter Emissions in Alamosa

Rule/Ordinance	Description
City of Alamosa Code of Ordinances Article VII of Section 21-140 (5)	Addresses dust control for home occupations.
City of Alamosa Code of Ordinances Article V Sec. 17-87(3))	Requires all new roads and alleys to be paved.
City of Alamosa Code of Ordinances (Article VI Sec. 21-119(g)(3)).	New large commercial/retail establishments must install underground automatic irrigation systems for all landscaped areas.
Alamosa County Land Use and Development Code (1.4.2)	Agriculture an important part of the economy and adds intrinsic value to life in Alamosa County. Agriculture, as a business, brings dust and other inconveniences. To maintain this way of life, Alamosa County intends to protect agricultural operators from unnecessary, intrusive litigation. Therefore, no inconvenience shall be considered a nuisance so long as it occurs as a part of non-negligent and legal agricultural practice, as stated in C.R.S. 35-3.5-101, 102 and 103.
Alamosa County Land Use and Development Code (3.5.2(A)(8))	For Feed lot, animal waste treatment, or animal waste collection facilities fugitive dust shall be confined on the property.
Alamosa County Land Use and Development Code (3.5.6(D)(2))	For a proposed oil and gas well installation, any interior transportation network shall be paved, or the company shall undertake appropriate dust abatement measures.
Alamosa County Land Use and Development Code (3.5.7(G))	All roads, driveways, parking lots and loading and unloading areas within 500 feet of any lot line shall be graded and paved with an approved concrete or asphalt/concrete surface as to limit adjoining lots and public roads the nuisance caused by wind-borne dust.
Alamosa County Land Use and Development Code (4.2.3(C)(2))	Where off-street facilities are provided for parking or any other vehicular use area, they shall be surfaced with asphalt bituminous, concrete or other dustless material approved by the administrator and shall be maintained in a smooth, well-graded condition.

City of Alamosa's Control Measures

The City of Alamosa has been active in addressing potential PM_{10} sources within the Alamosa area through various efforts. Some of these efforts, plus other potential future measures, include the adoption of local ordinances to reduce PM_{10}. Copies of current ordinances and any related commitments are included in the Final NEAP (See http://www.colorado.gov/airquality/tech_doc_repository.aspx?action=open&file=AlamosaNaturalEventsActionPlan2003.pdf). According to the City's Public Works Director, in 2013, the City is planning on adding additional dust control best management practices to the

International Building Codes that are adopted by the city in the next update. The best management practices will include requiring a Dust Control Plan for any site that is issued a clearing permit over 2 acres. In 2013 the City was also working on revising part of their landscaping ordinances to require mulch in areas that are not vegetated or covered by rock to help mitigate fugitive particulate emissions. These efforts have been stalled in the past due to employee turnover at City Manager's Office.

Street Sweeping
The City of Alamosa sweeps on an every 4-week schedule or as needed, as determined by local officials on a case by case situation (e.g., following each snowstorm and/or where sand was applied). Sweeping occurs on every single City street with an emphasis on the downtown corridor where public exposure is expected to be greatest. As of spring 2013, street sweeping in the downtown corridor takes place twice per week according to the City's Public Works Director.

According to the City's Public Works Director in 2013, the city owns an Elgin Pelican (mobile mechanical sweeper) and a Tymko 600 (brush-assisted head) street sweeper. In June 2013, the City also acquired a new Elgin Broom Badger street sweeper and the Tymko 600 was sent in for a re-build. The new Elgin Broom Badger street sweeper can be used in the winter months when the Tymko cannot due to freezing of the water delivery system.

Unpaved Roads within the City
The City of Alamosa (as of 2008) requires all new roads and alleys to be paved according to the Municipal Code (Article V Sec. 17-87(3)) and some existing unpaved roads are being treated with dust suppressants until all underground utilities are installed. No new development is allowed until paving is complete unless a performance bond is in place.

According to the City's Public Works Director, in 2013, less than 3% of City roads were unpaved; most of these unpaved roads are legacy annexations. One of these unpaved roads was scheduled for paving in 2013. The remaining unpaved roads are all low traffic (less than 100 ADT) and the City continues to seek funding sources for paving these streets.

Sod/Vegetative Cover Projects in the City of Alamosa
In 2008, the City of Alamosa placed vegetative cover in all city parks and has installed irrigation systems to maintain the cover. In 2013, the City began emphasizing more low-water use landscaping with shrubs, mulch, etc. including both organic and rock. All turf areas do have irrigation systems which utilize drip systems for specimen plantings.

Alamosa County's Control Measures

Alamosa County has also been active in addressing blowing dust as detailed below.

Unpaved Roads
Alamosa County continues to address unpaved roads and lanes that are anticipated to contribute to PM_{10} emissions in the community. In 2002, Alamosa County was nearing the end of its five-year road paving plan and was developing their next plan with the intention of paving on a yearly basis, based on traffic, community needs/priorities, and funding availability.

In 2002, Alamosa County addressed approximately ten (10) miles of unpaved roads. This included the stabilization of approximately five section roads, the seal coating of two roads, and the overlay (repaving) of four (4) additional roads.

In 2003, approximately 14 miles of roads were paved. This includes the Seven Mile Road (three miles long), Road 109 (one mile long), and 10th Street (also one mile long). These roads are in close proximity to the City of Alamosa, are upwind (prevailing) from the city, and have heavy traffic. Paving is anticipated to greatly reduce blowing dust and impacts in the vicinity.

No paving projects took place between 2004 and 2010 due to lack of funding. Between 2010 and 2013, the County was able to get funding but only for maintenance paving on previously paved roads that needed repair. Now that the county is caught up on maintenance paving, it is focusing on paving the remaining unpaved roads. The County's goal is to pave about 2.5 miles of unpaved road per year depending on funding availability.

In 2013, Alamosa County had funding to pave approximately 2.5 miles of County Road 106 North (located north of Alamosa off of Highway 17) which is currently unpaved. After this paving project the County will only have 2.5 miles of unpaved road remaining on the 106 North which is anticipated to be paved in the summer of 2014.

In the summer time the County regularly hauls water and wets down the unpaved roads (mostly gravel, clay and sand) to reduce the fugitive particulate emissions. The County wets the unpaved roads on an as needed basis based on weather conditions and traffic volume in the summer and wets down some of the more sandy roads in the winter when temperatures drop below a threshold in the area. Once the water soaks in and freezes, good dust suppression is seen. Road construction areas are also being dampened with water for dust control. These practices reduce PM_{10} emissions in and near Alamosa. This control measure is balanced with the availability of water in the area.

Alamosa County used to assess the need to use $MgC1_2$ treatment on roads in front of residences that request such service. This practice stopped in 2004 when funding was lost. Assessments included the sensitivity to dust of residents, the materials of the road base for safety reasons, and possible environmental concerns of the neighborhood. Most requests for treatment were granted. Other areas for treatment, such as commercial construction zones or gravel pits, were investigated on a case by case basis. The County hopes to be able to start offering this service again when funding is restored.

Dust Control Plans

Alamosa County requires dust control plans for selected construction/developments. The dust control plans are typically done through a negotiated agreement by the Alamosa Land Use Department and is supported by zoning codes.

The County may update the Comprehensive Plan to include a dust control plan. The Land Use Administrator is researching the potential for a dust control ordinance. This effort is anticipated to reduce PM_{10} emissions in Alamosa, especially as it relates to impacts on the community and high recorded PM_{10} values. At the time of this submittal, this effort is still underway.

Wind Erosion of Open Areas

To reduce PM_{10} emissions from open areas outside of the City limits, low tilling and other soil conservation practices continue to be utilized in the community. The Mosca-Hooper Conservation District and Natural Resources Conservation Service is working on education efforts to promote cover crops and no-till agriculture. In addition, the community is strategically using the Colorado State Forest Service's program to purchase and plant shelter trees to reduce wind erosion in open areas. Nursery seedlings from the program have been sold in Alamosa County since 1956. The number of seedlings sold has varied over the last few years as illustrated in Table 7.

Table 7: Number of Seedlings Sold in Alamosa per Year.

Year:	2008	2009	2010	2011	2012	2013
Seedlings Sold:	7,432	5,963	2,805	4,197	3,327	4,231

These trees have a demonstrated advantage for the community and for air quality. Once the trees reach maturity, it is anticipated that the equivalent of 112 miles of double-rowed trees will be in place. The survival rate of the tree seedlings varies but according to the District Coordinator for the Seedling Tree Program, potted seedlings have about a 60% to 80% survival rate and the bare root seedlings have about a 40% to 60% survival rate. The Seedling Program recommends Siberian elm and Rocky Mountain juniper trees for low maintenance, drought resistance windbreaks in the valley, but offers over 40 varieties to suit specific site conditions. The Colorado State Forest Service and the Mosca-Hooper Conservation District promote the windbreak program through workshops and consulting landowners.

In addition, there is ongoing planting of trees (approximately 50) on newly developed Alamosa County property south/southwest of Alamosa (prevailing winds from southwest) and the Airport south of Alamosa for added air quality improvement. Also, The Bureau of Reclamation has an ongoing project to plant windbreaks along their Closed-Basin Canal.

Windblown Dust from Disturbed Soils

Alamosa has a semi-arid climate with approximately 7.25 inches of precipitation annually. The San Luis Valley, as noted within 25 miles of the San Luis Valley Regional Airport in Alamosa, is primarily comprised of forests (43%) and scrublands (42%). Consequently, soils in all areas are typically a mixture of silt and sand with limited vegetation due to low precipitation. In winter and spring, windstorms are common, especially in drier years. It is due to these high velocity windstorms that Alamosa experiences most of the PM_{10} problems for the area. The City zoning map in Figure 18 which was provided by the City of Alamosa, depicts various areas of possible soil disturbance. These were evaluated by Air Division staff in conjunction with local input from the City and County for the Alamosa Adams State and Municipal PM_{10} monitors over the past years. The area zoned agricultural remains mostly natural grassland and "Chico" shrubs. Figure 17 through Figure 31 illustrate other potential areas of local soil disturbance that have been evaluated by the APCD for the Alamosa Adams State PM_{10} monitor and the Alamosa Municipal Building PM_{10} monitor with regards to the March 30, 2014 high wind event.

5.2 Potential areas of local soil disturbance south and southwest of Alamosa (ASC Monitor)

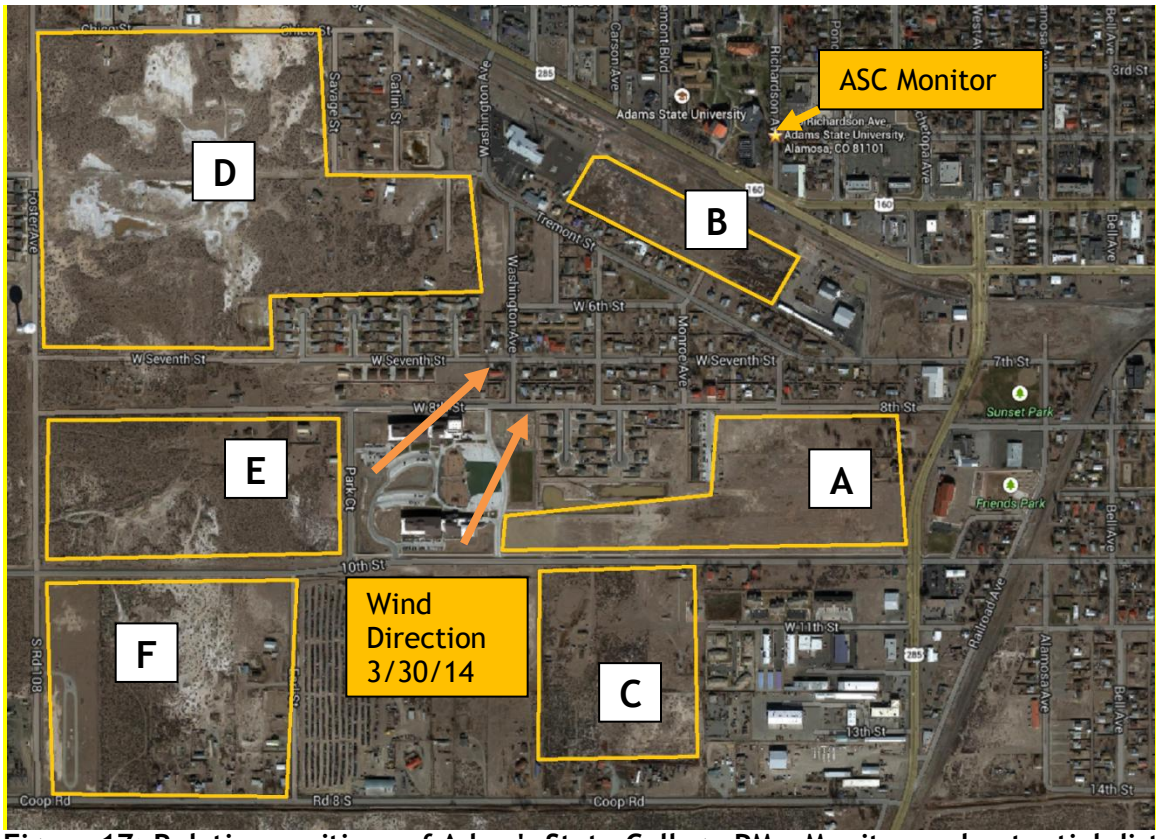

Figure 17: Relative positions of Adam's State College PM_{10} Monitor and potential disturbed soil. (Google Image 2015)

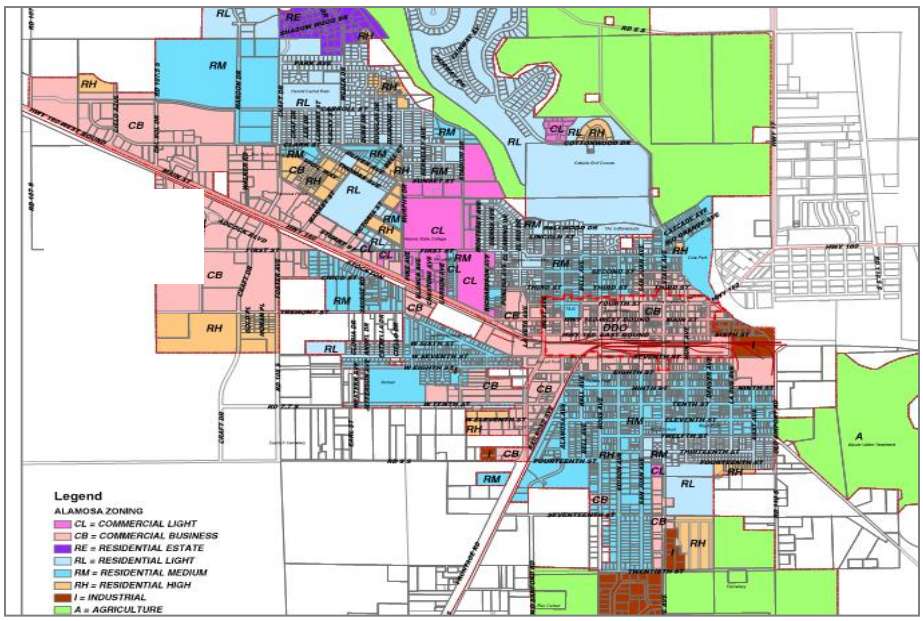

Figure 18: 2011 City of Alamosa Zoning Map (Provided by the Public Works Department)

Site A in Figure 17 (approximately 30 acres) is north of 10th St, south of 8th St, east of Park Ct, and west of West Ave. It is zoned mostly as a "Commercial Business" as shown in Figure 18. There is a small portion in the top right corner that is zoned as a "Parcel" and is outside of the city's limits. Site B in Figure 17 (approximately 22 acres) is south of Highway 160 and north east of Tremont St. It is zoned as a "Parcel" outside of the city's limits as shown in Figure 18. Site C (approximately 23 acres) in Figure 17 is east of Earl St, south of 10th St, and north of Rd 8 S. It is zoned as "Commercial business", "Residential High" and some "Industrial" as shown in Figure 18. Sites A, B, and C are naturally vegetated and potentially irrigated as shown in Figure 19, Figure 20, and Figure 22, which demonstrates that these sites are minimally (if at all) disturbed soil areas as of this writing. Photos of sites A, B, and C are shown in Figure 19 through Figure 22.

Figure 19: Site B (CDPHE August 2013)

Figure 20: Site A facing north (CDPHE August 2013)

Figure 21: West end of site A is a gravel elementary school overflow parking lot (CDPHE August 2013)

Figure 22: Site C with natural vegetation (CDPHE August 2013)

Sites D, E and F are noted by the City of Alamosa's Public Works Director and County Health Director to be vacant land with natural vegetation (i.e. scrubland, mostly Chico bush) with no artificial irrigation and no access restriction. The City emphasizes that the areas are not suited for motorized travel. These lots are not considered to be anthropogenically disturbed soils and should be considered to be natural sources as of this writing. If future high wind or other exceptional events occur, the APCD will re-assess these lots to determine if they are still natural sources.

Site D in Figure 17 (approximately 85 acres) is East of Rd S 108 and South of Chico St. It is zoned outside of the city's limits by the city as a "Parcel" as shown in Figure 18. The eastern portion of site D is being considered for annexation into the City. A photo of site D is shown in Figure 23.

Figure 23: Site D facing north (CDPHE August 2013)

Site E in Figure 17 (approximately 34 acres) is north of 10th Street, east of Road S 108, west of Park Ct, and south of 8th St. It is zoned as a "Parcel" outside of the city's limits as shown in Figure 18. A photo of Site E is shown in Figure 24.

Figure 24: Site E facing north (CDPHE August 2013)

Site F in Figure 17 is located between 10th street and Coop Road and is west of Earl Street and east of Road 108. It is zoned as a "Parcel" outside of the city's limits as shown in Figure 18. A photo of Site F is shown in Figure 25.

Figure 25: Site F facing south (Google Image 2012)

5.3 Potential areas of local soil disturbance south and southwest of Alamosa (Muni Monitor)

Figure 26 illustrates potential areas of local soil disturbance that have been evaluated by the APCD for the Alamosa Municipal Building (08-003-0003) PM_{10} monitor. The climate for this monitor is identical to the Alamosa Adams State PM_{10} monitor, described above.

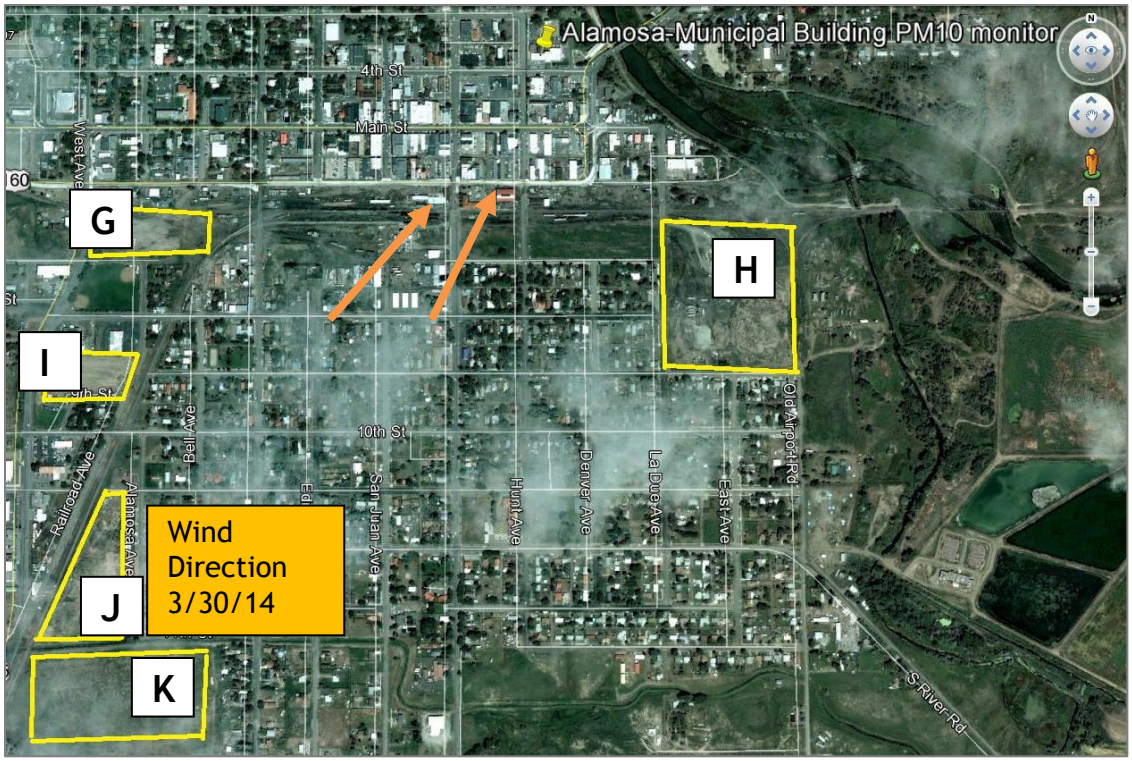

Figure 26: Relative positions of Municipal Building PM_{10} Monitor and potential disturbed soil. (Google Earth 2007)

Site G in Figure 26 (approximately 5 acres) is south of 6th St, west of Ross Ave, east of West Ave, and north of 7th St. It is zoned by the city as "Commercial Business" as shown in Figure 18. The vacant land is undisturbed gravel, dirt, and is naturally vegetated as shown in Figure 27. The railroad runs through this narrow strip of land rendering it unlikely to be developed in the future.

Figure 27: Site G as of August 2013 (CDPHE August 2013)

Site H in Figure 26 (approximately 22 acres) is east of La Due Ave, south of 6th St, north of 9th St, and west of Old Airport Rd. It is zoned by the city as "Commercial Business" and "Industrial" as shown in Figure 18. Site H is private property with restricted access located just south of the rail yard. The land is naturally vegetated and undisturbed as shown in Figure 28.

Figure 28: Site H as of August 2013 (CDPHE August 2013)

Site I in Figure 26 (approximately 3 acres) is east of West Ave, north of 10th St, south of 8th St, and west of Railroad Ave. It is zoned by the city as "Commercial Business" as shown in Figure 18. Site I is "Friends" Park that is maintained by the City of Alamosa (Figure 29). Friends Park has a well maintained gravel parking lot, a cement basketball court, an irrigated field, and a small hard packed clay BMX bike dirt track. The park is well maintained by the City and implements reasonable dust control measures on a regular basis.

Figure 29: Site I - Friends Park as of August 2013 (CDPHE August 2013)

Site J in Figure 26 (approximately 9 acres) is north of 14th St, west of Alamosa Ave, east of Railroad Ave, and south of 10th St. It is zoned by the city as "Residential Medium" as shown in Figure 18. Site J is a vacant lot behind a small apartment building. The land is natural and undisturbed. There is no irrigation but natural vegetation grows as shown in Figure 30. The soil has a crust on the surface. When asked, residents of the adjacent apartment complex did not complain about blowing dust coming from Site J.

Figure 30: Site J as of August 2013 (CDPHE August 2013)

Site K in Figure 26 (approximately 26 acres) is south of 14th St, north of 17th St, west of Ross Ave, and east of the Frontage Road. It is zoned by the city as "Residential Medium" as shown in Figure 18. Site K, as shown in Figure 31, is vacant land that is naturally vegetated and undisturbed.

Figure 31: Site K as of August 2013 (CDPHE August 2013)

The APCD conducted thorough assessments to determine if the potential soil disturbances shown in Figure 17 through Figure 31 were present during the March 30, 2014 exceedances in Alamosa. During the course of these assessments, the APCD discovered that these sites were either reasonably controlled or considered to be natural sources during the March 30, 2014 high wind event. Therefore, these sites were not significant contributors to fugitive dust in the Alamosa area during this high wind event.

Sod and Vegetative Projects in the County

The development and construction of a local park, Eastside Park, is complete in Alamosa County. It has been completed with turf grass, shrubs, and landscape rock. No exposed soil remains.

Numerous other projects to reduce blowing dust and its impacts have happened or are happening at the County Airport. For example:

- Through additional grounds maintenance of the 40-acre Alamosa County airport south of the city, "Xeriscape" has been installed for aesthetics and dust control.

- Decorative rock and xeriscape have been implemented in the landscaping of the Alamosa County property (2007-2012). These measures have directly abated blowing dust at the Airport.

- Also, the widening of the airport's safety areas (250 feet on either side of the runway) is complete and seeding of natural grasses was incorporated in the project. Trees and grass were incorporated in the approaches to the airport and have provided additional wind-break advantages to South Alamosa.

In other areas where watering is a problem, xeriscape (the use of native drought resistant vegetation and/or rock cover) is being encouraged for County owned property and for all other property owners.

Colorado State University Co-Op Extension Office
In response to extremely dry conditions, the need to maintain area topsoil, and reduce impacts, the Colorado State University Co-Op Extension Office of Alamosa County provides the following outreach efforts and recommendations:

- Modification of grazing practices to improve protective crop cover;
- Increasing crop residues left in the fields to reduce blowing dust;
- Planting of fall crops to maintain fields;
- Application of manure to protect top soils from blowing away;
- Staggering of the harvest to minimize blowing dust;
- Outreach programs on soil conservation efforts;
- Development of outreach/education materials (e.g., news articles, newsletters, fact sheets, etc.); and
- Attendance at Statewide workshop to educate other Co-Op offices to various practices to reduce blowing top soil and minimize impacts.

These control strategies are not meant to be enforceable. They are meant only to demonstrate the regional nature of cooperation in addressing blowing dust and its impacts on the community.

Natural Resources Conservation Service (NRCS)
Alamosa County is a predominately agricultural area where limited water, coupled with the frequent high winds experienced during late fall and early spring, can destroy crops, encourage pests, and damage soil surfaces lending them susceptible to wind erosion. Thus, activities that improve the topsoil and prevent its lifting during high wind events are encouraged. Some notable NRCS and agricultural examples include:

- Local Conservation Districts and farmers hold monthly meetings as an informal Soil Health Group, discussing ways to improve soil health. Cover crops, compost

applications, and reduced tillage are the targeted practices. Public tours are held twice a year;
- NRCS continues to work with area farmers in the development of conservation compliance plans to also protect topsoil;
- NRCS encourages planting perennial grasses or the leaving weeds undisturbed or mowed on the corners of center pivots (instead of tilling that might lead to open, barren lands) to reduce soil blowing;
- NRCS "cost shares" on soil health practices and perennial grass seeding conservation practices with local farmers to prevent soil erosion; and
- The NRCS is working with Colorado State University, local Water Conservation District, and Farm Service Agency to encourage retirement of marginal cropland in the Conservation Enhanced Reserve Program (CREP) and seeding those acreages back to native grass, forbs and shrubs.

Other successful agricultural practices encouraged in the area include: timing of tillage, crop rotation, amount of crop residue left on the land, and proper water usage. These control strategies are not meant to be enforceable. They are meant only to demonstrate the regional nature of cooperation in addressing blowing dust and its impacts on the community.

Please refer to the Final NEAP for Alamosa at http://www.colorado.gov/airquality/tech_doc_repository.aspx?action=open&file=AlamosaNaturalEventsActionPlan2003.pdf for more detail if needed.

6.0 Summary and Conclusions

APCD is requesting concurrence on exclusion of the PM_{10} values from Alamosa-Adams State College (08-003-0001) and Alamosa Municipal Building (08-003-0003) on March 30, 2014.

Elevated 24-hour PM_{10} concentrations were recorded at the Adams State College and Alamosa Municipal Building monitors on March 30, 2014. All of the noted twenty-four-hour PM_{10} concentrations were above the 90^{th} percentile concentrations for their locations (see Section 3) and exceeded the 99^{th} percentile value of any evaluation criteria. The statistical and meteorological data clearly shows that but for these high wind blowing dust events, Alamosa would not have exceeded the 24-hour NAAQS on March 30, 2014. Since at least 2005, there has not been an exceedance that was not associated with high winds carrying PM_{10} dust from distant sources in these areas. This is evidence that the event was associated with measured concentrations in excess of normal historical fluctuations including background.

The PM_{10} exceedances in Alamosa would not have occurred if not for the following: (a) dry soil conditions over source regions with 30-day precipitation totals below the threshold identified as a precondition for blowing dust; and (b) meteorological conditions that caused strong surface winds over the area of concern.

Surface weather observations provide strong evidence that a dust storm took place on March 30, 2014. The meteorological conditions during this event caused regional surface winds over 30 mph with gusts exceeding 40 mph. These speeds are above the thresholds for blowing dust identified in EPA draft guidance and in detailed analyses completed by the State of Colorado (see the Lamar, Colorado, Blowing Dust Climatology at http://www.colorado.gov/airquality/tech_doc_repository.aspx). These PM_{10} exceedances were due to an exceptional event associated with regional windstorm-caused emissions from erodible soil sources over a large source area outside of the monitored areas. These sources are not reasonably controllable during significant windstorms under abnormally dry or moderate drought conditions.

Both wind speeds and soil moisture in surrounding areas were conducive to the generation of significant blowing dust. Multiple sources of data for the event in question and analyses of past dust storms in this area prove that this was a natural event and, more specifically, a significant natural dust storm originating outside the monitored areas. But for the dust storm on March 30, 2014, these exceedances would not have occurred.

As demonstrated in this report, the PM_{10} exceedances in Alamosa on March 30, 2014 would not have occurred “but for” the large regional dust storm that occurred on that date.

7.0 References

United States Environmental Protection Agency, June 2012. Draft Guidance on the Preparation of Demonstrations in Support of Requests to Exclude Ambient Air Quality Data Affected by High Winds under the Exceptional Events Rule.