Assessment of Qualification for Treatment under the Federal Exceptional Events Rule: High Particulate (PM_{10}) Concentrations in the Yuma, AZ Area on March 2, 2008

Air Quality Division

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Assessment of Qualification for Treatment under the Federal Exceptional Events Rule: High Particulate (PM_{10}) Concentration Event in the Yuma Area on March 2, 2008

Section 1. Summary of the High Wind Event

The Arizona Department of Environmental Quality (ADEQ) issues Dust Control Action Forecasts for the Yuma area as part of their Natural Events Action Plan (NEAP). On Friday, February 29, 2008, in response to an approaching trough of low pressure expected to bring strong and gusty winds to Arizona, ADEQ air quality forecasters issued the Yuma and Vicinity Dust Control Action Forecast which called for a high risk of wind-blown dust in the Yuma area for Sunday, March 2, 2008 (Appendix A). Winds were forecasted to be out of the north and to increase to 25 mph sustained with occasional stronger gusts possible. This forecasted wind event equated to a significant risk of windblown dust and of exceeding the PM_{10} National Ambient Air Quality Standards (NAAQS) in the Yuma area. The forecasts/advisories issued by ADEQ are meant to put the public and those responsible for placing controls on potential sources of wind-blown dust on alert, and these forecasts/advisories satisfy the requirement in 40 CFR 51.930(a)(1).

Strong winds were observed throughout much of the state of Arizona on March 2, 2008, with the strongest winds occurring in western and southwestern Arizona beginning in the late morning and lasting throughout the afternoon and evening. The proximity of the Yuma area to the Colorado River drainage, as well as other local topographical factors (see Section 2), resulted in increased surface winds at various locations in that area. Sustained winds reported at the National Weather Service (NWS) Yuma Marine Corps Air Station (MCAS) were out of the north and first exceeded 20 mph between 9:00 a.m. and 10:00 a.m. with gusts as high as 32 mph during that same time. During the 10:00 a.m. to 11:00 a.m. hour, wind speeds at Yuma MCAS reached 28 mph sustained and gusted to 37 mph. Sustained winds at Yuma MCAS remained above 25 mph for the next six hours, and wind gusts reached as high as 47 mph and did not fall below 30 mph until about 6:00 p.m. Additionally, visibility at the Yuma MCAS NWS site began to decrease during the 9:00 a.m. to 10:00 a.m. hour with the onset of strong winds. Visibility at the Yuma MCAS was reported to be as low as 3 miles for several hours and blowing dust was noted beginning about 2:00 p.m. and continuing through the rest of the afternoon and evening.

In addition to the high winds, reduced visibility, and blowing dust reported at the NWS Yuma MCAS site, high winds were also reported at the Yuma Mesa and Yuma Agricultural Center Farm (Yuma Ag. Center) monitoring sites maintained by ADEQ. Yuma Agricultural Center Farm reported sustained winds ranging from 16 mph to 31 mph and remaining above 25 mph from the 10:00 to 11:00 a.m. hour through the 6:00 to 7:00 p.m. hour. Wind gusts at the Yuma Ag. Center ranged from 28 mph to 47 mph beginning in the morning and continuing throughout the afternoon and into the evening. Yuma Mesa reported sustained winds ranging from 12 to 19 mph and wind gusts ranging from 28 mph to 41 mph beginning in the morning and continuing throughout the afternoon and into the evening. These winds are fairly consistent with the wind speeds reported at the NWS Yuma MCAS, although the sustained winds at the Yuma Mesa site were notably lower than either the Yuma Agricultural Center Farm or Yuma MCAS sites (see Section 3 and Appendix B for additional explanation).

Given the magnitude of the high wind event and its duration, including seven consecutive hours of sustained winds greater than 25 mph and numerous gusts greater than 40 mph at the NWS Yuma MCAS site, it is clear that the wind-blown dust event was not reasonably controllable or preventable, despite the numerous controls that were in place in the area (see Section 4).

This high wind event brought elevated ambient concentrations of PM_{10} to the Yuma area that exceeded the NAAQS at the Yuma Courthouse monitor. The fact that ambient concentrations exceeded the NAAQS satisfies the criteria in 40 CFR 50.1(j) that the event "affects air quality." The table below summarizes the PM_{10} readings collected at the Yuma Courthouse TEOM monitor on March 2, 2008:

Monitor (Operator/Type)	AQS ID	24-hr Avg PM_{10}	1-hr Max PM_{10}	Max Time	Flag**
YUMA AREA					
Yuma Courthouse (ADEQ/TEOM)	**04-027-0004***	**161**	**610**	**1200**	**RJ**

Section 2. Background on Geographic Setting and Control Programs for Yuma

Geographic Setting

Yuma is located in the Lower Colorado River Valley in extreme southwestern Arizona at an elevation of 138 feet above sea level. It is near the borders of Mexico and California to the west and Mexico to the south, and it lies just west of the confluence of the Colorado and Gila Rivers (see Figure 1). Most of the city lies in the part of the Colorado River Floodplain known as the Yuma Valley. Some of the City is built on the Yuma Mesa, another prominent land feature found to the east. The Valley follows the course of the Colorado River to the north and is open all the way to the Sea of Cortez to the south.

Climate

Yuma is one of the hottest cities of any size in the United States, with average July high temperatures of about 107°F. Average January highs are around 70°F. Of the possible 4,456 hours of daylight each year, the sun shines in Yuma for roughly 4,050 hours, or about 90 percent of the time. On average Yuma receives about 3 inches of rain annually. The last time Yuma had experienced any measurable rainfall leading up to the March 2, 2008, high wind event was on January 28, 2008, when 0.01" of rainfall was recorded at the NWS Yuma MCAS.

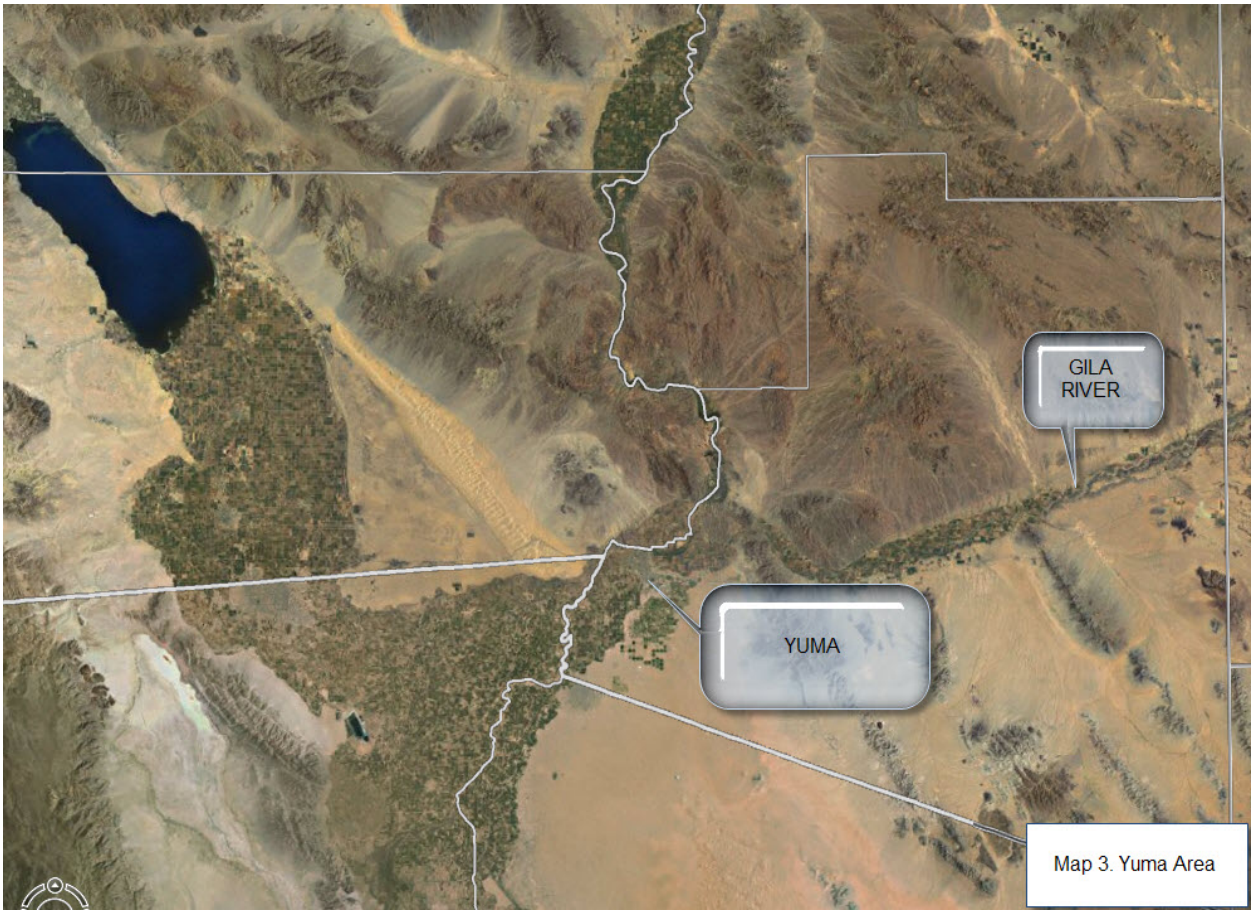


Figure 1. Map of Yuma Area.

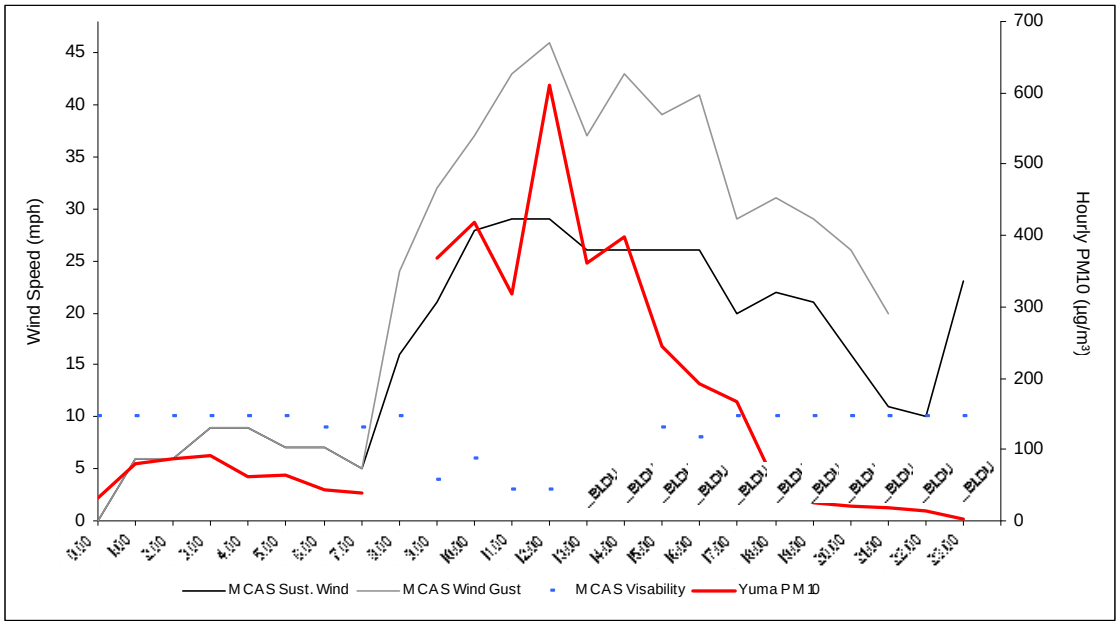
Yuma Area PM_{10} and Meteorological Monitors

Figure 2. Map of Yuma & southeastern California with PM_{10} & Meteorological Sites.
Source: US EPA, ADEQ, & Google Earth

Figure 2 shows the location of the NWS Yuma MCAS as well as the location of ADEQ's Yuma Courthouse monitor, Yuma Ag. Center Farm, and Yuma Mesa monitoring locations. The NWS Yuma MCAS site is located closest to the Yuma Courthouse monitor and should provide the most relatable data for comparison to the PM_{10} recorded at Yuma Courthouse. Yuma Agricultural Center Farm is located northwest of the Yuma Courthouse monitor and the wind data recorded there serve as a sort of "upwind" point of reference. The Yuma Mesa site is located south-southeast of the Yuma Courthouse monitor and can be considered a "downwind" point of reference in this instance where winds are mostly out of the north or north-northwest. Again, some caution is warranted when interpreting the Yuma Mesa wind data as obstructions to the west, northwest, and north of the site may influence wind speed measurements at the site (see Section 3 and Appendix B for additional information).

Section 3. Detailed Analysis of the Wind-blown Dust Event

March 2, 2008 - NWS Yuma MCAS Winds vs. Yuma Courthouse PM_{10}

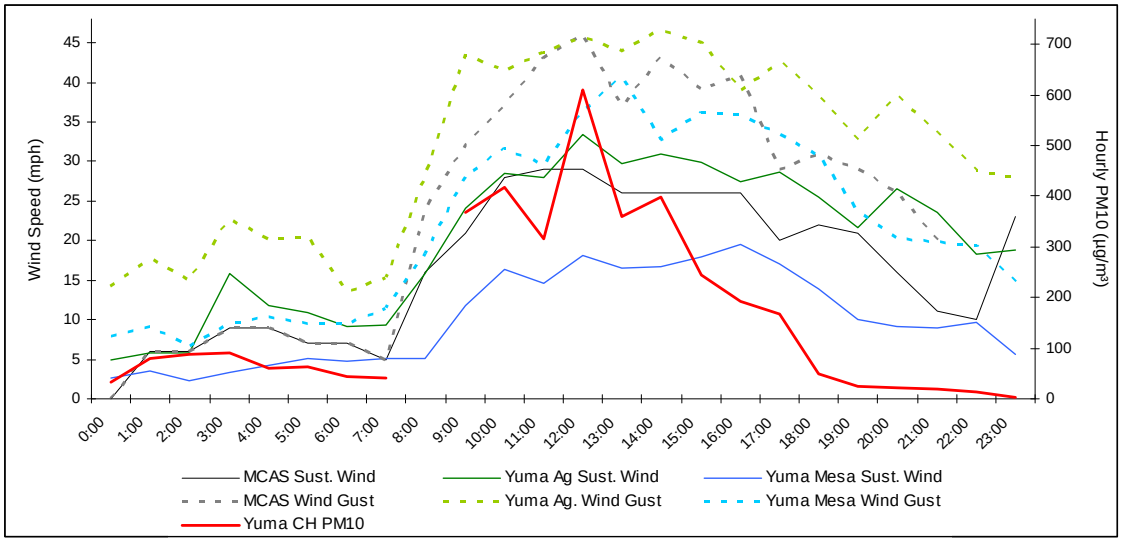


Graph 1. Graph of Yuma MCAS winds & visibility vs. Yuma Courthouse PM_{10} concentrations

Although no monitor specific winds were available at the Yuma Courthouse monitor on March 2, 2008, there were a number of sites collecting wind speed and direction data in the area of Yuma on that date. The NWS Yuma MCAS, Yuma Agricultural Center Farm, and Yuma Mesa sites all collected wind data on March 2nd. As can be seen in Graph 1, wind speeds and PM_{10} concentrations at Yuma MCAS and Yuma Courthouse, respectively, track each other well on March 2, 2008. The exact timing of the onset of elevated PM_{10} is difficult to determine as there was an instrument malfunction and no PM reading is available for the 8:00 a.m. to 9:00 a.m. hour. Using simple interpolation, however, it can be deduced that the PM would have began to increase during this missing hour, concurrent with the onset of high winds.

Graph 2 shows Yuma area average sustained winds and wind gusts at all three available wind data sources in Yuma for March 2, 2008, as well as the PM_{10} concentrations recorded at the Yuma Courthouse monitor on that date. The onset of increased sustained winds at the NWS Yuma MCAS and Yuma Ag. site occurred coincident with the apparent onset of elevated PM_{10} concentrations at the Yuma Courthouse monitoring site. Likewise, the onset of increased wind gusts at the NWS Yuma MCAS and the Yuma Ag. site occurred coincident with the onset of elevated PM_{10} concentrations. Additionally, both sustained winds and wind gusts at both of these locations peak at nearly the same time as do Yuma Courthouse PM_{10} concentrations. There is a slight lag time (one hour) to when the Yuma Mesa site first experiences elevated sustained winds and when it has its peak in sustained winds and wind gusts. This is likely due to the Yuma Mesa site being located downwind of the monitor. There are also some potential influences of local terrain and monitor citing issues that may contribute to the wind speeds and timing reported at Yuma Mesa. These issues are discussed in greater detail below and in Appendix B.

March 2, 2008 – Yuma Area Wind Data and Yuma Courthouse PM_{10} Data



Graph 2. Yuma area hourly wind speeds and PM_{10} concentrations for March 2, 2008.

Time	Yuma CH PM_{10}	Yuma MCAS Sustained Wind	Yuma MCAS Gusts	Yuma Ag. Sustained Wind	Yuma Ag. Gusts	Yuma Mesa Sustained Wind	Yuma Mesa Gusts
0:00	33	0	0	5	14	3	8
1:00	81	6	6	6	18	4	9
2:00	87	6	6	6	15	2	7
3:00	91	9	9	16	23	3	10
4:00	62	9	9	12	20	4	10
5:00	64	7	7	11	20	5	10
6:00	44	7	7	9	14	5	9
7:00	40	5	5	9	15	5	11
8:00	N/A	16	24	16	28	5	18
9:00	369	21	32	24	43	12	28
10:00	419	28	37	28	41	16	32
11:00	317	29	43	28	44	15	30
12:00	610	29	46	33	46	18	36
13:00	361	26	37	30	44	17	41
14:00	398	26	43	31	47	17	33
15:00	245	26	39	30	45	18	36
16:00	192	26	41	28	39	19	36
17:00	167	20	29	29	43	17	33
18:00	50	22	31	26	38	14	31
19:00	24	21	29	22	33	10	24
20:00	22	16	26	27	38	9	20
21:00	19	11	20	23	34	9	20
22:00	15	10	N/A	18	29	10	19
23:00	2	23	34	19	28	6	15

Table 1. Yuma Courthouse PM_{10} data and Yuma area wind speed data for March 2, 2008.

Wind speed and PM_{10} data are presented in Table 1 to allow for an easy comparison of the onset of elevated sustained wind speeds and wind gusts to the onset of elevated PM_{10} concentrations. Average wind speeds greater than 25 mph are shaded orange, average wind speeds greater than 20 mph are shaded yellow, wind gusts greater than 25 mph are shaded pink and wind gusts greater than 40 mph are shaded magenta. Hours of elevated PM_{10} due to the windblown dust event are shaded in red. The data indicate that the timing of the elevated PM_{10} is coincident with

the timing of elevated sustained winds greater than 25 mph and wind gusts from 30-45 mph. The timing of maximum PM_{10} is also concurrent with the timing of some of the highest wind gusts recorded at both the Yuma MCAS as well as the Yuma Agricultural Center Farm. During the 12:00 p.m. hour when PM_{10} reached its hourly concentration peak of 610µg/m³, wind gusts at both the Yuma MCAS and Yuma Agricultural site reached 46 mph and sustained winds at both locations were also at their peaks of 29 mph and 33 mph respectively. Possibly due to terrain or monitor citing issues, Yuma Mesa reported wind speeds significantly lower than those reported by the National Weather Service or at the Yuma Agricultural Center Farm monitor site. A review of historic data shows that wind speeds at the Yuma Mesa site are significantly lower when wind directions fall between about 270 degrees and 25 degrees (i.e. westerly, northwesterly, and northerly directions). The monitor is sited such that obstructions exist to the west, northwest, and north of the site which may influence the wind speeds recorded there (see Appendix B). While the sustained winds reported at the downwind location of Yuma Mesa were on average 10 mph less than those reported at the other sites, the wind gusts reported there were elevated above 25 mph throughout the event and reached a peak of 41 mph in the hour following the peak of the elevated PM_{10} event at Yuma Courthouse. This timing is consistent with its location downwind of the exceeding monitor.

Time	Yuma MCAS Wind Dir.	Yuma Ag. Wind Dir.	Yuma Mesa Wind Dir.
0:00	0	326	12
1:00	270	333	319
2:00	270	300	258
3:00	310	306	291
4:00	290	300	300
5:00	300	302	313
6:00	290	297	316
7:00	310	331	308
8:00	350	359	320
9:00	10	360	349
10:00	10	1	354
11:00	10	1	349
12:00	10	3	350
13:00	360	359	344
14:00	360	357	339
15:00	360	3	345
16:00	350	3	353
17:00	360	3	352
18:00	360	4	351
19:00	360	5	350
20:00	10	6	345
21:00	360	1	341
22:00	340	354	315
23:00	10	348	289

Table 2. Wind Directions at the three Yuma area sites on March 2, 2008.

As can be seen in Table 2, wind directions throughout the Yuma area recorded at the three local meteorological sites were generally out of the northwest in the early morning hours, followed by winds out of the north-northwest to north-northeast during high wind and dust event. Wind directions were generally within 10 to 15 degrees of due north throughout the entirety of the high wind event beginning around 9:00 a.m. and continuing throughout the rest of the day and into the evening. The two most representative stations, located at the NWS Yuma MCAS and at the Yuma Agricultural Center Farm site, depict similar wind directions (northerly) throughout the day.

A HYSPLIT Model back trajectory was run to verify that any transport of dust due to the high winds occurring in the Yuma area on March 2, 2008, was from the north or north-northwest. The HYSPLIT model run began at 0000Z March 3rd (5:00 p.m. local time March 2nd) and went backward 8 hours to 1700Z (10:00 am local time March 2nd), or about the time of the start of the high wind and blowing dust event (see Figure 3).

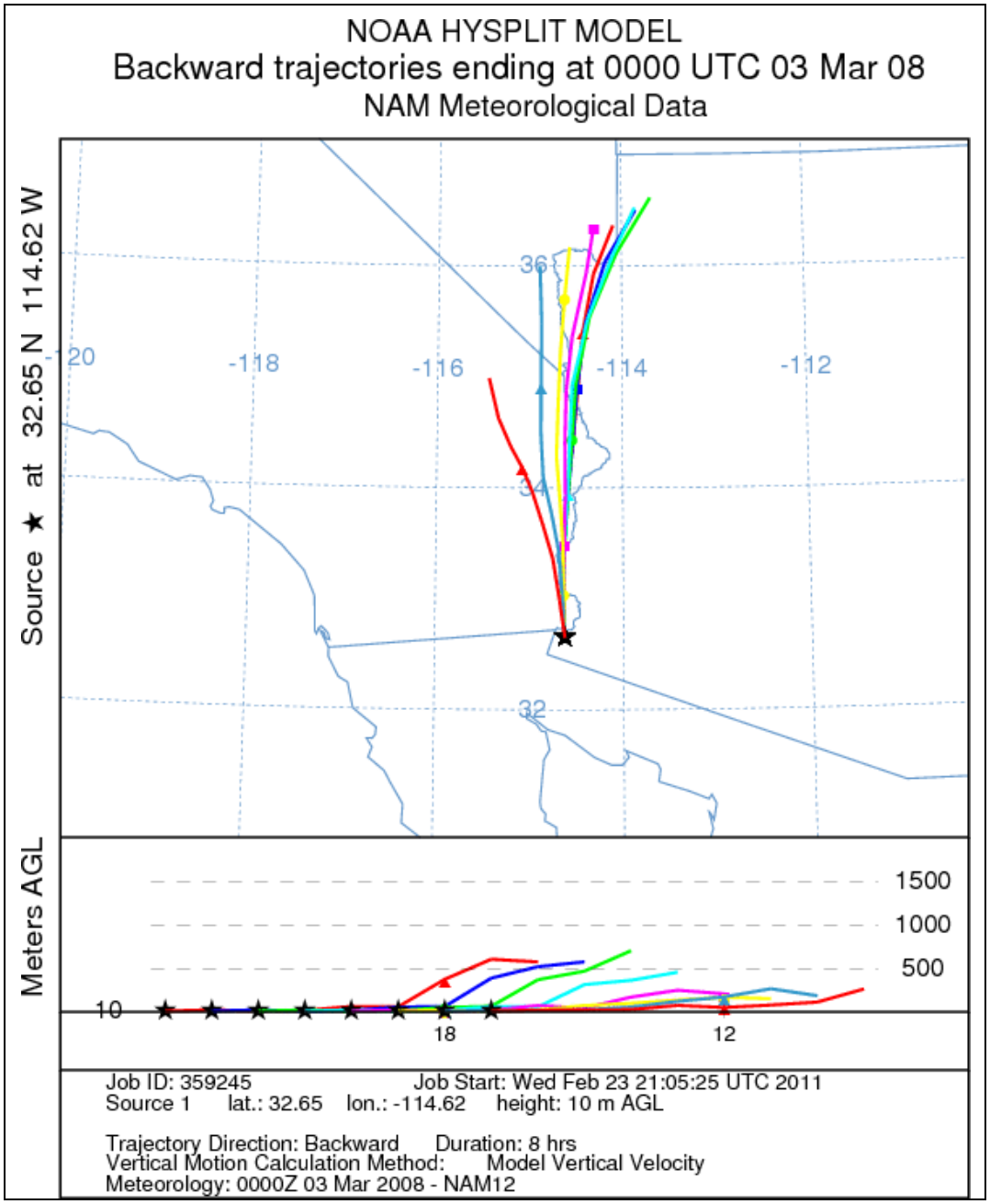


Figure 3. HYSPLIT back trajectory of 10m winds during the event on March 2, 2008.

According to the HYSPLIT Model back trajectories, potential sources of PM_{10} during the March 2, 2008 event include the urbanized area of Yuma, agricultural areas in California, and dry

depositional areas in California. Control measures that are in place for the Yuma area are discussed in detail in Section 4. Most of the agricultural fields surrounding Yuma on the Arizona side of the border lie to the east and west of Yuma. The agricultural fields to the north, the primary direction form which the winds were blowing on March 2, 2008, are out of Arizona's jurisdiction and would be subject to California controls. The HYSPLIT Model run verifies what the local wind data indicated, which is that the generally northerly winds would have brought transported particulate matter from areas north of Yuma, including potential dust sources located in California that do not fall under Arizona's jurisdiction (see Figure 4).

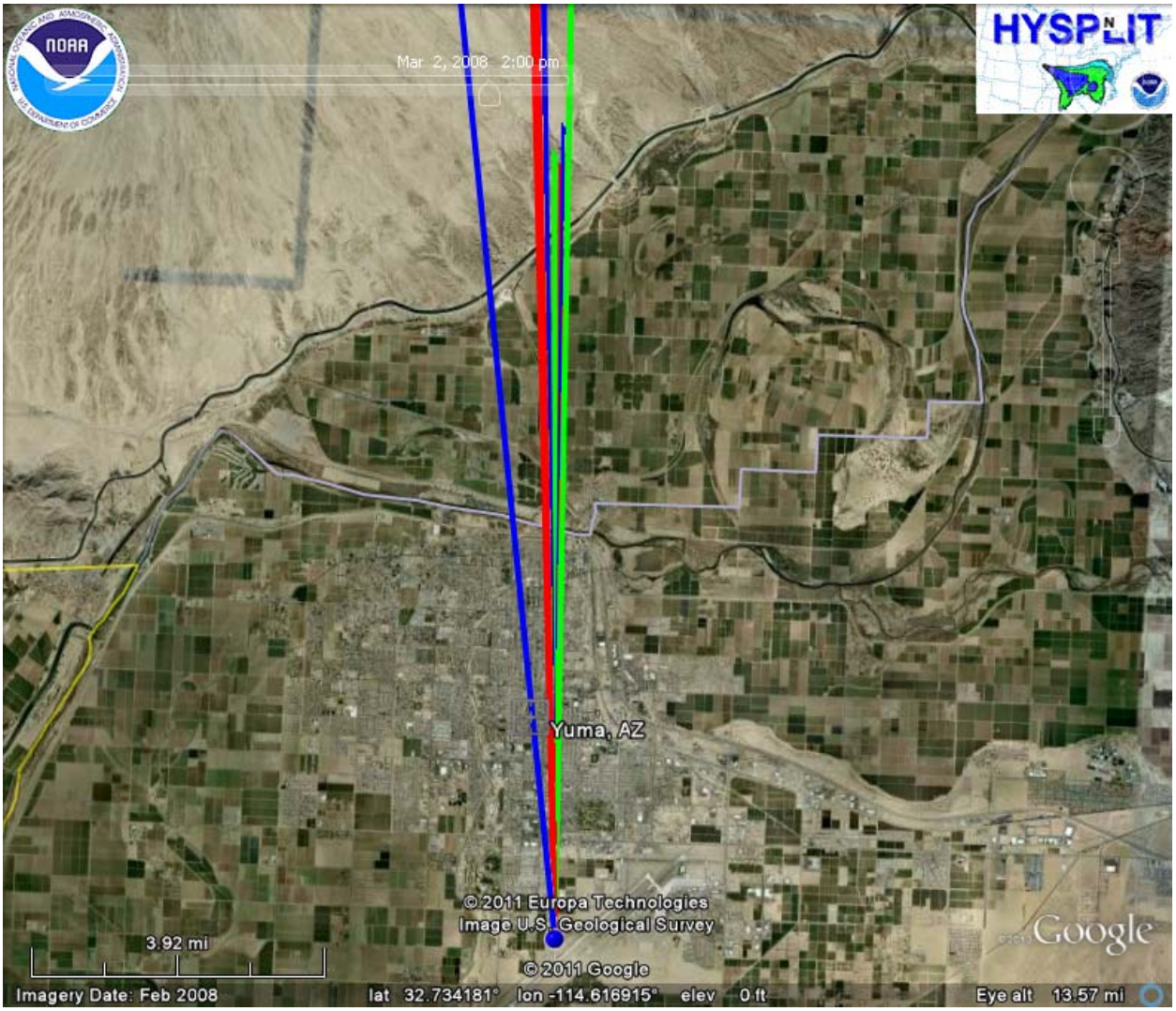


Figure 4. HYSPLIT back trajectory displayed in Google Earth.

Concentrations Were In Excess of Normal, Historical Fluctuations

The Federal Register Notice[1] promulgating the final rule for exceptional events included the following guidance for preparing this demonstration.

> *The final rule permits a case-by-case evaluation, without prescribed threshold criteria, to demonstrate that an event affected air quality. This demonstration would be based on the weight of available evidence, but must consider the historical frequency of such measured concentrations. While a State may determine the specific approach to use for such analysis, it must compare contemporary concentrations with the distribution of all measured data during the past several years. The evidence that an event affected air quality may be presented on a seasonal or other temporal basis to best compare contemporary concentrations with the distribution of historical values. For consistency with data reporting and computation of NAAQS statistics, a calendar quarter basis is suggested.*

To address this requirement, ADEQ has assembled data for the spring (March, April and May) season, as defined by the National Weather Service. A summary of the frequency distribution of the previous 5-years of certified data (2005-2009) from the Yuma Courthouse TEOM monitor is presented in Table 3. Historical distributions are presented for the monitor for both the entire 5-year dataset and for the spring season.

Percentile	**Spring Season (Mar, Apr, May)**	**All Data**
	Yuma Courthouse	*Yuma Courthouse*
5th	20	17
25th	30	29
50th	39	40
75th	50	54
90th	71	72
95th	97	89
98th	163	135
99th	211	188
Max	349	386

Table 3. Historic distribution of 24-hr averaged PM_{10} data (in µg/m^3) from the Yuma Courthouse TEOM monitor

The Yuma Courthouse monitor's concentration is over the 95th percentile value for both the 5-year spring seasonal dataset and the entire 5-year annual dataset. The flagged concentration of 161µg/m³ places it between the 98th and 99th percentile based on the full year of data and places it just below the 98th percentile based on the spring season data. Thus, given the recorded values and using similar methodology to the one accepted by EPA, it is clear that the PM_{10} levels on March 2, 2008, were outside of normal historical fluctuations. While this fact alone does not

[1] Federal Register/ Vol. 72, No. 55, Thursday, March 22, 2007 / Rules and Regulations, Environmental Protection Agency, 40 CFR Parts 50 and 51, Treatment of Data Influenced by Exceptional Events, Final Rule

prove that the event was exceptional in nature or that the sources of the concentrations were not reasonably controllable or the event preventable, it does provide evidence that the event affected air quality and was significant on a historical scale.

No Exceedance But-For the Event

Event Contribution Analysis

Hourly PM_{10} Concentrations ($\mu g/m^3$)

MONITORS:

Yuma Courthouse - 3/2/2008

24-Hr. Avg PM_{10}					
Monitor:	Event w/o Replacement	50th Percentile Replacement		95th Percentile Replacement	
		Seasonal	All Data	Seasonal	All Data
Yuma Courthouse	161	39	38	71	64
	> NAAQS	< NAAQS		< NAAQS	

Pink=Event Contribution

Conclusion:

As shown above, the PM_{10} concentration would have been below the NAAQS "BUT FOR" the event contribution.

50th Percentile and 95th Percentile values at Yuma Courthouse were used to replace concentrations during high wind / high PM hours. This was done by using all data over a 5 year period (2005-2009) and using only the seasonal data from March, April, and May for the 5 year period (2005-2009). The 50th Percentile and 95th Percentile values were also used as replacement for the missing data value during the 8:00 a.m. hour.

Hr	PM_{10}	PM_{10} w/ 50% Replacement		PM_{10} w/ 95% Replacement	
		Seasonal	All Data	Seasonal	All Data
0	33	33	33	33	33
1	81	81	81	81	81
2	87	87	87	87	87
3	91	91	91	91	91
4	62	62	62	62	62
5	64	64	64	64	64
6	44	44	44	44	44
7	40	40	40	40	40
8	N/A	42	41	108	115
9	369	34	34	102	100
10	419	30	30	88	90
11	317	28	28	90	91
12	610	25	25	81	79
13	361	23	23	99	83
14	398	24	23	97	72
15	245	25	24	91	74
16	192	28	26	148	84
17	167	32	31	166	110
18	50	50	50	50	50
19	24	24	24	24	24
20	22	22	22	22	22
21	19	19	19	19	19
22	15	15	15	15	15
23	2	2	2	2	2

The Event Contribution Analysis was prepared to show that there would have been no exceedances "But-For" the windblown dust event. It has been established that the high wind event began during the 8:00 a.m. and 9:00 a.m. hours on March 2nd, and continued throughout the afternoon hours. High PM_{10} values due to this high wind event, and the replacements for those values, are shaded pink in the Event Contribution Analysis. Four different replacements were done. Two were done using the 50th percentile replacement method, with one representing values that would typically be seen on an average day over the five year period running from 2005 to 2009, and another representing values that would typically be seen on an average day during the spring season (as defined by the National Weather Service) over the five year period. This replacement can be considered the "best case scenario" for what concentrations would have been expected if no high wind event occurred. As can be seen in the analysis, both the seasonal and full data set replacements result in 24-hr average PM_{10} concentrations that are well below the NAAQS. Two more replacements were done to represent a "worst case scenario" using the 95th

percentile replacement method, using the same full year and spring season data breaks as was done in the 50th percentile method. The 24-hr concentrations arrived at by using these 95th percentile value replacements, while slightly higher than the 50th percentile method, are still well below the NAAQS.

Wind Speeds Were In Excess of Normal, Historical Fluctuations

The table below (Table 4) shows the historical distribution of hourly averaged wind speed data from the Yuma Mesa and Yuma Agricultural Center Farm sites for the time period 2008 – 2009. The Yuma Agricultural Center Farm site was established in July, 2007 and was removed in February, 2010, therefore only two complete years of data were available from this site. While the Yuma Mesa site existed prior to the installation of the Yuma Ag site, for consistency, the same time period (2008-2009) was analyzed for both sites.

Percentile	**Spring Season (Mar, Apr, May)**		**All Data**	
	Yuma Mesa	*Yuma Ag*	*Yuma Mesa*	*Yuma Ag*
5th	1.3	1.8	1.3	1.8
25th	2.9	3.6	2.9	3.6
50th	4.5	6.0	4.5	5.8
75th	6.3	9.8	6.5	9.8
90th	8.5	14.8	8.9	14.5
95th	10.1	17.4	10.5	17.2
98th	12.1	20.4	12.5	20.6
99th	13.6	21.7	13.6	22.8
99.5th	15.2	23.7	15.2	25.1
Max	21.0	33.3	23.5	33.3

Table 4. Historic distribution of hourly averaged wind data (in mph) from the Yuma Mesa and Yuma Ag monitoring sites

Comparing the hourly wind data from the March 2, 2008, event (table X) with the historical distributions shown in table 1, it can be seen that eight of the nine hours during the event exceeded the 99.5th percentile at the Yuma Ag site and seven of the nine hours exceeded the 99.5th percentile at the Yuma Mesa site. When considering just the Spring season months (Mar, Apr, May), hourly averaged wind speeds at the Yuma Ag site during all hours of the event exceeded the 99.5th percentile. These data indicate that the wind speeds measured on March 2, 2008, were atypical and occurred less than 0.5% of the time.

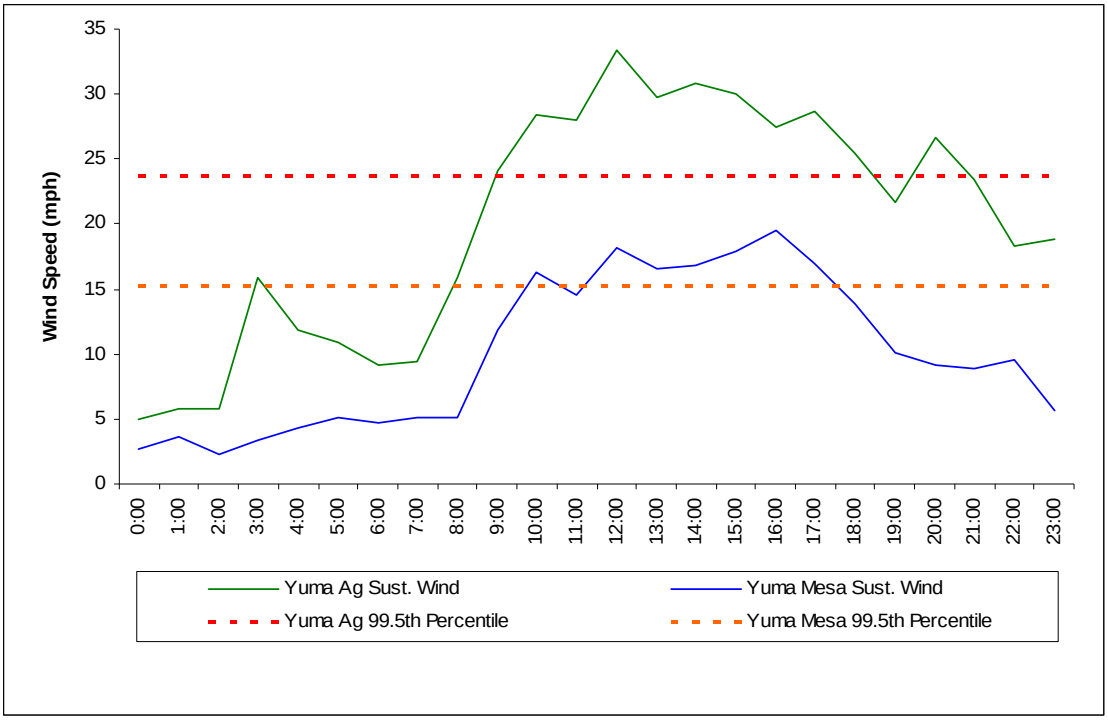


Figure 5. Comparison of wind speed data from March 2, 2008, to the Spring Season 99.5th Percentiles at ADEQ's Yuma Ag and Yuma Mesa sites

Section 4. Control Measures for the Yuma PM_{10} Maintenance Area

Background

Yuma was designated as a moderate PM_{10} nonattainment area by operation of the 1990 Clean Air Act. The nonattainment area is defined in 40 CFR §481.303. ADEQ completed a state implementation plan (SIP) for the area in 1991; however, the plan was found incomplete and in 1994 ADEQ updated the plan, identifying additional reasonably available control measures (RACM). In 2001, due to several years of "clean data" and the existence of permanent and enforceable measures, ADEQ began the development of a maintenance plan and request for redesignation of the area to attainment. The maintenance plan was submitted to EPA in August, 2006.

Control Measures

Details of the control measures implemented 1994-2001 are in Appendix G of the 2006 Yuma PM_{10} Maintenance Plan. For convenience, a list of the measures is contained in Table 5.

Implementing Agency	Reasonably Available Control Measure
City of Yuma	Paving unpaved roads
	Closing unpaved roads
	Chemically stabilize unpaved roads
	Paved or stabilized parking lots
	Traffic re- routing or rapid cleanup of temporary sources of dust and spills
	Covering haul trucks
	Dust control plans for land clearing, construction projects
	Soil stabilization; control dust on open lands
	Building code amendments
Town of Somerton	Traffic re- routing or rapid cleanup of temporary sources of dust and spills
	Covering haul trucks
	Dust control plans for land clearing, construction projects
	Soil stabilization
Yuma County	Paving unpaved roads
	Stabilizing unpaved roads
	Traffic re-routing or rapid cleanup of temporary sources of dust and spills
	Covering haul trucks
	Open Burn Permit Program (Rural Metro)
Irrigation Districts	Reduced traffic on unpaved roads
AZ Dept. of Transportation	Require contractors to adhere to local dust control plans

Table 5. Control Measures Implemented in Yuma Nonattainment Area 1994-2001

RACM for 2000 through 2004 can be found in Table 6.3 of the 2006 plan and is reproduced in part for Table 6 below; a narrative for each measure is located in Chapter 6.3 of the plan. The

maintenance plan also contains in Chapter 7.0 a list of contingencies measures that could be implemented promptly should any violation of the National Ambient Air Quality Standard (NAAQS) for PM_{10} occur.

Implementing Agency	Reasonably Available Control Measure
City of Yuma	Pave unpaved roads
	Pave unpaved alleys
	Paving unpaved vacant land
	Chemically stabilize unpaved roads
	Watering shoulders
	Street sweeping paved roads
	Install curbs and sidewalks
	Landscaping median
	Magnesium chloride on alleys
	Magnesium chloride on City property
Town of Somerton	Water unpaved roads
	Water unpaved shoulders
	Pave unpaved roads
	Weekly cleanup of paved roads, mud, trackout, spills
	Pave unpaved lots
	Landscape shoulders
	Install curbs
	Pave/stabilize unpaved roads
	Chip/seal
	Magnesium chloride on unpaved roads
	Street sweeping
Yuma County	Pave unpaved roads
	Developers add new paved roads
	Chip/seal unpaved roads
	Magnesium chloride unpaved roads
	Street sweeping
Immigration & Naturalization	Water drag roads
	Pipelined
	Maintain 350 “No Trespassing” signs and 50 barricades
	Patrol and water unpaved canal roads
	3 mi posted/barricaded
	Paved 2.5 mi
	2.5 mi fenced off
	Abandoned 3/8 mi
	Lined 8 mi of canal
N. Gila Irrigation District	20 miles posted
Unit B Irrigation District	3 mi posted/barricaded
Implementing Agency	**Reasonably Available Control Measure**
Bureau of Reclamation	Water 960 miles of canal banks
Marine Corps Air Station	Remove 26 gas vehicles

	Remove 25 gas scooters
	Pave 240,329 ft roadway
	Pave 102,112 ft parking
	Sweeping 717221 yd runway
	Sweeping 388952 yd taxiway
	Sweeping 401090 yd aprons and 121,380 yd other
	Stabilize desert

Table 6. Yuma Area Implemented Control Measures 2000-2004

In 2010, the Yuma Metropolitan Planning Organization (YMPO) updated the Transportation Improvement Plan (TIP) as required to comply with the requirements for transportation conformity under Section 176(c)(2) of the Clean Air Act. The update required a review of control measures included in the 2006 PM_{10} plan to assure emissions were within the limits found in both plans for the current review years through the 2016 projected maintenance period. Yuma's plans related to transportation can be found under "plans and reports" at http://www.ympo.org/.

Additional Measures

On August 18, 2002, Yuma experienced a 170 $\mu g/m^3$ concentration of the 24-hour 150 $\mu g/m^3$ average PM_{10} NAAQS and developed a Natural Events Action Plan (NEAP) to address any measures that could be implemented to prevent future violations. The option to develop a NEAP is no longer available; however, Yuma reviewed existing measures and developed additional measures that were later incorporated into the 2006 maintenance plan. These included: (1) a public notification and education program still in place today and augmented recently by a pilot flag program for public schools and facilities based on the Yuma Dust Control Action Forecast [Appendices D, E and F]; (2) an analysis of best available control measures (BACM) normally reserved for serious nonattainment areas, and (3) a review of existing control measures for construction sources, street sweepers, paved roads, covered trucks, off-highway vehicles, stationary source opacity limits, other stationary source control measures, and agricultural best management practices [Appendix H]. In 2002 ADEQ met with Yuma stakeholders and began work on the development of a Yuma Agricultural Best Management Practices (AgBMP) rule. The rule became effective July 18, 2005, as R18-2-613 of the *Arizona Administrative Code*, and was submitted to EPA on August 16, 2006.

Review of Source Permitted Inspections and Public Complaints

ADEQ's Arizona Unified Repository for Information Tracking of the Environment (AZURITE) database was queried to compile a list of inspections for the permitted sources in the Yuma area around the time of the PM_{10} exceedance. Using a date range that includes the date of the exceedance, three days prior, and three days following the event, it was determined that no inspections occurred during this time. Similarly, the same date range was used to search for complaints within the AZURITE database. This search also resulted in no complaints being submitted from the Yuma area around the time of the exceedance.

Section 5. Procedural Requirements

The procedural requirements described in EPA's *Treatment of Data Influenced by Exceptional Events* rule (codified in 40 CFR 50) include a public notification that an event was occurring, the placement of informational flags on data in the Air Quality System, the notification of EPA of the intent to flag through 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. All of these procedural requirements are met, or will be met, with the submittal of this demonstration document.

The public comment period for this analysis was opened on Monday, February 28, 2011. It was announced in the Yuma Daily Sun. It ran for thirty days and closed on Wednesday, March 30, 2011. Any public comments received will be forwarded to EPA, consistent with the requirements of 40 CFR 50.14(c)(3)(iv). A copy of the public notice and the affidavit of publication of the public notice were also forwarded to EPA.

Section 6. Conclusion

The information presented in this assessment report of the March 2, 2008, high wind event provides evidence that the elevated PM_{10} concentrations measured at ADEQ's Yuma Courthouse monitor on this day were caused by strong winds that suspended and transported dust that was not reasonably controllable or preventable. Historical wind data show that the winds speeds measured on March 2, 2008, at the Yuma area meteorological stations were above the 99.5th percentile, a measure that indicates the event was unusual. Sustained winds speeds during the event exceeded 25 mph for approximately eight hours, which overwhelmed the reasonably available control measures that are in place throughout the Yuma area. The Event Contribution Analysis in Section 3 shows that but for the contribution of windblown dust from the strong winds, an exceedance of the PM_{10} NAAQS would not have occurred on March 2, 2008.

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Appendix A - Yuma Dust Control Forecast

ADEQ
Arizona Department of Environmental Quality
Janet Napolitano, Governor
Stephen A. Owens, ADEQ Director

YUMA AND VICINITY
DUST CONTROL ACTION FORECAST
ISSUED FRIDAY, FEBRUARY 29, 2008
Three-day weather outlook:

Afternoon desert temperatures will reach the low to mid 80s on Saturday with increasing winds ahead of an approaching trough of low pressure. This system is lacking moisture and will be primarily a wind-maker. As a result, gusty winds are expected across much of Arizona on Sunday as the system pushes through. Winds will decrease a bit on Monday with afternoon desert temperatures holding in the mid to upper 70s under mostly sunny skies. The risk on wind-blow dust in Yuma will be "HIGH" on Sunday, dropping to "Moderate" on Monday.

	WINDS	WIND BLOWN DUST RISK
Day #1: Sat 03/01/2008	Southeast winds 10 to 20 mph are expected much of the day.	**LOW**
Day #2: Sun 03/02/2008	North winds 15-20 mph are expected early, increasing to 20 to 25 mph by the afternoon with occasional higher gusts.	**HIGH**
Day #3: Mon 03/03/2008	North winds 15 to 20 mph are likely early, decreasing by the afternoon hours.	**MODERATE**

PM-10 & PM-2.5 (PARTICLES)

Description – The term "particulate matter" (PM) includes both solid particles and liquid droplets found in air. Many manmade and natural sources emit PM directly or emit other pollutants that react in the atmosphere to form PM. Particles less than 10 micrometers in diameter tend to pose the greatest health concern because they can be inhaled into and accumulate in the respiratory system. Particles less than 2.5 micrometers in diameter are referred to as "fine" particles and are responsible for many visibility degradations (brown cloud). Particles with diameters between 2.5 and 10 micrometers are referred to as "coarse".

Sources – Fine = All types of combustion (motor vehicles, power plants, wood burning, etc.) and some industrial processes. Coarse = crushing or grinding operations and dust from paved or unpaved roads.

Potential health impacts – PM can increase susceptibility to respiratory infections and can aggravate existing respiratory diseases, such as asthma and chronic bronchitis.

Units of measurement – Micrograms per cubic meter (ug/m3)

Averaging interval – 24 hours (midnight to midnight).

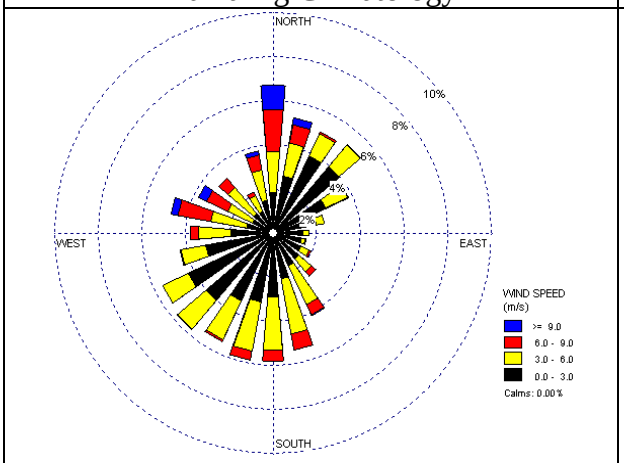
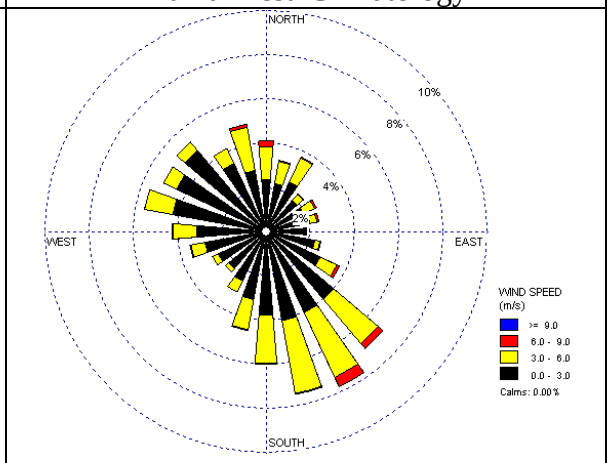
Reduction tips – Stabilize loose soils, minimize travel on dirt roads, utilize tarps on haul trucks, limit use of leaf-blowers, and on high-wind days reduce outdoor activities.

CKR 05/09/2005

Appendix B - Yuma Area Meteorological Monitors Site Description & Data Summary

During routine data review procedures, the following information was documented regarding wind data from the Yuma Mesa and Yuma Agricultural Center sites.

The wind rose plots below show climatological values of wind speed and wind direction at both the Yuma Mesa and Yuma Agricultural Center Farm sites. It can be seen that the wind climatologies at the two sites differ substantially. Some of this difference may be attributed to Yuma Ag's proximity to the Colorado River Valley. The predominantly northeast / southwest wind direction lines up nicely with the flow of the Colorado River. Local microclimate wind regimes characterized by up river and down river flows are apparent in the Yuma Ag wind data. The Yuma Mesa site on the other hand is characterized by predominantly a west / northwest and south / southeast component. The south / southeasterly component is likely an artifact of monsoonal flow, while the west / northwest direction is typical during the winter and spring months. While the Yuma Ag site does not contain a large overall percentage of winds from the northwest, it does contain a large percentage of high winds from this direction. These winds are likely associated with low pressure troughs and surface frontal passages during the winter and spring time. Despite a low overall percentage of winds from the northwest, the difference in wind speed between Yuma Ag and Yuma Mesa is greatest when winds are from the west, northwest, and northerly directions (Table 1 – (c)). Meanwhile, wind speeds at Yuma Mesa are virtually never greater than those at Yuma Ag when winds are out of these directions. The wind roses below show the general wind climatology at the Yuma Mesa and Yuma Ag sites, as well as differences in wind speeds between the two sites and how those differences relate to wind direction. In table 1 (c) and (d), black colors indicate wind speed differences less than 3 m/s while yellow indicates wind speed differences greater than 3 m/s. It can be seen that the greatest differences occur when winds are out of the west, northwest, and northerly directions. The lower wind speeds at Yuma Mesa may be attributed to nearby obstructions that are located to west, northwest, and north of the site.

Yuma Ag Climatology	Yuma Mesa Climatology
	
(a)	(b)

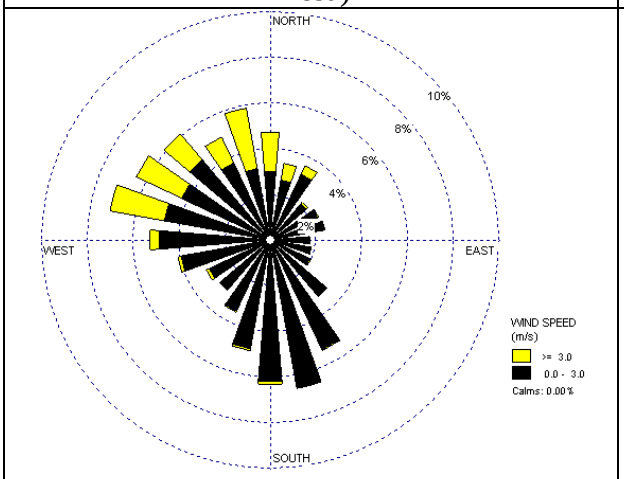
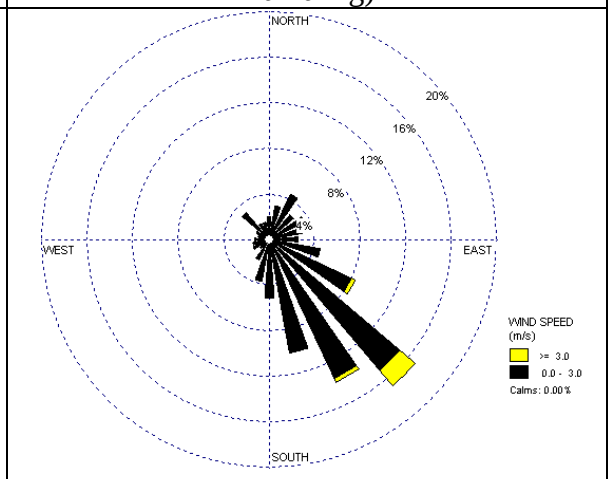
Wind speed difference (Yuma Ag > Yuma Mesa)	Wind speed difference (Yuma Mesa > Yuma Ag)
	
(c)	(d)

Table 1 - Typical wind rose plots for Yuma Ag (a) and Yuma Mesa (b). Yuma Mesa winds speeds are only greater than that at Yuma Ag when winds are out of the southeast (d). Yuma Ag wind speeds are much greater than that at the Yuma Mesa site only when winds are out of the northwest (c).

Figures 2 and 3 show the aerial images of the Yuma Mesa and Yuma Ag sites. It can be seen that possible obstructions are located to the west, northwest, and north of the Yuma Mesa site, while there appear to be no obstructions at the Yuma Ag site (particularly to the north and northwest of the site). In general, the Yuma Ag site appears to have a much larger fetch of land for which the wind can blow without any obstructions from nearby facilities or vegetation.

Figure 1 - Aerial image of Yuma Mesa site and surrounding area

Figure 2 - Aerial image of Yuma Agricultural Center Farm site and surrounding area