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PRELIMINARY DOCUMENTATION

Assessment of Qualification for Treatment under the Arizona Natural and Exceptional Events Policy for the High Particulate (PM₁₀) Concentration Events in the Phoenix and Yuma Areas on November 9, 2008

Background

The Arizona Department of Environmental Quality (ADEQ) issues Dust Control Action Forecasts for the Yuma and Phoenix areas as part of their Natural Events Action Plans. On Friday, November 7, 2008, in response to a deepening upper level trough of low pressure passing north of Arizona causing a tightening pressure gradient over the State, ADEQ air quality forecasters issued both the Maricopa County Dust Control Action Forecast and Yuma Wind Forecast each of which called for a moderate risk of wind-blown dust for Sunday, Nov 9th. Both forecasts mentioned the possibility of sustained 20 mph west or southwesterly winds with even stronger gusts possible. When forecast data were reanalyzed during the morning of Sunday, November 9th, a same day PM₁₀ Health Watch was issued for the Phoenix Metro area. This potential wind event equated to a significant risk of exceeding the PM₁₀ National Ambient Air Quality Standards (NAAQS) in both Yuma and Maricopa Counties. The forecasts/advisories satisfy the requirement in 40 CFR 51.920(a)(1).

Strong winds did occur and were observed in both the Phoenix Metro and Yuma areas on November 9, 2008. Beginning in the early afternoon and continuing throughout the early evening hours, strong west and southwesterly winds in Phoenix and strong westerly winds in Yuma

generated areas of blowing dust in both Yuma and Maricopa Counties. All appropriate State Implementation Plan (SIP) control measures were in place during the event demonstrating, per 40 CFR 50.1(j), that the event “is not reasonably controllable or preventable.”

The initialization of a wind-blown dust event is evident in the Phoenix visible camera images as well as the Arizona Meteorological Network (AzMET) and National Weather Service (NWS) monitors (see Fig. 1). Yuma radar data obtained from the National Climatic Data Center (NCDC) also showed areas of blowing dust in southeastern California and southwestern Arizona. These radar data indicate that some (though not all) of the dust that affected the Yuma area likely originated in southeastern California and was transported into southwestern Arizona. This significant wind event brought elevated ambient concentrations of PM₁₀ to the Phoenix and Yuma areas that exceeded the NAAQS at the Yuma Courthouse, West 43rd Ave., Durango, and South Phoenix monitors. The fact that ambient concentrations exceeded the NAAQS satisfies the criteria in 40 CFR 50.1(j) that the event “affects air quality.” The following are the key PM₁₀ monitor readings for the monitors examined in this report.

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*	252.4	1391	1300	RJ
PHOENIX METRO AREA					
West 43 rd Ave (MC/TEOM)	04-013-4009*	248.1	1832	1500	RJ
Durango Complex (MC/TEOM)	04-013-9812*	169.8	961	1500	RJ
South Phoenix (MC/TEOM)	04-013-4003*	230.4	1657	1500	RJ
Greenwood (MC/TEOM)	04-013-3010*	133.8	760	1500	None
Higley (MC/TEOM)	04-013-4006*	133.2	421	1600	None
Central Phoenix (MC/TEOM)	04-013-3002*	133.4	725	1500	None
BUCKEYE AREA					
Buckeye (MC/TEOM)	04-013-4011*	147.9	594	1400	None

* EPA Air Quality System Identification Number ** 24-hr PM₁₀ concentration influenced by natural or exceptional event to be flagged.

Type Abbreviations: BAM – Beta-Attenuation Mass Monitor (Continuous monitor)

TEOM – Tapered Element Oscillating Microbalance Monitor (Continuous monitor).

The preliminary findings from this analysis were presented at a stakeholders meeting on March 19, 2009, in Phoenix,

Arizona. This document is being submitted to EPA to satisfy the requirements of 40 CFR 50.14(c)(2)(iii), and

NWS-Luke Air Force Base

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	51	10		3	3	N
2	53	10		0	0	N
3	48	10		7	7	NW
4	50	10		8	8	NW
5	50	10		3	3	NW
6	51	10		0	0	N
7	50	10		6	6	N
8	53	10		3	3	SW
9	54	10		0	0	N
10	60	10		3	3	E
11	64	10		3	3	N
12	67	10		5	5	S
1	72	10		5	5	SW
2	74	10		3	3	SW
3	72	9	TSRA	5	5	W
4	73	2	HZ	30	40	SW
5	69	8		23	31	W
6	67	10		17	29	W
7	62	10		11	11	NW
8	62	10		11	11	NW
9	60	10		0	0	N
10	60	10		6	6	S
11	59	10		5	5	W
12	58	10		5	5	S

CENTRAL PHOENIX

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	56	31	-	2	5	SE
2	56	29	-	3	5	SE
3	54	29	-	2	5	SE
4	55	29	-	3	5	SE
5	55	27	-	4	7	SE
6	54	27	-	3	6	SE
7	53	28	-	3	6	E
8	54	27	-	3	9	E
9	55	26	-	4	8	SE
10	58	25	-	4	7	E
11	66	18	-	4	8	SE
12	69	16	-	5	10	SE
1	73	14	-	4	7	S
2	75	13	-	3	8	W
3	75	17	-	4	17	SW
4	74	28	-	11	23	W
5	70	18	-	13	24	W
6	67	26	-	12	23	W
7	65	31	-	9	17	NW
8	61	42	-	3	11	NW
9	59	47	-	2	8	NW
10	56	57	-	0	3	N
11	55	54	-	1	4	SW
12	43	65	-	3	7	E

Event Contrib. Analysis

Hourly PM₁₀ Conc. (µg/m³)

MONITORS: 1-South Phx, 2-West 43rd, 3-Durango

Hr	1	2	3
1	73	66.4	64.2
2	89.4	65.9	67.4
3	74.7	66.7	78.8
4	70.6	73.3	40.4
5	52.6	60.9	65.7
6	46	56.1	70.2
7	70.6	61.1	56.2
8	87.7	53.5	72.4
9	104	64.2	78.8
10	112	72.4	55.2
11	68.3	61	47.8
12	40	42.7	39.6

24-Hr. Avg PM₁₀ with w/o

Monitor	Event	Event
1-South	230	66
2-West 43rd	248	56
3-Durango	169	79

Conclusion: As shown above, the PM₁₀ concentration would have been below the NAAQS "BUT FOR" the event contribution (hours highlighted in pink).

Event Contrib. Analysis

Hourly PM₁₀ Conc. (µg/m³)

MONITORS: 4-Yuma CH

Hr	1
1	48.5
2	22.1
3	22.2
4	30.8
5	29.5
6	14.1
7	11.5
8	14.4
9	14.5
10	17
11	109
12	497

24-Hr. Avg PM₁₀ with w/o

Monitor	Event	Event
4-Yuma CH	252	36

Conclusion: As shown above, the PM₁₀ concentration would have been below the NAAQS "BUT FOR" the event contribution (hours highlighted in pink).

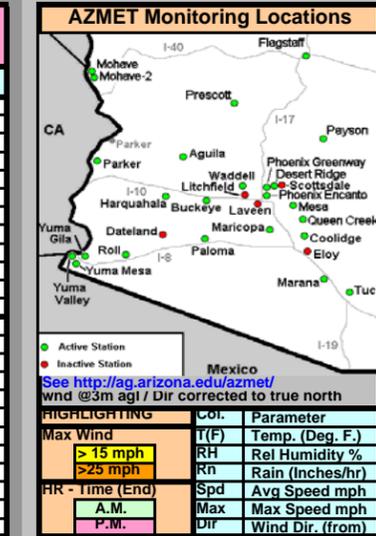
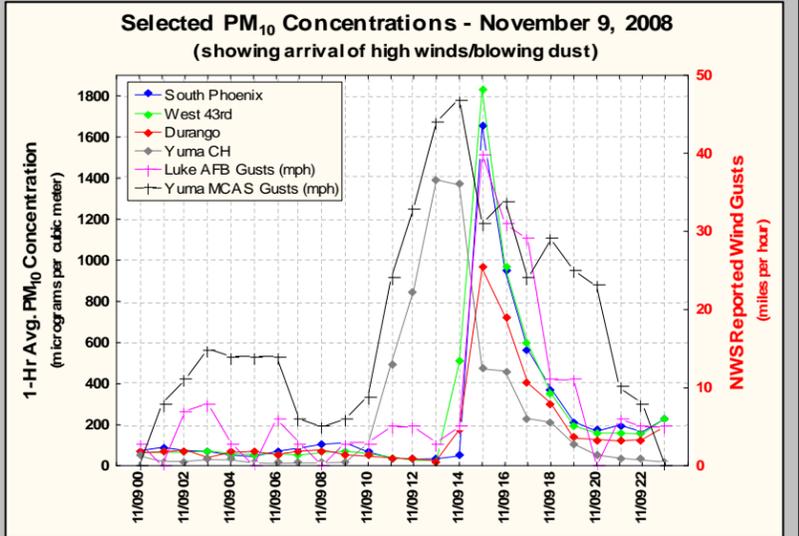


Figure 1. Key Data for Event of November 9, 2008

PHX WINDS	KEY	PM10 PLOT
CEN. AZ WINDS		SAT IMAGES
SO AZ WINDS		PHX VIS. CAMERAS

SUMMARY OF EVENT

Between 1:00 pm and 6:00 pm, dense blowing dust, gusty winds, and a few isolated thunderstorms were observed throughout the Valley. Chandler and Williams Gateway Airport reported southerly gusts up to 29 mph. Visibility was only 9 statute miles at 2:21 pm at Luke AFB.



NWS-Yuma MCAS

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	60	10		0	0	N
2	59	10		8	8	SE
3	61	10		11	11	SE
4	63	10		15	15	SE
5	64	10		14	14	S
6	64	10		14	14	S
7	63	10		14	14	S
8	62	10		6	6	S
9	64	10		5	5	SE
10	67	10		8	8	SW
11	71	10		9	9	W
12	73	5	HZ	18	24	W
1	74	3	HZ	28	33	W
2	73	1	HZ	33	44	W
3	73	0.50	HZ	29	47	W
4	71	8		22	31	W
5	67	6	HZ	22	34	W
6	65	7		18	24	W
7	63	10		22	29	W
8	62	10		16	25	W
9	61	10		15	23	W
10	60	10		10	10	W
11	57	10		8	8	W
12	57	10		0	0	N

MARICOPA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	53	24	-	5	9	S
2	54	16	-	7	10	S
3	53	18	-	3	7	SE
4	45	29	-	3	6	NW
5	42	33	-	3	5	NW
6	42	33	-	3	5	NW
7	43	40	-	2	6	N
8	44	35	-	3	6	NW
9	48	33	-	3	5	N
10	52	29	-	3	8	N
11	62	20	-	3	8	N
12	72	13	-	11	22	S
1	76	14	-	16	23	S
2	78	17	-	14	22	SW
3	76	28	-	12	26	W
4	74	30	-	16	24	W
5	71	14	-	18	25	W
6	67	18	-	13	23	W
7	65	24	-	11	21	W
8	63	29	-	10	16	W
9	62	31	-	8	14	W
10	59	35	-	6	11	SW
11	56	43	-	5	7	SW
12	53	49	-	5	8	S

Historical Distribution

5-Yr. Dist. of Values (µg/m³)

MONITORS: 1-South Phoenix, 2-West 43rd Ave, 3-Durango

Cum. Freq.	Mon 1			Mon 2			Mon 3		
	Yr	Sea	Yr	Sea	Yr	Sea	Yr	Sea	
Min	7	13	5	7	5	8	7	5	8
0.5%	7	16	9	11	9	11	10	11	13
1.0%	10	16	11	15	10	13	13	19	20
2.5%	13	19	15	16	15	20	18	20	24
5%	18	20	19	25	19	24	24	29	30
10%	24	29	29	33	26	30	36	37	44
25%	36	37	44	49	39	45	49	54	65
50%	49	54	65	74	56	66	64	67	91
75%	64	67	91	99	78	92	85	83	121
90%	85	83	121	125	109	114	94	87	139
95%	94	87	139	149	123	126	96	86	127
97.5%	126	90	157	154	144	139	127	94	131
99.0%	147	100	192	166	181	153	127	94	131
99.5%	164	105	227	174	200	161	211	204	349
Max	171	131	313	175	253	189	349	320	

Flagged Value: 230, 248, 169

Conclusion: Flagged Value is exceptional in nature (ie greater than 95% of all data)

Historical Distribution

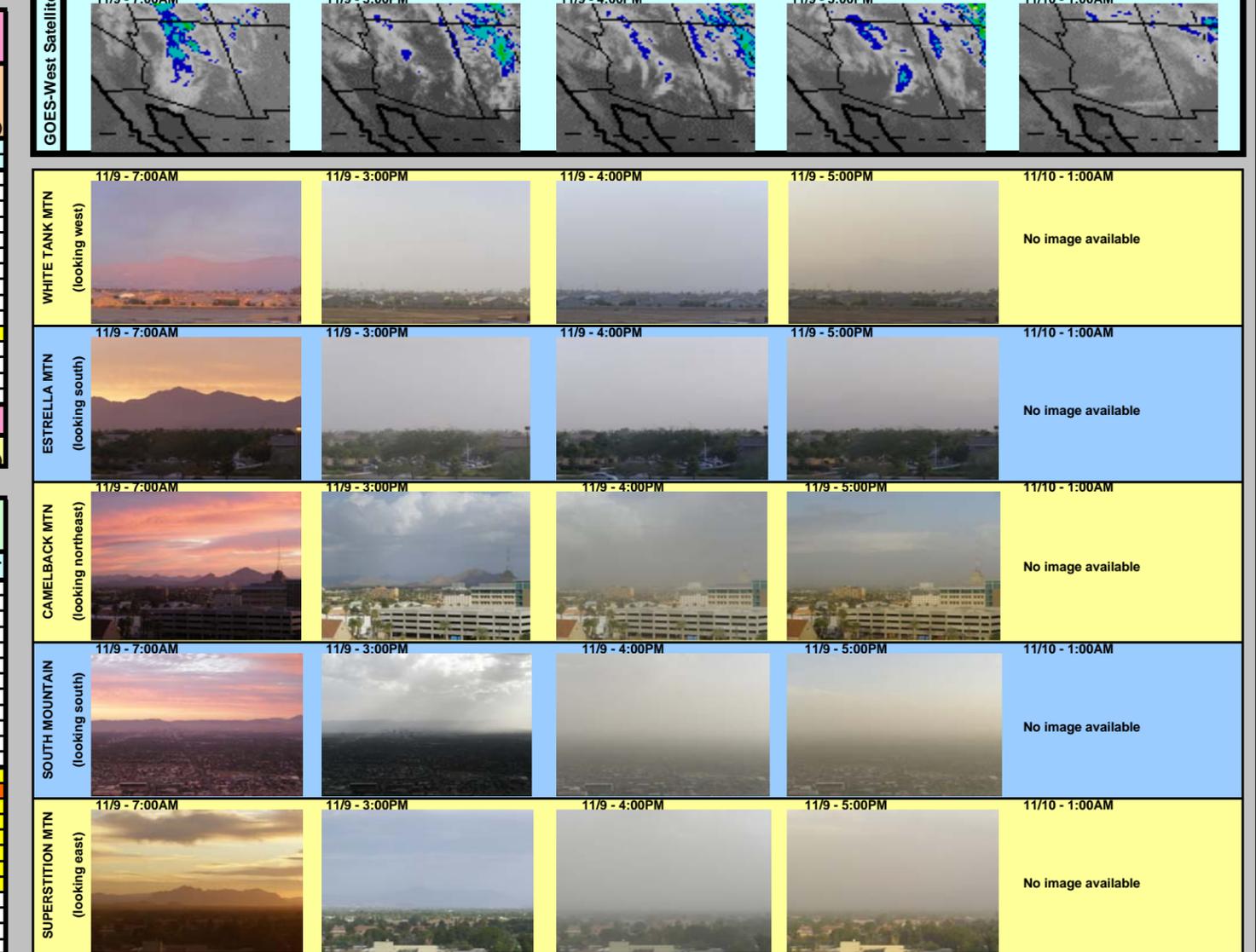
5-Yr. Dist. of Values (µg/m³)

MONITORS: 4-Yuma CH

Cum. Freq.	Mon 4		
	Yr	Sea	Yr
Min	8	12	12
0.5%	12	13	13
1.0%	14	15	15
2.5%	16	20	20
5%	19	22	22
10%	23	26	26
25%	31	34	34
50%	42	46	46
75%	57	58	58
90%	77	73	73
95%	96	86	86
97.5%	127	94	94
99.0%	186	131	131
99.5%	211	204	204
Max	349	320	320

Flagged Value: 252

Conclusion: Flagged Value is exceptional in nature (ie greater than 95% of all data)



YUMA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	57	56	-	2	3	NE
2	56	59	-	2	4	NE
3	57	46	-	2	4	NE
4	58	43	-	2	6	NE
5	59	64	-	1	5	NE
6	59	77	-	1	4	NE
7	59	86	-	2	6	W
8	59	87	-	4	7	SW
9	62	85	-	4	11	SE
10	65	75	-	4	9	SW
11	69	40	-	12	24	W
12	71	31	-	17	27	NW
1	72	29	-	22	33	W
2	72	27	-	25	37	NW
3	72	25	-	24	35	W
4	70	29	-	23	35	NW
5	67	35	-	22	33	W
6	65	39	-	17	26	W
7	63	44	-	16	26	W
8	61	47	-	14	25	W
9	60	51	-	13	20	NW
10	59	53	-	13	19	NW
11	59	54	-	11	15	NW
12	58	55	-	7	12	NW

PALOMA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	49	28	-	3	6	SE
2	45	59	-	2	5	NE
3	45	56	-	2	4	NE
4	46	49	-	3	6	E
5	46	52	-	2	5	E
6	47	43	-	3	4	E
7	47	52	-	3	6	E
8	50	40	-	4	6	E
9	52	49	-	3	6	NE
10	60	42	-	4	6	NW
11	70	25	-	3	8	E
12	76	27	-	15	27	SW
1	76	37	-	19	26	SW
2	76	38	-	20	26	W
3	75	27	-	21	29	W
4	71	23	-	22	29	

Assessment of November 9, 2008 event (Cont.)

will be supplemented and made available for public

comment to satisfy the requirements of 50.14(c)(3)(i).

Assessment under the Technical Criteria Document (TCD)

1. Properly qualify and validate the air quality measurement to be flagged. As this was not a filter sampling date (1-in-6 run day), only data from the continuous analyzers were examined. The air quality monitoring data were reviewed by the agency responsible for operation of the monitor. All hourly PM₁₀ readings from the Yuma Courthouse, West 43rd Ave., Durango, and South Phoenix monitoring sites were valid for November 9th. Audits of the analyzers revealed operations were within acceptable tolerance. No local sources were reported as significantly contributing to the dust event.

2. Review suspected contributing sources. The NWS and AzMET surface data for Arizona, along with the visible camera images in Phoenix, provide a good explanation as to what meteorological conditions were in place on November 9, 2008. Strong west and southwesterly winds were occurring in the Phoenix and Yuma areas due to a passing low-pressure system and tightening pressure gradient over Arizona. PM₁₀ concentrations spiked at the Yuma Courthouse monitor and numerous Phoenix area monitors throughout the afternoon and evening hours as gusty winds increased out of the west. The plot of hourly PM₁₀ concentration data in the upper right corner of Figure 1 confirms the nearly identical timing of the elevated PM₁₀ concentrations recorded at West 43rd Ave., Durango, South Phoenix, and Yuma Courthouse and the strong wind gusts at Luke Air Force Base and Yuma Marine Corps Air Station (MCAS). The Phoenix visibility network images provide visual evidence of large amounts of suspended dust throughout the Phoenix Metro area. While similar images are not available for the Yuma area, Yuma radar data help visualize the transport of dust and soils across southeastern California and southwestern Arizona (see attachment).

3. Examine all air quality monitoring information. Data from all monitors in the network were reviewed. Monitors from the affected areas are summarized in the table in the Background section of this assessment. Pursuant to 40 CFR 50.14(c)(3)(iii)(C), the "Historical Distribution" Table in Figure 1 has been included to demonstrate that the event is associated with measured concentrations in excess of normal historical fluctuations, including background (i.e., concentrations greater than the 95th percentile).

4. Examine the meteorological conditions before and during the event. The AzMET meteorological data are summarized in Figure 1. The wind data are highlighted yellow if the max wind speed in the hour exceeds 15 mph

and orange if it exceeds 25 mph. As can be seen in Figure 1, wind speeds did not pick up in central and southern Arizona until the afternoon, when several stations began reporting wind gusts of 15-20 mph or greater. As winds continued to increase through the afternoon, the onset of elevated PM₁₀ concentrations began at the four flagged monitoring sites, each of which continued to show higher PM₁₀ values as winds increased. PM₁₀ values at South Phoenix and West 43rd Ave. remained high even after the winds had died down, likely due to suspension and transport of PM₁₀ in the lower atmosphere.

5. Perform a qualitative attribution to emission source(s). All evidence indicates the elevated PM₁₀ concentrations in the Phoenix and Yuma areas can be attributed to soil emissions that were transported over portions of Maricopa County and Yuma County. No source specific emission allocation is possible based on the data available for analysis. The hourly concentration data do not show any significant source other than the wind-blown dust event occurring on November 9, 2008. Visual evidence of reduced visibility during the afternoon hours throughout portions of the Phoenix Metro area can be seen in the images located in the lower right portion of Figure 1. These images provide proof that the elevated PM₁₀ concentrations in and around Phoenix were coincident with strong gusty winds and can be attributed to soil emissions. Haze and reduced visibilities were observed and reported by Luke AFB weather spotters during the afternoon and evening hours of November 9th. In addition, visibility was reduced to 0.5 miles and haze was reported by trained weather spotters at the Yuma MCAS. These observations provide further proof that the elevated PM₁₀ concentrations recorded by the Yuma and Phoenix area monitors were the result of a wind-blown dust event.

6. Estimation of Contribution from Source or Event. The primary source appears to be wind-blown dust over southeastern California, southwestern and south central Arizona for which there is not an effective or efficient method to estimate the relative contributions from specific sources. The demonstration analysis contained in this report establishes the linkage between the measurements to be flagged and the event, thus satisfying the requirement in 40 CFR 50.14(c)(3)(iii)(B). Pursuant to 40 CFR 50.14(c)(3)(iii)(D), the "Event Contrib. Analysis" Table in Figure 1 was included to demonstrate that there would have been no exceedances but for the event (i.e., the contribution during the event overwhelmed the 24-hour averages).

7. Determination that a Natural or Exceptional Event Contributed To an Exceedance. Based on this analysis, the event satisfies the requirement in 40 CFR 50.1(j) that the elevated concentrations at Yuma Courthouse, West 43rd Ave., Durango, and South Phoenix were attributed to a natural event.

Conclusion

Long-range transport of dust from soils. The region wide elevated PM₁₀ event on November 9, 2008, in Yuma and Maricopa Counties was the result of transported dust and soils from winds that suspended natural soils and soils from areas where Best Available Control Measures are in place and should be flagged for air quality planning purposes.

The "high wind" (RJ) flag should be applied to the monitor readings indicated in the table at the beginning of this report, as the monitor would have been below the NAAQS but for the contribution of the event.