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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 June 4, 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 Tuesday, June 3, 2008, in response to a deepening upper level trough of low pressure and an approaching dry surface cold front, ADEQ air quality forecasters issued the Maricopa County Dust Control Action Forecast calling for a moderate risk of wind-blown dust for Wednesday, June 4th, in Maricopa County. The tightening pressure gradient was expected to impact the Yuma area as well, as the cold front moved into Arizona. Because of this, ADEQ air quality forecasters called for a high risk of wind-blown dust in their Yuma and Vicinity Dust Control Action Forecast for Wednesday, June 4th. 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. On the morning of June 4th, models predicted local wind gusts to be even stronger than anticipated based on the previous day's model runs, prompting ADEQ forecasters to issue a same day PM₁₀ Health Watch for Maricopa County stating that "Blowing and suspended dust, contributed to by strong and gusty gradient winds, may cause concentrations of coarse particles to approach unhealthy levels this afternoon and evening". The forecasts/advisories satisfy the requirement in 40 CFR 51.920(a)(1).

The initial forecast for June 4th for both Maricopa County and Yuma called for sustained winds of 15-25 mph with the

possibility for gusts over 30 mph which would be capable of producing significant wind-blown dust. Subsequent forecasts the morning of June 4th called for even stronger winds and prompted a Health Watch. This potential wind-blown dust event equated to a moderate risk of exceeding the PM₁₀ NAAQS in Maricopa County and a high risk for wind blown dust in Yuma. Strong winds did occur and were observed in the Phoenix Metro and Yuma areas on June 4, 2008. Beginning in the early afternoon and continuing throughout the evening hours, strong southwesterly winds in Phoenix and strong westerly winds in Yuma generated areas of blowing dust. 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 6:00-6:30 p.m. Phoenix visible camera images, as well as the Arizona Meteorological Network (AzMET) and National Weather Service (NWS) monitors (see Fig. 1). This significant wind event brought elevated ambient concentrations of PM₁₀ to the Phoenix and Yuma areas that exceeded the NAAQS at the Yuma Courthouse, Buckeye, West 43rd Ave. and Coyote Lakes 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*	386	2341	2000	RJ
BUCKEYE AREA					
Buckeye (MC/TEOM)	04-013-4011*	204	772	2300	RJ
PHOENIX METRO AREA					
West 43 rd Ave (MC/TEOM)	04-013-4009*	194	645	1400	RJ
Coyote Lakes (MC/TEOM)	04-013-4014*	187	656	2300	RJ

* 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 stakeholders meetings on November 19, 2008, and

March 19, 2009, in Phoenix, Arizona. This document is being submitted to EPA to satisfy the requirements of 40

NWS-Luke AFB							
Hr	T(F)	VR	Dust	Spd	Gust	Dir	
1	75	10		0	0	N/A	
2	80	10		8	8	SW	
3	75	10		6	6	W	
4	75	10		5	5	S	
5	73	10		0	0	N/A	
6	69	10		0	0	N/A	
7	72	10		0	0	N/A	
8	75	10	DZ	3	3	VR	
9	82	10		0	0	N/A	
10	84	10	DZ	11	16	S	
11	88	10		20	25	SW	
12	89	10		17	26	S	
1	90	10		21	28	SW	
2	92	10		23	32	SW	
3	93	10		24	33	SW	
4	93	10		26	36	SW	
5	93	10		29	36	SW	
6	92	10		28	36	SW	
7	90	4	BLDU	25	36	SW	
8	86	6	DU	24	33	SW	
9	84	10		23	28	SW	
10	82	10		21	21	SW	
11	80	9		24	24	SW	
12	78	6	HZ	23	23	SW	

NWS-Yuma MCAS							
Hr	T(F)	VR	Dust	Spd	Gust	Dir	
1	77	10		3	3	S	
2	79	10		0	0	N	
3	75	10		3	3	S	
4	76	10		3	3	NW	
5	75	10		8	8	W	
6	74	10		5	5	NW	
7	77	10		7	7	NW	
8	80	10		13	13	W	
9	83	10		7	7	W	
10	86	10		5	5	SW	
11	91	10		3	3	VR	
12	95	10		15	22	SW	
1	97	10		10	10	SW	
2	100	10		22	28	W	
3	100	6	BLDU	22	29	W	
4	98	10		17	28	W	
5	96	6	HZ	24	37	W	
6	93	10	HZ BL	23	30	W	
7	88	3	HZ BL	22	33	NW	
8	81	10	HZ BL	23	36	W	
9	77	0.50	HZs	22	39	NW	
10	75	10	HZ BL	20	31	NW	
11	75	5	BLDU	14	20	W	
12	75	10	BLDU	11	23	W	

Event Contrib. Analysis					
Hourly PM ₁₀ Conc. (µg/m ³)					
MONITORS:	Hr	1	2	3	
1-BUCKEYE	1	44.7	52	496	
2-W43RD	2	36.3	34	373	
3-COYOTE	3	37.2	35	402	
	4	42.7	71	95.7	
	5	45.4	65	80.3	
24-Hr. Avg PM ₁₀	6	67.3	142	143	
Monitor: Event	7	117	199	190	
1-BUCKEYE	8	204	53	63.4	
2-W43RD	9	194	78	44.2	
3-COYOTE	10	186	130	19	
> NAAQS	< NAAQS	11	27.8	40	28
Pink=Event Contrib.	12	34.2	64	35.7	
Conclusion: As shown above, the PM ₁₀ concentration would have been below the NAAQS "BUT FOR" the event contribution (hours highlighted in pink).	1	38.2	165	37.4	
	2	48.8	307	37.6	
	3	66.1	645	43	
	4	131	520	84.3	
	5	210	382	83.5	
	6	285	569	96.7	
	7	411	266	229	
	8	570	161	313	
	9	515	95	254	
	10	511	84	272	
	11	760	241	417	
	12	772	283	656	

Event Contrib. Analysis				
Hourly PM ₁₀ Conc. (µg/m ³)				
MONITORS:	Hr	1		
4-YUMA CH	1	48.7		
	2	44.7		
	3	44.3		
	4	105		
24-Hr. Avg PM ₁₀	5	18.4		
Monitor: Event	6	37.5		
4-YUMA	7	33.2		
	8	46.4		
	9	42.3		
	10	69.2		
> NAAQS	< NAAQS	11	42.1	
Pink=Event Contrib.	12	50.6		
Conclusion: As shown above, the PM ₁₀ concentration would have been below the NAAQS "BUT FOR" the event contribution (hours highlighted in pink).	1	75.9		
	2	119		
	3	183		
	4	570		
	5	301		
	6	547		
	7	570		
	8	2163		
	9	2341		
	10	965		
	11	523		
	12	343		

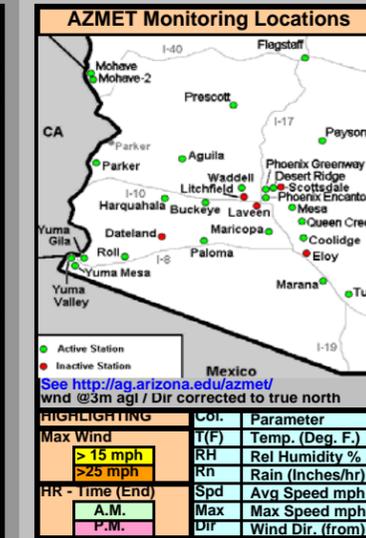
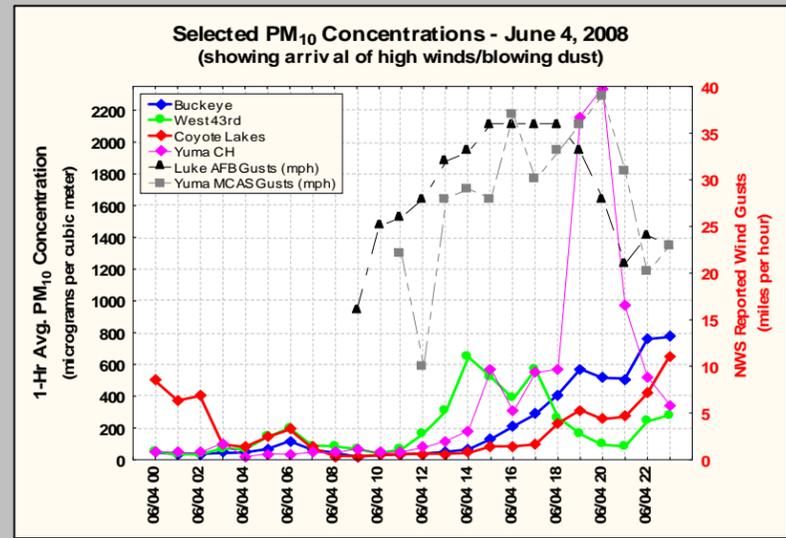


Figure 1. Key Data for Event of June 4, 2008

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

SUMMARY OF EVENT

At 2:00 pm, the Yuma area experienced westerly wind gusts up to 28 mph. Yuma had a visibility of 6 miles in blowing dust at 3:00 pm with westerly wind gusts between 22 and 41 mph. By 11:00 am, Luke AFB began experiencing gusts over 25 mph with blowing dust and reduced visibility by 7:00 pm.



NORTH PHOENIX							
Hr	T(F)	RH	Rn	Spd	Max	Dir	
1	71	24	-	1	3	NE	
2	70	25	-	1	3	NE	
3	69	25	-	1	3	E	
4	70	26	-	1	3	S	
5	68	25	-	1	3	N	
6	69	23	-	1	3	NE	
7	74	17	-	2	4	NE	
8	77	17	-	5	8	E	
9	80	15	-	4	8	E	
10	84	13	-	4	9	S	
11	85	12	-	6	10	S	
12	86	11	-	6	14	SW	
1	88	11	-	9	16	SW	
2	89	11	-	11	20	SW	
3	90	12	-	11	20	SW	
4	90	13	-	12	21	SW	
5	91	12	-	13	23	SW	
6	90	13	-	13	26	SW	
7	89	14	-	13	25	SW	
8	86	20	-	11	20	SW	
9	83	19	-	8	16	SW	
10	82	20	-	8	17	SW	
11	79	24	-	10	17	SW	
12	77	28	-	10	18	SW	

BUCKEYE							
Hr	T(F)	RH	Rn	Spd	Max	Dir	
1	71	16	-	2	5	N	
2	73	22	-	1	4	W	
3	67	31	-	2	5	NE	
4	66	27	-	3	6	NE	
5	64	28	-	4	6	NE	
6	64	27	-	2	5	NE	
7	70	25	-	2	4	NE	
8	78	28	-	2	5	SE	
9	81	21	-	4	8	S	
10	85	12	-	8	14	SW	
11	87	13	-	9	14	SW	
12	89	13	-	11	18	SW	
1	90	13	-	11	18	SW	
2	92	13	-	14	26	W	
3	93	11	-	17	26	W	
4	93	12	-	18	28	W	
5	92	13	-	18	28	SW	
6	92	13	-	20	31	W	
7	90	15	-	20	29	W	
8	87	17	-	19	28	SW	
9	84	19	-	16	23	SW	
10	81	21	-	12	18	W	
11	79	24	-	13	20	SW	
12	76	26	-	12	21	SW	

Historical Distribution				
5-Yr. Dist. of Values (µg/m ³)				
MONITORS:	Column Index			
1-BUCKEYE	Yr - All Data (5-Yrs)			
2-WEST 43RD	Sea - Data for Summer season only (5-Yrs)			
3-COYOTE LAKES				
Cum. Freq.	Mon 1	Mon 2	Mon 3	
	Yr	Sea	Yr	Sea
Min	5	14	5	16
0.5%	7	15	9	18
1.0%	9	15	11	18
2.5%	13	17	15	20
5%	16	21	19	24
10%	22	25	29	31
25%	33	34	44	40
50%	48	49	65	61
75%	67	68	91	82
90%	83	86	121	102
95%	98	101	139	127
97.5%	120	115	157	157
99.0%	159	131	192	251
99.5%	260	155	227	251
Max	289	195	313	273
Flagged Value	204	194	186	
Conclusion: Flagged Value is exceptional in nature (ie greater than 95% of all data).				

Historical Distribution				
5-Yr. Dist. of Values (µg/m ³)				
MONITORS:	Column Index			
4-YUMA CH	Yr - All Data (5-Yrs)			
Cum. Freq.	Mon 1			
	Yr	Sea		
Min	8	13		
0.5%	12	16		
1.0%	14	16		
2.5%	16	20		
5%	19	20		
10%	23	25		
25%	31	34		
50%	42	43		
75%	57	62		
90%	77	85		
95%	96	102		
97.5%	127	132		
99.0%	186	165		
99.5%	211	193		
Max	349	224		
Flagged Value	386			
Conclusion: Flagged Value is exceptional in nature (ie greater than 95% of all data).				



YUMA							
Hr	T(F)	RH	Rn	Spd	Max	Dir	
1	72	31	-	1	4	SW	
2	69	38	-	2	5	SE	
3	64	48	-	4	7	S	
4	62	57	-	3	6	S	
5	61	55	-	3	6	S	
6	61	53	-	3	4	S	
7	65	52	-	1	4	SW	
8	73	39	-	4	9	W	
9	77	28	-	5	9	W	
10	82	24	-	7	12	W	
11	85	21	-	8	13	SW	
12	89	20	-	10	17	W	
1	91	19	-	10	20	SW	
2	95	17	-	15	23	W	
3	94	17	-	17	25	W	
4	92	17	-	18	27	W	
5	90	19	-	18	27	W	
6	88	22	-	15	23	W	
7	84	24	-	16	26	NW	
8	78	31	-	22	30	NW	
9	74	37	-	20	30	NW	
10	72	40	-	20	29	NW	
11	71	39	-	17	27	NW	
12	71	39	-	10	22	NW	

PALOMA							
Hr	T(F)	RH	Rn	Spd	Max	Dir	
1	68	28	-	5	8	SW	
2							

Assessment of June 4, 2008 event (Cont.)

CFR 50.14(c)(2)(iii), and 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, Buckeye, West 43rd Ave. and Coyote Lakes monitoring sites were valid for June 4th. Audits of the analyzers revealed operations were within acceptable tolerance. No local sources were reported as significantly contributing to the air quality episode.

2. Review suspected contributing sources. The NWS and AzMET surface data for Arizona provide a good explanation as to what meteorological conditions were in place on June 4th. Strong southwesterly winds were occurring in the Phoenix area due to a low pressure system approaching from the northwest with a cold front passing over Arizona. PM₁₀ concentrations also spiked at Yuma Courthouse throughout the afternoon and evening hours as winds increased out of the west and northwest in Yuma. The plot of hourly PM₁₀ concentration data in the upper right corner of Figure 1 confirm the nearly identical timing of the elevated PM₁₀ concentrations recorded at West 43rd Ave., Coyote Lakes, Buckeye, and Yuma Courthouse and the strong wind gusts at Luke Air Force Base and Yuma Marine Corps Air Station (MCAS). Phoenix visibility camera images show the reduced visibility associated with this high wind event. These images indicate that reduced visibilities due to blowing dust were widespread throughout the entire Valley. While this visual evidence is not possible for the Yuma area, Yuma radar data show the transport of blowing dust from southeastern California into southwestern Arizona (see attachment for more detail).

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 a measured concentration 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 approximately noon, when several stations began reporting wind gusts of 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 throughout the day. Apart from a two hour lull in PM₁₀ concentrations at West 43rd Ave. around 9:00 p.m., the elevated concentrations at each flagged monitoring site continued throughout the evening.

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 June 4, 2008. Visual evidence of reduced visibility during the 6:00 p.m. hour 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. In addition, visibility was reduced to 0.5 miles and haze / blowing dust were reported by trained weather spotters at the Yuma MCAS during the afternoon and evening hours of June 4. These observations provide further proof that the elevated PM₁₀ concentrations recorded by the Yuma Courthouse monitor 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 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 has been included to demonstrate that there would have been no exceedances or violations 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, Buckeye, West 43rd Ave., and Coyote Lakes were attributed to a natural event.

Conclusion

Long-range transport of dust from soils. The region wide elevated PM₁₀ event on June 4, 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.