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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 Buckeye Area on March 2, 2008

Background

The Arizona Department of Environmental Quality (ADEQ) issues Dust Control Action Forecasts for the Phoenix area as part of their Natural Events Action Plans. On Friday, February 29, 2008, in response to an approaching trough of low pressure, ADEQ air quality forecasters issued the Maricopa County Dust Control Action Forecast calling for a moderate risk of wind-blown dust for Sunday, March 2nd, for Maricopa County. In addition to the approaching trough, a cutoff area of low-pressure was forecast to move eastward south of the Arizona border causing the pressure gradient over the state to become even tighter. This potential wind-blown dust event equated to a significant risk of exceeding the PM₁₀ National Ambient Air Quality Standards (NAAQS) in Maricopa County. The forecasts/advisories discussed above satisfy the requirement in 40 CFR 51.920(a)(1).

The initialization of the wind-blown dust event is evident in the Phoenix visible camera images, particularly for the White Tank and Estrella Mountains, as well as the Arizona Meteorological Network (AzMET), Maricopa County (MC), and National Weather Service (NWS) monitors (see Fig. 1). The high winds in the Phoenix Metro area were able to suspend soils leading to an exceedance of the NAAQS at the Buckeye monitor. There were numerous potential PM₁₀ sources upwind of the Buckeye monitor on March 2nd. Barren agricultural fields and dry washes lie to the northwest of the Buckeye monitor. Additionally, large

road construction projects were occurring along HWY 85 within a quarter mile west and northwest of the monitoring site at the time of the exceedance. The effect of the construction on local soils is apparent in the images showing the construction site and roadwork (see attachments). At the time the exceedance occurred, the major earth moving portion of the construction had been completed in order to prepare for storm drainage control, and the soils were being readied for hydro-mulching as can be seen in aerial photographs taken a few weeks after the event (see attachments). Unfortunately, the high-wind event occurred just days before the hydro-mulch was put down on the disturbed soils. While the exact source of PM cannot be determined for this event, the five consecutive hours of 40+ mph winds were strong enough to suspend and transport soils from any of these possible sources. 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 significant region wide wind event brought localized elevated ambient concentrations of PM₁₀ to the Buckeye area that exceeded the NAAQS at the Buckeye monitor operated by Maricopa County. 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**
BUCKEYE AREA					
Buckeye (MC/TEOM)	04-013-4011*	160	880	1400	RJ & L
PHOENIX METRO AREA					
West 43rd Ave (MC/TEOM)	04-013-4009*	45	178	1600	None
Durango Complex (MC/TEOM)	04-013-9812*	39	117	1800	None
South Phoenix (MC/TEOM)	04-013-4003*	56	181	1800	None

* EPA Air Quality System Identification Number

** 24-hr PM₁₀ concentration influenced by natural or exceptional event to be flagged.

Type Abbreviations: 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 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).

NWS-LUKE AFB							
Hr	T(F)	VR	Dust	Spd	Gust	Dir	
1	61	10		9	9	SW	
2	60	10		0	0	N	
3	63	10		14	14	SW	
4	62	10		10	10	SW	
5	60	10		13	13	SW	
6	58	10		11	11	SW	
7	51	10		3	3	N	
8	52	10		3	3	W	
9	57	10		3	3	N	
10	62	10		3	3	N	
11	65	10		3	3	W	
12	68	10		8	8	SW	
1	70	10		17	25	W	
2	72	10		10	17	NE	
3	72	10		26	36	NW	
4	70	10		26	37	NW	
5	68	10		30	36	NW	
6	64	10		22	30	NW	
7	60	10		18	18	NW	
8	56	10		13	13	NW	
9	54	10		11	11	NW	
10	53	10		8	8	NW	
11	49	10		8	8	NW	
12	49	10		13	13	NW	

(Maricopa County Monitor) MC-Buckeye							
Hr	T(F)	RH	Rn	Spd	Max	Dir	
1	55	30	-	4	4	9N	
2	54	30	-	4	4	9NW	
3	54	36	-	4	4	9W	
4	52	37	-	4	4	10N	
5	49	41	-	5	5	9NW	
6	48	42	-	3	7	W	
7	46	47	-	3	9	W	
8	45	49	-	8	13	W	
9	51	43	-	5	11	NW	
10	62	31	-	7	13	W	
11	65	32	-	5	15	W	
12	68	30	-	16	30	NW	
1	69	29	-	19	35	NW	
2	71	26	-	19	40	NW	
3	73	23	-	24	43	NW	
4	73	18	-	27	45	NW	
5	72	19	-	26	45	NW	
6	68	21	-	25	45	NW	
7	63	25	-	21	37	N	
8	60	26	-	19	30	N	
9	59	24	-	11	22	N	
10	56	25	-	17	37	N	
11	54	24	-	19	38	N	
12	49	26	-	15	23	N	

BUCKEYE							
Hr	T(F)	RH	Rn	Spd	Max	Dir	
1	58	41	-	4	4	6NW	
2	56	45	-	2	2	6N	
3	53	57	-	3	3	6NW	
4	52	55	-	3	3	8N	
5	51	55	-	3	3	5N	
6	51	55	-	2	5	5SW	
7	48	64	-	1	4	NE	
8	46	73	-	4	7	NW	
9	53	60	-	5	8	NW	
10	60	53	-	4	7	W	
11	66	33	-	9	17	NW	
12	69	19	-	17	24	N	
1	69	11	-	19	29	N	
2	70	8	-	23	34	NW	
3	70	6	-	26	34	N	
4	69	6	-	25	36	N	
5	67	7	-	25	36	N	
6	65	9	-	22	34	N	
7	62	10	-	17	25	N	
8	60	11	-	17	24	N	
9	57	12	-	13	19	N	
10	56	12	-	14	20	N	
11	53	13	-	11	16	N	
12	50	17	-	10	14	N	

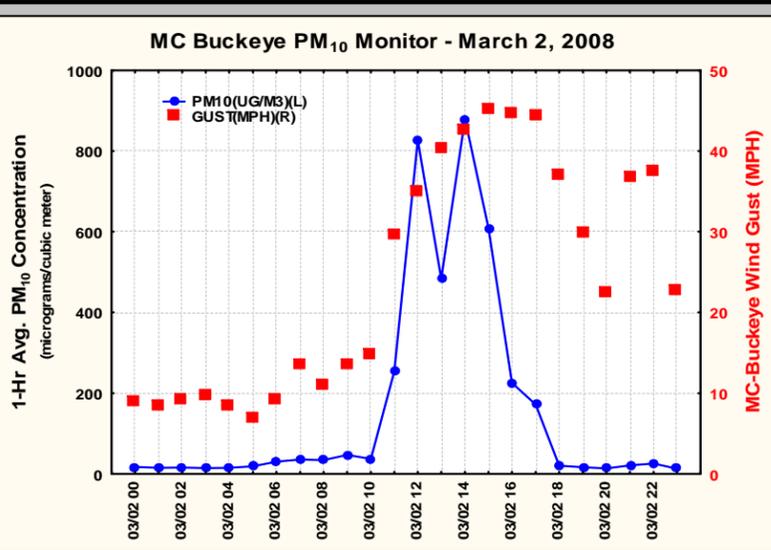
Event Contrib. Analysis Hourly PM ₁₀ Conc. (µg/m ³)			
MONITORS:	Hr	1	
1-Buckeye	1	17.8	
	2	15	
	3	15.8	
	4	14.6	
	5	15	
	6	19.2	
	7	30	
	8	35.9	
	9	33.9	
	10	47.2	
	11	37.2	
	12	25.4	
> NAAQS	< NAAQS		
1-Buckeye	160	23	
Conclusion: As shown above, the PM ₁₀ concentration would have been below the NAAQS "BUT FOR" the event contribution (hours highlighted in pink).			
	1	827	
	2	484	
	3	880	
	4	610	
	5	226	
	6	172	
	7	20.5	
	8	16.8	
	9	13.9	
	10	21.4	
	11	25.7	
	12	13.1	



Figure 1. Key Data for Event of March 2, 2008

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

SUMMARY OF EVENT
A major frontal system passed through the Phoenix Metro area on March 2, 2008, bringing wide spread blowing dust in the area west of Phoenix. Wind gusts in excess of 40 miles per hour in the Buckeye area contributed to an exceedance of the NAAQS.



PARKER							
Hr	T(F)	RH	Rn	Spd	Max	Dir	
1	64	32	-	20	32	NW	
2	63	35	-	21	33	NW	
3	61	37	-	17	29	W	
4	60	39	-	15	22	NW	
5	59	38	-	17	28	NW	
6	61	27	-	18	30	N	
7	60	22	-	15	25	N	
8	59	22	-	14	22	N	
9	60	22	-	22	37	N	
10	62	19	-	29	40	N	
11	64	17	-	29	39	N	
12	66	15	-	26	35	N	
1	68	13	-	27	38	N	
2	68	13	-	26	37	N	
3	68	13	-	27	35	N	
4	67	14	-	26	33	N	
5	66	14	-	26	35	N	
6	64	15	-	23	33	N	
7	61	15	-	20	26	N	
8	59	16	-	16	23	N	
9	56	20	-	13	20	N	
10	51	27	-	8	16	N	
11	49	28	-	2	8	NE	
12	49	20	-	7	13	NE	

W CEN AZ - AGUILA							
Hr	T(F)	RH	Rn	Spd	Max	Dir	
1	47	55	-	3	7	NE	
2	47	53	-	3	6	E	
3	45	58	-	3	6	SE	
4	47	53	-	3	7	NW	
5	49	53	-	7	14	NW	
6	50	51	-	7	12	W	
7	50	51	-	7	12	NW	
8	52	47	-	7	18	N	
9	55	33	-	4	11	NW	
10	58	28	-	13	24	NW	
11	60	22	-	23	32	N	
12	62	12	-	26	36	N	
1	63	8	-	22	33	N	
2	63	7	-	23	32	N	
3	63	8	-	24	34	N	
4	62	9	-	22	31	N	
5	61	10	-	21	29	N	
6	59	12	-	21	29	N	
7	55	13	-	17	24	N	
8	53	14	-	16	23	N	
9	51	16	-	14	20	N	
10	49	18	-	13	18	N	
11	48	19	-	13	18	N	
12	43	65	-	3	7	E	

MARICOPA							
Hr	T(F)	RH	Rn	Spd	Max	Dir	
1	56	47	-	6	9	S	
2	53	54	-	4	7	SE	
3	54	44	-	8	10	S	
4	52	46	-	6	9	S	
5	50	49	-	5	8	S	
6	49	52	-	4	6	S	
7	48	54	-	4	7	SW	
8	53	48	-	4	9	S	
9	59	39	-	6	11	SW	
10	64	33	-	7	13	NW	
11	66	30	-	6	11	W	
12	68	28	-	7	12	NW	
1	70	23	-	9	17	NW	
2	71	20	-	13	24	NW	
3	72	11	-	13	23	W	
4	72	11	-	12	18	NW	
5	70	9	-	16	24	NW	
6	67	8	-	18	25	NW	
7	62	10	-	16	24	NW	
8	59	11	-	12	21	N	
9	57	12	-	9	14	N	
10	54	15	-	6	12	N	
11	53	14	-	8	15	N	
12	53	15	-	8	14	N	

Historical Distribution 5-Yr. Dist. of Values (µg/m ³)			
MONITORS:	Column Index	Yr	All Data (5-Yrs)
1-BUCKEYE			Sea - Data for Spring season only (5-Yrs)
Cum. Freq.	Mon 1		
Min	5	7	
0.5%	7	9	
1.0%	9	10	
2.5%	13	13	
5%	16	16	
10%	22	24	
25%	33	32	
50%	48	45	
75%	67	59	
90%	83	75	
95%	98	83	
97.5%	120	98	
99.0%	159	122	
99.5%	260	143	
Max	289	212	
Flagged Value	160		
Conclusion: Flagged Value is exceptional in nature (ie greater than 95% of all data)			



YUMA							
Hr	T(F)	RH	Rn	Spd	Max	Dir	
1	61	38	-	5	12	NW	
2	59	46	-	5	11	N	
3	58	50	-	4	13	NW	
4	60	51	-	13	19	NW	
5	57	57	-	9	15	NW	
6	57	59	-	9	14	NW	
7	56	61	-	8	12	NW	
8	58	45	-	6	12	N	
9	64	23	-	11	22	N	
10	66	15	-	15	32	N	
11	67	12	-	19	29	N	
12	69	11	-	20	33	N	
1	69	10	-	22	32	N	
2	69	10	-	20	31	N	
3	68	9	-	21	36	N	
4	68	10	-	19	29	N	
5	68	11	-	18	29	N	
6	66	11	-	18	28	N	
7	64	12	-	16	25	N	
8	62	13	-	14	22	N	
9	62	12	-	17	26	N	
10	61	13	-	15	28	N	
11	61	12	-	11	19	N	
12	60	12	-	13	21	N	

PALOMA							
Hr	T(F)	RH	Rn	Spd	Max	Dir	
1	53	59	-	5	9	W	
2	48	71	-	5	7	NW	
3	49	65	-	5	6	W	
4	47	69	-	5	7	W	
5	48						

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 Buckeye monitor were valid for March 2nd. Audits of the analyzers revealed operations were within acceptable tolerance. No local sources were reported as significantly contributing to the air quality episode. An exceedance of the NAAQS was recorded at the Buckeye monitor operated by Maricopa County.

2. Review suspected contributing sources. The NWS, AzMET, and MC surface data for Arizona, along with the visible camera images in Phoenix, provide a good explanation of the meteorological conditions that were in place on March 2nd. Throughout much of the State, strong north-northwesterly winds associated with a frontal system passage were reported throughout the afternoon hours. HYSPLIT back trajectories show that likely dust sources included the dry Hassayampa River bed as well as many barren dirt fields (see attachments). The direction of these winds would have also allowed for any loose or disturbed soils associated with the construction project occurring along HWY 85 to be suspended and transported the short distance to the Buckeye monitor site. The plot of hourly PM₁₀ concentration data in the upper right corner of Figure 1 confirms the identical timing of elevated PM₁₀ concentrations at the Buckeye site with gusty winds recorded at the Buckeye MC site and Luke Air Force Base NWS monitor beginning at approximately 11:00 a.m. and continuing through the afternoon.

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). Monitors with readings greater than that of the NAAQS on March 2nd, which should be flagged, include the Buckeye monitor.

4. Examine the meteorological conditions before and during the event. The 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 Arizona until approximately 11:00 a.m., when several stations reported gusty winds that approached 40 mph at times. Winds were generally out of the north-northwest with sustained wind speeds above 15 mph beginning around 11:00 am and continuing through the late afternoon and evening hours. Gusty winds over 25 mph were recorded beginning around noon and continuing through the 6:00 pm hour. This timing corresponded to the onset of elevated PM₁₀ concentrations recorded at Buckeye. Additionally, an exceedance due to abnormally high winds was also measured at the Yuma Courthouse monitor, which shows that this was not merely a localized wind event.

5. Perform a qualitative attribution to emission source(s). All evidence indicates the elevated PM₁₀ concentrations in the Buckeye area can be attributed to a high wind event which occurred over a broad area causing some localized windblown dust. No source-specific emission allocation is possible based on the data available for analysis; however, it is possible that construction occurring north and west of the Buckeye monitor provided additional loose soil for wind transport and added to the dust event recorded as an exceedance at the Buckeye monitor. The timing of the high winds, as well as the visual evidence of reduced visibility most clearly seen in the 3:00 p.m. images for the White Tank and Estrella Mountains in the lower right portion of Figure 1, is evidence that elevated PM₁₀ concentrations in Buckeye can be attributed to soil emissions.

6. Estimation of Contribution from Source or Event. The primary source appears to be wind-blown dust over central and southwestern 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 a 40 CFR 50.14(c)(3)(iii)(B) requirement. 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 wind 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 the Buckeye monitoring sites can be attributed to a natural event.

Conclusion

Long-range transport of dust from soils. A region wide wind event lead to elevated PM₁₀ concentrations in Buckeye on March 2, 2008, due to the transport of dust from winds that suspended natural soils and soils from areas where Best Available Control Measures are in place or from areas where the monitor was not cited for the purpose of sampling a potential PM₁₀ source. For these reasons, the monitor readings for the Buckeye site should be

flagged for air quality planning purposes. The “high wind” (RJ) flag and “highway construction” (L) 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 event contribution.