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DRAFT

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 July 4, 2008

Background

The Arizona Department of Environmental Quality (ADEQ) issues Dust Control Action Forecasts for Phoenix and surrounding areas as part of their Natural Events Action Plan. On Thursday July 3, 2008 ADEQ air quality forecasters issued the Maricopa County Dust Control Action Forecast calling for a moderate risk of wind-blown dust for Friday July 4th in Maricopa County. This moderate risk was due to the increased probability for thunderstorms developing over the Mogollon Rim and tending to drift toward the desert areas in the evening with the potential for gusty outflow winds to produce areas of dense blowing dust. The forecast did mention the possibility of strong gusty winds to 20 mph and possibly stronger in Maricopa County due to outflow from even distant thunderstorms. This potential wind-blown dust event equated to a moderate risk of exceeding the PM₁₀ National Ambient Air Quality Standards (NAAQS) in Maricopa County. The forecasts/advisories satisfy the requirement in 40 CFR 51.920(a)(1).

Strong north and northeasterly winds associated with an outflow boundary were observed during the evening hours

of July 4, 2008. This outflow boundary also initiated isolated thunderstorm activity in the Valley as can be seen in the satellite images of Figure 1. The initialization of the wind-blown dust event is evident in the Phoenix visible camera images, the satellite imagery, as well as in the Arizona Meteorological Network (AzMET) and National Weather Service (NWS) monitor data (see Fig. 1). 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 wind event brought elevated ambient concentrations of PM₁₀ to the Phoenix area that exceeded the NAAQS at the Buckeye monitor operated by Maricopa County. The fact that ambient concentrations exceed 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*	223	2820	2000	A or RJ
PHOENIX METRO AREA					
West 43rd Ave (MC/TEOM)	04-013-4009*	40	156	1900	None
Durango Complex (MC/TEOM)	04-013-9812*	32	109	1900	None
Greenwood (MC/TEOM)	04-013-3010*	29	44	0600	None
Higley (MC/TEOM)	04-013-4006*	43	139	0600	None
West Phoenix (MC/TEOM)	04-013-0019*	34	134	1900	None
Central Phoenix (MC/TEOM)	04-013-3002*	31	114	1900	None
JLG Supersite (ADEQ/TEOM)	04-013-9997*	30	110	1900	None
Coyote Lakes (MC/TEOM)	04-013-4014*	111	1354	1900	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 November 19, 2008, in Phoenix, Arizona. Following this stakeholders meeting, ADEQ will finalize this demonstration and solicit public

comment on the final demonstration. Any comments that are received will be forwarded to EPA with this demonstration pursuant to 40 CFR 50.14(c)(3)(i).

BUCKEYE						
Hr	T(F)	RH	Rn	Spd	Max	Dir
1	89	39	-	6	11	SW
2	89	43	-	9	15	W
3	87	46	-	3	9	W
4	86	49	-	3	9	W
5	83	54	-	2	4	SW
6	83	51	-	3	5	N
7	87	44	-	6	9	N
8	90	40	-	5	9	NW
9	93	38	-	4	9	W
10	94	37	-	5	10	SW
11	95	38	-	6	11	SW
12	97	34	-	6	12	SW
1	99	31	-	6	12	SW
2	101	28	-	6	12	S
3	103	25	-	6	12	SW
4	105	22	-	8	15	W
5	105	22	-	8	16	W
6	105	22	-	7	12	W
7	103	23	-	7	12	W
8	98	28	-	7	27	SE
9	92	33	-	14	29	NE
10	88	43	-	17	34	N
11	85	47	-	13	21	N
12	90	31	-	9	15	N

NWS-Luke AFB						
Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	93	10	17	17	17	S
2	93	10	14	14	14	S
3	91	10	6	6	6	E
4	90	10	7	7	7	SE
5	88	10	7	7	7	W
6	86	10	7	7	7	NW
7	90	10	7	7	7	N
8	93	10	5	5	5	N
9	94	10	3	3	3	VR
10	96	10	11	11	11	S
11	97	10	9	9	9	S
12	99	10	10	10	10	S
1	101	10	7	7	7	S
2	102	10	15	22	22	S
3	103	10	11	11	11	SW
4	104	10	15	15	15	SW
5	105	10	14	22	22	SW
6	105	10	14	22	22	SW
7	99	6	24	39	39	NE
8	94	6	28	39	39	NE
9	89	10	16	28	28	N
10	89	10	30	34	34	NW
11	87	10	15	21	21	NW
12	90	10	17	26	26	NW

NORTH PHOENIX						
Hr	T(F)	RH	Rn	Spd	Max	Dir
1	87	40	-	4	7	SW
2	88	35	-	3	7	NE
3	87	40	-	6	11	E
4	87	40	-	4	9	SE
5	85	44	-	2	6	SE
6	84	46	-	0	2	SW
7	86	42	-	2	4	NE
8	90	37	-	1	4	E
9	92	33	-	2	6	W
10	94	32	-	3	8	SW
11	95	32	-	4	9	SW
12	96	32	-	5	11	SW
1	97	30	-	5	12	SW
2	99	27	-	5	11	SW
3	101	26	-	6	12	SW
4	102	25	-	6	15	SW
5	102	23	-	7	13	SW
6	102	23	-	6	13	SW
7	98	24	-	7	17	NW
8	90	34	-	13	24	NE
9	88	36	-	11	19	N
10	88	35	-	9	17	N
11	86	40	-	7	19	NW
12	85	41	-	2	6	N

Event Contrib. Analysis		
Hourly PM ₁₀ Conc. (µg/m ³)		
MONITORS:	Hr	1
1-Buckeye	1	52.4
	2	43.9
	3	41.2
	4	35.4
	5	57.8
	6	116
	7	54.9
	8	78
	9	39.8
	10	33.2
	11	26.9
	12	21.7
24-Hr. Avg PM ₁₀		22.3
with W/O		17.8
Monitor: Event	233	39
1-Buckeye		
> NAAQS		
< NAAQS		
Pink=Event Contrib.		
Conclusion: As shown above, the PM ₁₀ concentration would have been below the NAAQS "BUT FOR" the event contribution (hours highlighted in pink).		

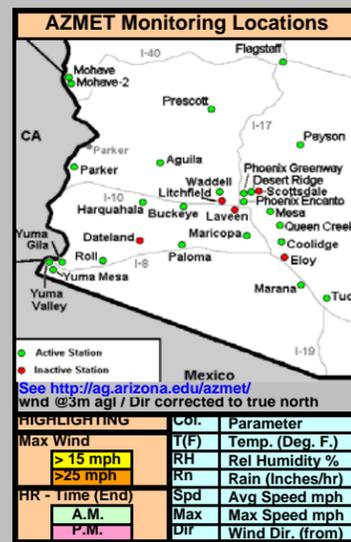
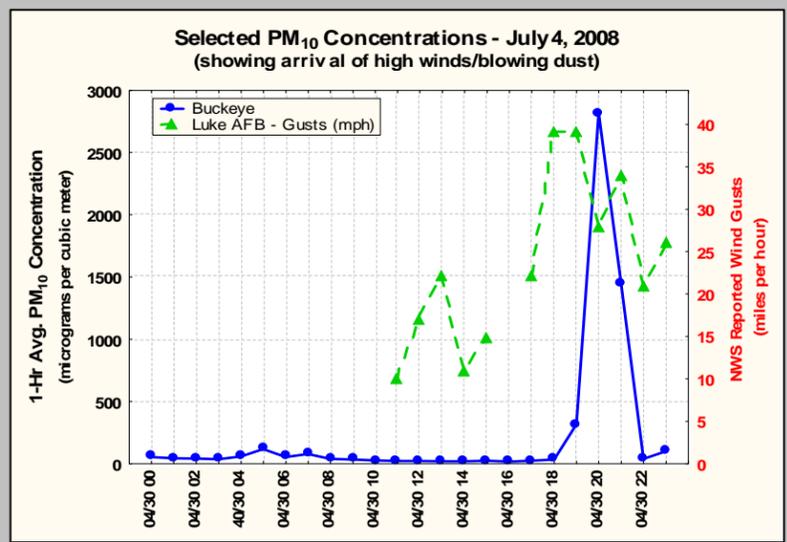


Figure 1. Key Data for Event of July 4, 2008

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

SUMMARY OF EVENT

At 7:00 p.m., Luke AFB had a visibility of 7 statute miles in blowing dust with gusts from the northeast up to 39 mph; between 7:00 p.m. and 8:00 p.m., Scottsdale had visibilities as low as 1 1/4 statute miles in blowing dust with northeast gusts up to 53 mph.

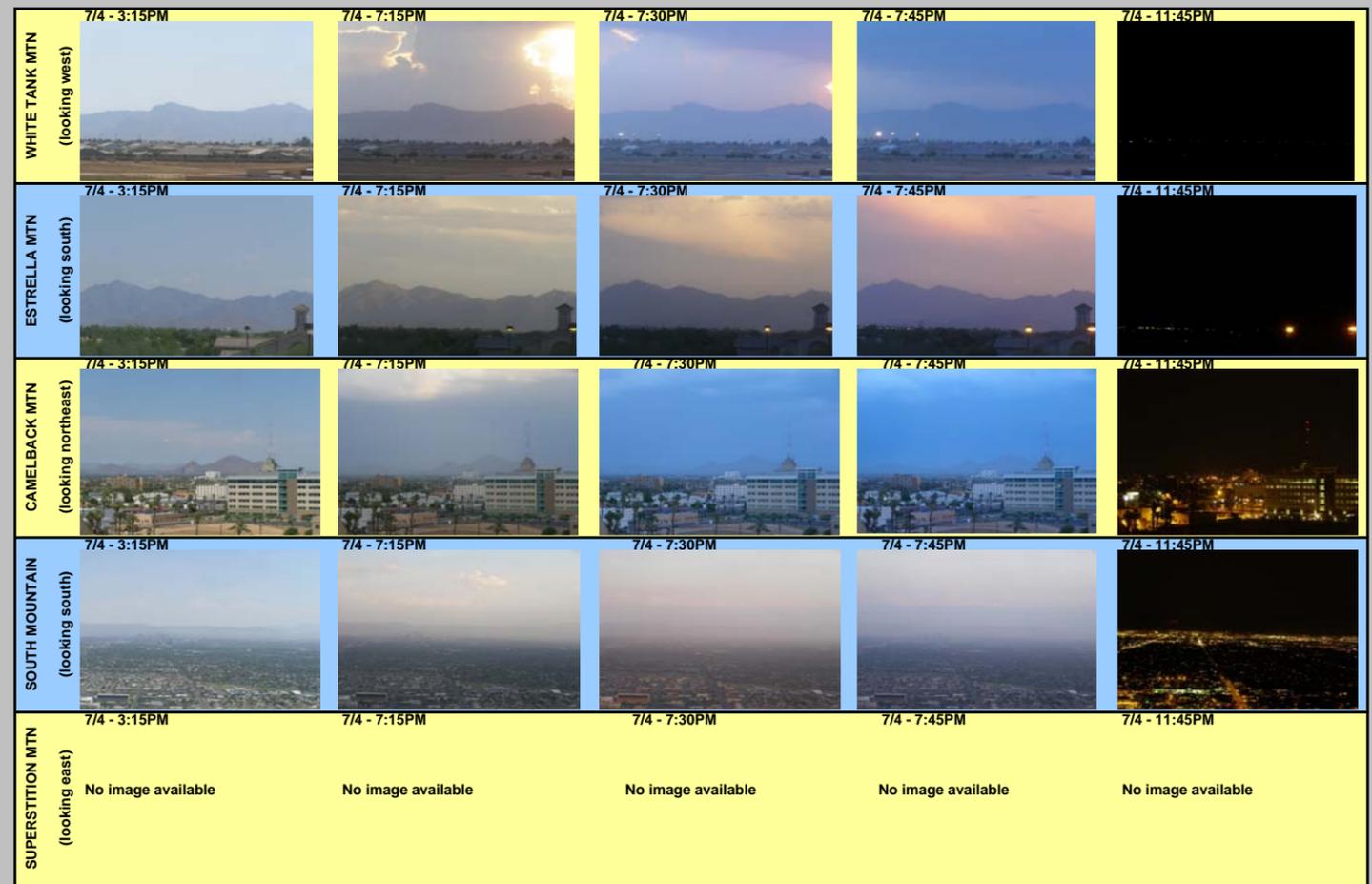


PARKER						
Hr	T(F)	RH	Rn	Spd	Max	Dir
1	89	38	-	12	17	SW
2	89	36	-	12	17	SW
3	88	39	-	9	13	SW
4	85	46	-	6	12	SW
5	83	54	-	7	14	S
6	84	53	-	9	15	SW
7	83	63	-	6	16	S
8	87	57	-	9	14	S
9	90	52	-	9	16	SW
10	93	47	-	8	13	SW
11	96	45	-	6	10	S
12	99	38	-	4	8	S
1	100	34	-	9	16	SW
2	101	33	-	11	15	SW
3	103	30	-	11	15	SW
4	103	31	-	11	15	SW
5	102	32	-	10	16	SW
6	99	37	-	9	13	S
7	96	41	-	9	12	S
8	92	46	-	7	11	S
9	91	44	-	8	11	S
10	90	45	-	7	10	S
11	88	50	-	10	18	S
12	92	38	-	13	20	SE

NORTHWEST PHOENIX						
Hr	T(F)	RH	Rn	Spd	Max	Dir
1	92	27	-	7	13	W
2	93	28	-	6	13	W
3	89	31	-	4	11	E
4	85	38	-	0	2	N
5	83	45	-	1	4	N
6	80	53	-	0	0	N
7	85	50	-	1	4	N
8	91	41	-	1	4	N
9	94	37	-	1	5	NE
10	95	33	-	3	8	SE
11	96	32	-	2	7	SE
12	98	30	-	4	9	SE
1	99	30	-	5	9	SE
2	102	28	-	4	10	SE
3	103	24	-	5	11	W
4	104	22	-	5	20	W
5	104	21	-	5	11	W
6	104	21	-	4	9	W
7	102	22	-	4	17	NE
8	93	28	-	11	21	NE
9	87	39	-	4	12	NE
10	85	45	-	5	17	NW
11	85	42	-	6	13	NW
12	83	65	-	3	7	E

MARICOPA						
Hr	T(F)	RH	Rn	Spd	Max	Dir
1	86	43	-	7	12	S
2	85	50	-	7	14	SE
3	88	40	-	8	15	SE
4	85	46	-	7	14	S
5	83	49	-	3	8	W
6	83	50	-	2	5	N
7	84	48	-	5	11	SE
8	89	38	-	7	11	SE
9	91	38	-	5	10	S
10	93	34	-	3	6	SW
11	95	31	-	2	6	SW
12	98	28	-	3	9	N
1	99	27	-	4	10	NE
2	100	25	-	4	10	W
3	102	22	-	5	11	SW
4	104	21	-	4	13	W
5	105	19	-	6	15	W
6	105	20	-	5	10	N
7	103	23	-	6	11	N
8	100	27	-	5	8	N
9	94	29	-	8	23	N
10	90	34	-	7	15	N
11	89	33	-	9	16	NW
12	87	36	-	6	13	N

Historical Distribution		
5-Yr. Dist. of Values (µg/m ³)		
MONITORS:	Column Index	
1-BUCKEYE	Yr	All Data (5-Yrs)
	Sea	Data for Summer season only (5-Yrs)
Cum. Freq.	Mon 1	
Min	5	14
0.5%	7	15
1.0%	9	15
2.5%	13	17
5%	16	21
10%	22	25
25%	33	34
50%	48	49
75%	67	68
90%	83	86
95%	98	101
97.5%	120	115
99.0%	159	131
99.5%	260	155
Max	289	195
Flagged Value	233	
Conclusion: Flagged Value is exceptional in nature (ie greater than 95% of all data)		



YUMA						
Hr	T(F)	RH	Rn	Spd	Max	Dir
1	83	61	-	3	6	S
2	83	62	-	7	14	SE
3	84	59	-	10	15	SE
4	84	61	-	9	16	S
5	84	64	-	11	17	S
6	83	64	-	7	13	S
7	84	66	-	8	11	S
8	86	62	-	9	14	S
9	87	58	-	7	14	S
10	90	50	-	13	18	SE
11	93	46	-	12	18	S
12	97	38	-	11	18	S
1	99	32	-	12	19	S
2	101	29	-	12	20	S
3	103	26	-	12	20	S
4	104	26	-	13	19	S
5	103	27	-	13	19	SW
6	101	29	-	13	18	SW
7	99	30	-	12	15	SW
8	95	33	-	10	14	S
9	91	40	-	4	9	SW
10	87	48	-	3	5	SW
11	85	50	-	1	4	N
12	85	50	-	2	5	S

PALOMA						
Hr	T(F)	RH	Rn	Spd	Max	Dir
1	87	57	###	7	13	S
2	84	65	-	12	19	SW
3	83	68	-	5	14	SW
4	80	77	-	3	6	N
5	80	78	-	2	4	E
6	79	80	-	3	5	N
7	82	73	-	1	4	NW
8	86	65	-	6	9	W
9	89	58	-	6	10	W
10	93	47	-	4	9	W

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 July 4th. 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 and AzMET 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 July 4th. Strong north and northeasterly winds associated with a thunderstorm outflow boundary occurred in and around the Phoenix area between the 7:00 p.m. and 10:00 p.m. hours. Wind speeds gusted between 20 and 40 mph at various Valley locations during that time period causing spikes in PM₁₀ concentrations at multiple monitoring sites around the Phoenix area. Large spikes in PM₁₀ concentration occurred within that same 7:00 p.m. to 10:00 p.m. time period in Buckeye, which lead to the NAAQS exceedance there. Similar spikes such as the 1354 microgram per cubic meter reading at Coyote Lakes did occur during that same time period throughout the valley, but these spikes were not enough to cause additional exceedances of the 24-hr NAAQS standard.

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 July 4th, 2008, which should be flagged, include the Buckeye monitors.

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. The Buckeye AzMET

station experienced hourly max wind speeds greater than 15 mph beginning during the 7:00 p.m. hour, with a maximum gust of 34 mph occurring during the 9:00 p.m. hour. The Luke AFB NWS station reported wind gusts of 39 mph and reduced visibility to 6 miles (see Fig. 1). Other Phoenix area locations such as Scottsdale Airport reported reduced visibilities and blowing dust as well. The timing of the reduced visibilities and wind gusts correspond to the onset of elevated PM₁₀ concentrations recorded at Buckeye.

5. Perform a qualitative attribution to emission source(s). All evidence indicates the elevated PM₁₀ concentrations in the Buckeye area can be attributed to soil emissions that were transported over a broad area. 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 July 4th. Observational reports of blowing dust from trained officials in the Phoenix area, along with reduced visibility, provide further proof that the elevated PM₁₀ concentrations in Buckeye were attributed to soil emissions. These reports, in addition to the visual evidence of reduced visibility seen in the Phoenix visibility images located in the lower right portion of figure 1, provide proof that elevated PM₁₀ concentrations in and around Phoenix are attributable to soil emissions. The thunderstorm activity and movement of the outflow boundary from the northeast toward the southwest through the Phoenix and Buckeye areas is also apparent in the satellite images located in the right-center portion of Figure 1.

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 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 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 site was attributed to a natural event.

Conclusion

Long-range transport of dust from soils. The region wide elevated PM₁₀ event on July 4, 2008 in Maricopa County was the result of the transport of 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” flag (A or RJ) 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.