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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 Area on October 11, 2008

Background

The Arizona Department of Environmental Quality (ADEQ) issues Dust Control Action Forecasts as part of the Natural Events Action Plan for the Phoenix area. On Friday, October 10, 2008, in response to a tightening pressure gradient associated with an approaching trough of low pressure and cold frontal passage through Arizona, ADEQ air quality forecasters issued the Maricopa County Dust Control Action Forecast, which called for a moderate risk of wind-blown dust and thus a moderate risk for unhealthy PM₁₀ levels in the Phoenix area for Saturday, October 11th. The Dust Control Action Forecast called for southwesterly winds of 15 to 20 mph with stronger gusts possible during the afternoon. The forecasts/advisories satisfy the requirement in 40 CFR 51.920(a)(1).

The forecast for October 11th called for strong winds capable of producing wind-blown dust. This potential wind-blown dust event equated to a moderate risk of exceeding the PM₁₀ National Ambient Air Quality Standards (NAAQS) in Maricopa County. Strong winds did occur and were observed throughout portions of Maricopa County and the Phoenix Metro area on October 11th, 2008. Beginning in the morning of October 11th and continuing through the afternoon hours, strong westerly winds generated blowing dust which moved into portions of the Phoenix Metro area. 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). Strong winds gusting over 15 mph and as high as 30 mph were reported between the 4:00 a.m. and 6:00 p.m. hours at the NWS Phoenix Sky Harbor Airport monitoring location, while other Valley monitoring locations measured wind gusts between 15 mph and 25 mph during the same time. This significant event brought elevated ambient concentrations of PM₁₀ to portions of the Phoenix area that exceeded the NAAQS at the South Phoenix 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.” As seen in a number of previous high wind events, the highest concentrations were measured in the vicinity of the Salt River, though concentrations were elevated throughout the entire Phoenix Metro area.

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**
PHOENIX METRO AREA					
South Phoenix (MC/TEOM)	04-013-4003*	161.8	630	1500	RJ
West 43 rd Ave (MC/TEOM)	04-013-4009*	138.6	453	0600	No
Durango Complex (MC/TEOM)	04-013-9812*	114.7	362	0600	No
Greenwood (MC/TEOM)	04-013-3010*	103.8	326	0700	No
Higley (MC/TEOM)	04-013-4006*	70.2	225	0900	No
West Phoenix (MC/TEOM)	04-013-0019*	93.6	327	0700	No
Central Phoenix (MC/TEOM)	04-013-3002*	98.4	326	0700	No
JLG Supersite (ADEQ/TEOM)	04-013-9997*	69.1	311	0700	No
Coyote Lakes (MC/TEOM)	04-013-4014*	48.3	256	0700	No

* 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 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 will be supplemented

NWS-Phoenix Sky Harbor

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	74	10		9	9	SE
2	76	10		10	10	S
3	75	10		7	7	S
4	73	10		7	7	S
5	77	10	24	30	30	S
6	74	10	8	20	20	SW
7	67	10	13	21	21	W
8	68	10	11	11	11	W
9	65	10	14	14	14	W
10	68	10	17	17	17	W
11	71	10	10	10	10	W
12	74	10	16	24	24	W
1	73	10	23	32	32	W
2	74	10	17	26	26	W
3	72	10	20	30	30	W
4	73	10	29	34	34	W
5	71	10	24	24	24	W
6	69	10	15	28	28	W
7	67	10	17	17	17	W
8	65	10	11	11	11	W
9	62	10	6	6	6	SW
10	60	10	5	5	5	SW
11	59	10	5	5	5	SW
12	57	10	5	5	5	SW

NWS-Luke AFB

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	72	10		3	3	W
2	75	10		11	11	S
3	74	10		9	9	S
4	71	10		5	5	SW
5	71	10		8	8	SW
6	66	10		8	8	W
7	66	10		10	10	W
8	64	8		7	7	NW
9	67	10	15	15	15	NW
10	68	10		8	8	NW
11	70	10		5	5	SW
12	72	10	14	21	21	SW
1	73	10	21	24	24	SW
2	72	10	14	24	24	W
3	74	10	13	13	13	W
4	73	10	17	22	22	NW
5	72	10	11	22	22	W
6	68	10	14	14	14	NW
7	66	10	11	11	11	W
8	63	10	5	5	5	NW
9	60	10	6	6	6	NW
10	56	10	7	7	7	NW
11	55	10	6	6	6	NW
12	51	10	8	8	8	NW

CENTRAL PHOENIX

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	73	20	-	4	9	SE
2	73	23	-	3	7	S
3	70	28	-	2	6	W
4	71	32	-	4	12	S
5	75	29	-	6	13	SW
6	73	32	-	5	13	W
7	66	28	-	9	14	W
8	63	29	-	7	16	W
9	64	25	-	7	14	W
10	67	21	-	7	13	NW
11	69	20	-	6	13	W
12	71	17	-	7	13	W
1	72	15	-	8	17	W
2	72	14	-	10	19	W
3	72	11	-	11	22	W
4	72	10	-	11	18	W
5	71	10	-	11	20	W
6	68	10	-	9	15	W
7	65	12	-	6	14	W
8	64	13	-	4	8	NW
9	62	15	-	2	5	NW
10	58	19	-	1	2	W
11	53	26	-	0	0	W
12	43	65	-	3	7	E

Event Contrib. Analysis

Hourly PM₁₀ Conc. (µg/m³)

MONITORS:	Hr	1
1-South Phoenix	1	26
	2	26
	3	15.8
	4	26.9
	5	39.8
	6	40.4
	7	386
	8	306
	9	259
	10	226
	11	164
	12	107
24-Hr. Avg PM ₁₀		166
with w/o		
Monitor: Event		
1-S. Phx	161	46
> NAAQS		
Pink=Event Contrib.		
Conclusion: As shown above, the PM ₁₀ concentration would have been below the NAAQS "BUT FOR" the event (hours highlighted in pink).		

AZMET Monitoring Locations

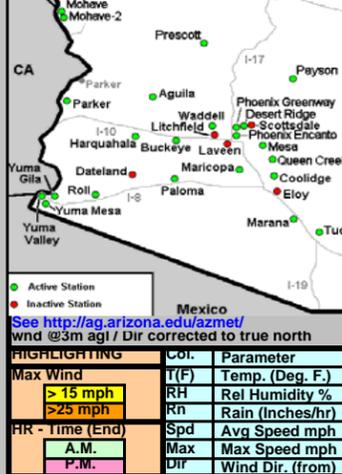
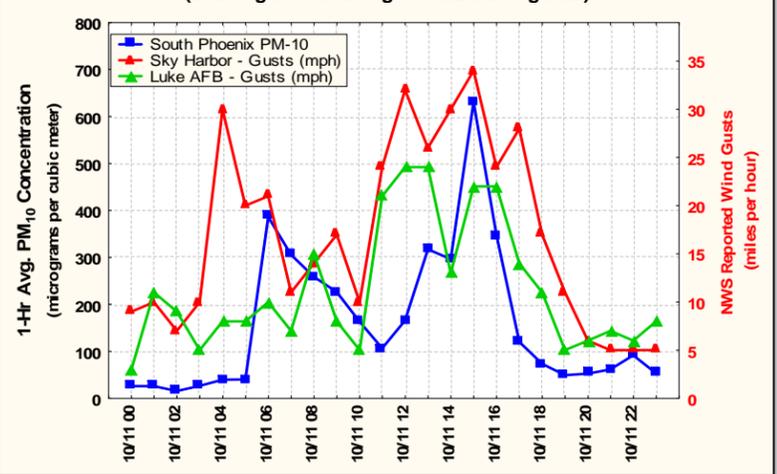


Figure 1. Key Data for Event of October 11, 2008

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

SUMMARY OF EVENT
In the early morning hours, gusts of 30 mph were reported at Sky Harbor at the 4:00 a.m. hour. Winds over Metro Phoenix were from the west and southwest with gusts between 17 and 34 mph throughout most of the period as much drier air arrived.

Selected PM₁₀ Concentrations - October 11, 2008 (showing arrival of high winds/blowing dust)



PARKER

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	65	19	-	23	32	NW
2	63	18	-	19	31	NW
3	62	17	-	18	29	NW
4	61	14	-	21	31	NW
5	59	15	-	20	28	NW
6	58	19	-	15	24	NW
7	57	22	-	16	25	NW
8	58	26	-	11	21	NW
9	61	24	-	7	10	NW
10	64	21	-	7	16	NW
11	65	20	-	14	21	NW
12	67	18	-	14	21	NW
1	69	15	-	15	26	NW
2	70	12	-	17	26	NW
3	71	11	-	17	27	NW
4	71	10	-	15	22	NW
5	70	11	-	16	24	NW
6	67	12	-	13	20	NW
7	62	16	-	7	10	NW
8	60	16	-	9	10	NW
9	57	20	-	5	11	N
10	53	28	-	1	4	N
11	53	25	-	1	5	SE
12	51	25	-	1	3	NE

SOUTHEAST PHOENIX

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	67	23	-	4	6	E
2	69	22	-	4	8	E
3	69	24	-	1	4	E
4	67	30	-	1	4	SE
5	67	39	-	2	4	NE
6	68	48	-	2	5	NE
7	69	59	-	4	7	S
8	71	45	-	4	12	SW
9	72	30	-	9	16	W
10	70	27	-	12	18	NW
11	71	21	-	11	17	NW
12	73	20	-	11	17	NW
1	75	18	-	10	19	NW
2	75	15	-	11	17	NW
3	75	13	-	10	16	NW
4	73	12	-	12	19	NW
5	71	10	-	11	17	NW
6	67	9	-	11	19	NW
7	64	9	-	8	14	W
8	61	10	-	6	10	NW
9	57	14	-	4	6	W
10	53	20	-	3	5	NW
11	51	23	-	2	4	NW
12	51	25	-	2	4	N

MARICOPA

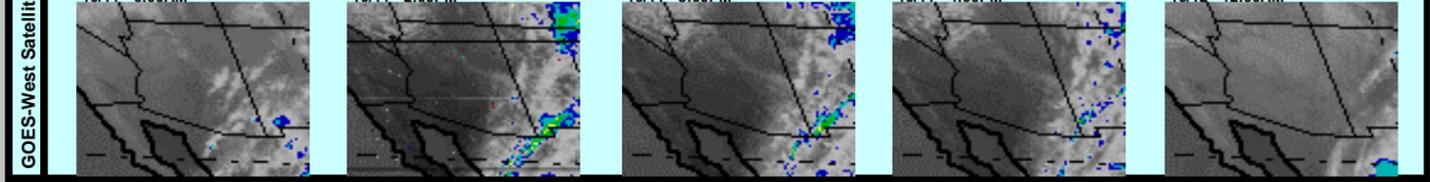
Hr	T(F)	RH	Rn	Spd	Max	Dir
1	69	24	-	3	6	E
2	69	27	-	4	13	E
3	70	38	-	3	8	SE
4	69	51	-	2	6	SE
5	66	57	-	1	4	S
6	69	37	-	7	17	SW
7	72	28	-	13	21	SW
8	65	27	-	11	17	W
9	66	22	-	10	18	W
10	67	19	-	11	17	W
11	69	17	-	11	17	W
12	71	15	-	13	19	W
1	72	14	-	13	19	W
2	73	13	-	12	20	W
3	74	12	-	13	23	W
4	73	10	-	12	20	NW
5	70	11	-	13	19	NW
6	68	11	-	10	18	NW
7	65	10	-	9	14	NW
8	61	13	-	4	10	NW
9	58	16	-	4	8	NW
10	56	17	-	3	5	NW
11	50	24	-	2	4	NE
12	49	31	-	2	3	SW

Historical Distribution

5-Yr. Dist. of Values (µg/m³)

MONITORS:	Column Index		
4-SOUTH PHOENIX	Yr - All Data (5-Yrs)		
5-JLG SUPERSITE	Sea - Data for Autumn season only (5-Yrs)		
6-CENTRAL PHOENIX			
Cum. Freq.	Mon 1	Mon 2	Mon 3
Min	7	13	5
0.5%	7	16	8
1.0%	10	16	9
2.5%	13	19	11
5%	18	20	14
10%	24	29	17
25%	36	37	23
50%	49	54	31
75%	64	67	39
90%	85	83	50
95%	94	87	59
97.5%	126	90	67
99.0%	147	100	82
99.5%	164	105	92
Max	171	131	73
Flagged Value	161	69	98

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



YUMA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	68	33	-	9	20	NW
2	66	39	-	8	15	NW
3	65	45	-	5	13	N
4	64	47	-	2	7	N
5	63	41	-	6	11	N
6	60	31	-	4	7	N
7	60	25	-	6	12	N
8	61	22	-	6	10	N
9	64	21	-	8	15	N
10	66	19	-	11	17	N
11	69	17	-	9	17	N
12	70	16	-	8	19	N
1	71	19	-	9	21	NW
2	73	17	-	10	18	NW
3	73	15	-	11	17	NW
4	74	12	-	11	22	NW
5	74	11	-	11	18	NW
6	73	11	-	11	16	N
7	69	14	-	6	10	N
8	64	19	-	2	5	NE
9	61	22	-	3	6	NE
10	59	24	-	5	7	NE
11	57	26	-	4	6	NE
12	55	28	-	3	5	NE

PALOMA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	71	42	-	5	14	SW
2	72	42	-	7	12	SW
3	64	37	-	4	6	S
4	64	34	-	4	6	W
5	61	41	-	3	7	NW
6	58	45	-	5	8	W
7	57	39	-	3	7	NW
8	58	34	-	6	10	NW
9	62	27	-	9	13	NW
10	66	21	-	10	15	NW
11	68	17	-			

Assessment of October 11, 2008 event (Cont.)

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 South Phoenix monitor were valid for October 11th. 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 South Phoenix 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 as to what meteorological conditions were in place on October 11th. Strong westerly to southwesterly winds were occurring in the Phoenix area due to a low pressure system approaching from the west with a cold front passing through Arizona. The plot of hourly PM₁₀ concentration data in the upper right corner of Figure 1 confirms the similar timing of the elevated PM₁₀ concentrations recorded by the South Phoenix monitor and the strong wind gusts at both Sky Harbor and Deer Valley Airports. While PM₁₀ concentrations also spiked at several other monitors during the morning hours, the 24-hour averages at these monitoring sites remained below the NAAQS. Thus, besides the South Phoenix monitor, no other data flags are necessary for this October 11, 2008, event.

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). The monitor with readings greater than the NAAQS on October 11, 2008, which should be flagged, is South Phoenix. While the South Phoenix monitor was the only monitor to exceed the NAAQS in the Phoenix Metro area on October 11, 2008, it can be seen in Figure 1 that even monitors with lower PM₁₀ concentrations (relative to those measured at South Phoenix) saw 24-hour concentrations near their respective 99th percentile. This is an indication that the

PM₁₀ concentrations were unusually high across the entire Phoenix Metro area on this day.

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 Arizona until approximately 6:00 a.m., when the Sky Harbor NWS station and Maricopa AzMET station first reported significant winds. These and various other Valley weather stations reported strong gusty winds off and on through the afternoon. This timing corresponds to the onset and continuation of elevated PM₁₀ concentrations recorded at the South Phoenix monitoring site. Concentrations there remained elevated throughout the morning and afternoon hours until a time when winds decreased to below about 20 mph.

5. Perform a qualitative attribution to emission source(s). All evidence indicates the elevated PM₁₀ concentrations in the Phoenix area can be attributed to soil emissions that were transported over portions of the Phoenix Metro area in Maricopa 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 October 11, 2008. Visual evidence of reduced visibility can be seen in the images located in the lower right portion of Figure 1. These images, along with the graph of Sky Harbor and Deer Valley wind gusts and South Phoenix PM₁₀ concentrations, provide proof that the elevated PM₁₀ concentrations in Phoenix were coincident with strong gusty winds and 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 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 exceedance or violation but for the event (i.e., the contribution during the event overwhelmed the 24-hour average).

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 concentration at South Phoenix was attributed to a natural event.

Conclusion

Long-range transport of dust from soils. The elevated PM₁₀ event on October 11, 2008 in Maricopa County was the result of the transport of dust and soils from high 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.