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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 March 14, 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 Thursday, March 13, 2008, in response to a tightening pressure gradient ahead of a low pressure system and associated cold front approaching Arizona from the west, ADEQ air quality forecasters issued the Maricopa County Dust Control Action Forecast, which called for a moderate risk of wind-blown dust for Friday, March 14th. In addition, ADEQ air quality forecasters issued a PM₁₀ Health Watch for March 14, 2008, due to the possibility of strong winds and blowing dust throughout the Maricopa County area. The forecasts/advisories satisfy the requirement in 40 CFR 51.920(a)(1).

The forecast for March 14th 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. During the late morning / early afternoon hours of March 14th, strong, gusty westerly winds generated blowing dust which moved into the Phoenix Metro area from the west. 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.”

Strong winds were observed throughout portions of Maricopa County and the Phoenix Metro area on March 14, 2008. The initialization of the 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, gusty winds greater than 20 and 30 mph were reported between the 10:00 a.m. and 5:00 p.m. hours at several Phoenix area monitoring locations. In addition, Phoenix Goodyear Airport reported reduced visibility and wind gust of 43 mph during the event. This significant event brought elevated ambient concentrations of PM₁₀ to the Phoenix area. Due to the spatial variability of PM sources both within and outside of the Phoenix urban core, the PM₁₀ NAAQS was only exceeded at the West 43rd Ave. monitor operated by Maricopa County (see Section 2 for more detail). 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**
PHOENIX METRO AREA					
West 43 rd Ave (MC/TEOM)	04-013-4009*	251	1286	1300	RJ
Durango Complex (MC/TEOM)	04-013-9812*	92	310	1300	None
Greenwood (MC/TEOM)	04-013-3010*	71	151	1300	None
Higley (MC/TEOM)	04-013-4006*	51	140	0700	None
West Phoenix (MC/TEOM)	04-013-0019*	57	126	1300	None
Central Phoenix (MC/TEOM)	04-013-3002*	69	231	1300	None
JLG Supersite (ADEQ/TEOM)	04-013-9997*	40	62	1300	None
Coyote Lakes (MC/TEOM)	04-013-4014*	47	107	0700	None
South Phoenix (MC/TEOM)	04-013-4003*	119	461	1300	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-Goodyear Airport

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	0	0	0	0	0	N/A
2	0	0	0	0	0	N/A
3	0	0	0	0	0	N/A
4	0	0	0	0	0	N/A
5	0	0	0	0	0	N/A
6	0	0	0	0	0	N/A
7	0	0	0	0	0	N/A
8	61	60	0	9	9	W
9	66	40	0	9	9	SW
10	70	30	0	7	7	W
11	73	20	0	6	6	SW
12	82	15	0	14	29	W
1	86	10	0	18	34	W
2	86	15	0	25	43	W
3	84	20	0	14	23	W
4	84	20	0	17	17	SW
5	82	40	0	17	17	SW
6	81	40	0	11	11	W
7	75	40	0	6	6	VR
8	0	0	0	0	0	N/A
9	70	20	0	11	11	SW
10	0	0	0	0	0	N/A
11	0	0	0	0	0	N/A
12	0	0	0	0	0	N/A

NWS-Glendale Airport

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	0	0	0	0	0	N/A
2	0	0	0	0	0	N/A
3	0	0	0	0	0	N/A
4	0	0	0	0	0	N/A
5	0	0	0	0	0	N/A
6	0	0	0	0	0	N/A
7	0	0	0	0	0	N/A
8	0	0	0	0	0	N/A
9	0	0	0	0	0	N/A
10	70	20	0	15	23	SW
11	73	20	0	16	23	SW
12	79	20	0	18	23	W
1	81	20	0	20	26	W
2	82	20	0	21	26	W
3	82	20	0	20	25	W
4	81	20	0	14	23	SW
5	82	20	0	11	21	W
6	81	20	0	11	11	SW
7	75	20	0	5	5	W
8	0	0	0	0	0	N/A
9	0	0	0	0	0	N/A
10	0	0	0	0	0	N/A
11	0	0	0	0	0	N/A
12	0	0	0	0	0	N/A

NWS-Phx Sky Harbor

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	63	10	0	6	6	E
2	62	10	0	6	6	E
3	60	10	0	6	6	E
4	59	10	0	7	7	E
5	59	10	0	5	5	E
6	57	10	0	8	8	E
7	57	10	0	0	0	N
8	61	10	0	0	0	N
9	65	10	0	6	6	E
10	70	10	0	5	5	SW
11	77	10	0	11	20	W
12	79	10	0	21	29	W
1	81	10	0	21	30	W
2	82	10	0	25	30	W
3	82	10	0	23	23	W
4	82	10	0	17	24	W
5	81	10	0	13	23	W
6	80	10	0	14	14	W
7	77	10	0	7	7	W
8	76	10	0	9	9	SW
9	72	10	0	11	11	SW
10	73	10	0	10	10	W
11	69	10	0	10	10	W
12	67	10	0	7	7	W

Event Contrib. Analysis

Hourly PM₁₀ Conc. (µg/m³)

MONITORS:	Hr	1
1-W43RD	1	26.1
	2	28.9
	3	22.2
	4	28.4
	5	64.6
	6	155
	7	146
	8	134
	9	188
	10	329
	11	355
	12	1052
> NAAQS	< NAAQS	
1-W43RD	251	69

24-Hr. Avg PM₁₀ 5 64.6

Monitor: Event Even

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

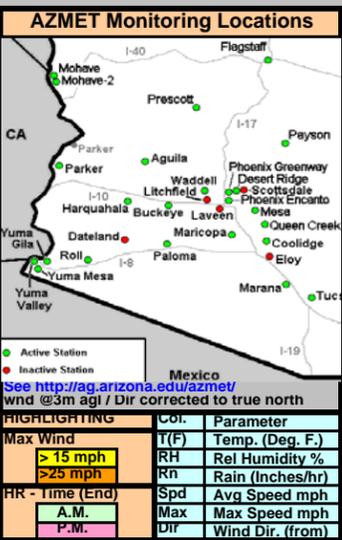
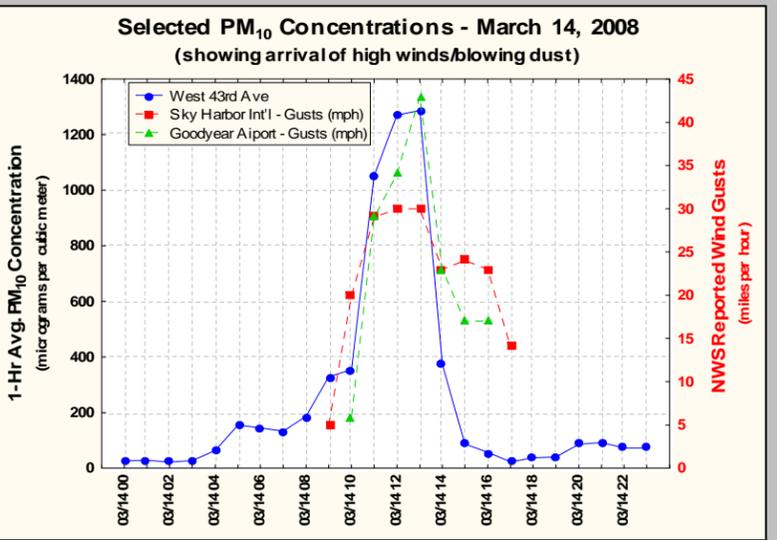


Figure 1. Key Data for Event of March 14, 2008

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

SUMMARY OF EVENT

A low pressure system caused strong west-southwesterly winds on 3/14 throughout portions of the valley. Sky Harbor Int'l Airport reported gusts to 30 m.p.h. while Goodyear Airport had gusts as high as 43 m.p.h. These gusty winds coincided with elevated PM10 levels at West 43rd Ave.



PARKER

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	68	24	-	4	11	S
2	71	20	-	11	18	W
3	69	22	-	8	17	SW
4	65	29	-	4	8	SE
5	67	31	-	8	22	W
6	68	34	-	16	26	NW
7	66	36	-	9	17	NW
8	67	36	-	13	21	NW
9	68	37	-	10	20	NW
10	70	33	-	12	18	NW
11	73	27	-	10	18	NW
12	76	24	-	5	11	N
1	78	20	-	4	9	W
2	80	16	-	9	18	NW
3	80	14	-	13	18	NW
4	80	14	-	13	20	NW
5	79	14	-	13	19	NW
6	76	13	-	11	17	NW
7	72	13	-	9	13	NW
8	69	13	-	11	15	NW
9	68	13	-	11	16	NW
10	67	13	-	17	27	NW
11	66	14	-	19	26	NW
12	64	15	-	20	27	NW

BUCKEYE

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	62	36	-	2	5	W
2	61	36	-	4	7	NW
3	59	38	-	4	6	NW
4	56	39	-	4	5	N
5	54	44	-	4	6	N
6	54	45	-	4	7	N
7	51	53	-	3	6	NW
8	55	51	-	4	6	N
9	60	57	-	5	9	W
10	67	39	-	9	13	W
11	72	30	-	11	22	W
12	74	21	-	16	24	NW
1	76	16	-	17	25	NW
2	77	20	-	13	22	W
3	77	24	-	10	18	W
4	77	24	-	9	17	W
5	77	24	-	6	15	W
6	76	19	-	7	12	NW
7	71	22	-	4	7	NW
8	66	25	-	4	7	W
9	60	32	-	4	7	W
10	63	27	-	4	7	NW
11	58	30	-	3	5	N
12	54	39	-	2	3	NW

CENTRAL PHOENIX

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	58	55	-	1	3	E
2	56	57	-	1	2	E
3	55	61	-	1	2	E
4	53	65	-	1	3	E
5	53	60	-	0	2	NE
6	51	64	-	0	2	NE
7	51	59	-	1	2	E
8	57	46	-	1	3	E
9	65	35	-	1	3	SE
10	69	27	-	6	17	W
11	72	21	-	9	16	W
12	75	17	-	9	17	W
1	78	13	-	10	21	W
2	79	11	-	11	18	W
3	80	10	-	11	20	W
4	79	13	-	9	18	W
5	79	13	-	9	16	W
6	78	13	-	7	13	W
7	76	14	-	3	9	W
8	73	15	-	3	8	SW
9	73	12	-	4	11	SW
10	69	15	-	2	6	W
11	67	15	-	3	7	W
12	63	65	-	3	7	E

Historical Distribution

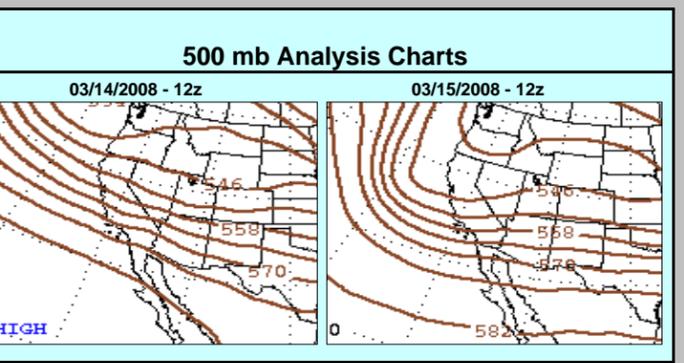
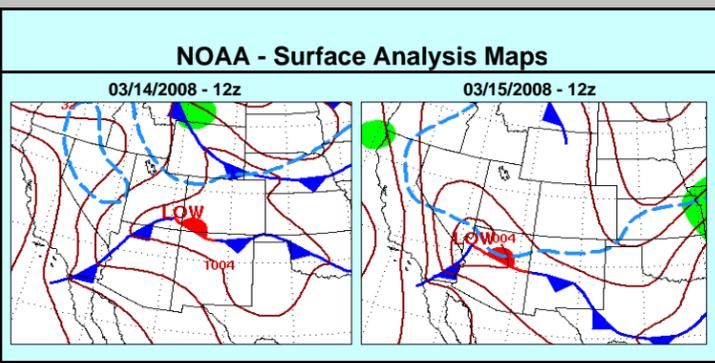
5-Yr. Dist. of Values (µg/m³)

MONITORS:	Column Index
1-W43RD	Yr - All Data (5-Yrs)
	Sea - Data for Spring season only (5-Yrs)

Cum. Freq.	Mon 1	Yr	Sea
Min	5	8	
0.5%	9	9	
1.0%	11	11	
2.5%	15	13	
5%	19	19	
10%	29	28	
25%	44	46	
50%	65	63	
75%	91	82	
90%	121	107	
95%	139	125	
97.5%	157	134	
99.0%	192	194	
99.5%	227	220	
Max	313	313	

Flagged Value: 251

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



YUMA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	58	61	-	4	6	S
2	57	64	-	3	8	SW
3	55	63	-	2	5	S
4	54	69	-	3	5	SW
5	53	74	-	2	4	SW
6	52	73	-	3	5	SW
7	50	76	-	2	6	E
8	53	72	-	1	3	NE
9	62	55	-	2	6	E
10	69	42	-	2	5	E
11	76	28	-	2	6	S
12	78	25	-	6	12	SW
1	80	20	-	10	16	SW
2	82	16	-	10	19	SW
3	84	13	-	11	17	SW
4	84	12	-	13	21	NW
5	82	12	-	18	27	W
6	79	13	-	17	23	W
7	76	12	-	15	22	W
8	72	14	-	11	18	W
9	67	23	-	11	17	NW
10	64	26	-	10	19	NW
11	64	27	-	17	26	NW
12	61	32	-	16	25	NW

SW AZ - YUMA N GILA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	61	53	-	5	8	S
2	59	62	-	4	6	S
3	59	60	-	6	8	S
4	57	62	-	4	9	S
5	56	64	-	3	6	W
6	53	72	-	3	9	NW
7	52	74	-	2	4	SE
8	54	71	-	1	3	E
9	65	53	-	2	4	S
10	72	36	-	2	4	S
11	76	26	-	2	5	SW
12	79	22	-	6	13	SW
1	81	21	-	10	16	SW
2						

Assessment of March 14, 2008 event (Cont.)

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 West 43rd Ave. monitoring site were valid for March 14th. Audits of the analyzers revealed operations were within acceptable tolerance. No local sources were reported as significantly contributing to the air quality episode. Exceedances of the NAAQS were recorded at the West 43rd Ave. monitoring site 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 March 14th. Strong westerly winds were occurring in the Phoenix area due to a low pressure system approaching from the west with a cold front situated west of Arizona. The plot of hourly PM₁₀ concentration data in the upper right corner of Figure 1 confirms the nearly identical timing of elevated PM₁₀ at the West 43rd Ave. monitor and strong wind gusts at Sky Harbor Airport. The high wind event was a regional phenomenon that affected the entire Phoenix Metro area. However, PM sources are highly variable across space; therefore, the locations of higher PM₁₀ concentrations (namely the Salt River channel) are likely an indication that these locations (or areas upwind of these locations) contain greater sources of PM than other locations within the Phoenix Metropolitan area. While no specific source allocation can be determined for this particular day, the 2005 ADEQ revised PM₁₀ SIP for the Salt River area (attached) contains modeled source contributions on high wind days (see section 4.2 – Source Categories). Results estimate that approximately 76% of PM₁₀ concentrations can be attributed to windblown dust, of which 21% is from agricultural fields, 15% from alluvial channels, and 21% from vacant lots. It is not clear whether similar source allocations can be assumed for this March 14, 2008, high wind 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 that of the NAAQS, which should be flagged, is West 43rd Ave.

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 10:00 or 11:00 a.m., when several stations reported gusty winds that approached 30 and even 40 mph at times. This timing corresponds to the onset of elevated PM₁₀ concentrations recorded at the West 43rd Ave. monitoring site, which remained elevated through the afternoon hours until the winds decreased to below 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 March 14, 2008. Observational reports of reduced visibility throughout portions of Phoenix are further proof that the elevated PM₁₀ concentrations were attributed to soil emissions transported by high winds. These reports, in addition to the visual evidence of reduced visibility seen in the lower right portion of Figure 1, provide proof that the elevated PM₁₀ concentrations in Phoenix 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 West 43rd Ave. was attributed to a natural event.

Conclusion

Long-range transport of dust from soils. The elevated PM₁₀ event on March 14, 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.