



Janice K. Brewer
Governor

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

1110 West Washington Street • Phoenix, Arizona 85007
(602) 771-2300 • www.azdeq.gov



Benjamin H. Grumbles
Director

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 22, 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 Tuesday, October 21, 2008, a tightening pressure gradient associated with a deep ridge to the east of Arizona and a strong trough of low pressure to the west of the state was in place when ADEQ air quality forecasters issued the Maricopa County Dust Control Action Forecast. While the forecast called for only a low risk of wind-blown dust in Maricopa County on Wednesday, October 22nd, it did mention the possibility of gusty north-northeasterly winds up to 25 mph in the Valley with sustained winds ranging from 10 to 20 mph. The forecasts/advisories satisfy the requirement in 40 CFR 51.920(a)(1).

The forecast for October 22nd called for gusty winds, and while the risk of exceeding the PM₁₀ National Ambient Air Quality Standards (NAAQS) in Maricopa County was forecast to be low, these winds had the potential to be strong enough to exceed threshold friction velocities for local soils, causing a wind-blown dust event. Strong winds did occur and were observed throughout portions of Maricopa County and the Phoenix Metro area on October 22nd, 2008. Beginning in the mid-morning and continuing through the early afternoon hours, strong north and northeasterly winds were observed over much of the

Phoenix Metro area generating blowing dust which caused spikes at multiple West Valley monitors during the morning hours. 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 can be seen in the Phoenix visible camera images, as well as the data from the Arizona Meteorological Network (AzMET) and National Weather Service (NWS) monitors (see Fig. 1). Significant winds gusting over 15 and 20 mph were reported between the 9:00 a.m. and 1:00 p.m. hours at the NWS Deer Valley and Glendale monitoring locations, while a gust as high as 29 mph was recorded at the Chandler Municipal Airport monitoring location. 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 Coyote Lakes 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					
Coyote Lakes (MC/TEOM)	04-013-4014*	167.6	695	0900	RJ
West 43 rd Ave (MC/TEOM)	04-013-4009*	91.1	378	0600	No
Durango Complex (MC/TEOM)	04-013-9812*	81.4	389	0700	No
Greenwood (MC/TEOM)	04-013-3010*	56.1	175	0600	No
Higley (MC/TEOM)	04-013-4006*	58.8	197	0800	No
West Phoenix (MC/TEOM)	04-013-0019*	45.5	145	0700	No
Central Phoenix (MC/TEOM)	04-013-3002*	35.4	64	0800	No
South Phoenix	04-013-4003*	48.1	141	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 and made available for public comment to satisfy the requirements of 50.14(c)(3)(i).

NWS-Phoenix Sky Harbor

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	70	10	0	0	0	N
2	69	10	0	0	0	N
3	69	10	0	0	0	N
4	66	10	0	0	0	N
5	66	10	0	0	0	N
6	64	10	0	0	0	N
7	66	10	3	3	3	E
8	69	10	6	6	6	E
9	77	10	7	7	7	E
10	81	10	14	14	14	N
11	82	10	13	23	23	NE
12	84	10	16	20	20	E

NWS-Deer Valley Airport

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	70	10	0	5	5	E
2	69	10	0	3	3	E
3	65	10	0	0	0	N
4	72	10	0	8	8	NE
5	71	10	5	5	5	NE
6	69	10	0	0	0	N
7	69	9	7	7	7	NE
8	74	10	7	7	7	NE
9	77	10	15	23	23	NE
10	79	10	14	21	21	N
11	81	10	11	11	11	NE
12	84	10	8	8	8	NE

MC - Coyote Lakes

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	68	N/A	-	1	6	N
2	65	N/A	-	1	5	N
3	64	N/A	-	2	5	NE
4	67	N/A	-	3	17	NE
5	75	N/A	-	9	18	NE
6	75	N/A	-	9	20	NE
7	74	N/A	-	11	25	NE
8	74	N/A	-	13	31	NE
9	76	N/A	-	14	35	NE
10	78	N/A	-	16	35	NE
11	80	N/A	-	15	34	NE
12	82	N/A	-	14	29	NE

Event Contrib. Analysis

Hourly PM₁₀ Conc. (µg/m³)

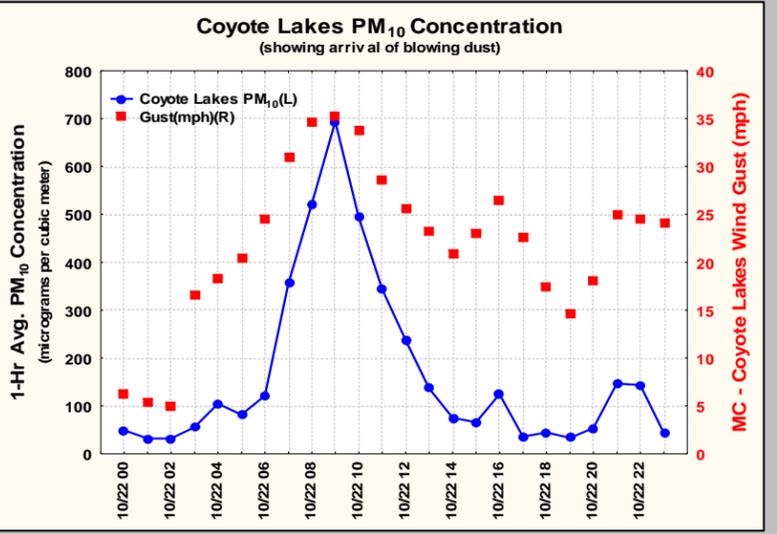
MONITORS:	Hr	1
1-Coyote Lakes	1	48.6
2-Mon 2	2	31.5
3-Mon 3	3	32.2
24-Hr. Avg PM ₁₀	5	105
with W/O	6	81.4
Monitor: Event	7	121
1-Coyote	8	355
	9	522
	10	695
> NAAQS	11	494
< NAAQS	12	344
Pink=Event Contrib.	1	237
Conclusion: As shown above, the PM ₁₀ concentration would have been below the NAAQS "BUT FOR" the event contribution (hours highlighted in pink).	2	136
	3	75.1
	4	65.3
	5	124
	6	35.3
	7	44.7
	8	33.3
	9	53.7
	10	147
	11	144
	12	43.6



Figure 1. Key Data for Event of October 22, 2008

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

SUMMARY OF EVENT
At 9:00 a.m., winds in the Valley were from the north, northeast with gusts between 15 and 23 mph. By noon, winds were from the north and east with gusts between 24 and 29 in some parts of the Valley while Goodyear had a visibility of 7 statute miles during this period.



PARKER

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	69	24	-	5	9	N
2	68	25	-	5	11	NE
3	64	25	-	2	6	NE
4	64	25	-	2	5	E
5	66	26	-	2	5	N
6	65	28	-	4	7	N
7	64	27	-	3	7	N
8	67	24	-	4	10	N
9	73	21	-	6	11	N
10	79	12	-	13	18	N
11	82	11	-	15	21	N
12	85	8	-	15	21	N

NORTHWEST PHOENIX

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	63	31	-	1	3	N
2	60	36	-	0	2	N
3	60	34	-	1	2	N
4	59	35	-	1	3	NW
5	61	29	-	1	4	NW
6	60	30	-	1	3	NE
7	62	25	-	1	4	N
8	69	18	-	4	11	NE
9	75	12	-	5	12	E
10	77	10	-	8	16	NE
11	78	8	-	10	19	NE
12	80	8	-	8	15	NE

BUCKEYE

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	63	30	-	2	6	NW
2	62	31	-	3	8	NW
3	65	24	-	3	7	NE
4	64	24	-	4	7	N
5	59	30	-	2	6	N
6	57	36	-	2	6	NE
7	57	45	-	3	5	W
8	59	40	-	2	6	W
9	67	36	-	4	8	SW
10	78	20	-	7	19	E
11	82	8	-	15	25	E
12	84	7	-	13	20	E

Historical Distribution

5-Yr. Dist. of Values (µg/m³)

MONITORS:	Column Index
1-COYOTE LAKES	Yr - All Data (5-Yrs)
	Sea - Data for Autumn season only (5-Yrs)

Cum. Freq.	Mon 1	Yr	Sea
Min	7	16	
0.5%	7	17	
1.0%	9	18	
2.5%	10	21	
5%	14	23	
10%	19	25	
25%	30	35	
50%	44	49	
75%	58	66	
90%	77	80	
95%	91	91	
97.5%	109	102	
99.0%	122	131	
99.5%	219	222	
Max	313	313	

Flagged Value: 167

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



YUMA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	65	49	-	1	3	SE
2	62	57	-	2	5	E
3	62	57	-	2	6	NE
4	60	59	-	2	5	W
5	71	25	-	3	12	N
6	76	17	-	5	13	N
7	76	16	-	13	23	N
8	76	15	-	17	25	NE
9	77	15	-	18	26	N
10	79	15	-	18	28	N
11	81	14	-	16	24	N
12	83	13	-	14	22	N

PALOMA

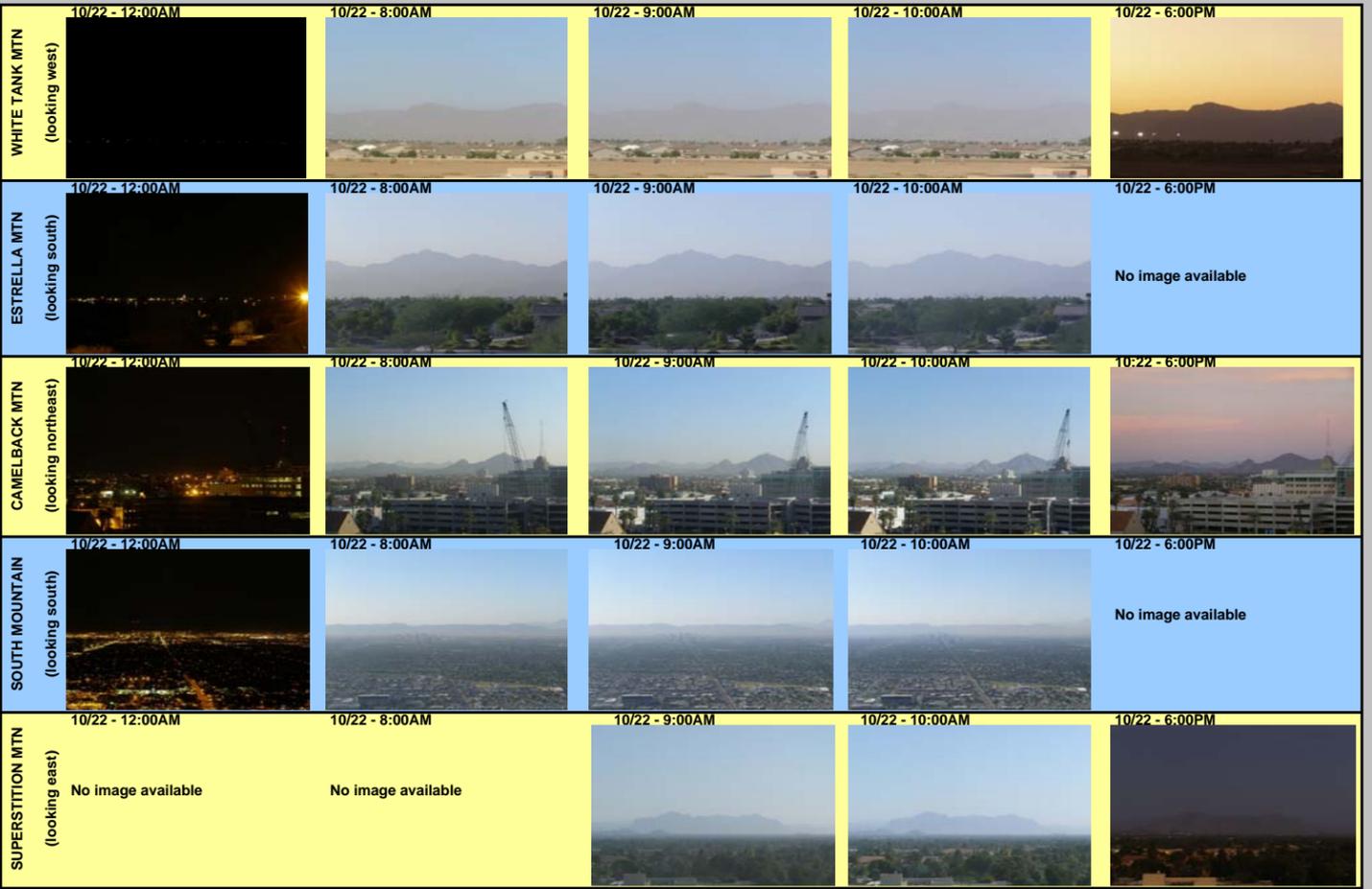
Hr	T(F)	RH	Rn	Spd	Max	Dir
1	62	40	-	3	5	SW
2	59	40	-	1	3	SW
3	56	56	-	1	4	NE
4	54	55	-	2	5	SW
5	56	45	-	2	5	S
6	51	63	-	2	4	E
7	51	62	-	2	5	E
8	56	50	-	1	2	NW
9	67	35	-	2	4	E
10	76	25	-	4	7	NE
11	82	20	-	7	11	NE
12	85	16	-	7	11	NE

MARANA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	61	29	-	6	9	E
2	60	31	-	6	11	SE
3	58	33	-	8	11	E
4	58	34	-	7	11	SE
5	57	36	-	5	8	SE
6	55	39	-	7	11	SE
7	55	40	-	7	12	SE
8	61	30	-	6	12	SE
9	73	15	-	5	15	E
10	79	8	-	11	22	NE
11	81	6	-	15	22	NE
12	85	5	-	11	19	NE

TUCSON

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	57	35	-	2	4	E
2	55	38	-	2	5	E
3	52	44	-	1	3	SE
4	50	48	-	1	3	E
5	49	51	-	2	4	E
6	48	55	-	1	3	E
7	47	56	-	2	4	E
8	53	49	-	1	3	SE
9	63	35	-	1	2	E
10	70	29	-	1	3	SE
11	76	21	-	2	6	W
12	80	14	-	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 Coyote Lakes monitor were valid for October 22nd. 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 Coyote Lakes 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 22nd. Strong north and northeasterly winds were occurring in the Phoenix area due to a tightening pressure gradient associated with a low pressure system to the east and a high pressure ridge building in the west. 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 Coyote Lakes monitor and the strong wind gusts at both Glendale and Deer Valley Airports. PM₁₀ concentrations also spiked at several other monitors during the morning hours; however, the 24-hour averages at these monitoring sites remained below that of the NAAQS. While this high wind event affected the entire Phoenix Metro area, PM sources are spatially diverse, and therefore, the locations of higher PM₁₀ concentrations (West Valley) are likely an indication that these locations (or areas upwind of these locations) contain greater sources of PM than the urbanized core of the Phoenix Metropolitan area. In particular, recent elevated PM₁₀ events at Coyote Lakes indicate that this monitoring location is susceptible to high PM₁₀ concentrations under strong northerly and northeasterly flow regimes.

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 on October 22, 2008, which should be flagged, is Coyote Lakes.

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 8:00 or 9:00 a.m., when several NWS and AzMET stations first began to report significant winds. Multiple weather stations in and around Maricopa County continued to report strong, gusty winds through the early afternoon hours. This timing corresponds to the onset and continuation of elevated PM₁₀ concentrations recorded at the Coyote Lakes monitoring site. Concentrations there remained elevated through the morning and afternoon hours until a time when winds decreased to below 15 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 22, 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 Phoenix area wind gusts and Coyote Lakes PM₁₀ concentrations, provide evidence that the elevated PM₁₀ concentrations at Coyote Lakes 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 portions of 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 Coyote Lakes was attributed to a natural event.

Conclusion

Long-range transport of dust from soils. The elevated PM₁₀ concentrations at Coyote Lakes on October 22, 2008, was a result of the transport of dust and soils due to 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.