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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 Event in the Nogales, Arizona Area on May 22, 2008

Background

The Arizona Department of Environmental Quality (ADEQ) operates monitors at the Post Office in Nogales, Arizona for PM₁₀ and PM_{2.5} and at the Fire Station in Nogales, Sonora for PM₁₀. Federal Reference Method (FRM) filter based samples are collected at both locations. Beta-Attenuation Monitor Systems (BAMS) collect hourly PM₁₀ and PM_{2.5} concentration data at the Post Office site.

ADEQ issues a Dust Control Action Forecast for Maricopa County as part of the Natural Events Action Plan for the area. Additionally, ADEQ also issues a Dust Re-Entrainment Risk Wind Forecast for the Green Valley area south of Tucson as well as a Yuma Wind forecast for the Yuma area. All of these forecasts issued on Wednesday, May 21, 2008, indicated that strong winds were likely throughout much of the state and that there was a moderate risk of wind blown dust for these areas (see attachments). In addition to these standard forecasts, a PM₁₀ Health Watch was also issued for the Phoenix Metro area in anticipation of elevated PM₁₀ concentrations from wind blown dust. While there is not a specific forecast for the Nogales area, the issuance of a PM₁₀ Health Watch in conjunction with multiple forecasts of moderate risks for wind blown dust is evidence that the high wind event on May 22, 2008 was expected to be a region wide phenomenon. These forecasts/advisories satisfy the requirement in 40 CFR 51.920(a)(1).

Throughout most of the day of May 22, 2008, strong southerly winds associated with an unseasonably strong

low pressure system were occurring in the Nogales area. The initialization of the wind-blown dust event is evident in the Arizona Meteorological Network (AzMET) and National Weather Service (NWS) monitor data (see Fig. 1). Sustained winds measured at the NWS monitor in Nogales were at or above 25 mph for most of the day with gusts as high as 49 mph and regularly in the 30 and 40 mph range. The wind-blown dust event brought significant elevated ambient concentrations of PM₁₀ that exceeded the National Ambient Air Quality Standards (NAAQS) at the ADEQ Nogales Post Office monitor (BAM). 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 Nogales area that exceeded the NAAQS at the Nogales Post Office monitor operated by ADEQ. The fact that ambient concentrations exceed the NAAQS satisfies the criteria in 40 CFR 50.1(j) that the event "affects air quality."

Elevated PM₁₀ concentrations were measured in the Nogales area. While most elevated PM₁₀ episodes in the Nogales area can be attributed to international transport during stable atmospheric conditions, this particular case was due to strong southerly winds that picked up loose and unstable soils and transported them northward across the international border. The table below shows the key PM monitor readings for the monitors examined in this report.

Monitor (Operator/Type)	AQS/AAAD ID	24-hr Avg PM ₁₀	1-hr Max PM ₁₀	Time of Max 1-hr	Flag**
NOGALES AREA					
Nogales Post Office PM₁₀ (ADEQ/BAM)	04-023-0004*	217	640	1600	RL & RJ
Nogales Post Office PM_{2.5} (ADEQ/BAM)	04-023-0004*	19.8	43	1600	None

* EPA Air Quality System Identification Number

** 24-hr PM₁₀ concentration influenced by exceptional event (international transport) to be flagged.

Type Abbreviations: BAM – Beta-Attenuation Mass 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-Nogales

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	60	10	17	17	17	SW
2	57	10	8	8	8	S
3	56	10	8	8	8	S
4	56	10	11	11	11	S
5	55	10	15	15	15	S
6	55	10	10	20	20	S
7	57	10	16	23	23	S
8	59	10	24	36	36	S
9	62	10	23	31	31	S
10	64	10	26	40	40	S
11	67	10	26	36	36	S
12	67	10	25	37	37	S
1	64	10	26	47	47	S
2	65	10	25	34	34	S
3	66	10	32	49	49	SW
4	67	10	25	43	43	S
5	65	8	31	44	44	S
6	63	8	26	44	44	S
7	60	10	23	34	34	S
8	57	10	29	37	37	S
9	56	10	22	30	30	S
10	55	10	RA	22	36	S
11	51	10	16	24	24	SW
12	49	6	RA	17	28	S

NWS-Douglas Bisbee

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	63	10	21	33	33	SW
2	60	10	18	29	29	SW
3	59	10	17	28	28	SW
4	57	10	13	13	13	SW
5	56	10	14	14	14	SW
6	56	10	13	13	13	SW
7	61	10	24	31	31	SW
8	64	10	32	43	43	SW
9	65	10	20	26	26	SW
10	68	10	28	38	38	S
11	68	10	26	38	38	S
12	69	10	30	43	43	SW
1	74	10	32	47	47	SW
2	76	10	34	49	49	S
3	76	10	32	51	51	S
4	75	9	33	54	54	SW
5	71	8	32	48	48	S
6	69	9	31	45	45	S
7	65	10	28	38	38	SW
8	63	10	23	38	38	SW
9	62	10	26	41	41	S
10	60	10	21	29	29	S
11	59	10	22	30	30	S
12	58	10	24	41	41	S

NWS-Sierra Vista

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	59	10	24	32	32	SW
2	57	10	17	26	26	SW
3	56	10	20	25	25	S
4	55	10	23	33	33	SW
5	55	10	25	36	36	SW
6	55	35	30	37	37	SW
7	57	35	26	34	34	SW
8	59	35	24	33	33	S
9	63	35	21	34	34	SW
10	64	35	21	37	37	SW
11	66	35	21	32	32	SW
12	68	35	22	44	44	SW
1	66	35	22	37	37	SW
2	70	35	18	28	28	SW
3	70	35	26	47	47	SW
4	66	35	31	43	43	SW
5	66	7	34	46	46	SW
6	63	7	39	51	51	SW
7	61	7	24	44	44	SW
8	57	7	26	47	47	SW
9	57	7	18	34	34	SW
10	55	7	17	37	37	SW
11	55	7	25	37	37	SW
12	51	10	30	40	40	S

Event Contrib. Analysis

Hourly PM₁₀ Conc. (µg/m³)

MONITORS:	Hr	1	2
1-Nogales PM10	1	39	12
2-Nogales PM2.5	2	43	10
	3	50	8
	4	40	9
	5	46	16
	6	47	9
	7	58	11
	8	41	11
	9	66	10
	10	116	9
	11	156	16
	12	215	15

24-Hr. Avg PM₁₀ with w/o: 5 46 16
Monitor: Event Even: 6 47 9
1-Nogales: 217 50
2-Nogales: 19.8 10.7

> NAAQS < NAAQS: 11 156 16
Pink=Event Contrib.: 12 215 15

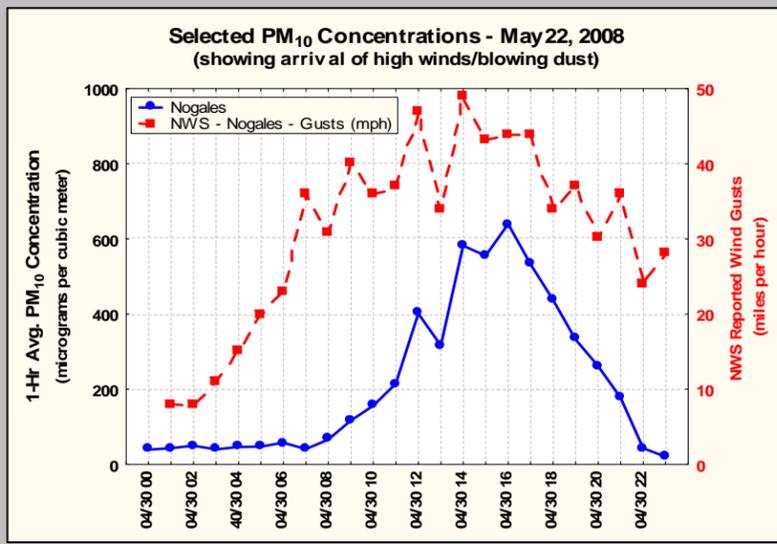
Conclusion: As shown above, the PM₁₀ concentration would have been below the NAAQS "BUT FOR" the event contribution (hours highlighted in pink).



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

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

SUMMARY OF EVENT:
Between 1:00 and 6:00 p.m. winds were unremitting over southeast Arizona. Nogales and Douglas had gusts from the south to southwest up to 47 mph at 1:00 p.m. At 6:00 p.m., Nogales had a visibility of 8 statute miles in blowing dust with wind gust from the south up to 44 mph.



BUCKEYE

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	75	14	-	11	17	NW
2	75	14	-	11	22	NW
3	74	14	-	11	29	NW
4	71	17	-	8	17	W
5	70	20	-	6	11	SW
6	68	24	-	7	12	SW
7	68	28	-	7	14	SW
8	69	35	-	9	15	SW
9	70	32	-	9	14	SW
10	71	29	-	8	13	SW
11	74	17	-	9	15	W
12	75	18	-	7	14	SW
1	74	18	-	8	17	W
2	75	21	-	8	21	W
3	75	16	-	9	23	W
4	69	34	-	11	18	S
5	69	33	-	10	18	S
6	68	33	-	9	16	S
7	64	42	-	9	22	S
8	59	65	-	12	23	S
9	56	75	-	8	19	S
10	55	79	-	11	20	S
11	55	78	-	9	17	SE
12	53	88	-	7	15	SE

MARICOPA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	72	29	-	7	12	SW
2	69	32	-	9	15	SW
3	72	26	-	10	19	W
4	72	25	-	8	17	W
5	68	38	-	9	14	SW
6	65	52	-	11	16	S
7	66	52	-	11	15	S
8	66	52	-	13	18	S
9	67	52	-	13	17	S
10	69	49	-	12	17	SW
11	71	42	-	12	19	SW
12	74	28	-	11	17	SW
1	72	32	0.01	14	29	W
2	60	71	0.12	10	23	NW
3	58	76	0.20	8	17	N
4	58	80	0.07	6	11	N
5	57	78	0.10	10	21	NW
6	55	82	0.04	7	13	E
7	54	92	0.08	6	10	SE
8	54	94	0.17	6	10	SE
9	53	96	0.16	5	9	SE
10	53	96	0.07	7	14	S
11	52	96	0.17	7	11	S
12	50	97	0.27	8	13	SW

COOLIDGE

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	69	45	-	12	18	SW
2	67	50	-	11	16	SW
3	66	51	-	11	18	SW
4	65	55	-	11	17	SW
5	64	58	-	11	18	SW
6	63	58	-	10	21	SW
7	65	53	-	13	20	SW
8	66	52	-	16	23	SW
9	67	51	-	13	21	SW
10	67	51	-	12	20	SW
11	69	49	-	12	20	SW
12	71	43	-	15	23	SW
1	73	36	-	15	25	SW
2	70	37	-	16	26	W
3	63	57	-	15	24	N
4	59	68	0.04	13	22	N
5	54	92	0.28	5	11	NE
6	54	94	0.04	4	9	E
7	54	95	0.04	7	11	E
8	52	96	0.12	6	12	E
9	51	97	0.16	5	9	NE
10	51	98	0.12	2	8	E
11	51	96	0.04	1	3	SE
12	51	96	0.08	2	6	W

Historical Distribution

5-Yr. Dist. of Values (µg/m³)

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

Cum. Freq.	Mon 1	Yr	Sea
Min	4	7	
0.5%	8	8	
1.0%	8	9	
2.5%	13	15	
5%	17	18	
10%	22	25	
25%	35	39	
50%	56	56	
75%	96	83	
90%	146	109	
95%	180	128	
97.5%	213	139	
99.0%	244	164	
99.5%	291	174	
Max	351	179	

Flagged Value: 217

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



YUMA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	72	31	-	16	27	NW
2	71	34	-	15	24	NW
3	66	45	-	4	15	W
4	60	60	-	5	8	SW
5	57	67	-	6	8	SW
6	57	63	-	6	9	SW
7	63	47	-	8	17	NW
8	67	38	-	12	19	NW
9	71	35	-	14	21	NW
10	74	32	-	12	19	NW
11	76	27	-	10	16	NW
12	78	19	-	8	15	NW
1	78	21	-	9	18	W
2	79	25	-	12	24	NW
3	78	24	-	11	17	NW
4	77	24	-	14	23	NW
5	76	27	-	15	22	NW
6	73	32	-	14	21	NW
7	70	35	-	13	21	NW
8	67	39	-	12	21	NW
9	65	47	-	6	12	W
10	64	52	-	4	7	SW
11	63	49	-	4	9	W
12	60	55	-	2	5	W

PALOMA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	68	45	-	11	15	SW
2	67	42	-	11	15	SW
3	68	37	-	11	17	SW
4	67	39	-	11	17	SW
5	67	52	-	12	17	SW
6	66	50	-	11	18	SW
7	66	52	-	13	19	SW
8	67	51	-	15	21	SW
9	70	39	-	16	22	SW
10	72	32	-	15	22	SW
11	75	24	-	14	20	SW
1						

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 ADEQ, the agency responsible for operation of the monitor. All hourly PM₁₀ readings from the Nogales BAMS monitor were found to be valid for May 22nd. No specific local sources were reported as significantly contributing to the air quality episode.

2. Review suspected contributing sources. The event began during the late morning hours of May 22nd. There was not a significant fraction of PM_{2.5} measured during this episode. This is typical for the arid southwest, except when smoke from smoldering fires can be a significant source of PM_{2.5}. This event is distinctly different from previous elevated PM₁₀ events in Nogales, as strong southerly winds allowed for loose and unstable soils to be picked up and transported. The plot of hourly PM₁₀ concentration data in the upper right corner of Figure 1, in conjunction with the wind speed data, confirms the identical timing of the transport from the south across the border when the elevated PM concentrations began. It is clear from the PM_{2.5} data presented for informational purposes in the Event Contribution Analysis table, that there was not an overwhelming contribution from wood fire smoke that had been seen in other events. This event appears to have significantly more non-specific coarse dust, probably from dirt roads, than the January 1, 2008 episode, where nearly half of the PM₁₀ concentration could be attributed to fine particulate matter, most likely in the form of smoke.

3. Examine all air quality monitoring information. Data from all monitors in the network were reviewed. Monitors from the Nogales area 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 (e.g., concentrations greater than the 95th percentile).

4. Examine the meteorological conditions before and during the event. Figure 1 includes a map showing the terrain and drainage patterns of the Nogales area. Typically, during the nighttime hours under stable atmospheric conditions, cold air forming in the mountains south of the border will flow northward into the Santa Cruz River Drainage Basin. It is during these nighttime hours when PM concentrations typically spike in the Nogales

area, due to international transport. On May 22nd, the elevated PM₁₀ concentrations occurred during daytime hours when strong southerly winds were in place. In fact, it was these same strong winds that actually helped reduce PM₁₀ concentrations during the early morning hours as the typically strong radiation inversion was held in check by greater than normal mixing of the lower atmosphere. Regardless, the strong winds that occurred during the daytime hours transported enough loose and unstable soils into the Nogales, AZ area to cause an exceedance of the 24-hour PM₁₀ NAAQS. National Weather Service data from the Nogales Airport, northeast of the city, showed moderate winds in the early morning hours of May 22nd. As daytime heating commenced, stronger winds aloft were mixed down to the surface where wind gust of nearly 50 mph were recorded. It was during this time when PM₁₀ concentrations significantly increased. PM₁₀ concentrations would have likely remained elevated during the evening hours of May 22nd had precipitation not occurred. Instead, rainfall that began at 10:00 p.m. marked an abrupt end to the elevated PM₁₀ event.

5. Perform a qualitative attribution to emission source(s). All evidence indicates the elevated PM₁₀ concentrations in the Nogales, Arizona area can be attributed to dust emissions from sources south of Nogales, Arizona in Nogales, Sonora. The data available for this analysis do not allow for development of a source specific emission allocation. The hourly concentration data do not show any significant source other than the drainage dust associated with the event.

6. Estimation of Contribution from Source or Event. The primary source appears to be wind blown dust from Mexico for which there is no 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 exceedances or violations but for the event (e.g., 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 concentrations at the Nogales Post Office monitor can be attributed to international transport of emissions into the United States caused by strong southerly winds.

Conclusion

International transport of emissions. The elevated PM₁₀ event on May 22, 2008, in Nogales, Arizona was the result of emissions from Mexico which were transported into the United States by strong and gusty southerly winds. The fact that all appropriate SIP control measures were in place and emissions from international transport caused the

exceedance demonstrates, per 40 CFR 50.1(j), that the event "is not reasonably controllable or preventable." The "high wind" flag (RJ) and "other" flag (RL) were applied to the PM₁₀ measurements as the monitor would have been below the NAAQS but for the contribution of the event.