



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 and PM_{2.5}) Concentration Event in the Nogales, Arizona Area on January 26, 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. Two Beta-Attenuation Monitor Systems (BAMS) collect hourly PM₁₀ and PM_{2.5} concentration data at the Post Office site.

During the evening of January 26, 2008, a strong nighttime temperature inversion set up in the Nogales area. With no significant ventilating winds available to break up the surface inversion, the inversion intensified and set up a drainage flow from the higher terrain to the south in Mexico through Nogales, Sonora and into Nogales, Arizona.

The event brought significant elevated ambient concentrations of PM₁₀ that exceeded the National Ambient Air Quality Standards (NAAQS) at the ADEQ Nogales Post Office monitor. The fact that ambient concentrations exceeded the NAAQS satisfies the criteria in 40 CFR 50.1(j) that the event “affects air quality.”

Preliminary indications were that emissions from sources in Mexico, which are not subject to control by the Arizona SIP, may have contributed to the event.

A PM₁₀ State Implementation Plan (SIP) exists for Nogales, Arizona. All appropriate 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,” if in fact emissions from Mexico caused the exceedance.

Elevated PM₁₀ concentrations were measured in the Nogales area. The table below shows the key PM monitor readings for the monitors examined in this report. The PM_{2.5} data were included in this analysis for informational purposes only. While the PM_{2.5} BAM did exceed the PM_{2.5} NAAQS, this monitor is not an EPA approved federal reference or equivalent method. These data are particularly useful for the Event Contribution Analysis contained in Figure 1, as well as identifying the type of PM that may have been present, as discussed in section 2.

Monitor (Operator/Type)	AQS ID*	24-hr Avg PM ₁₀ or PM _{2.5}	1-hr Max PM ₁₀ or PM _{2.5}	Time of Max 1-hr	Flag**
NOGALES AREA					
Nogales AZ Post Office PM ₁₀ (ADEQ/BAM)	04-023-0004 (3)	204	692	2000	RL
Nogales AZ Post Office PM _{2.5} (ADEQ/BAM)	04-023-0004 (3)	35.8	89	2000	IL

* 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 a stakeholders meeting on November 19, 2008, 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-Tucson INT Airport

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	44	10		6	8	SE
2	43	10		8	8	SE
3	44	10		3	3	SE
4	42	10		6	6	SE
5	42	10		7	7	SE
6	42	10		5	5	E
7	41	10		8	8	S
8	43	10		10	10	SE
9	48	10		8	8	SE
10	53	10		6	6	SE
11	60	10		8	8	S
12	61	10		8	8	S
1	65	10		3	3	S
2	67	10		0	0	N
3	69	10		3	3	VR
4	69	10		0	0	N
5	68	10		6	6	N
6	65	10		3	3	N
7	61	10		3	3	E
8	59	10		3	3	SE
9	56	10		3	3	S
10	59	10		9	9	E
11	56	10		7	7	S
12	57	10		7	7	SE

NWS-Nogales INT Airport

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	41	10		0	0	N
2	39	10		0	0	N
3	41	10		0	0	N
4	39	10		3	3	E
5	37	10		0	0	N
6	36	10		0	0	N
7	35	10		5	5	E
8	36	10		0	0	N
9	39	10		5	5	S
10	50	10		3	3	E
11	56	10		0	0	N
12	60	10		6	6	VR
1	62	10		0	0	N
2	64	10		7	7	VR
3	64	10		0	0	N
4	64	10		0	0	N
5	63	10		0	0	N
6	58	10		0	0	N
7	53	10		5	5	E
8	54	10		5	5	NE
9	54	10		5	5	NE
10	54	10		0	0	N
11	52	10		5	5	E
12	53	10		3	3	N

ADEQ-Nogales P.O.

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	N/A	N/A	-	1	1	SE
2	N/A	N/A	-	1	1	SE
3	N/A	N/A	-	0	0	N
4	N/A	N/A	-	0	0	E
5	N/A	N/A	-	0	0	SE
6	N/A	N/A	-	0	0	SW
7	N/A	N/A	-	0	0	NE
8	N/A	N/A	-	1	1	SE
9	N/A	N/A	-	1	1	SW
10	N/A	N/A	-	2	2	NE
11	N/A	N/A	-	1	1	N
12	N/A	N/A	-	2	2	N
1	N/A	N/A	-	2	2	SE
2	N/A	N/A	-	2	2	NE
3	N/A	N/A	-	3	3	N
4	N/A	N/A	-	4	4	NE
5	N/A	N/A	-	2	2	NE
6	N/A	N/A	-	2	2	E
7	N/A	N/A	-	1	1	SE
8	N/A	N/A	-	0	0	SE
9	N/A	N/A	-	1	1	SE
10	N/A	N/A	-	1	1	SE
11	N/A	N/A	-	2	2	N
12	N/A	N/A	-	1	1	SW

Event Contrib. Analysis

Hourly PM₁₀ Conc. (µg/m³)

MONITORS:	Hr	1	2
1-Nogales PM 10	1	135	34
2-Nogales PM2.5	2	262	55
	3	187	40
	4	171	42
	5	155	41
	6	125	36
	7	124	44
	8	166	57
	9	83	19
	10	105	27
	11	73	20
	12	52	2
	1	38	1
	2	40	0
	3	9	0
	4	12	1
	5	29	3
	6	41	4
	7	549	52
	8	611	72
	9	692	89
	10	501	83
	11	484	89
	12	255	50

24-Hr. Avg PM₁₀ with W/O Event: 204
2-Nogales: 35.8
23

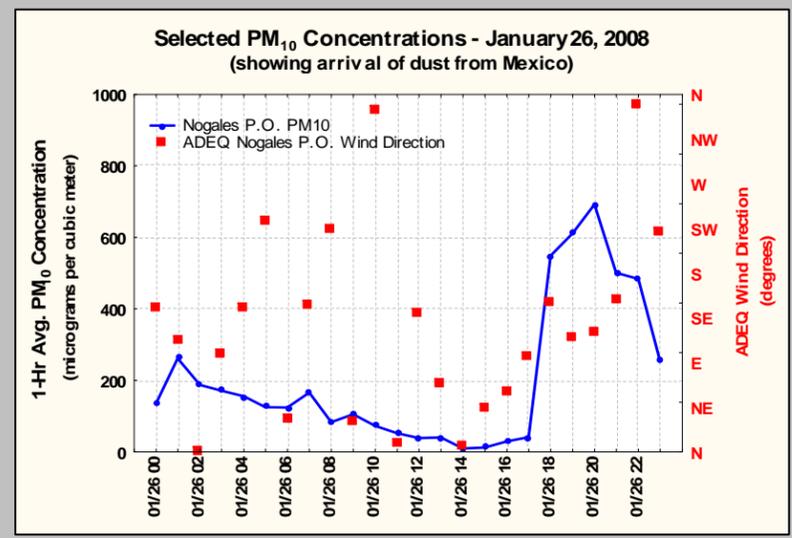
Conclusion: As shown above, the PM₁₀ concentration would have been below the NAAQS "BUT FOR" the event contribution (hours highlighted in pink).



Figure 1. Key Data for Event of January 26, 2008

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

SUMMARY OF EVENT:
Stable atmospheric conditions allowed for a nocturnal drainage flow to set up during the evening hours of 01/26. Light, southerly winds transported coarse particulate matter (PM₁₀) from Sonora, Nogales into Nogales, AZ.



PARKER

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	44	87	-	2	5	NE
2	43	87	-	1	3	N
3	43	87	-	2	3	N
4	41	90	-	2	5	NE
5	40	90	-	3	6	N
6	43	84	-	3	6	N
7	42	85	-	2	6	N
8	38	91	-	2	5	N
9	39	92	-	2	5	NE
10	47	81	-	4	8	N
11	54	68	-	5	9	N
12	58	56	-	5	9	N
1	61	45	-	4	7	N
2	62	44	-	3	6	NW
3	63	42	-	3	6	N
4	63	42	-	2	4	N
5	62	44	-	3	4	NW
6	61	52	-	1	3	W
7	57	63	-	2	5	SE
8	54	70	-	3	6	SE
9	52	73	-	2	4	S
10	53	71	-	3	7	S
11	54	69	-	2	6	SE
12	52	76	-	1	3	NE

BUCKEYE

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	44	94	-	3	6	NW
2	42	96	-	2	6	NW
3	41	97	-	1	4	N
4	41	96	-	1	3	NE
5	40	98	-	2	5	NW
6	39	98	-	2	4	N
7	40	94	-	1	4	NE
8	39	95	-	1	3	E
9	41	94	-	2	4	N
10	48	80	-	2	11	N
11	57	56	-	9	15	E
12	60	47	-	11	17	E
1	63	42	-	10	15	SE
2	64	38	-	10	13	SE
3	66	37	-	8	13	E
4	67	34	-	7	11	E
5	67	38	-	6	10	E
6	62	49	-	4	6	E
7	59	60	-	2	4	N
8	57	67	-	3	5	NE
9	55	71	-	1	5	E
10	55	74	-	3	4	N
11	54	81	-	2	4	N
12	53	85	-	1	3	N

MARICOPA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	46	73	-	2	3	NE
2	46	73	-	2	4	N
3	46	71	-	3	6	N
4	40	82	-	1	4	SW
5	37	88	-	2	4	S
6	37	90	-	2	4	S
7	37	90	-	1	4	S
8	36	91	-	2	4	S
9	39	87	-	1	4	NE
10	45	78	-	2	4	N
11	51	64	-	2	5	NE
12	56	51	-	4	7	NE
1	61	41	-	3	7	NE
2	63	36	-	3	8	E
3	66	32	-	3	7	NE
4	68	31	-	3	7	NE
5	68	31	-	5	8	NE
6	64	37	-	3	5	N
7	58	48	-	0	1	NW
8	56	52	-	1	3	W
9	53	65	-	1	3	SE
10	55	74	-	1	3	S
11	52	66	-	1	3	SW
12	52	66	-	2	5	SW

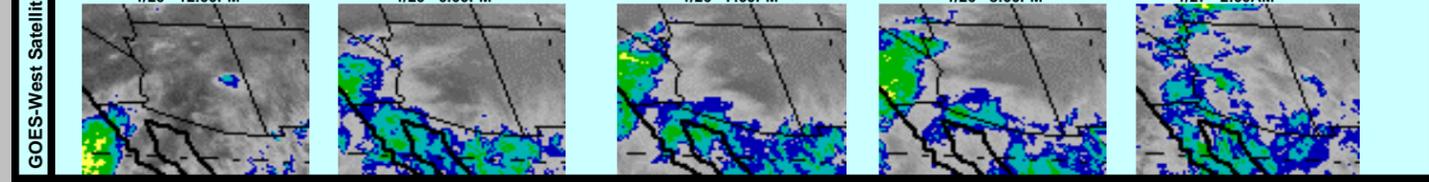
Historical Distribution

5-Yr. Dist. of Values (µg/m³)

MONITORS:	Column Index
1-NOGALES POST OFFICE	- All Data (5-Yrs)
	Sea - Data for Winter season only (5-Yrs)

Cum. Freq.	Mon 1	Yr	Sea
Min	4	5	
0.5%	8	7	
1.0%	8	8	
2.5%	13	9	
5%	17	15	
10%	22	25	
25%	35	48	
50%	56	96	
75%	96	138	
90%	146	194	
95%	180	233	
97.5%	213	285	
99.0%	244	322	
99.5%	291	327	
Max	351	351	

Flagged Value: 204
Conclusion: Flagged Value is exceptional in nature (ie greater than 95% of all data)



YUMA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	45	73	-	1	3	NE
2	44	71	-	1	3	NE
3	43	74	-	2	4	NE
4	43	74	-	3	4	NE
5	42	76	-	3	4	NE
6	42	77	-	2	4	NE
7	40	81	-	1	3	W
8	40	83	-	1	3	NW
9	43	78	-	1	4	NE
10	48	72	-	4	7	NE
11	53	66	-	3	7	SW
12	58	59	-	2	5	SW
1	62	49	-	4	8	NE
2	63	47	-	4	7	NE
3	64	44	-	4	7	NE
4	64	43	-	2	5	NE
5	64	46	-	2	4	W
6	60	57	-	3	5	W
7	58	58	-	3	7	W
8	56	61	-	0	2	SW
9	56	64	-	2	7	N
10	56	67	-	6	9	W
11	54	77	###	5	7	W
12	53	81	###	4	8	NW

PALOMA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	44	84	-	2	4	E
2	42	82	-	3	4	E
3	41	84	-	4	5	SE
4	41	86	-	3	6	SE
5	41	86	-	4	6	SE
6	40	87	-	4	6	SE
7	39	88	-	4	6	SE
8	40	86	-	4	6	SE
9	41	87	-	3	4	E
10	48	79	-	2	6	E
11	55	65	-	1	5	NE
12	59	56	-	5	8	NE
1	62	44	-	4	6	NE
2	65	39	-	2	7	N
3	67	38	-	2	6	NW
4	68	40	-	2	4	N
5	67	50	-	0	2	NW
6	63	57	-	0	2	NW
7	58	66				

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 January 26th. No specific local sources were reported as significantly contributing to the air quality episode.

2. Review suspected contributing sources. The event began on the evening of January 26th. 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}. Lack of any significant transport winds would indicate that the emissions were probably from nearby the monitor. The plot of hourly PM₁₀ concentration data in the upper right corner of Figure 1, in conjunction with the wind direction 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 had significantly more non-specific coarse dust, probably from dirt roads, than the January 1, 2008 episode. In the January 1st episode, 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.i., 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. Cold air

forming in the mountains south of the border flows northward into the Santa Cruz River Drainage Basin. National Weather Service data from the Nogales Airport, northeast of the city, showed calm to light and variable winds in the evening hours from the east or south. The data from ADEQ's wind monitor are also included in Figure 1. At the Post Office, winds shifted from northeast to southeast at approximately 6:00 p.m. and remained very light. It was at this time when PM concentrations significantly increased. PM₁₀ (as well as PM_{2.5}) concentrations remained elevated throughout the remainder of the evening on January 26th, as light winds continued out of the south. It appears the source was coming from Mexico, since there are no sources in the United States between the monitor and the border.

5. Perform a qualitative attribution to emission source(s). All evidence indicates the elevated PM₁₀ and PM_{2.5} 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 drainage 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.i., 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 were attributed to an exceptional event caused by international transport of emissions into the United States.

Conclusion

International transport of emissions. The elevated PM₁₀ event on January 26, 2008, in Nogales, Arizona was the result of emissions from Mexico which were transported into the United States in a slow moving drainage flow originating in the mountains south of Nogales, Sonora. 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 "other" (RL and IL) flag was applied to the PM₁₀ and PM_{2.5} measurements, respectively, as the monitors would have been below the NAAQS but for the contribution of the event. (All data regardless of the type of monitor were impacted by international transport. The "IL" flag was applied to the PM_{2.5} BAMS monitor since the "RL" flag could not be set.)