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## PRELIMINARY DOCUMENTATION

### Assessment of Qualification for Treatment under the Arizona Natural and Exceptional Events Policy for the High Particulate Concentration Event in the Nogales, Arizona Area on October 31, 2008 and November 1, 2008

#### Background

The Arizona Department of Environmental Quality (ADEQ) operates monitors at the Post Office in Nogales, Arizona for PM<sub>10</sub> and PM<sub>2.5</sub> and at the Fire Station in Nogales, Sonora for PM<sub>10</sub>. Federal Reference Method (FRM) filter based samples are collected at both locations. Two Beta-Attenuation Monitor Systems (BAMS) collect hourly PM<sub>10</sub> and PM<sub>2.5</sub> concentration data at the Post Office site.

During the late evening hours of October 31 and November 1, 2008, a strong night-time 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 PM<sub>10</sub> 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 State Implementation Plan (SIP), may have contributed to the event.

A PM<sub>10</sub> 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 PM<sub>10</sub> 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<sub>2.5</sub> data were included in this analysis for informational purposes only. 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 <sub>10</sub> or PM <sub>2.5</sub>	1-hr Max PM <sub>10</sub> or PM <sub>2.5</sub>	Time of Max 1-hr	Flag**
<b>NOGALES AREA – 10/31</b>					
Nogales AZ Post Office PM <sub>10</sub> (ADEQ/BAM)	04-023-0004 (3)	159	598	1900	RL
Nogales AZ Post Office PM <sub>2.5</sub> (ADEQ/BAM)	04-023-0004 (3)	19.4	75	1900	None
<b>NOGALES AREA – 11/01</b>					
Nogales AZ Post Office PM <sub>10</sub> (ADEQ/BAM)	04-023-0004 (3)	234	826	1800	RL
Nogales AZ Post Office PM <sub>2.5</sub> (ADEQ/BAM)	04-023-0004 (3)	28.1	85	1900	None

\* EPA Air Quality System Identification Number

\*\* 24-hr PM<sub>10</sub> 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 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 Int Airport 10/31

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	54	10		0	0	0N
2	53	10		0	0	0N
3	52	10		0	0	0N
4	52	10		3	3	0E
5	51	10		0	0	0N
6	50	10		0	0	0N
7	50	10		0	0	0N
8	57	10		0	0	0N
9	65	10		0	0	0N
10	71	10		5	5	5SW
11	76	10		3	3	3VR
12	82	10		0	0	0N
1	85	10		5	5	5SW
2	85	10		7	7	7S
3	84	10		6	6	6E
4	83	10		7	7	7NE
5	81	10		6	6	6NE
6	78	10		0	0	0N
7	73	10		5	5	5NE
8	68	10		5	5	5E
9	68	10		0	0	0N
10	65	10		5	5	5S
11	62	10		3	3	3N
12	64	10		7	7	7NE

### ADEQ-Nogales P.O. 10/31

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

### Event Contrib. Analysis

Hourly PM Conc. (µg/m³) 10/31

MONITORS:	Hr	1	2
1-Nogales PM10	1	267	32
2-Nogales PM2.5	2	179	21
	3	127	16
	4	142	19
	5	128	17
24-Hr. Avg PM10	6	95	15
	7	182	24
Monitor: Event Even	8	234	29
1-Nogales	9	80	6
2-Nogales	10	79	7
	11	53	6
	12	53	3
> NAAQS	1	32	5
< NAAQS	2	16	6
Pink=Event Contrib.	3	21	6
	4	38	6
	5	35	5
	6	30	5
	7	190	22
	8	598	75
	9	570	64
	10	345	39
	11	163	17
	12	176	20

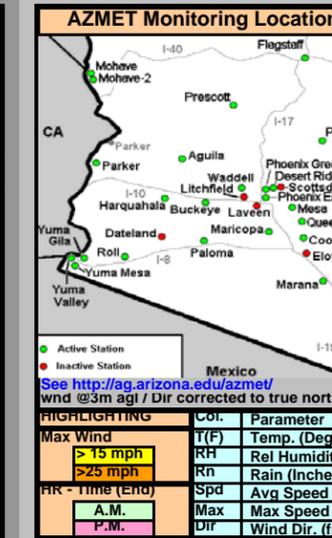
Conclusion: As shown above, the PM10 concentration would have been below the NAAQS "BUT FOR" the event contribution (hours highlighted in pink).

### Historical Distribution

5-Yr. Dist. of Values (µg/m³)

MONITORS:	Column Index
1-NOGALES PM10 10/31	Yr - All Data (5-Yrs)
	Sea - Data for Autumn season only (5-Yrs)
Cum. Freq.	Mon 1
Min	4 4
0.5%	8 8
1.0%	8 10
2.5%	13 18
5%	17 21
10%	22 27
25%	35 44
50%	56 75
75%	96 130
90%	146 177
95%	180 199
97.5%	213 216
99.0%	244 231
99.5%	291 238
Max	351 284
Flagged Value	159

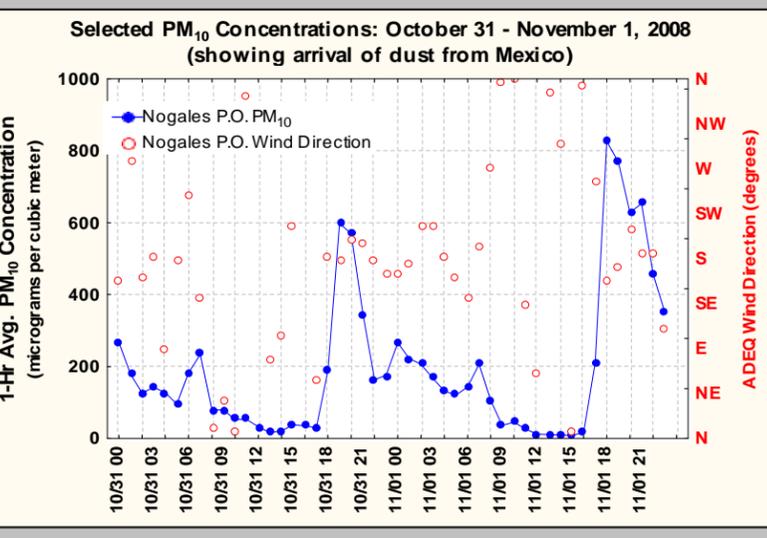
Conclusion: Flagged Value is exceptional in nature (ie greater than 95% of all data)



### Figure 1. Key Data for Event of October 31 - November 1, 2008

Oct 31 Data	KEY	PM10 PLOT
Nov 1 Data	SAT IMAGES	
SO AZ WINDS	PHX VIS.	CAMERAS

**SUMMARY OF EVENT**  
 From 7:00 p.m. to midnight, a band of thick mid and high clouds moved over northwestern Arizona. Over southern Arizona, it was mostly clear during this timeframe. Statewide, winds were mostly light or calm during this time.



### NWS-Nogales Int Airport 11/01

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	57	10		0	0	0N
2	55	10		0	0	0N
3	54	10		0	0	0N
4	51	10		3	3	3E
5	51	10		0	0	0N
6	50	10		5	5	5E
7	50	10		0	0	0N
8	60	10		0	0	0N
9	70	10		0	0	0N
10	77	10		6	6	6SW
11	82	10		5	5	5SW
12	85	10		3	3	3VR
1	86	10		9	9	9S
2	86	10		7	7	7S
3	87	10		7	7	7S
4	85	10		0	0	0N
5	84	10		0	0	0N
6	73	10		0	0	0N
7	73	10		10	10	10NE
8	67	10		5	5	5E
9	64	10		0	0	0N
10	61	10		0	0	0N
11	58	10		5	5	5E
12	57	10		0	0	0N

### ADEQ-Nogales P.O. 11/01

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

### Event Contrib. Analysis

Hourly PM Conc. (µg/m³) 11/01

MONITORS:	Hr	1	2
4-Nogales PM10	1	266	37
5-Nogales PM2.5	2	222	27
	3	207	23
	4	168	25
24-Hr. Avg PM10	5	132	21
	6	121	15
Monitor: Event Even	7	143	21
4-Nogales	8	207	27
5-Nogales	9	106	18
	10	36	3
	11	45	1
> NAAQS	1	12	3
< NAAQS	2	11	1
Pink=Event Contrib.	3	10	0
	4	9	1
	5	17	9
	6	211	17
	7	826	79
	8	769	85
	9	628	75
	10	653	80
	11	457	56
	12	352	48

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

### Historical Distribution

5-Yr. Dist. of Values (µg/m³)

MONITORS:	Column Index
4-NOGALES PM10 11/01	Yr - All Data (5-Yrs)
	Sea - Data for Autumn season only (5-Yrs)
Cum. Freq.	Mon 1
Min	4 4
0.5%	8 8
1.0%	8 10
2.5%	13 18
5%	17 21
10%	22 27
25%	35 44
50%	56 75
75%	96 130
90%	146 177
95%	180 199
97.5%	213 216
99.0%	244 231
99.5%	291 238
Max	351 284
Flagged Value	234

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



### YUMA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	69	62	-	2	2	2NE
2	69	66	-	2	2	2NE
3	69	62	-	1	1	1NE
4	69	65	-	2	2	2NE
5	69	65	-	1	1	1NE
6	69	66	-	2	2	2N
7	68	68	-	3	3	3SW
8	68	67	-	1	1	1SW
9	71	65	-	2	2	2E
10	78	52	-	2	2	2NE
11	83	41	-	2	2	2E
12	87	35	-	2	2	2E
1	90	26	-	2	2	2E
2	92	25	-	2	2	2E
3	93	22	-	2	2	2E
4	94	22	-	1	1	1SE
5	93	22	-	3	3	3S
6	90	26	-	3	3	3S
7	83	38	-	2	2	2SW
8	80	41	-	0	0	0SE
9	77	44	-	1	1	1S
10	74	47	-	1	1	1SW
11	81	35	-	5	5	5NW
12	77	40	-	2	2	2W

### PALOMA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	62	69	-	1	1	1NE
2	63	61	-	1	1	1NE
3	62	56	-	2	2	2SE
4	63	48	-	4	4	4SE
5	62	58	-	3	3	3E
6	61	70	-	2	2	2N
7	60	67	-	3	3	3SE
8	62	56	-	3	3	3SE
9	67	52	-	2	2	2E
10	74	39	-	3	3	3E
11	81	37	-	2	2	2N
12	86	30	-	3	3	3N
1	90	24	-	2	2	2N
2	92	23	-	2	2	2N
3	94	21	-	2	2	2NW
4	93	25	-	2	2	2NE
5	93	32	-	1	1	1NW
6	86	45	-	1	1	1SW
7	77	49	-	2	2	2W
8	75	50	-	3	3	3SW
9	74	49	-	3	3	3SE
10	71	48	-	4	4	4SE
11	69	45	-	4	4	4S
12	66	59	-	3	3	3S

### MARANA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	65	31	-	6	6	6E
2	63	33	-	5	5	5SE
3	63	36	-	8	8	8SE
4	64	35	-	7	7	7SE
5	64	34	-	5	5	5SE
6	61	39	-	6	6	6SE
7	60	41	-	11	11	11SE
8	63	38	-	7	7	7SE
9	66	34	-	5	5	5SE
10	73	28	-	7	7	7SE
11	79	23	-	7	7	7SE
12	85	18	-	3	3	3SE
1	87	16	-	3	3	3W
2	89	15	-	4	4	4NW
3	91	13	-	5	5	5NW
4	91					

## 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 PM<sub>10</sub> and PM<sub>2.5</sub> readings from the Nogales BAMS monitors were found to be valid for October 31<sup>st</sup> and November 1<sup>st</sup>. 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 October 31<sup>st</sup>. There was not a significant fraction of PM<sub>2.5</sub> measured during this episode. This is typical for the arid southwest, except when smoke from smoldering fires can be a significant source of PM<sub>2.5</sub>. Lack of any significant transport winds would indicate that the emissions were probably from nearby the monitor. The plot of hourly PM<sub>10</sub> 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<sub>2.5</sub> 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 course dust, probably from dirt roads, than the January 1, 2008, and January 1, 2009, episodes. In the January 1<sup>st</sup> episodes, nearly half of the PM<sub>10</sub> 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 (i.e., concentrations greater than the 95<sup>th</sup> 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 (NWS) 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 north to south at approximately 7:00 p.m. and remained very light. It was at this time that PM concentrations significantly increased. PM<sub>10</sub> (as well as PM<sub>2.5</sub>) concentrations remained elevated throughout the remainder of the evening on October 31<sup>st</sup> and November 1<sup>st</sup>, 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 PM<sub>10</sub> 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” Tables in Figure 1 have been included to demonstrate that there would have been no exceedances or violations 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 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 PM<sub>10</sub> event on October 31 and November 1, 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 “request exclusion - other” (RL) flag was applied to the PM<sub>10</sub> measurements as the monitors would have been below the NAAQS but for the contribution of the event. The “other” flag is being used because there is not an appropriate flag available for use in the Air Quality System (AQS) database that describes this event (“international transport”).