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PRELIMINARY DOCUMENTATION

Description of the High Particulate (PM_{10}) Concentration Event in the Durango Complex Vicinity on November 7, 2008

Background

The Arizona Department of Environmental Quality (ADEQ) issues Dust Control Action Forecasts for the Yuma and Phoenix areas as part of their Natural Events Action Plans. On Thursday, November 6, 2008, ADEQ air quality forecasters issued the Maricopa County Dust Control Action Forecast which called for a low risk of exceeding the PM_{10} National Ambient Air Quality Standards (NAAQS) in the Phoenix Metropolitan area for Friday, November 7. The forecast called for maximum PM_{10} concentrations to reach the mid moderate range of the Air Quality Index (AQI) in the Phoenix Metro area. These forecasts/advisories satisfy the requirement in 40 CFR 51.920(a)(1).

Forecasts of maximum PM_{10} concentrations in the mid-moderate range of the AQI are fairly typical for the fall stagnation season in Phoenix. The meteorological conditions in place at the time did not show any indication of the potential for wind blown dust nor severely stagnant conditions. Aside from the usual elevated PM_{10} concentrations during the morning and evening rush hours, PM_{10} concentrations were held in check at nearly all monitoring sites across the Valley. The lone exception occurred at the Durango Complex monitoring site operated by Maricopa County. While Durango PM_{10} concentrations were in line with most other Phoenix Metro monitoring sites for much of the day, uncharacteristic elevated PM_{10} concentrations began to occur during the late evening hours of November 7th. The maximum hourly concentration exceeded 2,000 $\mu g/m^3$ during the 2100 hour on this day. At that time, no explanation could be given for the extremely high hourly concentrations. One week later on November 14th, staff from the Maricopa County Air Quality Department Dust Control Division went out to the site to perform a site survey in an attempt to determine the source of the elevated concentrations on November 7th. Upon doing so, it was discovered that a nearby agricultural field, which had previously been out of use for over two years, was now in the process of being put back into service. Pictures taken during the site survey (shown in Figure 1 and also included as an attachment) show evidence of agricultural operations that had been underway in the recent past. Freshly worked soil, excavation exposing field irrigation control pipes, and leveled soil with distinctive GPS controlled scraper pan markings were all signs that the field was in the process of being put back into service. Repeated visits to this location confirmed these suspicions, as green alfalfa plants had sprouted and fully covered the field. While winds were fairly light at the time of this event, the monitor specific wind data indicate that the spike in PM_{10} concentrations was coincident with a shift in winds from the west to the south / southeast.

These agricultural activities brought elevated ambient concentrations of PM_{10} to the Durango Complex vicinity that exceeded the NAAQS at the Durango monitor. 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 PM_{10} 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 43rd Ave	(MC/TEOM)	04-013-4009*	85.2	207.1	0600	No
Durango Complex	(MC/TEOM)	04-013-9812*	248.5	2066.7	2100	K
South Phoenix	(MC/TEOM)	04-013-4003*	61.1	146.3	1800	No
Greenwood	(MC/TEOM)	04-013-3010*	62.9	133.1	0700	No
Higley	(MC/TEOM)	04-013-4006*	50.1	116.4	1000	No
Central Phoenix	(MC/TEOM)	04-013-3002*	44.8	81.8	2100	No
Buckeye	(MC/TEOM)	04-013-4011*	53.9	115.1	2100	No

* EPA Air Quality System Identification Number ** 24-hr PM_{10} concentration influenced by agricultural tilling.
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).

NORTH PHOENIX

12-PHX Greenway

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	53	25	-	1	3	N
2	53	21	-	1	4	NE
3	51	24	-	1	3	N
4	50	26	-	1	3	NE
5	49	27	-	1	3	NE
6	47	31	-	1	3	NE
7	46	37	-	0	2	N
8	49	33	-	1	4	NE
9	58	24	-	2	5	NE
10	65	15	-	2	4	NE
11	68	12	-	2	6	NW
12	71	11	-	2	6	NW
1	73	10	-	2	6	NE
2	75	10	-	3	6	SE
3	77	9	-	3	6	S
4	77	9	-	3	5	S
5	77	9	-	3	5	SW
6	73	11	-	2	5	SW
7	64	16	-	0	2	S
8	60	22	-	0	2	NE
9	60	24	-	1	3	NE
10	59	25	-	1	3	N
11	57	25	-	1	3	NE
12	55	27	-	2	4	NE

NWS-Phoenix Sky Harbor

NWS-Phoenix Sky Harbor

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	57	10		0	0	N
2	55	10		3	3	SW
3	57	10		0	0	N
4	55	10		0	0	N
5	57	10		5	5	NE
6	51	10		0	0	N
7	51	10		3	3	SW
8	56	10		0	0	N
9	62	10		0	0	N
10	67	10		10	10	E
11	69	10		6	6	E
12	72	10		6	6	N
1	73	10		0	0	N
2	75	10		5	5	NW
3	76	10		3	3	*VR
4	77	10		0	0	N
5	77	10		5	5	NW
6	73	10		6	6	NW
7	72	10		7	7	W
8	67	10		0	0	N
9	65	10		0	0	N
10	63	10		6	6	E
11	63	10		3	3	NE
12	58	10		0	0	N

Maricopa County - Durango Complex

Maricopa County - Durango Comple

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	55	29	-	1	4	SW
2	54	29	-	1	6	E
3	53	30	-	0	8	W
4	53	31	-	1	4	E
5	51	34	-	1	4	NW
6	51	34	-	1	3	W
7	51	34	-	1	3	N
8	52	35	-	1	4	SW
9	56	30	-	1	5	S
10	62	17	-	2	7	SE
11	67	13	-	1	6	E
12	69	12	-	2	8	N
1	71	11	-	2	9	NE
2	73	10	-	1	11	N
3	75	10	-	2	8	SW
4	76	9	-	2	8	W
5	75	10	-	3	7	W
6	72	12	-	2	6	W
7	69	14	-	1	3	NW
8	65	21	-	1	4	S
9	63	23	-	0	2	S
10	62	25	-	1	4	SE
11	61	21	-	1	4	E
12	59	24	-	1	4	E

Event Contrib. Analysis

Hourly PM_{10} Conc. (µg/m^3)

MONITORS:

1-Durango

24-Hr. Avg PM_{10}

Monitor:	with Event	w/o Event
1-Durang	248	77

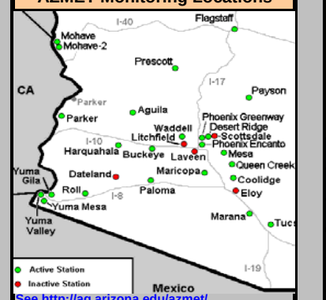
> NAAQS | < NAAQS

Pink=Event Contrib.

Conclusion: The PM_{10} concentration exceeded the NAAQS due to an evening event. However, no meteorological data exists to suggest that the event was natural/exceptional.

Hr	1
1	72.4
2	63
3	81.9
4	65.3
5	78.8
6	101
7	113
8	213
9	216
10	78
11	83.3
12	22.6
1	22.7
2	17
3	29.5
4	27.9
5	35.9
6	53.5
7	102
8	2067
9	1308
10	741
11	182
12	190

AZMET Monitoring Locations



See http://ag.arizona.edu/azmet/

wnd @3m agl / Dir corrected to true north

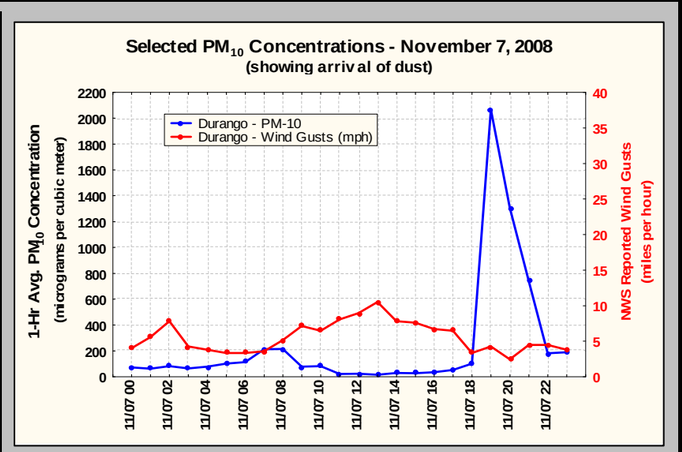
HIGHLIGHTING	Col.	Parameter
Max Wind	T(F)	Temp. (Deg. F.)
> 15 mph	RH	Rel Humidity %
>25 mph	Rn	Rain (Inches/hr)
HR - Time (End)	Spd	Avg Speed mph
A.M.	Max	Max Speed mph
P.M.	Dir	Wind Dir. (from)

Figure 1. Key Data for Event of November 7, 2008

PHX WINDS	KEY	PM10 PLOT
CEN. AZ WINDS		Ag Field Pics
SO AZ WINDS		Durango Area Map

SUMMARY OF EVENT

Agricultural practices created large plumes of dust that affected air quality at nearby locations. As evening winds shifted from west to south / southeast, the Durango PM monitor recorded extremely high PM10 concentrations.



NORTHWEST PHOENIX

10-Waddell

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	53	25	-	1	5	W
2	56	24	-	1	6	N
3	54	28	-	2	6	NE
4	59	20	-	3	9	NE
5	58	19	-	3	7	NE
6	58	18	-	4	7	NE
7	54	25	-	1	6	N
8	51	31	-	0	3	N
9	62	22	-	1	4	SE
10	67	15	-	1	7	E
11	70	13	-	6	11	E
12	72	12	-	4	11	E
1	74	11	-	4	8	E
2	77	10	-	2	11	NE
3	77	10	-	3	7	S
4	77	10	-	3	6	S
5	76	10	-	2	5	SW
6	66	25	-	1	2	W
7	56	33	-	0	2	N
8	52	35	-	0	2	NW
9	50	34	-	0	2	NW
10	49	34	-	0	2	N
11	52	32	-	0	2	N
12	43	65	-	3	7	E

CENTRAL PHOENIX

15-Phx Encanto

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	51	35	-	0	2	NE
2	49	41	-	1	4	E
3	47	43	-	1	3	N
4	45	53	-	1	3	E
5	44	52	-	1	3	N
6	43	57	-	1	2	N
7	42	63	-	1	3	NE
8	46	54	-	1	3	NE
9	60	36	-	1	3	SE
10	67	19	-	1	4	S
11	69	15	-	1	4	S
12	71	14	-	2	5	SE
1	73	13	-	2	7	NW
2	76	11	-	2	6	NE
3	77	11	-	2	5	SE
4	79	10	-	1	5	W
5	78	11	-	1	5	W
6	71	14	-	1	4	W
7	63	22	-	0	1	NW
8	57	33	-	0	2	NW
9	55	43	-	0	2	NW
10	53	50	-	1	3	E
11	51	54	-	0	1	NE
12	43	65	-	3	7	E

BUCKEYE

26-Buckeye

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	47	36	-	2	4	N
2	47	37	-	2	6	N
3	49	32	-	2	5	NW
4	47	33	-	2	6	N
5	48	26	-	3	7	N
6	47	29	-	3	7	NW
7	46	33	-	2	5	N
8	49	29	-	2	8	NE
9	59	22	-	2	6	N
10	64	17	-	3	6	NW
11	70	14	-	3	7	NW
12	73	11	-	3	8	N
1	74	11	-	4	11	S
2	76	12	-	5	9	SE
3	77	11	-	4	8	S
4	76	12	-	4	6	SW
5	75	14	-	2	4	SW
6	69	22	-	1	3	SW
7	60	26	-	2	5	N
8	57	23	-	3	4	N
9	55	24	-	2	4	N
10	53	23	-	3	5	N
11	51	29	-	2	4	N
12	51	26	-	3	4	N

Historical Distribution

5-Yr. Dist. of Values (µg/m^3)

MONITORS: 1-DURANGO COMPL

Column Index

Yr - All Data (5-Yrs)

Sea - Data for Autumn season only (5-Yrs)

Cum. Freq.	Mon 1 Yr	Mon 1 Sea
Min	5	8
0.5%	9	11
1.0%	10	13
2.5%	15	20
5%	19	24
10%	26	30
25%	39	45
50%	56	66
75%	78	92
90%	109	114
95%	123	126
97.5%	144	139
99.0%	181	153
99.5%	200	161
Max	253	189
Flagged Value	248	

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

YUMA

02-YumaValley

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	66	20	-	4	13	N
2	66	19	-	5	14	N
3	65	21	-	6	17	NE
4	65	21	-	9	15	N
5	65	22	-	9	17	N
6	65	22	-	11	17	N
7	64	23	-	7	15	NE
8	63	25	-	2	9	NE
9	67	24	-	1	5	W
10	70	22	-	9	20	N
11	72	20	-	13	19	N
12	74	19	-	11	19	N
1	76	17	-	9	16	N
2	78	17	-	9	16	N
3	79	17	-	9	15	N
4	79	17	-	8	15	N
5	79	17	-	7	13	N
6	76	20	-	5	10	N
7	72	23	-	4	6	N
8	67	28	-	4	6	N
9	66	30	-	4	5	N
10	62	38	-	2	4	W
11	59	40	-	2	4	NE
12	57	40	-	2	4	E

PALOMA

19-Paloma

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	42	58	-	3	5	E
2	42	47	-	3	6	S
3	43	37	-	2	6	S
4	42	61	-	2	5	NE
5	41	58	-	3	6	NE
6	43	48	-	3	6	N
7	45	42	-	2	7	N
8	46	40	-	2	6	S
9	57	32	-	1	3	SE
10	63	23	-	3	6	E
11	68	20	-	4	8	NE
12	72	16	-	5	10	NE
1	74	15	-	7	12	NE
2	75	14	-	7	15	NE
3	76	15	-	7	11	NE
4	76	20	-	6	9	N
5	73	30	-	4	6	NE
6	67	37	-	2	4	N
7	63	32	-	1	3	NW
8	59	32	-	2	3	SW
9	57	30	-	2	5	S
10	54	29	-	2	4	SE
11	48	40	-	1	4	S
12	47	34	-	2	6	S

MARANA

13-Marana

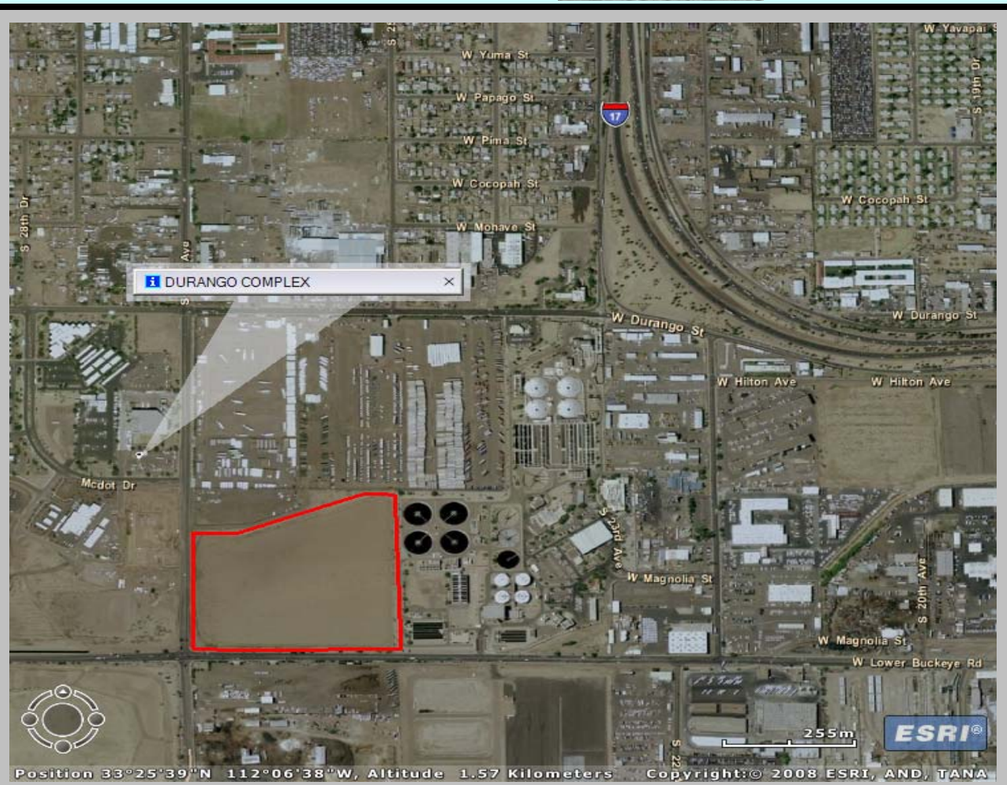
Hr	T(F)	RH	Rn	Spd	Max	Dir
1	50	17	-	4	8	SW
2	49	17	-	2	8	SW
3	45	20	-	1	7	NE
4	44	24	-	2	5	E
5	42	29	-	2	4	SE
6	40	29	-	2	6	E
7	40	33	-	3	6	E
8	43	32	-	4	7	E
9	51	24	-	4	7	E
10	60	14	-	2	5	SE
11	66	9	-	1	4	N
12	69	8	-	2	6	N
1	71	8	-	2	7	W
2	74	7	-	4	9	NW
3	75	6	-	6	10	W
4	75	6	-	6	10	NW
5	74	6	-	6	9	W
6	68	8	-	2	6	W
7	62	10	-	2	5	E
8	57	13	-	2	6	S
9	55	15	-	2	4	SE
10	52	14	-	2	5	E
11	47	15	-	3	6	E
12	46	18	-	4	7	E

TUCSON

01-Tucson

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	44	29	-	2	6	E
2	41	36	-	1	2	SE
3	38	41	-	1	4	SE
4	37	45	-	2	3	E
5	35	48	-	2	3	E
6	36	47	-	2	5	E
7	36	48	-	2	4	E
8	40	42	-	2	3	E
9	52	29	-	2	3	SE
10	59	16	-	3	6	E
11	64	13	-	2	5	N
12	67	11	-	4	9	NW
1	69	10	-	6	10	NW
2	71	9	-	6	10	NW
3	73	8	-	7	11	NW
4	73	7	-	7	10	NW
5	73	7	-	6	9	W
6	68	10	-	3	7	W
7	57	16	-	1	3	E
8	51	23	-	1	3	E
9	45	41	-	1	2	E
10	43	42	-	2	3	E
11	43	39	-	2	4	E
12	40	36	-	1	2	NE

Ag Field Images



Prepared by S. Kendall, A. Juniel, B. Busby and B. Paris/ ADEQ 3/19/09

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 24-hr averaged PM_{10} readings listed in the table above we valid for November 7th. Audits of the analyzers revealed operations were within acceptable tolerance. Agricultural activity to the south and east of the monitor are believed to have contributed to the dust event. An exceedance of the NAAQS was recorded at the Durango Complex monitoring site operated by Maricopa County.

2. Review suspected contributing sources. The NWS and AzMET surface data for Arizona provide a good explanation as to what meteorological conditions were in place on November 7, 2008. Winds were mostly light and variable throughout much of the day across the entire Valley. Monitor specific wind data at the Durango Complex, in conjunction with the hourly PM_{10} data, indicate that a shift in wind direction from the west / northwest to south / southeast marked the beginning of the elevated PM event. The location of the agricultural field to the southeast of the Durango Complex monitor would allow for PM_{10} emissions to travel in a northwesterly direction which is right in line with the Durango Complex monitor. Site survey photos would later verify that agricultural activity had taken place around the time of the exceedance.

3. Examine all air quality monitoring information. Data from all monitors in the network were reviewed. Monitors located within the Phoenix Metro 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 a measured concentration in excess of normal historical fluctuations, including background (i.e., concentrations greater than the 95th percentile). Monitors with readings greater than that of the NAAQS on November 7, 2008, include the Durango Complex monitoring site.

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 remained fairly light throughout much of the state for the entire duration of November 7th. Wind blown dust is not believed to have been the culprit as wind speeds remained well below threshold friction velocities.

5. Perform a qualitative attribution to emission source(s). All evidence indicates the elevated PM_{10} concentrations in the Durango Complex vicinity can be attributed to soil emissions that were disturbed by agricultural practices and then transported short distances to localized areas. No source specific emission allocation is possible based on the data available for analysis. The hourly wind and PM_{10} concentration data show a direct relationship between PM_{10} concentrations and a shift in wind direction. In addition to these hourly data, site survey photographs indicate that agricultural activity did occur around the time of the exceedance, as freshly worked soil and excavations were clearly visible. As shown in the lower right hand corner of Figure 1, an agricultural field located on the northeast corner of 27th Avenue and Lower Buckeye Road is believed to be the source of the elevated PM_{10} concentrations measured during the late evening hours of November 7, 2008. This field had previously been dormant, but showed clear signs of being put back into use. As of December 22nd 2008, a fresh crop of alfalfa was visible at this location.

6. Estimation of Contribution from Source or Event. The primary source appears to be soil emissions that were disturbed by agricultural activity to the southeast of the Durango Complex monitor. The demonstration analysis contained in this report establishes the linkage between the measurements in question 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 was included to demonstrate that there would have been no exceedance but for the event (i.e., the contribution during the event overwhelmed the 24-hour averages).

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 Durango Complex were attributed to rare and uncontrollable agricultural activity which is not likely to occur again.

Conclusion

Dust from local agricultural activities. The localized elevated PM_{10} event on November 7, 2008, in the Durango Complex vicinity was the result of agricultural activity that transported dust and soils short distances to localized areas downwind of the agricultural field. The "agricultural tilling" (K) flag should be applied to the monitor readings indicated in the table at the beginning of this report. ADEQ does not wish to exclude these data from comparison to the PM_{10} NAAQS, as this appears to be a local source issue and cannot be attributed to a natural event. This demonstration serves merely as an explanation for the elevated PM_{10} concentrations that occurred at the Durango Complex monitoring site on November 7, 2008.