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# ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

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## Assessment of Qualification for Treatment under the Arizona Natural and Exceptional Events Policy for the High Particulate (PM<sub>10</sub>) Concentration Events in the Phoenix Area on October 11, 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 Friday, October 10, 2008, in response to a tightening pressure gradient associated with an approaching trough of low pressure and cold frontal passage through Arizona, ADEQ air quality forecasters issued the Maricopa County Dust Control Action Forecast, which called for a moderate risk of wind-blown dust and thus a moderate risk for unhealthy PM<sub>10</sub> levels in the Phoenix area for Saturday, October 11<sup>th</sup>. The Dust Control Action Forecast called for southwesterly winds of 15 to 20 mph with stronger gusts possible during the afternoon. The forecasts/advisories satisfy the requirement in 40 CFR 51.930(a)(1).

The forecast for October 11<sup>th</sup> called for strong winds capable of producing wind-blown dust. This potential wind-blown dust event equated to a moderate risk of exceeding the PM<sub>10</sub> National Ambient Air Quality Standards (NAAQS) in Maricopa County. Strong winds did occur and were observed throughout portions of Maricopa County and the Phoenix Metro area on October 11<sup>th</sup>, 2008. Beginning in the morning of October 11<sup>th</sup> and continuing through the afternoon hours, strong westerly winds generated blowing dust in portions of the Phoenix Metro area. 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.” A discussion of commonly employed Best Available Control Measures (BACM) for dust in Maricopa and Yuma counties can be found in “High Wind Exceptional Events and Control Measures for PM<sub>10</sub> Areas” (see “References”).

The initialization of a wind-blown dust event is evident in the Phoenix visible camera images, as well as the Arizona Meteorological Network (AzMET), Maricopa County (MC), ADEQ, and National Weather Service (NWS) monitors (see Fig. 1). Winds gusting as high as 30 mph were reported between the 4:00 a.m. and 6:00 a.m. hours at the NWS Phoenix Sky Harbor Airport monitoring location, while other Valley monitoring locations measured wind gusts between 15 mph and 25 mph during the same time. Winds throughout much of the Valley remained elevated, gusting above 15 and 25 mph until the early evening hours. This significant event brought elevated ambient concentrations of PM<sub>10</sub> to portions of the Phoenix area that exceeded the PM<sub>10</sub> NAAQS at the South Phoenix monitor operated by Maricopa County. The fact that ambient concentrations exceeded the NAAQS satisfies the criteria in 40 CFR 50.1(j) that the event “affects air quality.” As seen in a number of previous high wind events, the highest concentrations were measured in the vicinity of the Salt River, though concentrations were elevated throughout the entire Phoenix Metro area. The following are the key PM<sub>10</sub> monitor readings for the monitors examined in this report:

Monitor (Operator/Type)	AQS ID	24-hr Avg PM <sub>10</sub>	1-hr Max PM <sub>10</sub>	Max Time	Flag**
<b>PHOENIX METRO AREA</b>					
South Phoenix (MC/TEOM)	04-013-4003*	161.8	630	1500	RJ
West 43 <sup>rd</sup> Ave (MC/TEOM)	04-013-4009*	138.6	453	0600	No
Durango Complex (MC/TEOM)	04-013-9812*	114.7	362	0600	No
Greenwood (MC/TEOM)	04-013-3010*	103.8	326	0700	No
Higley (MC/TEOM)	04-013-4006*	70.2	225	0900	No
West Phoenix (MC/TEOM)	04-013-0019*	93.6	327	0700	No
Central Phoenix (MC/TEOM)	04-013-3002*	98.4	326	0700	No

\* EPA Air Quality System Identification Number

\*\* 24-hr PM<sub>10</sub> 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 stakeholder’s meeting on March 19, 2009, in Phoenix, Arizona. Following the stakeholders meetings, ADEQ supplemented and finalized the analysis and a public

comment period was held from October 15, 2009 through November 13, 2009. This finalized document and any comments received are being submitted to EPA to satisfy the requirements in 40 CFR 50.14(c)(3)(i).

### NWS-Phoenix Sky Harbor

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	74	10		9	9	SE
2	76	10		10	10	S
3	75	10		7	7	S
4	73	10		7	7	S
5	77	10	24	30	30	S
6	74	10	8	20	20	SW
7	67	10	13	21	21	W
8	68	10	11	11	11	W
9	65	10	14	14	14	W
10	68	10	17	17	17	W
11	71	10	10	10	10	W
12	74	10	16	24	24	W
1	73	10	23	32	32	W
2	74	10	17	26	26	W
3	72	10	20	30	30	W
4	73	10	29	34	34	W
5	71	10	24	24	24	W
6	69	10	15	28	28	W
7	67	10	17	17	17	W
8	65	10	11	11	11	W
9	62	10	6	6	6	SW
10	60	10	5	5	5	SW
11	59	10	5	5	5	SW
12	57	10	5	5	5	SW

### NWS-Luke AFB

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	72	10		3	3	W
2	75	10		11	11	S
3	74	10		9	9	S
4	71	10		5	5	SW
5	71	10		8	8	SW
6	66	10		8	8	W
7	66	10		10	10	W
8	64	8		7	7	NW
9	67	10	15	15	15	NW
10	68	10		8	8	NW
11	70	10		5	5	SW
12	72	10	14	21	21	SW
1	73	10	21	24	24	SW
2	72	10	14	24	24	W
3	74	10	13	13	13	W
4	73	10	17	22	22	NW
5	72	10	11	22	22	W
6	68	10	14	14	14	NW
7	66	10	11	11	11	W
8	63	10	5	5	5	NW
9	60	10	6	6	6	NW
10	56	10	7	7	7	NW
11	55	10	6	6	6	NW
12	51	10	8	8	8	NW

### 16377 (112.08Wx33.40N) MC - SOUTH PHOENIX

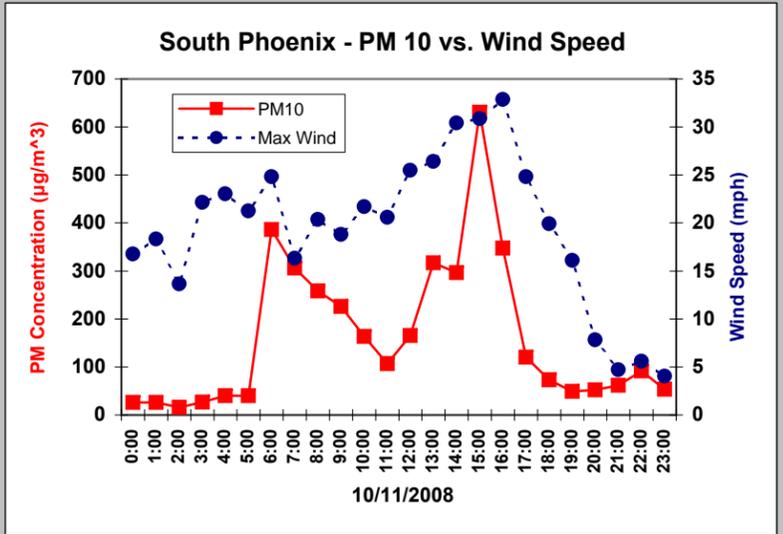
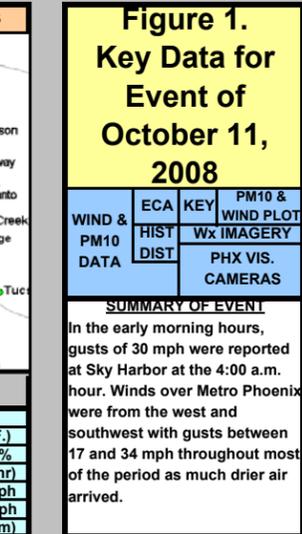
Hr	T(F)	PM	Spd	Max	Dir
1	80	26	8	17	S
2	80	26	9	18	S
3	79	15	6	14	S
4	79	28	9	22	S
5	79	39	10	23	S
6	77	40	7	21	SW
7	68	386	6	25	W
8	67	305	2	16	NW
9	66	258	10	20	W
10	68	226	10	19	W
11	70	163	6	22	W
12	72	107	8	21	W
1	73	165	11	26	W
2	73	317	12	26	W
3	73	296	13	30	W
4	73	630	15	31	W
5	72	347	14	33	W
6	70	120	10	25	W
7	67	73	9	20	W
8	65	49	6	16	W
9	63	52	4	8	W
10	60	61	1	5	W
11	58	91	2	6	W
12	56	53	1	4	SW

### Event Contrib. Analysis

Hourly PM<sub>10</sub> Conc. (µg/m<sup>3</sup>)

MONITORS:	Hr	1
1-South Phoenix	1	26
	2	26
	3	15.6
	4	26.9
	5	39.3
	6	40.4
	7	386
	8	306
	9	259
	10	226
	11	164
	12	107
24-Hr. Avg PM <sub>10</sub>		166
with W/O		317
Monitor: Event		297
1-S. Phx	161	46
Event		630
		348
		121
		73.5
		49.3
		52.5
		61.8
		91.9
		53.3

Conclusion: As shown above, the PM<sub>10</sub> concentration would have been below the NAAQS "BUT FOR" the event contribution (hours highlighted in pink).



### 16375 (112.12Wx33.43N) MC - DURANGO COMPLEX

Hr	T(F)	RH	PM	Spd	Max	Dir
1	79	15	19	8	15	S
2	79	19	26	9	16	S
3	76	24	18	5	11	S
4	77	26	21	9	19	S
5	76	26	18	9	16	S
6	74	27	59	8	23	SW
7	65	28	362	14	27	W
8	64	26	334	13	22	W
9	64	23	221	9	20	W
10	66	22	186	7	15	W
11	68	20	132	6	15	W
12	70	16	91	10	22	W
1	72	15	168	13	29	W
2	72	12	221	16	32	W
3	72	10	186	17	31	W
4	72	10	211	16	32	W
5	71	10	124	17	32	W
6	69	10	69	13	25	W
7	66	13	58	11	22	W
8	64	14	40	7	16	W
9	64	14	35	5	12	W
10	62	16	44	3	7	W
11	60	18	49	4	7	W
12	59	19	48	3	6	W

### 16659 (112.14Wx33.41N) MC - WEST FORTY THIR

Hr	T(F)	PM	Spd	Max	Dir
1	79	18	8	15	S
2	78	27	7	13	S
3	76	20	4	11	S
4	76	28	5	12	S
5	74	29	5	11	S
6	72	62	7	22	SW
7	65	453	15	25	W
8	66	294	12	20	W
9	67	202	10	19	W
10	70	173	6	16	W
11	72	112	8	18	W
12	74	120	13	23	W
1	75	226	14	29	W
2	75	310	16	28	W
3	75	280	17	29	W
4	74	334	17	30	W
5	72	207	16	30	W
6	69	84	14	25	W
7	66	50	12	22	W
8	62	33	4	10	W
9	60	40	4	8	W
10	58	38	4	7	W
11	58	38	4	7	W
12	56	39	3	5	W

### 16329 (112.05Wx33.46N) MC - CENTRAL PHOENIX

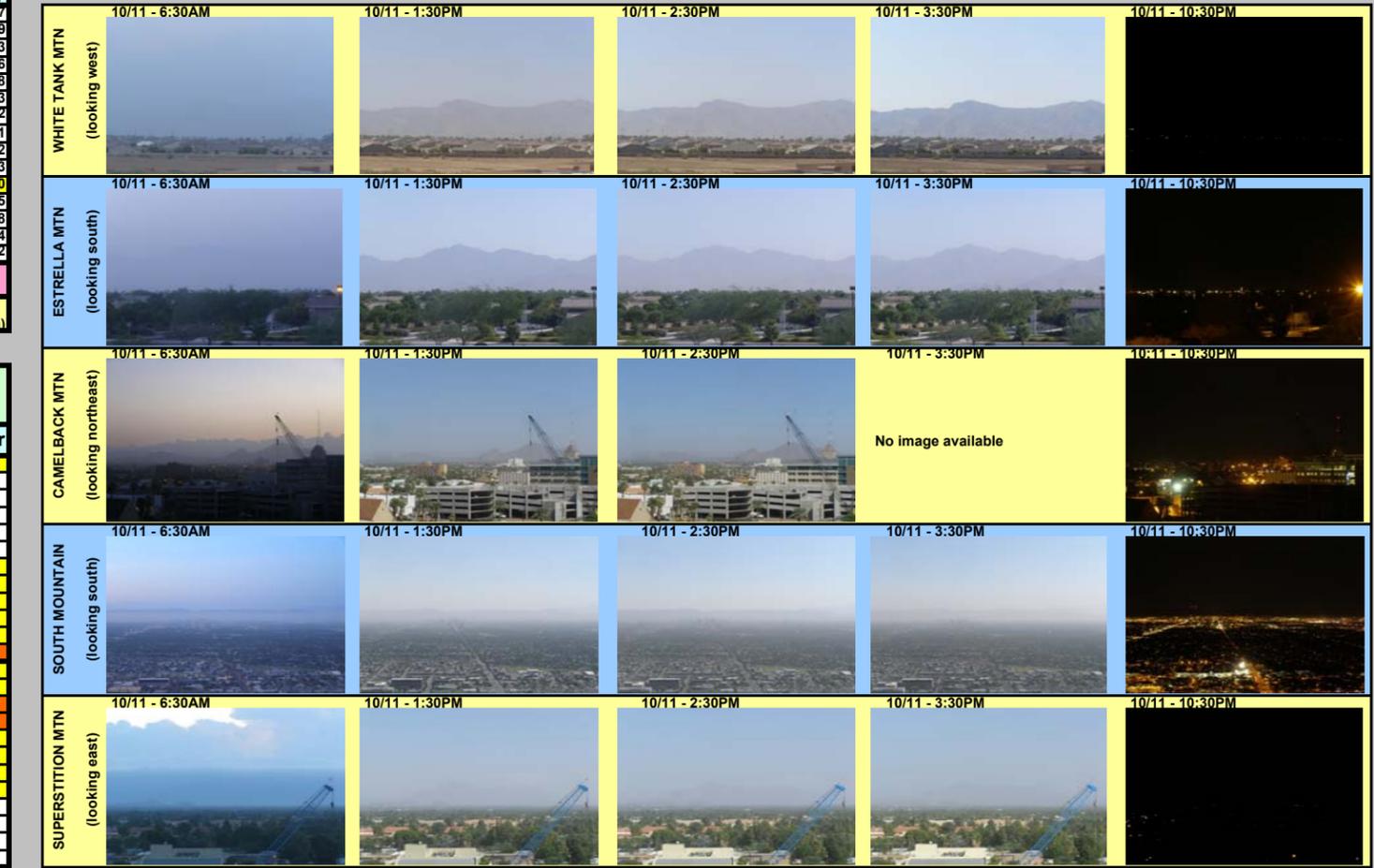
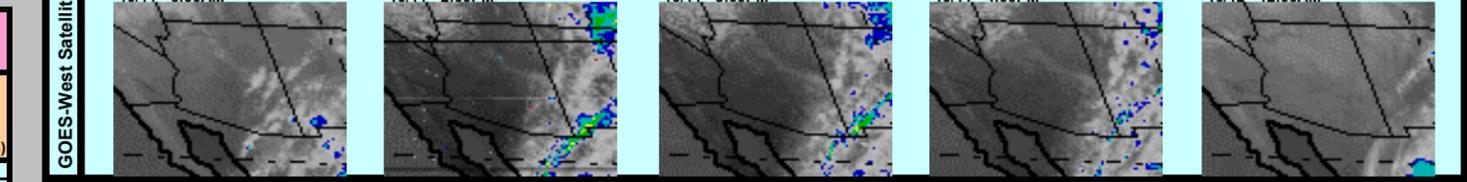
Hr	T(F)	PM	Spd	Max	Dir
1	75	20	5	12	SE
2	74	28	4	13	S
3	73	19	4	15	E
4	75	60	10	30	SW
5	76	69	15	28	SW
6	74	76	8	23	SW
7	67	172	7	19	W
8	68	325	9	26	W
9	68	249	11	26	W
10	71	149	10	20	W
11	74	129	10	21	W
12	74	125	16	30	W
1	74	93	13	28	W
2	75	94	12	26	W
3	75	100	12	26	W
4	74	170	16	31	W
5	72	147	17	34	W
6	69	88	14	30	W
7	66	53	10	22	W
8	64	41	7	16	W
9	62	32	5	14	W
10	60	39	4	7	W
11	59	39	4	7	W
12	57	35	5	9	W

### Historical Distribution

5-Yr. Dist. of Values (µg/m<sup>3</sup>)

MONITORS:	Column Index		
4-SOUTH PHOENIX	Yr - All Data (5-Yrs)		
5-JLG SUPERSITE	Sea - Data for Autumn season only (5-Yrs)		
6-CENTRAL PHOENIX			
Cum. Freq.	Mon 1	Mon 2	Mon 3
Min	7	13	5
0.5%	7	16	8
1.0%	10	16	9
2.5%	13	19	11
5%	18	20	14
10%	24	29	17
25%	36	37	23
50%	49	54	31
75%	64	67	41
90%	85	83	50
95%	94	87	59
97.5%	126	90	67
99.0%	147	100	82
99.5%	164	105	92
Max	171	131	73
Flagged Value	161	69	98

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



### 16477 (112.14Wx33.48N) MC - WEST PHOENIX

Hr	T(F)	PM	Spd	Max	Dir
1	76	19	5	13	E
2	75	24	2	9	S
3	75	30	4	15	S
4	76	21	7	16	S
5	74	30	4	11	SW
6	72	28	7	20	W
7	65	230	11	21	W
8	62	326	10	18	W
9	64	209	8	18	W
10	67	131	6	16	W
11	69	118	6	18	W
12	71	82	7	20	W
1	72	89	10	22	W
2	72	138	13	30	SW
3	72	164	14	29	SW
4	72	182	16	31	W
5	71	67	12	26	W
6	69	63	10	23	W
7	66	45	7	17	W
8	65	38	4	11	NW
9	63	39	3	9	NW
10	60	55	2	4	NW
11	58	62	3	5	W
12	56	43	2	4	W

### 16390 (112.07Wx33.56N) MC - NORTH PHOENIX

Hr	T(F)
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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 PM<sub>10</sub> readings from the South Phoenix monitor were valid for October 11<sup>th</sup>. 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 South Phoenix monitor operated by Maricopa County.

2. Review suspected contributing sources. The NWS, MC, ADEQ, 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 11<sup>th</sup>. Strong westerly to southwesterly winds were occurring in the Phoenix area due to a low pressure system approaching from the west with a cold front passing through Arizona. The plot of hourly PM<sub>10</sub> concentrations and wind data in the upper right corner of Figure 1 confirms the similar timing of the elevated PM<sub>10</sub> concentrations and high winds at the South Phoenix monitor. While winds and PM<sub>10</sub> concentrations also spiked at several other monitors throughout the Valley, the PM<sub>10</sub> 24-hour block averages at these monitoring sites remained below the NAAQS. Thus, besides the South Phoenix monitor, no other data flags are necessary for this October 11, 2008, event.

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 95<sup>th</sup> percentile). Additionally, the winds associated with the elevated PM<sub>10</sub> concentrations may be characterized as unusual as described in “Impact of Exceptional Events’ ‘Unusual Winds’ on PM<sub>10</sub> Concentrations” (see “References”). While the South Phoenix monitor was the only monitor to exceed the NAAQS in the Phoenix Metro area on October 11, 2008, it can be seen in Figure 1 that even monitors with lower PM<sub>10</sub> concentrations (relative to those measured at South Phoenix) saw 24-hour concentrations near their respective 99<sup>th</sup> percentile.

4. Examine the meteorological conditions before and during the event. The 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 between 4:00 a.m. and 6:00 a.m., when the Sky Harbor NWS station and MC’s Central Phoenix station first began reporting strong winds. Numerous Valley weather stations reported strong gusty winds off and on throughout the afternoon. This timing corresponds to the onset and continuation of elevated PM<sub>10</sub> concentrations recorded at the South Phoenix monitoring site. Concentrations there remained elevated throughout the morning and afternoon hours until a time when winds decreased to below about 20 mph.

5. Perform a qualitative attribution to emission source(s). All evidence indicates the elevated PM<sub>10</sub> 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 11, 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 graphs of site specific wind and PM<sub>10</sub> concentrations, provide proof that the elevated PM<sub>10</sub> concentrations in Phoenix 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 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 South Phoenix was attributed to a natural event.

**Conclusion**

Transport of dust from soils by high winds. The elevated PM<sub>10</sub> event on October 11, 2008 in Maricopa County was the result of the transport of dust and soils from 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.

**ATTACHMENTS AND REFERENCES**  
**FOR EXCEPTIONAL EVENTS ANALYSIS**

**The following are supplemental materials helpful in understanding the exceptional event summarized in the main report. In addition, the reader is referred to the following references.**

**REFERENCES**

Arizona Department of Environmental Quality (ADEQ), *Air Quality Exceptional and Natural Events Policy*, Policy Number 2009.002 (April 28, 1999; revised January 10, 2006 and June 22, 2007).

Arizona Department of Environmental Quality (ADEQ), *Technical Criteria Document for Determination of Natural Exceptional Events for Particulate Matter Equal to or Less Than Ten Microns in Aerodynamic Diameter (PM<sub>10</sub>)* (May 31, 2000).

Arizona Department of Environmental Quality (ADEQ), *Technical Criteria Document for Determination of Natural and Exceptional Events* (December 12, 2005).

Arizona Department of Environmental Quality (ADEQ), *Impact of Exceptional Events 'Unusual Winds' on PM<sub>10</sub> Concentrations* (October 14, 2009).

Arizona Department of Environmental Quality (ADEQ), *High Wind Exceptional Events and Control Measures for PM<sub>10</sub> Areas* (October 14, 2009).

Environmental Protection Agency (EPA), *The Treatment of Data Influenced by Exceptional Events (Exceptional Event Rule)*, 73 FR 70597; 40 CFR Parts 50 and 51 (November 21, 2008).



**MARICOPA COUNTY  
DUST CONTROL ACTION FORECAST  
ISSUED FRIDAY, OCTOBER 10, 2008**

Three-day weather outlook:

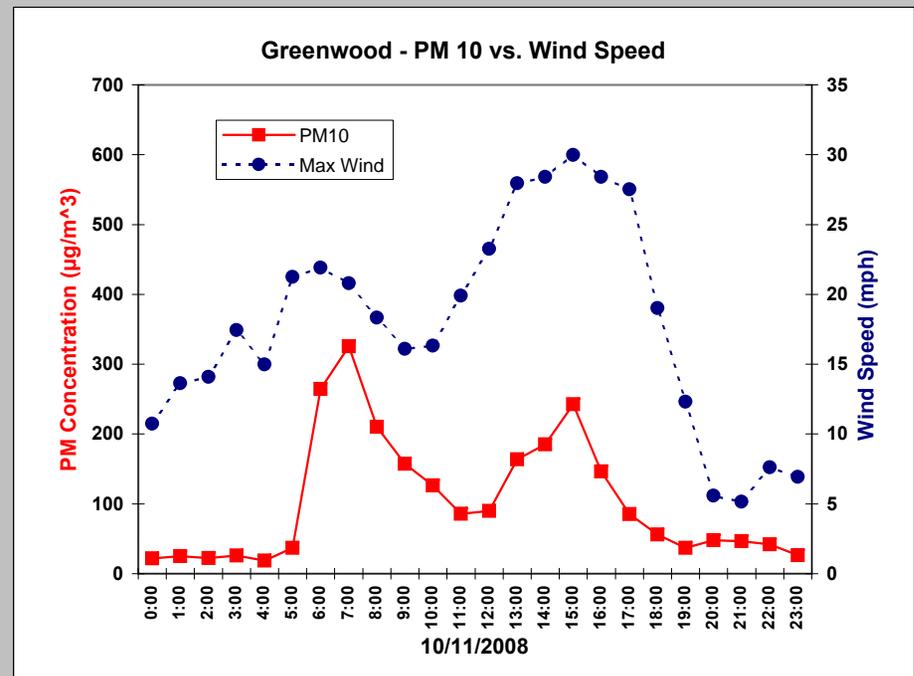
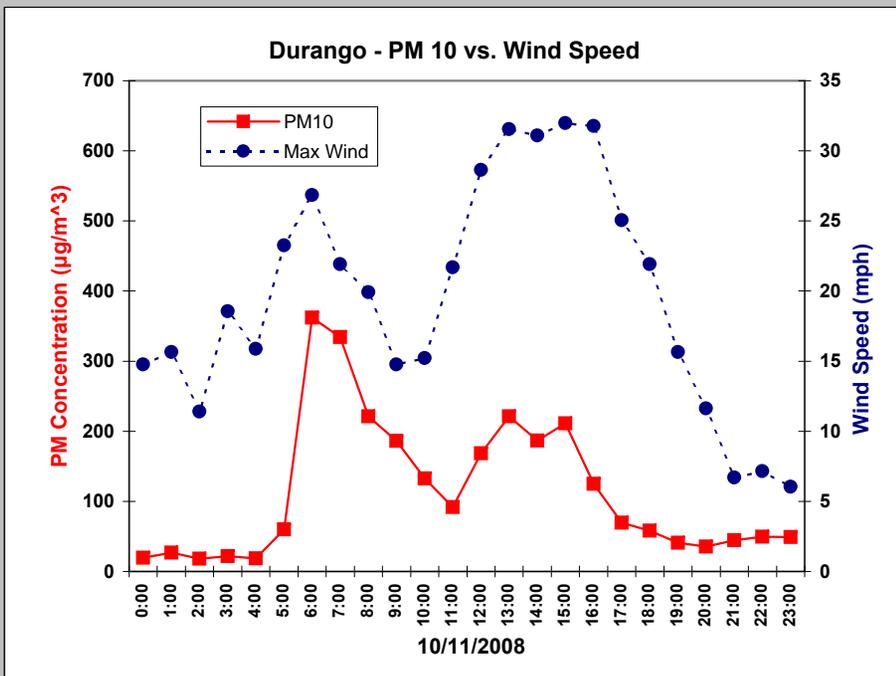
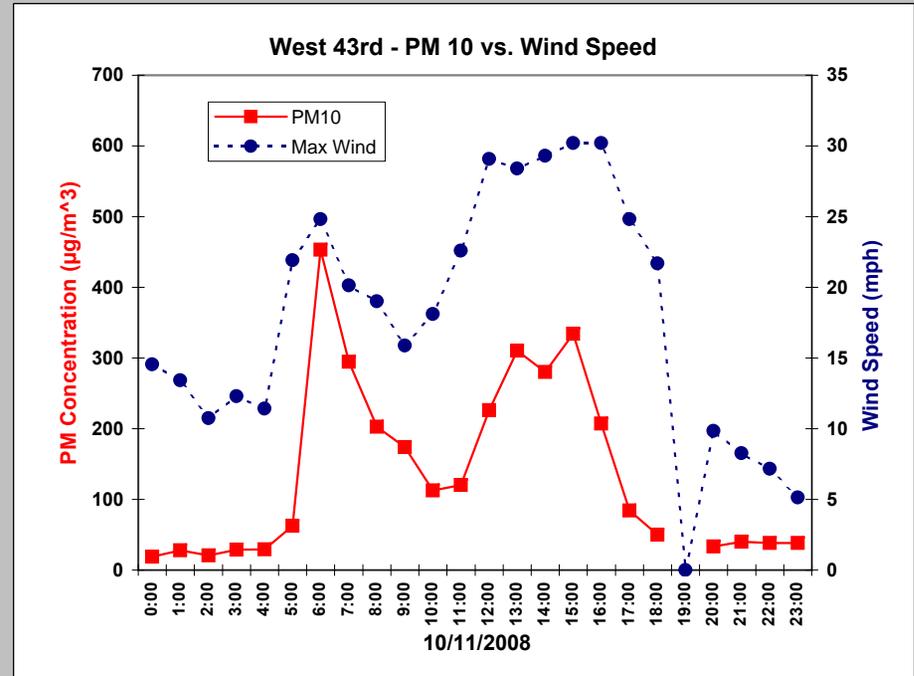
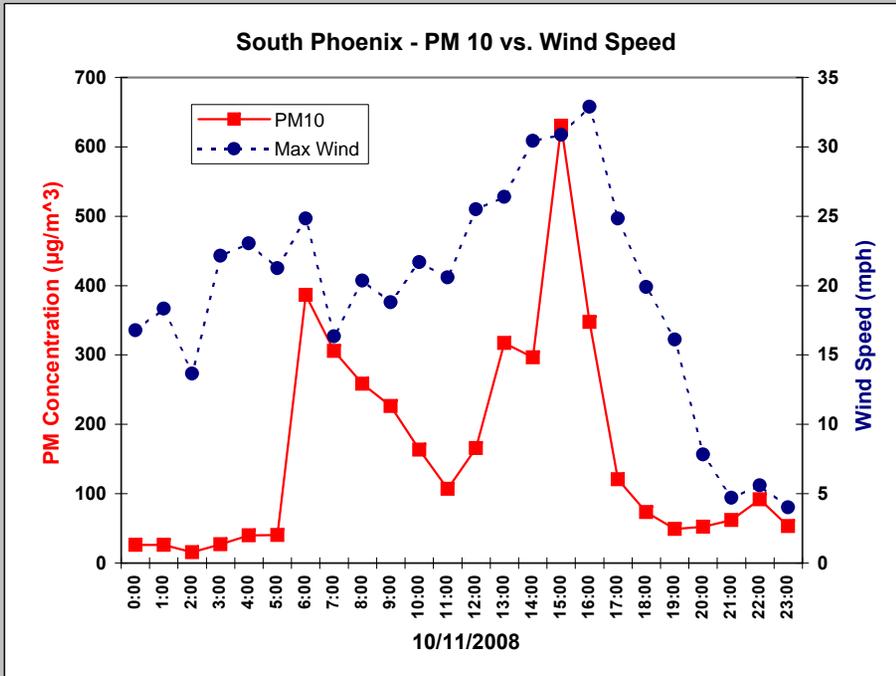
Another significant trough of low pressure will push through Arizona this weekend, dropping afternoon temperatures while increasing winds late Friday into early Saturday. As the system approaches Friday night, winds will be out of the southwest, possibly gusting to around 30 mph at times, especially around Yuma and the deserts near Tucson. By Sunday, the system moves east and winds decrease while shifting out of the north and northwest. Cooler air behind the system will keep afternoon desert temperatures around 80°F on Saturday and Sunday. A return to potentially stagnant conditions is possible early next week. The risk of exceeding the 24-hr PM-10 health standard in Phoenix will be “Moderate” on Saturday and Sunday, dropping to “Low” by Monday.

**RISK FACTORS**

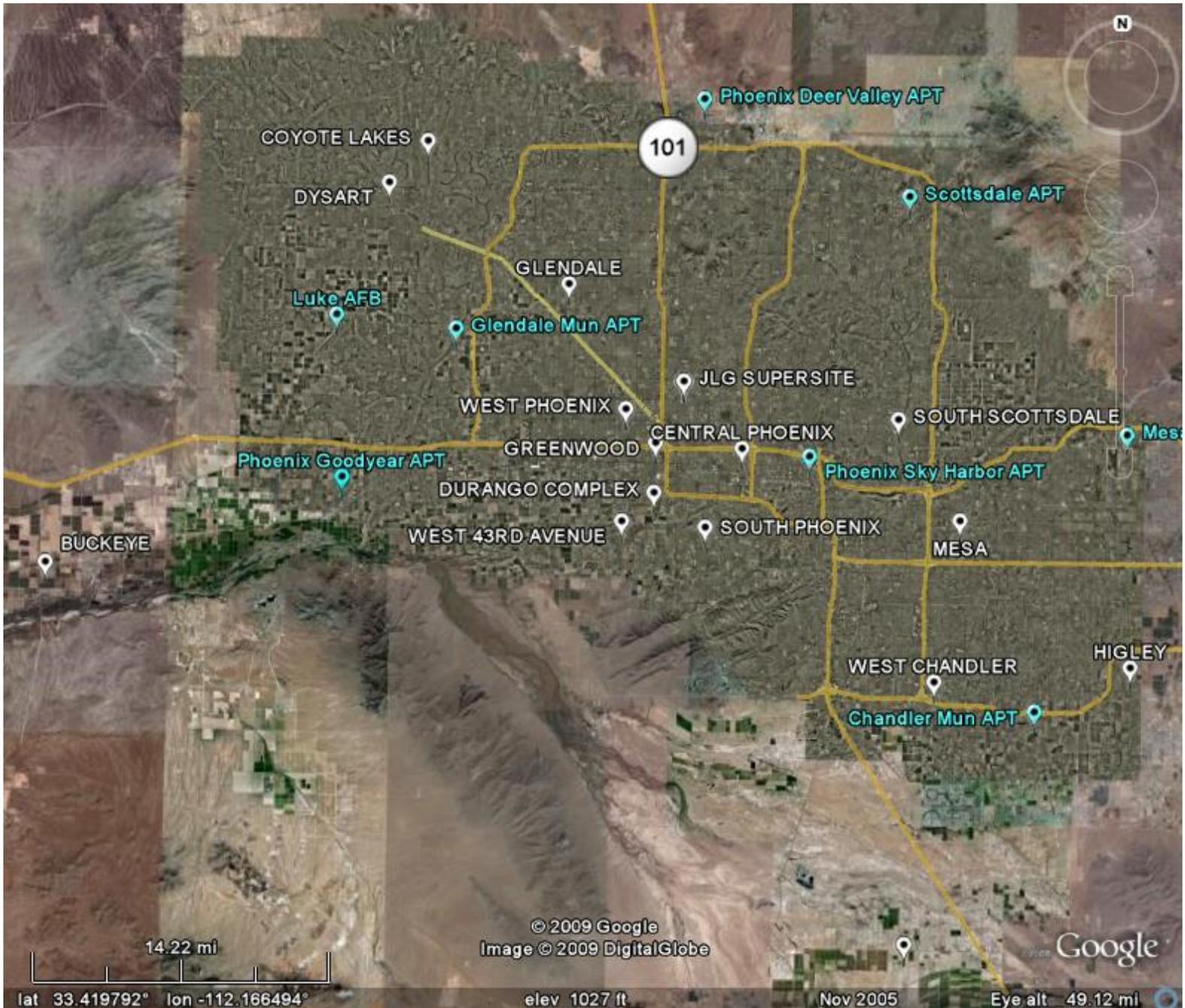
	<u>WINDS</u>	<u>STAGNATION</u>	<u>RISK LEVEL</u>
<b>Day #1: Sat 10/11/2008</b>	Southwest winds 15 to 20 mph are expected during the afternoon, with stronger gusts possible at times.	No stagnation is expected.	<b>MODERATE</b>
<b>Day #2: Sun 10/12/2008</b>	Northwest winds 5 to 15 mph are expected during the afternoon.	Slightly stagnant conditions are expected early with improvement by the afternoon.	<b>MODERATE</b>
<b>Day #3: Mon 10/13/2008</b>	Northeast winds around 5 to 10 mph are likely much of the day.	Somewhat stagnant conditions are expected early with improvement by the afternoon.	<b>LOW</b>

To review the complete air quality forecast for the Phoenix metropolitan area visit [www.azdeq.gov](http://www.azdeq.gov) or call 602-771-2367 for recorded forecast information.

# 10/11/2008 - ADDITIONAL GRAPHS

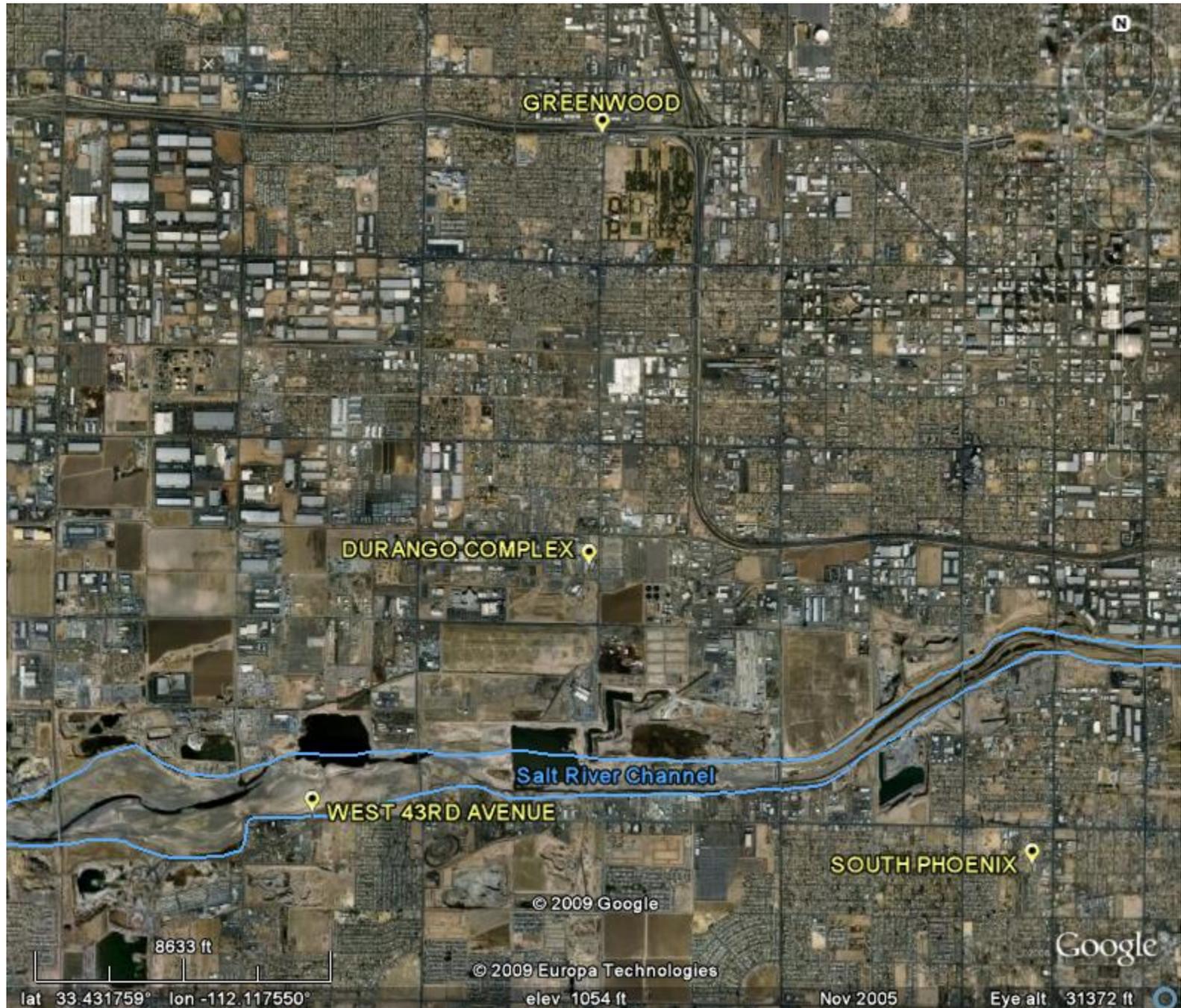


## Phoenix Area PM<sub>10</sub> and Meteorological Monitors



Source: US EPA, ADEQ, & Google Earth

# Salt River Area PM<sub>10</sub> and Meteorological Monitors



Source: US EPA, ADEQ, & Google Earth