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Assessment of Qualification for Treatment under the Arizona Natural and Exceptional Events Policy for the High Particulate (PM₁₀) Concentration Events in the Phoenix Area on November 15, 2007

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 Tuesday, November 13, 2007, due to a cut-off area of low pressure forecast to move eastward, pass south of Arizona, and cause strong easterly winds, ADEQ air quality forecasters issued the Maricopa County Dust Control Action Forecast. The forecast called for a moderate risk of wind-blown dust for Thursday, November 15, 2007. The forecasts/advisories satisfy the requirement in 40 CFR 51.920(a)(1).

A cut-off low, with the potential for causing unsettled weather in Arizona, was located southwest of Arizona and had the ability to generate thunderstorms capable of producing a wind-blown dust event. This meant a moderate risk of exceeding the PM₁₀ National Ambient Air Quality Standards (NAAQS) in Maricopa County. During the morning and early afternoon hours of November 15th, thunderstorm cells developed southeast of Phoenix in the Chandler area. These storms created strong downdrafts and outflow boundaries which generated blowing dust as they moved into the Phoenix Metro area from the east-southeast. All appropriate state implementation plans (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.”

Strong winds were observed throughout portions of Maricopa County and the Phoenix Metro area on November 15, 2007. Easterly winds at Goodyear Airport first gusted to 20 mph during the 8:00 a.m. hour. The Buckeye AzMET monitor also recorded numerous hours where wind gusts were greater than 20 mph with a maximum gust of 34 mph during the 9:00 a.m. hour. The initialization of the wind-blown dust event is evident in the Phoenix visible camera images as well as the Arizona Meteorological Network (AzMET) and National Weather Service (NWS) monitors (see Fig. 1). In addition, the Goodyear Airport NWS station reported reduced visibilities during the late morning and early afternoon due to the wind-blown/suspended dust event.

This significant event brought elevated ambient concentrations of PM₁₀ to the Phoenix area that exceeded the NAAQS at the Buckeye and Durango monitors operated by Maricopa County. The fact that ambient concentrations exceed the NAAQS satisfies the criteria in 40 CFR 50.1(j) that the event “affects air quality.” The following are the key PM₁₀ 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**
BUCKEYE AREA					
Buckeye (Maricopa Co.[MC]/TEOM)	04-013-4011	166	613	0800	A or RJ
PHOENIX METRO AREA					
West 43 rd Ave (MC/TEOM)	04-013-4009	154	429	0900	None
Durango Complex (MC/TEOM)	04-013-9812	155	356	0900	A or RJ
Greenwood (MC/TEOM)	04-013-3010	123	251	0900	None
Higley (MC/TEOM)	04-013-4006	138	388	0800	None
West Phoenix (MC/TEOM)	04-013-0019	98	277	0900	None
Central Phoenix (MC/TEOM)	04-013-3002	102	279	1300	None
JLG Supersite (ADEQ/TEOM)	04-013-9997	72	158	1100	None
Coyote Lakes (MC/TEOM)	04-013-4014	70	134	0900	None

* EPA Air Quality System Identification Number

** 24-hr PM₁₀ 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 stakeholders meeting on June 11, 2008. ADEQ has finalized this demonstration, which was made available for public comment from August 11, 2008 through September

10, 2008. Any comments that were received were forwarded to EPA with this demonstration pursuant to 40 CFR 51.14(c)(3)(i).

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 date), 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 PM₁₀ readings from the Buckeye and Durango Complex monitoring site were valid for November 15th. Audits of the analyzers revealed operations were within acceptable tolerance. No local sources were reported as significantly contributing to the air quality episode. Exceedances of the NAAQS were recorded at the Buckeye and Durango Complex monitors operated by Maricopa County.

2. Review suspected contributing sources. The NWS 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 November 15, 2007. Strong, easterly winds occurred in the Phoenix area due to an outflow boundary from thunderstorms that developed in the southeastern portion of the Phoenix Metro area during the morning hours. The plot of hourly PM₁₀ concentration data in the upper right corner of Figure 1 confirms the identical timing of elevated PM₁₀ concentrations at the Buckeye and Durango monitors with wind gusts recorded by the Buckeye AzMET monitor. Finally, reports of reduced visibility at the Goodyear Airport were coincident with elevated PM₁₀ concentrations measured at Buckeye and Durango.

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 measured concentrations in excess of normal historical fluctuations, including background (i.e., concentrations greater than the 95th percentile). The monitors with readings greater than that of the NAAQS on August 16th, 2007, which should be flagged, include Buckeye and Durango.

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 began to pick up in southern portions of the

Valley during the early to mid-morning hours and continued to gust at or above 20 mph throughout much of the afternoon. This timing corresponds well with the onset of elevated PM₁₀ concentrations recorded at the flagged monitoring sites. Dust, caused by thunderstorms in the southeast valley, first hit Durango, bringing elevated PM₁₀ concentrations. It then progressed westward, due to easterly winds, towards Buckeye as suspended dust. This transport time accounts for the fact that Buckeye experienced elevated PM₁₀ concentrations three hours after the onset in Durango.

5. Perform a qualitative attribution to emission source(s). All evidence indicates the elevated PM₁₀ concentrations in the Phoenix area can be attributed to soil emissions that were transported over southern 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 November 15, 2007. Additionally, the visibility images located in the lower left portion of Figure 1 demonstrate the reduction in visibility experienced over portions of the valley on November 15th. Not only do the images reveal areas of blowing and/or suspended dust (i.e. the White Tank Mountains) they also show cloud cover, precipitation, and the thunderstorm activity which lead to the blowing dust event.

6. Estimation of Contribution from Source or Event. The primary source appears to be wind-blown dust over portions of Maricopa County 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 exceedances or violations 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 measured at the Buckeye and Durango Complex monitors were attributed to a natural event.

Conclusion

Long-range transport of dust from soils. The region wide elevated PM₁₀ event on November 15th, 2007 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” flag (A or RJ) 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.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

**QUALITY CONTROLLED LOCAL
CLIMATOLOGICAL DATA
(final)
HOURLY OBSERVATIONS TABLE
PHOENIX SKY HARBOR INTL AIRPORT (23183)
PHOENIX , AZ
(11/2007)**

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 1105 ft. above sea level
Latitude: 33.443
Longitude: -111.990
Data Version: VER3

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
15	0051	11	CLR	10.00		67	19.4	53	11.9	41	5.0	39	0	000		28.77			29.91	AA		29.95
15	0151	11	CLR	10.00		65	18.3	53	11.4	41	5.0	42	6	090		28.76			29.90	AA		29.94
15	0251	11	CLR	10.00		65	18.3	53	11.4	41	5.0	42	0	000		28.76	6	002	29.90	AA		29.94
15	0351	11	CLR	10.00		64	17.8	51	10.7	39	3.9	40	0	000		28.76			29.90	AA		29.94
15	0451	11	FEW200	10.00		63	17.2	51	10.5	39	3.9	41	0	000		28.78			29.92	AA		29.96
15	0551	11	SCT200	10.00		63	17.2	51	10.5	39	3.9	41	0	000		28.79	3	005	29.93	AA		29.97
15	0651	11	SCT150 BKN200 BKN250	10.00		64	17.8	52	10.9	40	4.4	42	0	000		28.79			29.93	AA		29.97
15	0751	11	BKN150 BKN200 BKN250	10.00		71	21.7	52	11.2	33	0.6	25	8	130		28.86			30.00	AA		30.04
15	0851	11	FEW080 SCT120 BKN150	10.00		68	20.0	53	11.5	38	3.3	33	7	110		28.88	3	026	30.02	AA		30.06
15	0951	11	FEW080 BKN120 BKN150	10.00		70	21.1	53	11.5	36	2.2	29	6	100		28.90			30.04	AA		30.08
15	1040	11	SCT080CB BKN120 OVC150	10.00	VCTS	72	22.0	54	12.2	37	3.0	28	0	000		28.90			M	SP		30.08
15	1051	11	SCT080CB BKN120 OVC150	10.00	VCTS -RA	72	22.2	54	12.0	36	2.2	27	8	070		28.89	0	009	30.03	AA	T	30.07
15	1104	11	FEW080 BKN120 OVC150	10.00		72	22.0	54	12.2	37	3.0	28	9	080		28.88			M	SP		30.06
15	1128	11	SCT080CB BKN120 OVC150	9.00	-TSRA	72	22.0	56	13.5	43	6.0	35	8	090		28.88			M	SP		30.06
15	1151	11	SCT070 BKN120 BKN150	9.00	-RA	71	21.7	60	15.5	52	11.1	51	9	080		28.84			29.98	AA	0.02	30.02
15	1251	11	FEW080 SCT120 BKN150	10.00		77	25.0	56	13.1	36	2.2	23	21	090		28.81			29.95	AA	T	29.99
15	1351	11	FEW120 BKN150 BKN200	10.00		79	26.1	56	13.0	33	0.6	19	20	090		28.80	6	027	29.94	AA		29.98
15	1451	11	SCT120 BKN150 BKN200	10.00		78	25.6	55	12.5	31	-0.6	18	9	110		28.79			29.93	AA	T	29.97
15	1551	11	SCT120 BKN150 BKN200	10.00		77	25.0	55	12.6	33	0.6	20	14	080		28.79	6	005	29.93	AA		29.97
15	1651	11	SCT120 BKN150 BKN200	10.00		76	24.4	53	11.8	30	-1.1	18	15	090		28.79			29.93	AA		29.97
15	1751	11	SCT120 BKN150 BKN200	10.00		75	23.9	53	11.4	29	-1.7	18	14	080		28.79			29.93	AA		29.97
15	1851	11	SCT120 BKN150 BKN200	10.00		74	23.3	52	11.1	28	-2.2	18	11	080		28.80	3	006	29.94	AA		29.98
15	1951	11	FEW120 BKN150 BKN200	10.00		72	22.2	52	11.1	31	-0.6	22	9	080		28.81			29.95	AA		29.99
15	2051	11	FEW120 BKN150 BKN200	10.00		71	21.7	52	11.0	32	0.0	24	7	100		28.82			29.96	AA		30.00
15	2151	11	FEW120 BKN150	10.00		69	20.6	52	10.9	34	1.1	28	0	000		28.85	0	011	29.99	AA		30.03
15	2251	11	FEW120 BKN150	10.00		70	21.1	52	11.0	33	0.6	26	9	020		28.84			29.98	AA		30.02
15	2351	11	FEW120 BKN150	10.00		70	21.1	51	10.6	31	-0.6	24	10	050		28.83			29.97	AA		30.01

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U.S. Department of Commerce
National Oceanic & Atmospheric Administration

**QUALITY CONTROLLED LOCAL
CLIMATOLOGICAL DATA
(final)
HOURLY OBSERVATIONS TABLE
PHOENIX GOODYEAR AIRPORT (03186)
GOODYEAR , AZ
(11/2007)**

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 0 ft. above sea level
Latitude: 33.423
Longitude: -112.376
Data Version: VER2

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti- meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
15	0547	0	FEW150	10.00		55	13.0	47	8.4	39	4.0	55	6	VR		28.93			M	AA		29.96
15	0647	0	BKN150 BKN250	20.00		57	14.0	48	9.0	39	4.0	51	9	090		28.95			M	AA		29.98
15	0747	0	SCT100 BKN150 BKN250	20.00		61	16.0	50	10.0	39	4.0	44	11	060		28.98			M	AA		30.02
15	0850	0	SCT100 BKN150 OVC250	10.00		70	21.0	53	11.8	37	3.0	30	11	080	21	29.00			M	AA		30.03
15	0947	0	BKN100 BKN150 BKN250	10.00		68	20.0	53	11.7	39	4.0	35	11	090		29.00			M	AA		30.04
15	1047	0	BKN080 BKN150 OVC250	7.00		73	23.0	54	12.4	37	3.0	27	16	080		29.00			M	AA		30.04
15	1147	0	SCT080 BKN150 BKN250	7.00		75	24.0	55	12.9	37	3.0	25	14	090		28.98			M	AA		30.02
15	1247	0	SCT080 BKN150	7.00		82	28.0	59	14.8	39	4.0	22	17	100	23	28.95			M	AA		29.98
15	1350	0	FEW120 SCT150 BKN200	10.00		88	31.0	60	15.5	36	2.0	16	17	090	29	28.93			M	AA		29.96
15	1447	0	FEW120 BKN150 BKN200	15.00		82	28.0	58	14.2	36	2.0	19	14	070	25	28.92			M	AA		29.95
15	1547	0	FEW120 BKN150 BKN200	15.00		82	28.0	58	14.2	36	2.0	19	16	100	25	28.89			M	AA		29.92
15	1650	0	FEW120 BKN150 BKN200	15.00		79	26.0	57	13.6	36	2.0	21	16	080		28.93			M	AA		29.96
15	1747	0	FEW120 BKN150 BKN200	15.00		77	25.0	55	12.8	34	1.0	21	14	070		28.93			M	AA		29.96
15	1847	0	FEW120 BKN150 BKN200	20.00		75	24.0	54	12.3	34	1.0	22	11	070		28.94			M	AA		29.97
15	1947	0	FEW120 BKN150 BKN200	20.00		73	23.0	53	11.9	34	1.0	24	6	090		28.95			M	AA		29.98
15	2047	0	FEW120 BKN150 BKN200	20.00		72	22.0	53	11.6	34	1.0	25	9	050		28.95			M	AA		29.98

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