Sonoma Technology, Inc.
Air Quality Research and Innovative Solutions

State of Arizona
Exceptional Event Documentation for the Event of August 14, 2012, for the Phoenix PM_{10} Nonattainment Area

Final Report prepared for

Arizona Department of Environmental Quality
Phoenix, AZ

February 2013

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State of Arizona
Exceptional Event Documentation for the Event of August 14, 2012, for the Phoenix PM_{10} Nonattainment Area

Final Report
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Cover image depicts windblown dust and haze in the Phoenix area at 2235 LST on August 14, 2012, resulting from strong winds associated with thunderstorm outflow. This photo was taken by an ADEQ visibility camera near downtown Phoenix, facing northeast toward Camelback Mountain.

Acknowledgments

The authors would like to acknowledge the Arizona Department of Environmental Quality for helpful discussion and feedback during the preparation of this document.

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1. Introduction

On August 14, 2012, two air quality monitors in the Phoenix PM_{10} nonattainment area recorded 24-hr average PM_{10} concentrations in excess of the National Ambient Air Quality Standard (NAAQS) for PM_{10} of 150 µg/m^3. The purpose of this report is to demonstrate that these exceedances were due to naturally occurring windblown dust, were not reasonably controllable or preventable, were historically unusual, and would not have occurred "but for" the windblown dust and that they therefore constitute an Exceptional Event as defined by the U.S. Environmental Protection Agency's (EPA) Exceptional Events Rule (EER).

1.1 Report Contents

Section 2 of this assessment contains a conceptual model of the windblown dust event that transpired on August 14, 2012, providing a background narrative of the exceptional event and an overall explanation showing that the event affected air quality. Section 2 also provides evidence that the event was a natural event.

Section 3 of this assessment establishes a clear causal connection between the natural event on August 14, 2012, and the exceedances of the 24-hr PM_{10} standard at the monitoring stations. The evidence in this section also confirms that the event in question affected air quality and was the result of natural events.

Section 4 of this assessment illustrates that the event of August 14, 2012, produced PM_{10} concentrations in excess of normal historical fluctuations.

Section 5 of this assessment details the existing dust control measures and demonstrates that despite the presence and enforcement of these controls, the event of August 14, 2012, was not reasonably controllable or preventable.

Section 6 of this assessment builds upon the demonstrations made in the previous sections, showing a clear causal connection between the natural event and the exceedances, and concludes that the exceedances of the 24-hr PM_{10} standard on August 14, 2012, would not have occurred "but for" the event.

Appendix A contains time-series graphs and data tables to supplement Section 3. **Appendix B** contains links to videos, images, and media reports to supplement Section 3. **Appendix C** contains time-series graphs to supplement Section 4. **Appendix D** contains air quality forecasts issued by the Arizona Department of Environmental Quality (ADEQ) and weather statements and warnings issued by the National Weather Service (NWS). **Appendix E** contains a copy of the affidavit of public notice concerning this assessment report.

1.2 Exceptional Event Rule Requirements

In addition to the technical requirements that are contained within the EER, procedural requirements must also be met in order for the EPA to concur with the flagged air quality

monitoring data. This section of the report lists the requirements of the EER and associated guidance and discusses how ADEQ addressed those requirements.

1.2.1 Public Notification that the Event Was Occurring (40 CFR 50.14(c)(1)(i))

ADEQ issued Dust Control Action Forecasts and Air Quality Forecasts for Maricopa County advising citizens of the potential for high wind dust events on August 14, 2012. More information on ADEQ's forecasts can be found in Section 5.2 of this report. The forecast products that were issued for August 14, 2012, are included in Appendix D.

1.2.2 Place Informal Flag on Data in AQS (40 CFR 50.14(c)(2)(ii))

ADEQ and other operating air quality agencies in Arizona submit data into the EPA's Air Quality System (AQS), the official repository of ambient air quality data. This data submittal to AQS includes particulate matter (PM) data from both filter-based and continuous monitors operated in Arizona.

When ADEQ and/or another agency operating monitors in Arizona suspect that data may be influenced by an exceptional event, ADEQ and/or the other operating agency expedites analysis of the filters collected from the potentially-affected filter-based air monitoring instruments, quality-assures the results, and submits the data into AQS. ADEQ and/or other operating agencies also submit data from continuous monitors into AQS after quality assurance is complete.

If ADEQ and/or other operating air quality agencies have determined that the potential exists for a monitor's reading(s) to have been influenced by an exceptional event, a preliminary flag is submitted for the measurement in AQS. The data are not official until they undergo more thorough quality assurance and quality control, leading to certification by May 1 of the year following the calendar year in which the data were collected (40 CFR 58.15(a)(2)). The presence of the flag on the August 14, 2012, data can be confirmed in AQS.

1.2.3 Notify EPA of Intent to Flag Through Submission of Initial Event Description by July 1 of Calendar Year Following Event (40 CFR 50.14(c)(2)(iii))

ADEQ submitted notice to EPA on August 29, 2012 listing all days from calendar year 2012 that ADEQ intends to analyze under the Exceptional Events Rule. The PM_{10} exceedances that occurred on August 12, 2012, in the Phoenix PM_{10} nonattainment area were included on this list. This assessment report serves as demonstration supporting the flagging of these data.

1.2.4 Document that the Public Comment Process Was Followed for Event Documentation (40 CFR 50.14(c)(3)(iv))

ADEQ posted this assessment report on the ADEQ webpage and placed a hard copy of the report in the ADEQ Records Management Center for public review. ADEQ opened a 30-day public comment period on January 14, 2013. A copy of the public notice certification, along with

any comments received, will be submitted to the EPA, consistent with the requirements of 40 CFR 50.14(c)(3)(iv). See Appendix E for a copy of the affidavit of public notice.

1.2.5 Submit Demonstration Supporting Exceptional Event Flag (40 CFR 50.14(a)(1-2))

At the close of the public comment period, and after ADEQ has had the opportunity to consider any comments submitted on this document, ADEQ will submit this document, the comments received, and ADEQ's responses to those comments to EPA Region 9 headquarters in San Francisco, California. The deadline for the submittal of this package is September 30, 2015.

1.2.6 Documentation Requirements (40 CFR 50.14(c)(3)(iii))

The EER states that in order to justify the exclusion of air quality monitoring data, evidence must be provided for the following elements:

1. The event satisfies the criteria set forth in 40 CFR 50.1(j) that
    a. the event affected air quality,
    b. the event was not reasonably controllable or preventable, and
    c. the event was caused by human activity unlikely to recur in a particular location or was a natural event;
2. There is a clear causal relationship between the measurement(s) under consideration and the event;
3. The event is associated with a measured concentration(s) in excess of normal historical fluctuations; and
4. There would have been no exceedance or violation but for the event.

2. Conceptual Model

This section provides a narrative background and summarizes the meteorological and air quality conditions in place on August 14, 2012, in the Phoenix area. Elements described in this section include

- A description and map of the geographic setting of the air quality and meteorological monitors.
- A description of Phoenix's climate.
- An overall description of meteorological and air quality conditions on the event day.

2.1 Geographic Setting and Monitor Locations

Phoenix is located in the Salt River Valley in south-central Arizona. It lies at an elevation of 1,090 feet above mean sea level (msl) in the northeastern part of the Sonoran Desert. Other than the mountains in and around the city, the topography of Phoenix is generally flat. The Phoenix area is surrounded by the McDowell Mountains (~4,200 ft above msl) to the northeast, the foothills of the Bradshaw (~7,900 ft above msl) and Mazataal (~7,900 ft above msl) ranges to the north, the White Tank Mountains (~4,500 ft above msl) to the west, the Sierra Estrella (~4,450 ft above msl) to the southwest, and the Superstition Mountains (~5,000 ft above msl) far to the east. Within the City are the Phoenix Mountains (~2,600 ft above msl) and South Mountain (~2,600 ft above msl). Current development is pushing north, west, and south into Pinal County.

A fairly dense network of air quality and meteorological monitors exists throughout the Phoenix area, with a much less dense network of monitors throughout the rest of Arizona. **Figure 2-1** shows the general geographic setting of Phoenix, as well as the locations of PM_{10} monitors that recorded exceedances on August 14, 2012. Monitors shown in this map include AQS monitors, which measure air quality and meteorological data, and NWS monitors, which measure meteorological data only. Some of the AQS monitors in the Phoenix area are run by the Maricopa County Air Quality Department (MCAQD), while others are run by ADEQ. The primary NWS site used in this demonstration package was the Phoenix Sky Harbor International Airport (KPHX) site, because of that site's high data quality, data completeness, and representativeness of meteorological conditions in the Phoenix area. **Figure 2-2** shows the locations of PM_{10} monitors statewide on August 14, 2012.

Figure 2-3 depicts the drainage systems or watersheds for the State of Arizona. Many of the rivers that form Arizona's drainage system are dry for most of the year and, consequently, are sources of silt and fine soils that become suspended and add to regional PM_{10} loadings during high wind events. Much of this alluvial matter and fine soil is deposited in the low-lying areas of central and southern Arizona, with larger depositional areas focused in and around the confluences of dry river channels.

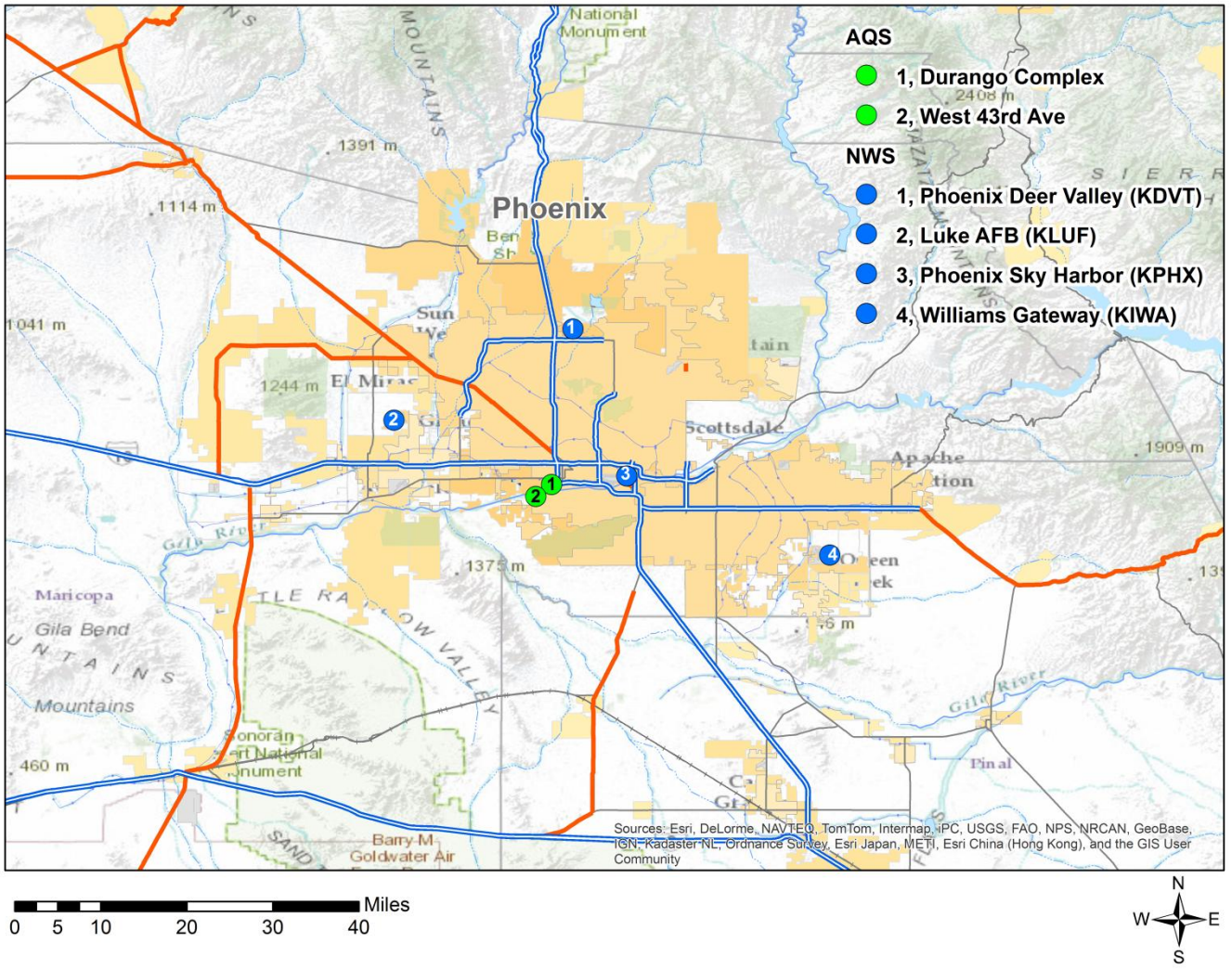


Figure 2-1. Locations of air quality monitors that recorded exceedances of the 24-hr PM_{10} NAAQS and NWS monitors primarily used in this report.

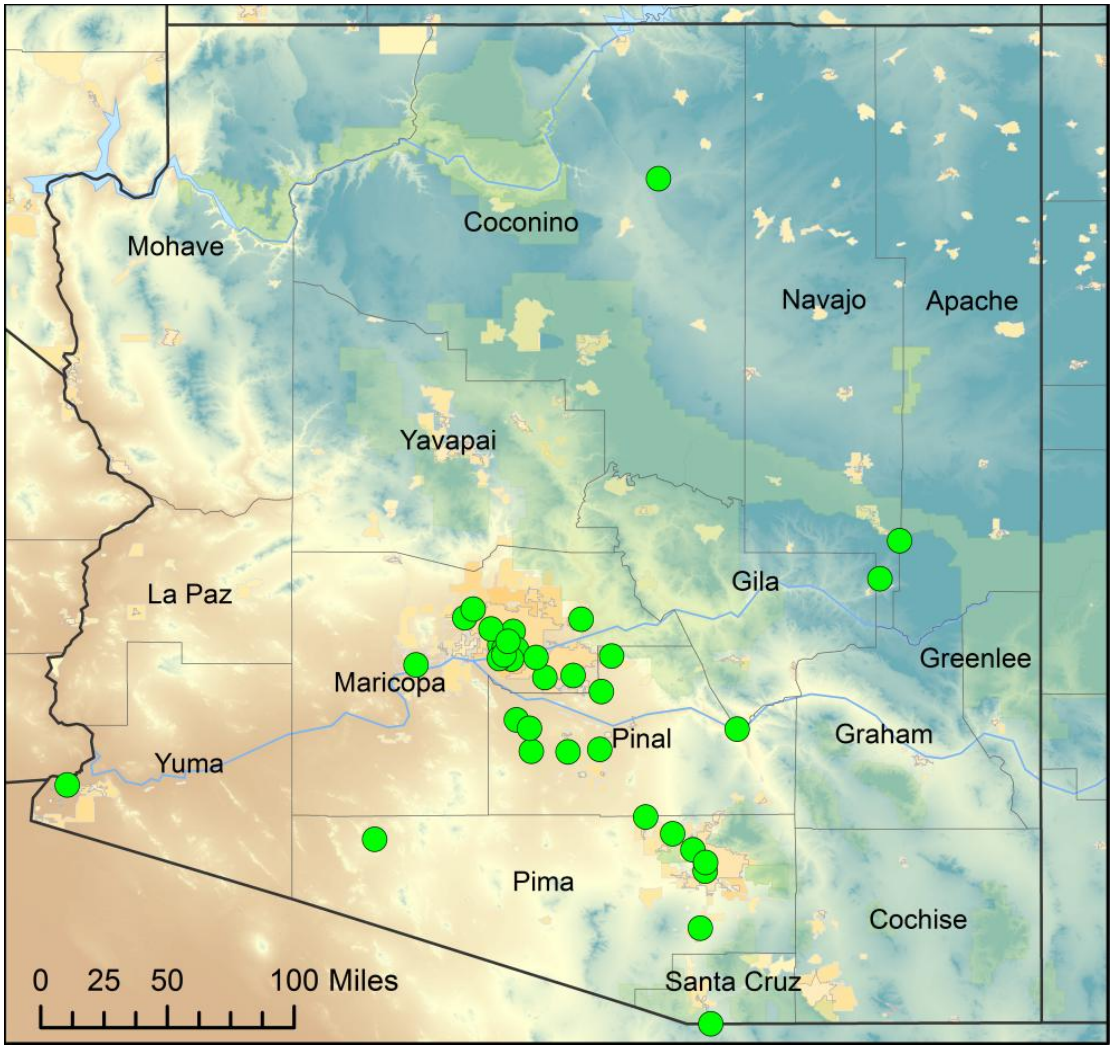


Figure 2-2. Location of sites monitoring PM_{10} in Arizona on August 14, 2012.

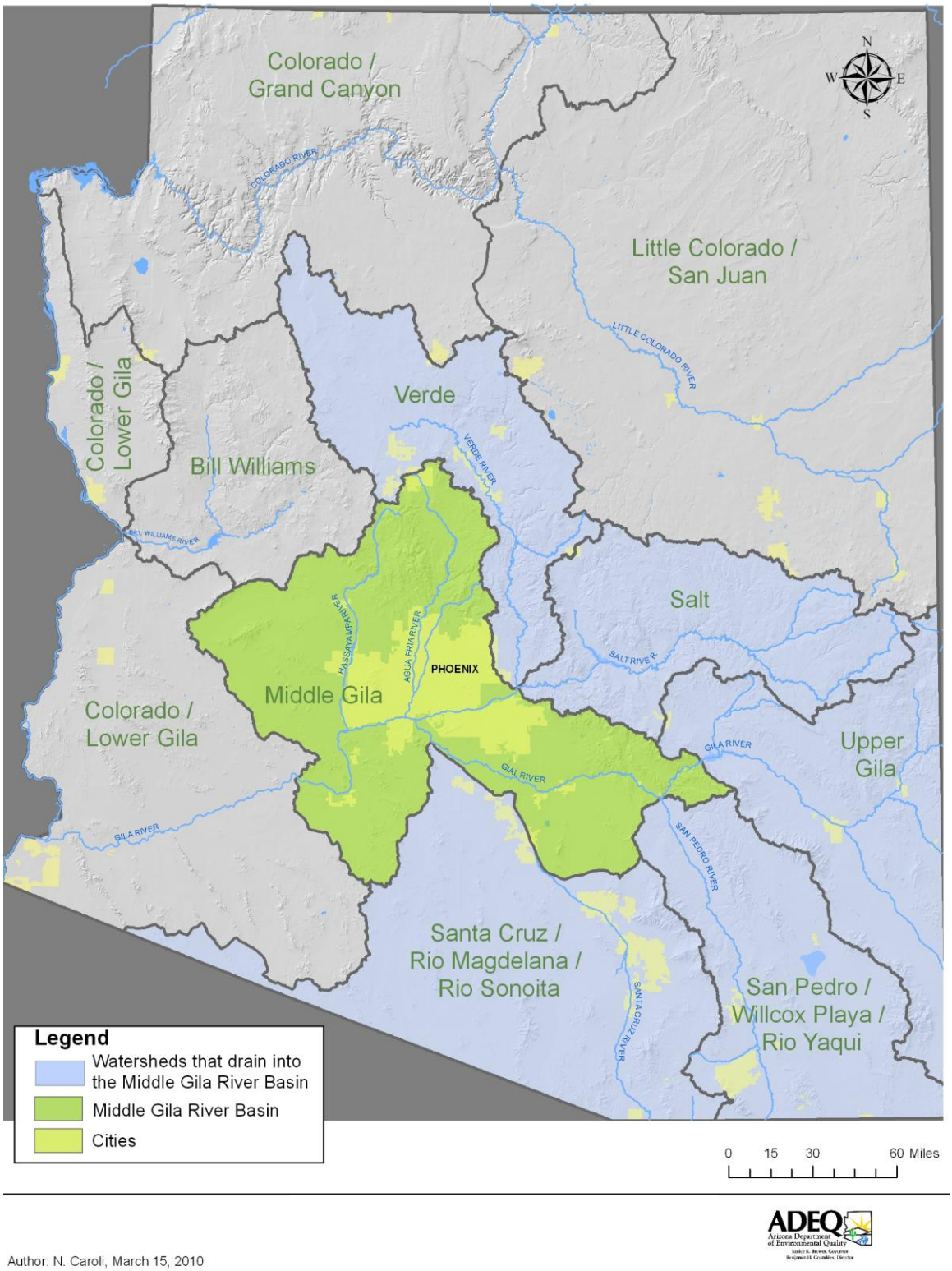


Figure 2-3. Drainage system of Phoenix, Arizona.

2.2 Climate

Phoenix has an arid climate, with very hot summers and temperate winters. The average summer high temperatures are among the hottest of any populated area in the United States (**Figure 2-4**). Temperatures reach or exceed 100°F an average of 110 days annually, and reach or exceed 110°F an average of 18 days annually. Phoenix receives an average of 7.66 inches of rain per year. The bulk of this rain usually falls during the December through March and July through August time periods. During the December through March period, winter storms originating from the Pacific Ocean can produce significant rains in southwestern Arizona. During the mid- to late-summer time period, monsoonal moisture originating from the Gulf of California, Gulf of Mexico, and large thunderstorm complexes over the Sierra Madre Occidental Mountains in Mexico move northward into Arizona.

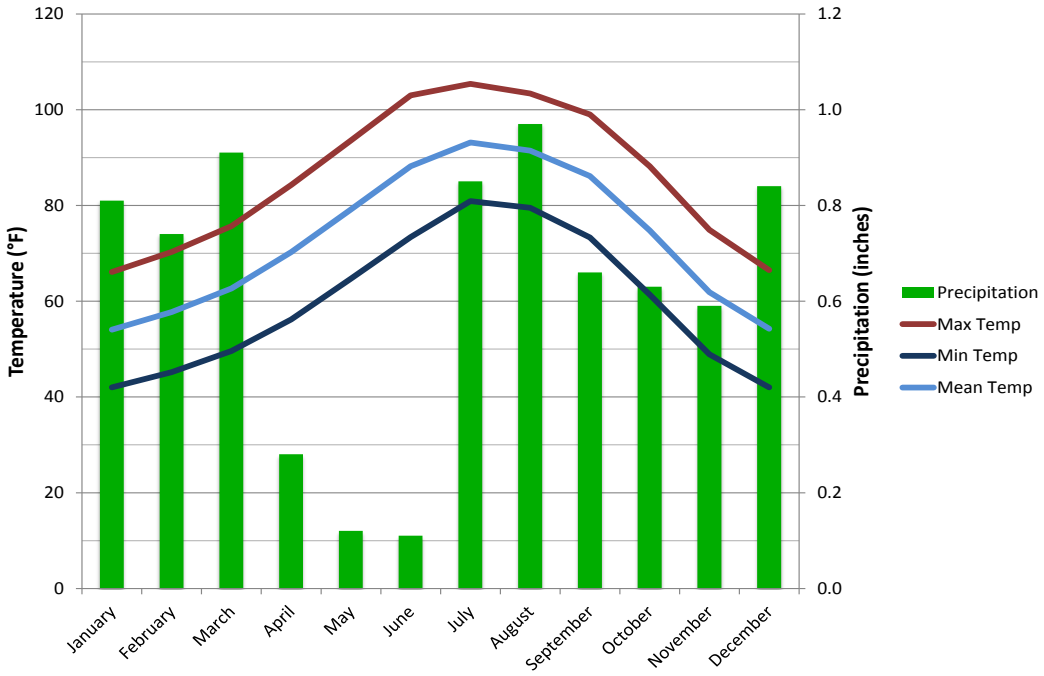
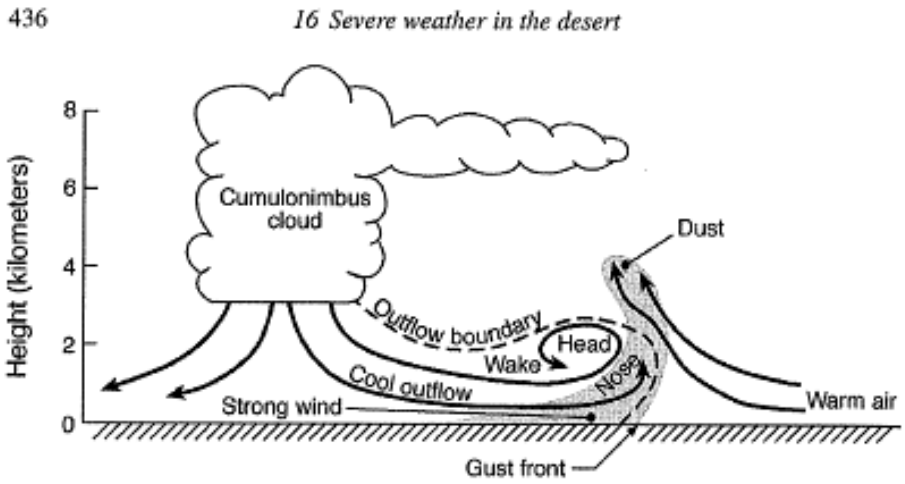


Figure 2-4. Average monthly temperatures and precipitation for Phoenix, 1981-2010.

The influx of moisture associated with the monsoon, combined with strong solar heating, can result in unstable atmospheric conditions that are favorable for the development of thunderstorms. Heavy precipitation associated with thunderstorms, and the eventual collapse or dissipation of thunderstorms, can generate what are known as downbursts. Downbursts are the rapid descent of rain-cooled air in a thunderstorm. Upon reaching the surface, this air rapidly disperses horizontally away from the storm as the outflow boundary (also called gust fronts), as shown in **Figure 2-5**. The high winds associated with outflow boundaries can efficiently loft dust into the air and transport the dust over long distances, resulting in dust storms (also called haboobs) with high PM_{10} concentrations and low visibilities.



Cross-section schematic of a haboob caused by the cool outflow from a thunderstorm, with the leading edge that is propagating ahead of the storm called an outflow boundary. The strong, gusty winds that prevail at the boundary are defined as a gust front. The leading edge of the cool air is called the nose, and the upward-protruding part of the features is referred to as the head. Behind the roll in the windfield at the leading edge is a turbulent wake. The rapidly moving cool air and the gustiness at the gust front raise dust (shaded) high into the atmosphere.

Figure 2-5. Cross-section of a thunderstorm creating an outflow boundary and haboob[1].

Dust storms associated with these thunderstorms typically occur in the early part of the monsoon season (July) before subsequent rains moisten the soil and limit potential lofting of soil into the air. However, depending on the amount and frequency of precipitation received during the monsoon season, the extremely hot temperatures can dry the surface soils very quickly; thus, dust storms can occur at any time during the year. Specific PM_{10} source regions are difficult to determine during thunderstorm-driven dust storms because the thunderstorm outflow can carry dust over long distances that encompass many possible sources of dust. Instead, we consider general PM_{10} source regions, which are typically identified based on the locations of the thunderstorms that are believed to have generated the dust-laden outflow winds.

2.3 Event Day Summary

On the afternoon and evening of August 14, 2012, strong winds generated by thunderstorms southeast of Phoenix transported dust northwestward into the Phoenix area (**Figure 2-6**). The windblown dust resulted in 24-hr average PM_{10} concentrations in exceedance of the NAAQS at two air quality monitors in Maricopa County (**Table 2-1**). The PM_{10} concentrations measured at these monitors were in excess of normal historical fluctuations. The dust was naturally occurring and likely originated over undeveloped lands south of Maricopa County, and wind gusts in excess of 30 to 40 mph overwhelmed reasonable dust control measures. While only two monitors in Maricopa County recorded PM_{10} concentrations in

[1] Image source: Warner T.T. (2004) *Desert meteorology*, Cambridge University Press, ISBN-10: 0521817986, ISBN-13: 978-0521817981, February 9.

exceedance of the NAAQS, monitors across Maricopa and Pinal counties recorded elevated PM_{10} concentrations during this dust storm.

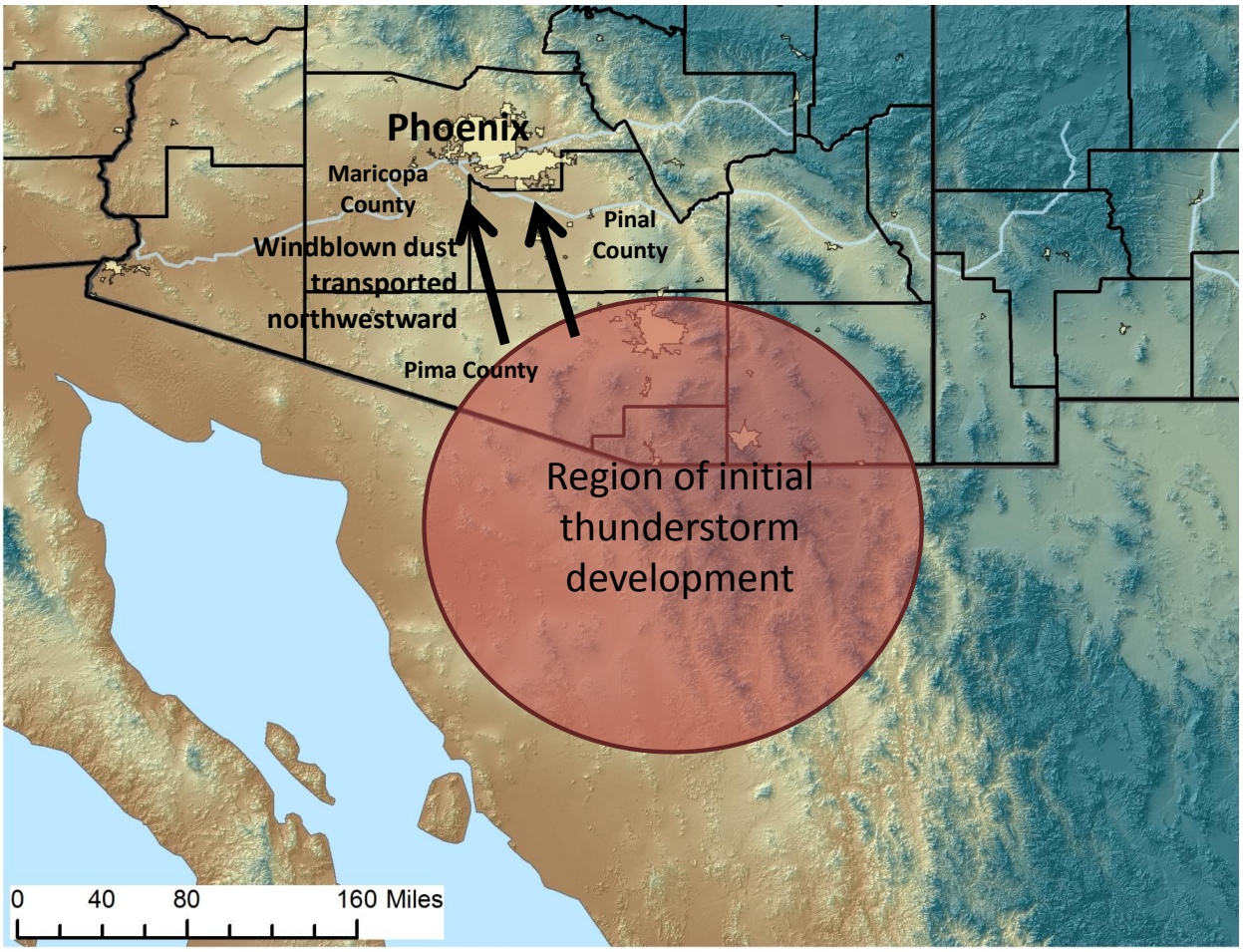


Figure 2-6. Thunderstorms over northwestern Mexico and southern Arizona produced outflow boundaries that propagated northwestward and transported dust to the Phoenix area on August 14, 2012.

Table 2-1. PM_{10} measurements on August 14, 2012. The exceedance monitors discussed in this report are shown in bold.

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Monitor	Monitor Type	Operator	AQS Monitor ID	24-hr Avg PM_{10} ($\mu g/m^3$)	1-hr Max PM_{10} ($\mu g/m^3$)	Time of Max 1-hr PM_{10} (LST)	AQS Qualifier Flag
Apache County							
N/A	TEOM	WMAT	04-001-1003-81102-1	15	49	1300	
Coconino County							
N/A	N/A	ADEQ	04-005-1237-81102-1	N/A	N/A	N/A	

Table 2-1. PM_{10} measurements on August 14, 2012. The exceedance monitors discussed in this report are shown in bold.

Monitor	Monitor Type	Operator	AQS Monitor ID	24-hr Avg PM_{10} ($\mu g/m^3$)	1-hr Max PM_{10} ($\mu g/m^3$)	Time of Max 1-hr PM_{10} (LST)	AQS Qualifier Flag
Gila County							
Hayden Old Jail	TEOM	ADEQ	04-007-1001-81102-3	28	49	1800	
Maricopa County							
West Phoenix	BAM	MC	04-013-0019-81102-1	106	1251	2200	
North Phoenix	BAM	MC	04-013-1004-81102-1	44	77	700	
Glendale	TEOM	MC	04-013-2001-81102-1	62	354	2300	
Central Phoenix	TEOM	MC	04-013-3002-81102-4	84	916	2200	
Greenwood	TEOM	MC	04-013-3010-81102-1	113	1352	2200	
South Phoenix	TEOM	MC	04-013-4003-81102-1	125	1624	2200	
West Chandler	TEOM	MC	04-013-4004-81102-1	126	1535	2200	
Tempe	TEOM	MC	04-013-4005-81102-1	90	978	2200	
Higley	TEOM	MC	04-013-4006-81102-1	95	313	2200	
West 43rd Ave	**TEOM**	**MC**	**04-013-4009-81102-1**	**254**	**3574**	**2200**	**RJ**
Dysart	TEOM	MC	04-013-4010-81102-1	66	651	2300	
Buckeye	TEOM	MC	04-013-4011-81102-1	68	283	2300	
Zuni Hills	TEOM	MC	04-013-4016-81102-1	44	372	2300	
Fort McDowell/Yuma Frank	TEOM	FMIR	04-013-5100-81102-3	47	N/A	N/A	
Durango Complex	**TEOM**	**MC**	**04-013-9812-81102-1**	**179**	**2540**	**2200**	**RJ**
JLG Supersite	BAM	ADEQ	04-013-9997-81102-3	79	724	2200	
JLG Supersite	TEOM	ADEQ	04-013-9997-81102-4	N/A	N/A	N/A	
Navajo County							
N/A	TEOM	WMAT	04-017-1002-81102-1	20	47	1900	
Pima County							
Ajo	TEOM	ADEQ	04-019-0001-81102-3	49	103	2200	
Rillito	TEOM	ADEQ	04-019-0020-81102-3	97	485	1900	
Orange Grove	FRM	PCDEQ	04-019-0011-81102-2	41	N/A	N/A	
South Tucson	FRM	PCDEQ	04-019-1001-81102-1	32	N/A	N/A	
Green Valley	TEOM	PCDEQ	04-019-1030-81102-1	25	63	1800	
Geronimo	TEOM	PCDEQ	04-019-1113-81102-1	32	57	1800	
Pinal County							
Casa Grande Downtown	TEOM	PCAQCD	04-021-0001-81102-3	132	773	2100	
Apache Junction Fire Station	FRM	PCAQCD	04-021-3002-81102-3	53	267	2100	
Stanfield	TEOM	PCAQCD	04-021-3008-81102-3	282	1209	2100	RJ

Table 2-1. PM_{10} measurements on August 14, 2012. The exceedance monitors discussed in this report are shown in bold.

Monitor	Monitor Type	Operator	AQS Monitor ID	24-hr Avg PM_{10} ($\mu g/m^3$)	1-hr Max PM_{10} ($\mu g/m^3$)	Time of Max 1-hr PM_{10} (LST)	AQS Qualifier Flag
Combs School	TEOM	PCAQCD	04-021-3009-81102-3	113	1163	2100	
Maricopa	TEOM	PCAQCD	04-021-3010-81102-3	231	1500	2200	RJ
Pinal County Housing	TEOM	PCAQCD	04-021-3011-81102-3	135	969	2000	
Cowtown	TEOM	PCAQCD	04-021-3013-81102-3	481	2859	2300	
Santa Cruz County							
Nogales Post Office	BAM	ADEQ	04-023-0004-81102-3	40	78	0000	
Yuma County							
Yuma Supersite	TEOM	ADEQ	04-027-8011-81102-3	81	492	2300	

TEOM: Tapered Element Oscillating Microbalance monitor
BAM: Beta Attenuation Monitor
FRM: Federal Reference Method
WMAT: White Mountain Apache Tribe of Fort Apache Reservation, AZ
MC: Maricopa County Air Quality Department
FMIR: Fort McDowell Indian Reservation
PCDEQ: Pima County Department of Environmental Quality
PCAQCD: Pinal County Air Quality Control District
RJ: qualifier flag for high winds

3. Causal Relationship

3.1 Discussion

Meteorological and air quality observations indicate that dust carried by thunderstorm outflow was directly responsible for the high PM_{10} concentrations observed in the Phoenix area on August 14, 2012. On the evening of August 14, a large area of thunderstorms developed over far northwestern Mexico and southeastern Arizona, south of the Phoenix area (**Figure 3-1**). Thunderstorms southeast of Maricopa County generated a dust-carrying outflow boundary that propagated northward into the Phoenix area. As stated in Section 2.2, thunderstorms associated with the summer monsoon season can generate strong winds and blow dust across Arizona. The likely source region for PM_{10} during the August 14, 2012, event was the desert region south of Phoenix, most of which lies outside the Phoenix PM_{10} nonattainment area. This region largely consists of natural, undisturbed desert. In addition, the weeks leading up to the event were dry in the Phoenix area, with the last measureable rainfall at KPHX occurring on July 28 and 29. This combination of geography and lack of rainfall preceding the event resulted in a large fetch of soils that were particularly vulnerable to particulate suspension.

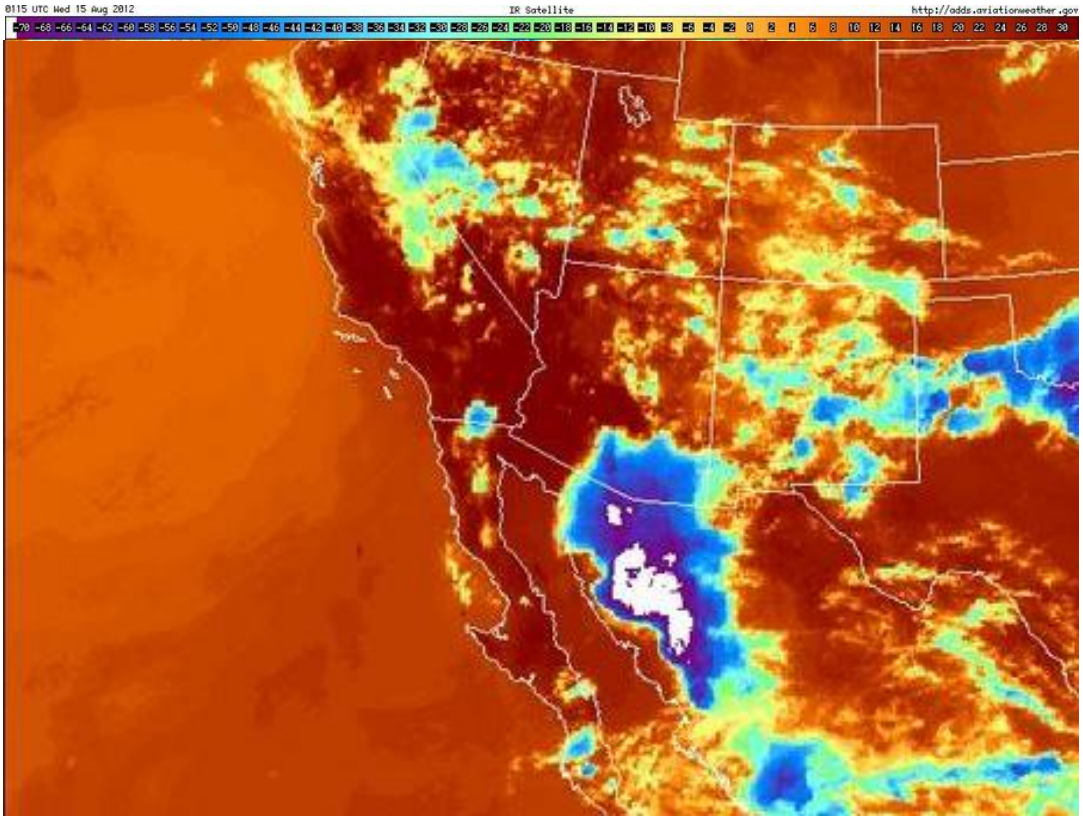

Figure 3-1. Infrared satellite image from 1815 LST on August 14, 2012 (GOES-West). Colder temperatures (blues, purples, and white) indicate tall, convective (thunderstorm) clouds. Thunderstorms over northwestern Mexico and south-central Arizona generated an outflow boundary that carried dust northward into Arizona.

The thunderstorm outflow and associated windblown dust were first evident at Pinal County monitors after 2000 LST on August 14, with a sharp increase in PM_{10} at several monitors (**Figure 3-2**). The thunderstorm outflow and associated dust continued north-northwestward and arrived in the Phoenix area during the 2200 LST hour on August 14, accompanied by significant reductions in visibility at KPHX (**Figure 3-3**). PM_{10} concentrations at the two exceedance monitors in Maricopa County increased sharply over this time period, with 1-hr PM_{10} concentrations exceeding 3,500 µg/m^3 at West 43rd Avenue (**Figure 3-4**) and 2,500 µg/m^3 at Durango Complex (**Figure 3-5**). Collocated wind observations at these monitors showed wind gusts in excess of 45 mph coincident with the high PM_{10} concentrations. Several other wind monitors in the Phoenix area reported strong winds at the same time as the high PM_{10} concentrations (Appendix A), but wind gusts were highest in the vicinity of the two exceedance monitors. Visibility cameras in the Phoenix area also clearly showed blowing dust and reduced visibility after 2200 LST as the outflow arrived (**Figure 3-6**). Links to these videos and other media coverage and images pertaining to this windblown dust event are shown in Appendix B. It is also important to note that the abrupt increase in PM_{10} corresponded with the arrival of high winds in the Phoenix area, whereas in the hours immediately before and after the event, winds were lighter and PM_{10} concentrations were lower. In response to the approaching thunderstorm outflow and associated dust and low visibilities, the NWS office in Phoenix issued a Blowing Dust Advisory (Appendix D).

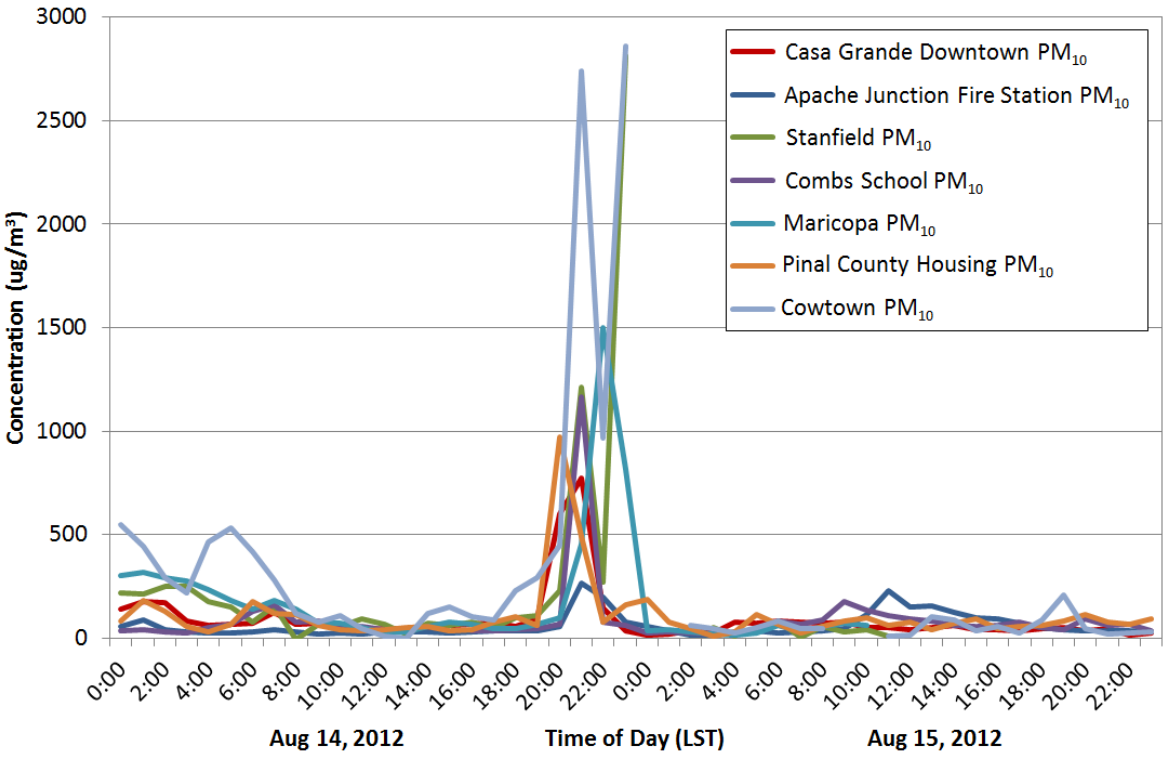

Figure 3-2. Hourly PM_{10} concentrations at Pinal County monitors on August 14 and 15, 2012. PM_{10} concentrations sharply increased between 2000 and 2300 LST on August 14, 2012, coinciding with the arrival of windblown dust.

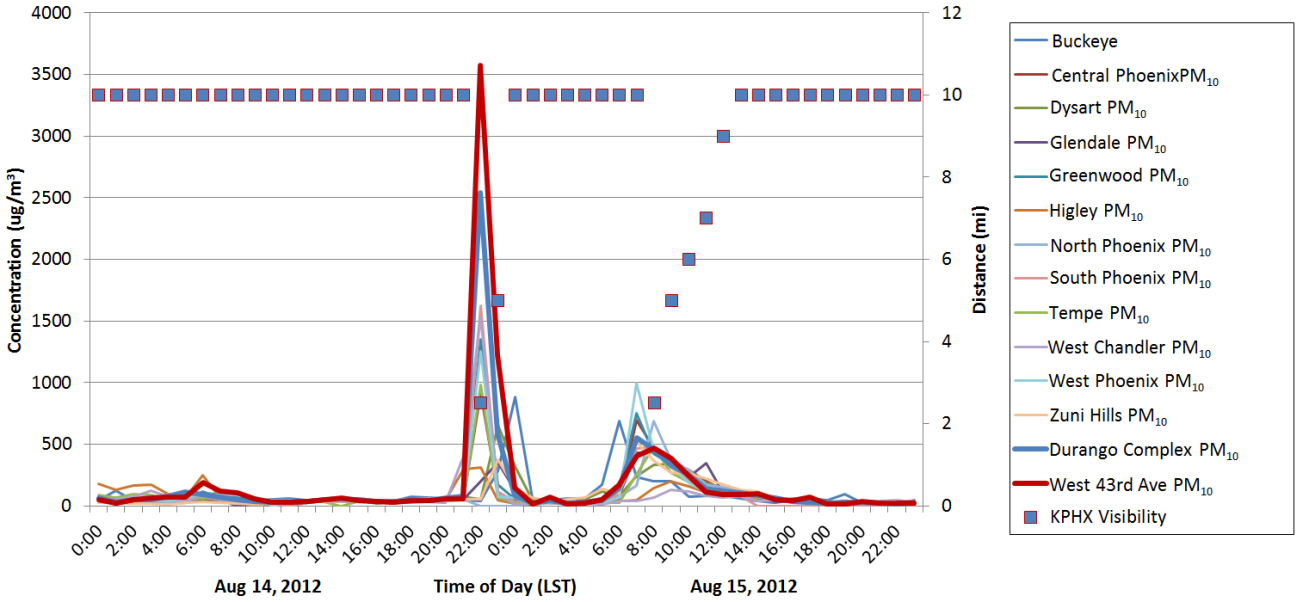

Figure 3-3. Hourly PM_{10} concentrations at Maricopa County monitors and visibility at KPHX. Visibility was greatly reduced at 2200 and 2300 LST on August 14, 2012, coinciding with the sharp increase in PM_{10} concentrations at Phoenix area monitors, indicating the arrival of windblown dust.

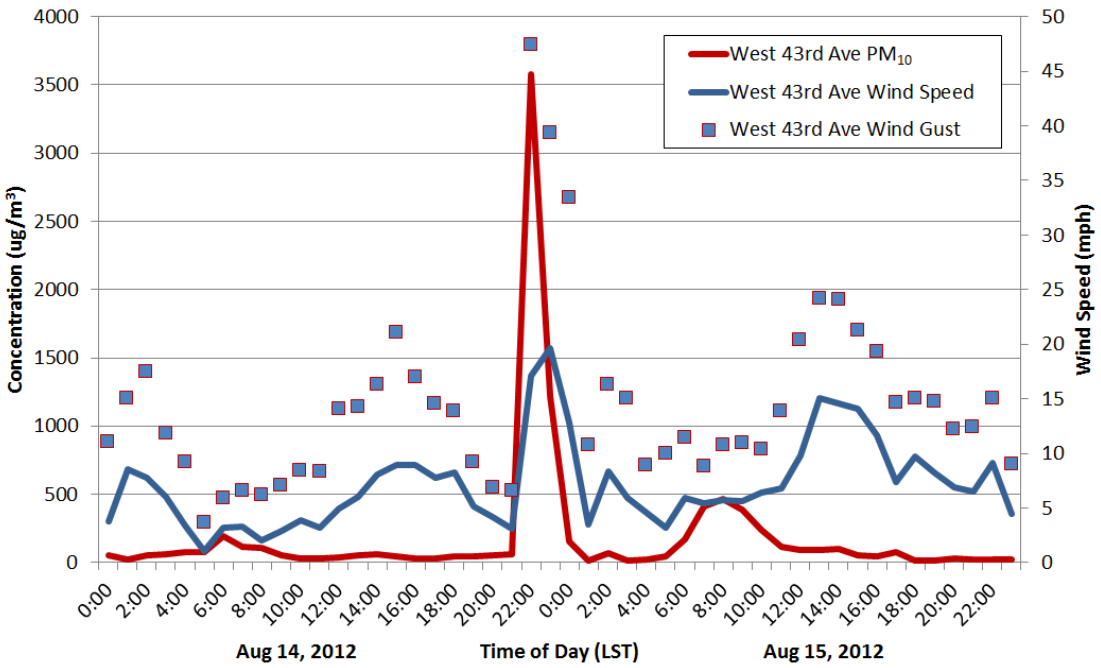

Figure 3-4. Hourly PM_{10} concentrations and wind speeds at the West 43rd Avenue monitor on August 14 and 15, 2012. PM_{10} concentrations and wind speeds sharply increased at 2200 LST on August 14, 2012, indicating the arrival of windblown dust.

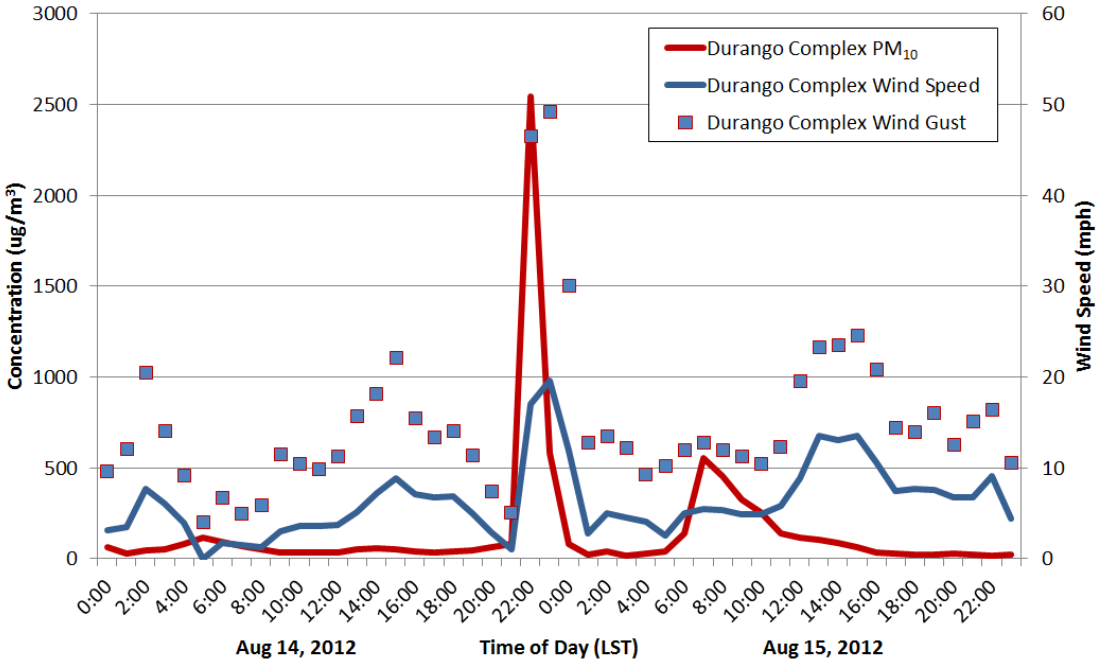

Figure 3-5. Hourly PM_{10} concentrations and wind speeds at the Durango Complex monitor on August 14 and 15, 2012. PM_{10} concentrations and wind speeds sharply increased at 2200 LST on August 14, 2012, indicating the arrival of windblown dust. Sustained winds of nearly 20 mph, with gusts over 45 mph, were measured.

Figure 3-6. Image from an ADEQ visibility camera near downtown Phoenix facing northeast toward Camelback Mountain. Windblown dust associated with thunderstorm outflow caused reduced visibilities throughout the Phoenix area.

The progression of the thunderstorm outflow and windblown dust through the Phoenix area is summarized by the radar velocity and wind vector spatial plots shown in **Figures 3-7 through 3-10**.

2030-2100 LST (Figure 3-7)

Doppler radar indicated an outflow boundary over Pinal County moving northwest toward the Phoenix area. Hourly PM_{10} concentrations at monitors in Pinal County near the outflow boundary had increased to over 500 $\mu g/m^3$. Conditions across Maricopa County and far northwestern Pinal County prior to the arrival of the dust-laden outflow were generally characterized by low PM_{10} concentrations, low wind speeds, and high visibilities.

2130-2200 LST (Figure 3-8)

Between 2130 and 2200 LST, the outflow boundary continued northwestward and passed through western Pinal County into the southernmost part of Maricopa County, where 5-minute PM_{10} concentrations exceeded 1000 $\mu g/m^3$ at some monitors, south to southeasterly winds gusted to over 30 mph, and visibilities dropped to below 1 mile at some monitors. Monitors not yet affected by the outflow across most of Maricopa County continued to report low PM_{10} concentrations, low wind speeds, and high visibilities.

2230-2300 LST (Figure 3-9)

Doppler radar indicated that the outflow boundary became better defined as it progressed into Maricopa County, with a large area of strong south-to-southeasterly winds (bright orange/red areas) over much of the central and eastern portions of the county. 5-minute PM_{10} concentrations increased to over 2500 $\mu g/m^3$ at several monitors in Maricopa County and over 5000 $\mu g/m^3$ at the Durango Complex and West 43rd Avenue monitors, with widespread gusty winds and reduced visibilities. Although only two monitors in Maricopa County (Durango Complex and West 43rd Avenue) recorded PM_{10} concentrations in exceedance of the NAAQS, it is apparent that nearly all monitors showed elevated PM_{10} concentrations as the outflow boundary moved through, illustrating that the outflow affected most of the metropolitan area.

The Durango Complex and West 43rd Avenue monitors showed the highest PM_{10} concentrations, most likely because of locally stronger winds of over 40 mph in the vicinity of the monitors. Winds were also gusty across much of central and eastern Maricopa County, but they were not quite as strong as the winds observed near the Durango Complex and West 43rd Avenue monitors. Doppler radar also indicated a corridor of enhanced south-southeasterly flow aimed directly at the Durango Complex and West 43rd Avenue monitors. The locally strong winds in the vicinity of the two exceedance monitors likely overwhelmed all dust control measures in place near those monitors. Wind directions near the two exceedance monitors were from the southeast, consistent with the movement of the outflow boundary. The two exceedance monitors were on the southern side of the Phoenix urban area, closer to the source region of the thunderstorm outflow and windblown dust, and thus they were subject to greater quantities of transported PM_{10} than were other monitors in the nonattainment area.

2330-0000 LST (Figure 3-10)

As the outflow boundary continued northwestward, gusty winds continued across much of Maricopa County, but PM_{10} concentrations started to decrease at most monitors, including the two exceedance monitors. PM_{10} concentrations increased again to over 2500 $\mu g/m^3$ at two Pinal County monitors because of another thunderstorm outflow affecting that area, as indicated by the strong outbound radar velocities over western Pinal County and strong surface winds.

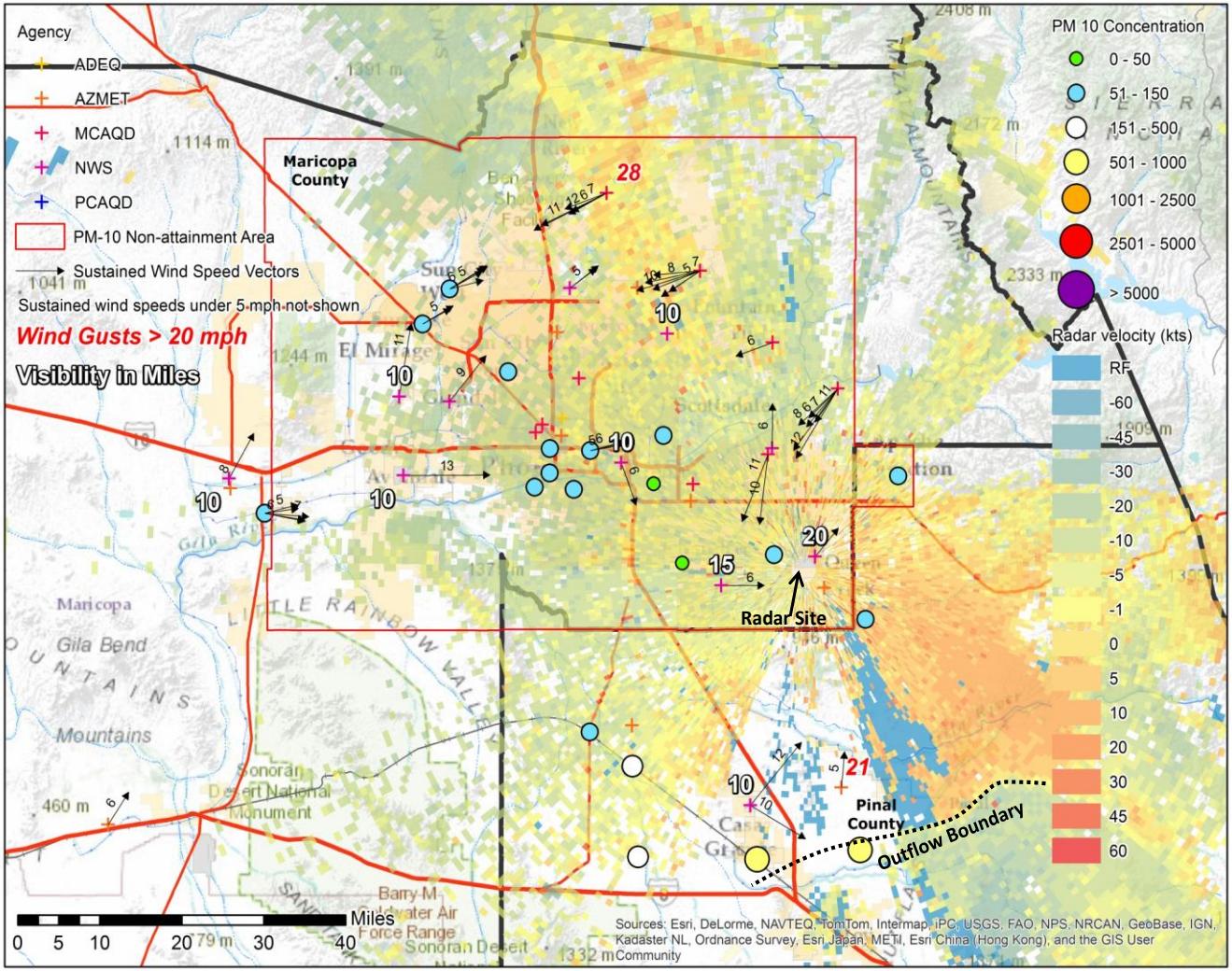

Figure 3-7. Maximum 5-minute PM_{10} concentrations (colored circles), 5-minute wind speed and direction, maximum wind gusts, and minimum visibility observations at Maricopa and Pinal County monitors between 2030 and 2100 LST on August 14, 2012. Where 5-minute data are not available (e.g., PM_{10} concentrations in Pinal County), 1-hour data are used. Underlying are Doppler radar velocity data at 2032 LST, where greens indicate motion toward the radar and oranges/reds indicate motion away from the radar.

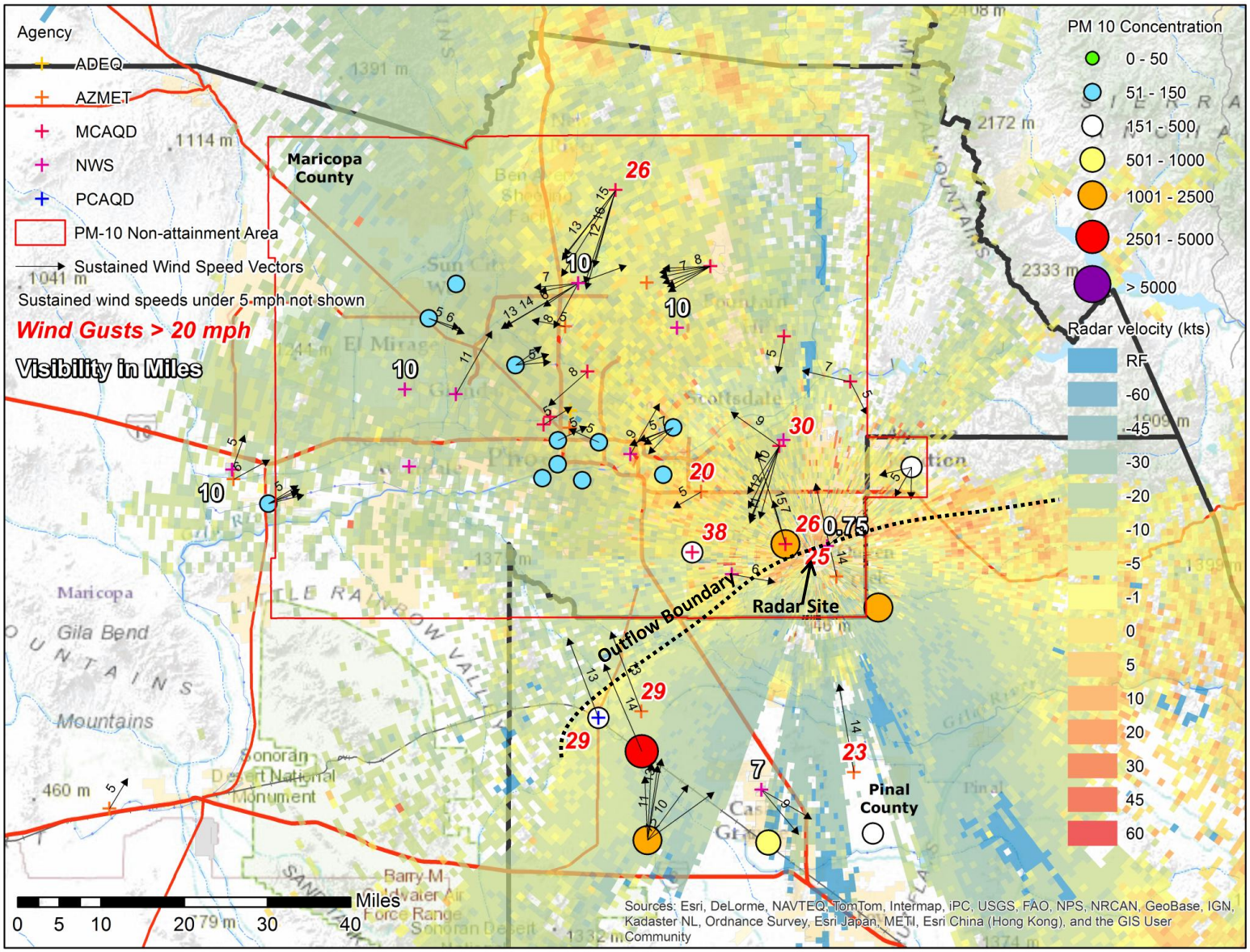
Agency
ADEQ
AZMET
MCAQD
NWS
PCAQD
PM-10 Non-attainment Area
Sustained Wind Speed Vectors
Sustained wind speeds under 5 mph not shown
Wind Gusts > 20 mph
Visibility in Miles
Maricopa County
Pinal County
Radar Site
Outflow Boundary
PM 10 Concentration
0 - 50
51 - 150
151 - 500
501 - 1000
1001 - 2500
2501 - 5000
> 5000
Radar velocity (kts)
RF
-60
-45
-30
-20
-10
-5
-1
0
5
10
20
30
45
60
Miles
0 5 10 20 30 40
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, iPC, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community

Figure 3-8. Similar to Figure 3-7, but representing observations from 2130 to 2200 LST. Doppler radar data are from 2133 LST.

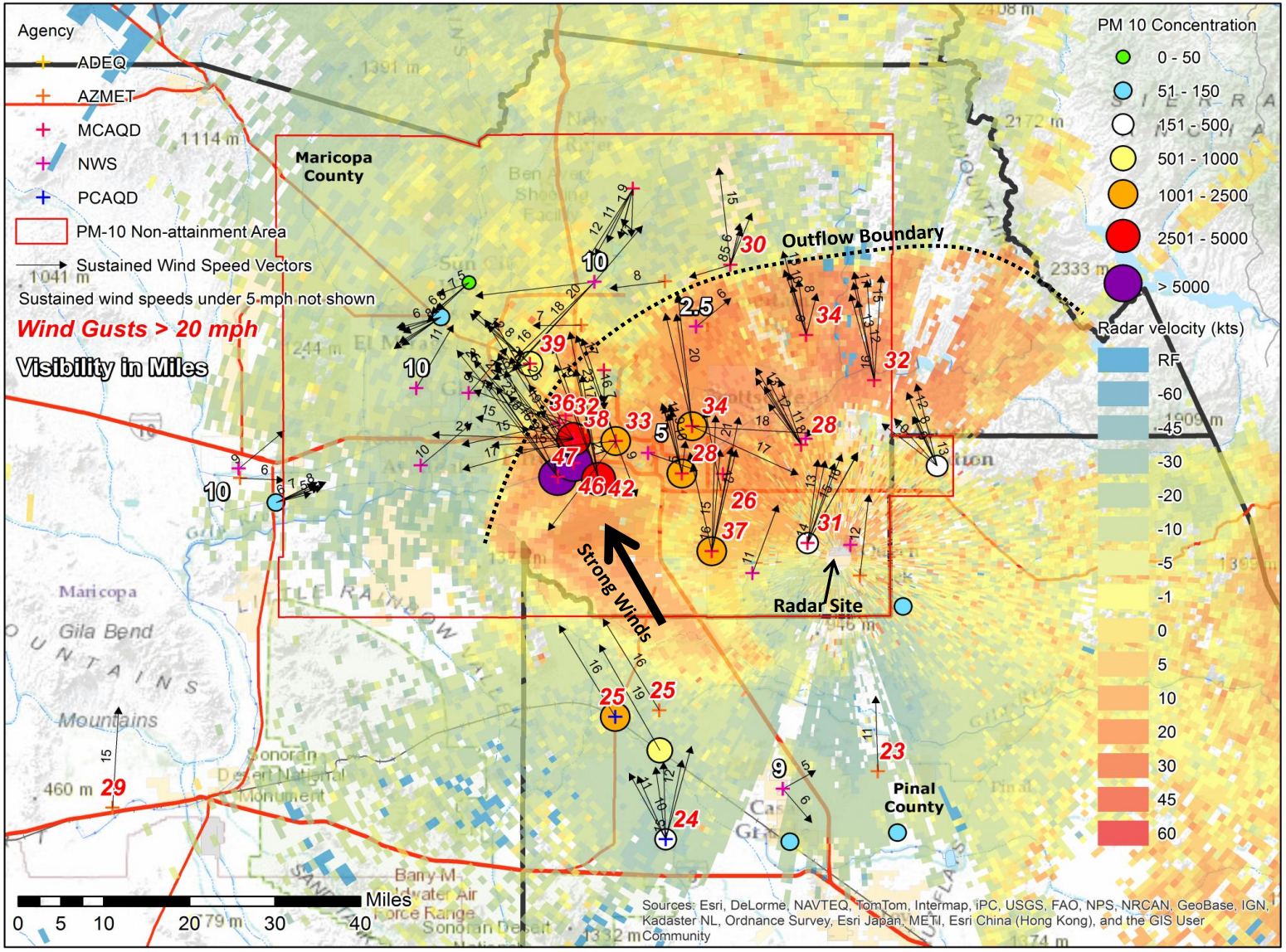

Figure 3-9. Similar to Figure 3-7, but representing observations from 2230 to 2300 LST. Doppler radar data are from 2234 LST.

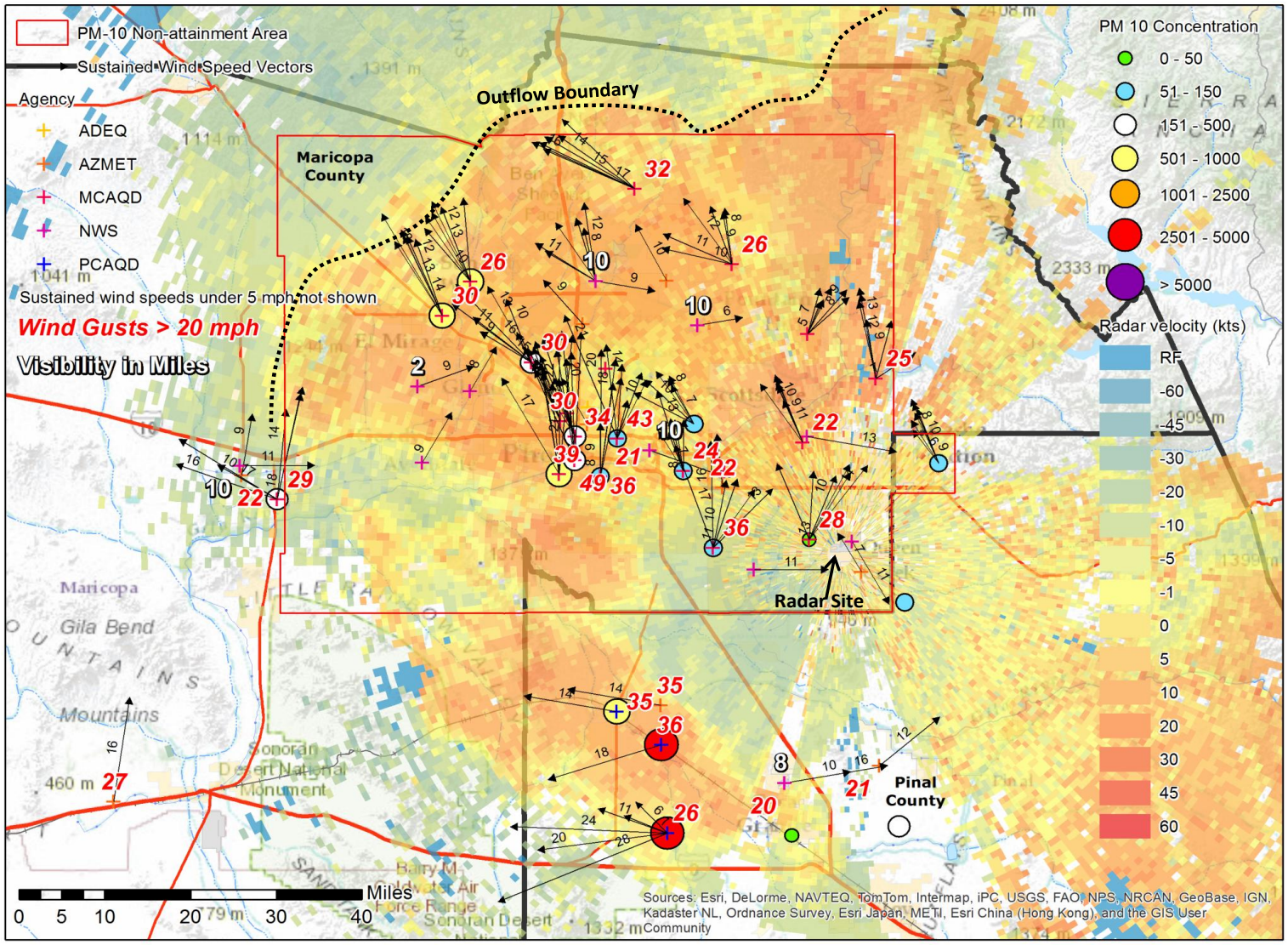

Figure 3-10. Similar to Figure 3-7, but representing observations from 2330 to 0000 LST. Doppler radar data are from 2330 LST.

3.2 Summary

The information presented in this section demonstrates a clear causal relationship between the windblown dust and the PM_{10} exceedances measured in the Phoenix PM_{10} nonattainment area on August 14, 2012. The wind, visibility, PM_{10}, and radar data shown in this section illustrate the spatial and temporal extent of the dust storm as it moved through Maricopa County. In addition, meteorological data tables found in Appendix A show that the sharp increase in PM_{10} concentrations coincided with the gusty winds, low visibilities, and airport reports of blowing dust. The fact that PM_{10} concentrations in Pinal County spiked before PM_{10} concentrations increased in Maricopa County shows that a vast majority of the dust that impacted the nonattainment area monitors originated outside of Maricopa County and was transported into the Phoenix PM_{10} nonattainment area. The proximity of the exceedance monitors to the open and desert areas of far southern Maricopa County and western Pinal County, combined with strong wind gusts over 40 mph that likely overwhelmed all available control measures, provides solid evidence showing why these two monitors within the Maricopa County nonattainment area recorded an exceedance.

4. Historical Norm

4.1 Analysis

PM_{10} concentrations measured at Phoenix-area monitors on August 14, 2012, were unusual and in excess of normal historical fluctuations. To establish the severity of this event, PM_{10} concentrations measured on August 14, 2012, were compared to a historical 2007-2012 six-year annual data set at each monitor (**Figure 4-1, 4-2,** and Appendix C). The PM_{10} concentrations measured at the West 43rd monitor (Figure 4-1) on August 14, 2012, resulted in one of the highest 24-hr averages measured over the five-year period, as well as one of the highest daily maximum hourly averages measured over the same period. Similar time-series plots for the other monitors with exceedances of the 24-hr PM_{10} standard are shown in Appendix C.

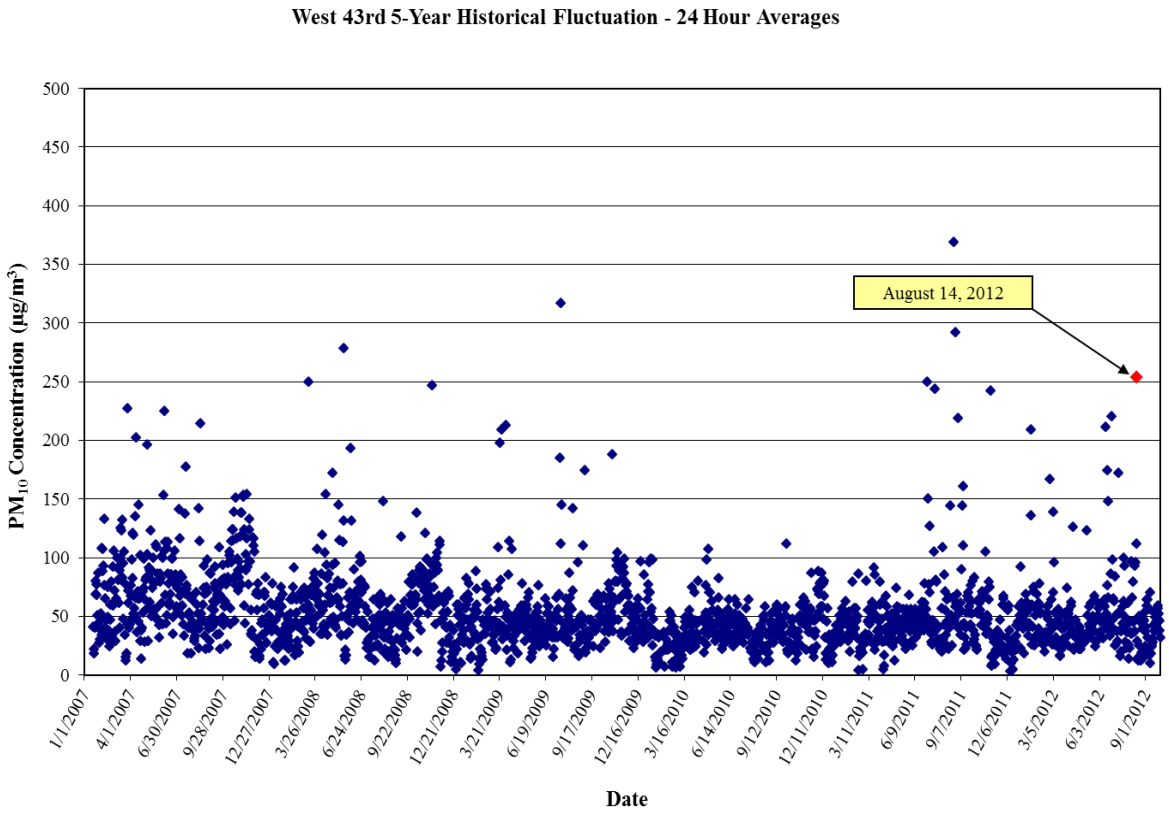

Figure 4-1. 24-hr average PM_{10} concentrations at the West 43rd monitor (2007–2012). The 24-hr average PM_{10} concentration on August 14, 2012, is highlighted in red.

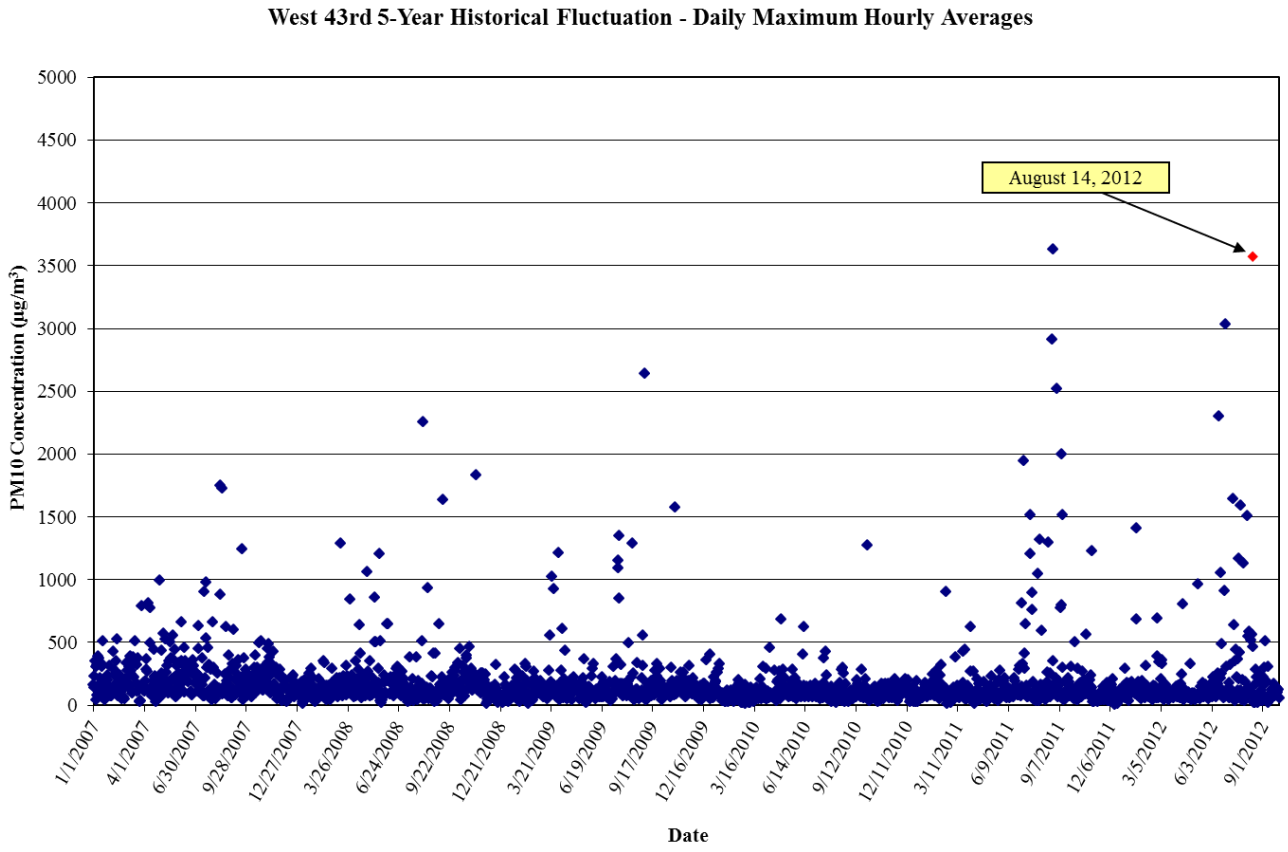

Figure 4-2. Daily maximum hourly average PM_{10} concentrations at the West 43rd monitor (2007-2012). The daily maximum hourly average PM_{10} concentration on August 14, 2012, is highlighted in red.

4.2 Summary

Given the recorded values and using a methodology similar to the one accepted by the EPA, it is clear that the PM_{10} levels on August 14, 2012, were outside normal historical fluctuations. This analysis provides evidence that the event affected air quality on a historic scale.

5. Not Reasonably Controllable or Preventable

5.1 Background

ADEQ and MCAQD are responsible for implementing regulatory measures to control emissions from agricultural sources, stationary sources, fugitive dust sources, and open burning within Maricopa County. Three major programs provide or contribute to air pollution control measures for the Greater Phoenix area. These programs include

1. ADEQ's Agricultural Best Management Program (Ag BMP)
2. Maricopa County's Inspection and Compliance Program
3. ADEQ's Air Quality Forecasting Program

Specifically, ADEQ is responsible for compliance assistance and enforcement of Agricultural Best Management Practices developed by the Governor's Agricultural Best Management Practices Committee, while MCAQD is responsible for compliance assurance for all other significant sources of PM_{10} emissions. In addition to routine inspections and inspections driven by complaints, inspections are often increased when (1) ADEQ forecasters issue a Maricopa County Dust Control Forecast of "High Risk", (2) ADEQ forecasters issue a High Pollution Advisory, or (3) near-real-time monitoring data indicate unique activity via high PM concentrations. The forecasting program and inspection/compliance programs work together so that resources can be best utilized during days of greatest risk for elevated PM emissions.

On July 25, 2002, EPA took initial action to finalize approval of the Best Available Control Measure (BACM) and the Most Stringent Measure (MSM) demonstrations in the Serious Area PM_{10} plan for the Maricopa County portion of the metropolitan Phoenix PM_{10} nonattainment area (67 FR 48718). These BACM and MSM demonstrations were again approved by EPA on July 14, 2006 (71 FR 43979). The Agricultural Best Management Practices General Permit rule and related definitions have been adopted into the Arizona Administrative Code as R18-2-610 and R18-2-611, pursuant to Arizona Revised Statutes §49-457[2].

5.1.1 Control Measures

Maricopa County regulations of PM_{10} emissions are listed in **Table 5-1**.

[2] Updates to the AgBMP program in December, 2011, clarified BMPs for crops and added BMPs for animal operations. Effective 12/29/2011, R18-2-611 was renumbered to R18-2-610.01 **Agricultural PM10 General Permit for Crop Operations** and R18-2-611.01 **Animal Operations PM10 General Permit** was added. Definitions for Crop Operations were revised at R18-2-610 and new definitions for Animal Operations were added at R18-2-611.

Table 5-1. Rules and ordinances regulating PM emissions in Maricopa County.

Rule/Ordinance Number & Title	Description
Rule 300: Visible emissions	Establishes standards for visible emissions and opacity.
Rule 310: Fugitive dust from dust-generating operations	Establishes limits for the emissions of particulate matter into the ambient air from any property, operations, or activity that may serve as a fugitive dust source.
Rule 310.01: Fugitive dust from non-traditional sources of fugitive dust	Establishes limits for the emissions of particulate matter into the ambient air from open areas, vacant lots, unpaved parking lots, and unpaved roadways which are not regulated by Rule 310 and which are not required to have either a permit or a dust control plan.
Rule 311: Particulate matter from process industries	Establishes emission rates based on process weight applicable to any affected operations not subject to Rule 316.
Rule 312: Abrasive blasting	Establishes limits for particulate emissions from abrasive blasting operations.
Rule 314: Open outdoor fires and indoor fireplaces at commercial and institutional establishments	Establishes limits for the emissions of air contaminants produced from open burning.
Rule 316: Nonmetallic mineral processing	Establishes limits for the emissions of particulate matter into the ambient air from any nonmetallic mining operation or rock product processing plant.
Rule 317: Hospital/medical/infectious waste incinerators	Establishes limits for the emissions of air pollutants from medical waste incinerators.
Rule 322: Power plant operations	Establishes limits for the emissions of nitrogen oxides, sulfur oxides, carbon monoxide, and particulate matter from existing power plants and cogeneration plants.
Rule 323: Fuel burning equipment from industrial/commercial/ institutional (ICI) sources	Establishes limits for the emissions of nitrogen oxides, sulfur oxides, carbon monoxide and particulate matter from ICI sources.
Rule 324: Stationary internal combustion (IC) engines	Establishes limits for the emissions of carbon monoxide, nitrogen oxides, sulfur oxides, volatile organic compounds, and particulate matter from stationary internal combustion engines, including stationary IC engines used in cogeneration.
Rule 325: Brick and structural clay products (BSCP) manufacturing	Establishes limits for particulate matter emissions from the use of tunnel kilns for curing in the BSCP manufacturing processes.
Ordinance P-25: Leaf blower restriction	Establishes restrictions for leaf blowers in incorporated and unincorporated sections of Area A in Maricopa County.
Ordinance P-26: Residential wood burning restriction	Establishes restrictions for residential wood burning.
Ordinance P-27: Vehicle parking and use on unstabilized vacant lots	Establishes restrictions for vehicle parking and use on unstabilized vacant lots in unincorporated sections of Area A in Maricopa County.
Ordinance P-28: Off-road vehicle use in unincorporated areas of Maricopa County	Establishes restrictions for operating vehicles on unpaved property in unincorporated areas of Maricopa County.

Rule/Ordinance Number & Title	Description
Arizona Administrative Code R18-2-611 & 610: Agricultural PM_{10} general permit	Establishes a requirement for commercial farmers to implement best management practices and maintain a record demonstrating compliance.

5.1.2 Additional Measures

In addition to the rules and regulations listed in **Table 5-1**, other PM_{10}-reducing control measures (e.g., paving unpaved roads, PM_{10}-certified street sweepers, controlling unpaved parking lots, etc.) have been committed to and implemented by local jurisdictions throughout the PM_{10} nonattainment area and incorporated into the Arizona state implementation plan (SIP) through PM_{10} plans such as the Revised Maricopa Association of Governments' (MAG) 1999 Serious Area Particulate Plan for PM_{10} for the Maricopa County Nonattainment Area. The Pinal County Air Quality Control District (PCAQCD) also implements regulatory control measures on emissions from existing and new non-point sources within Pinal County (see **Table 5-2**). Additionally, the PCAQCD implements specific nonattainment rules for that part of the Phoenix PM_{10} nonattainment area that resides in Pinal County (see **Table 5-3**).

Table 5-2. Pinal County rules regulating existing and new non-point sources in Pinal County.

Article Number & Title	Description
Article 2: Fugitive dust	Provides a mechanism to reasonably regulate operations which periodically may cause fugitive dust emissions into the atmosphere.
Article 3: Construction sites – fugitive dust	Improves the control of excessive fugitive dust emissions that have been traditionally associated with construction, earthwork, and land development, and thereby minimize nuisance impacts.

Table 5-3. Pinal County rules regulating fugitive dust in Pinal County portion of the Phoenix PM_{10} Nonattainment Area.

Article Number & Title	Description
Article 4: Nonattainment area rules; dustproofing for commercial parking, drives, and yards	Establishes rules to avoid violations of the prevailing PM_{10} standard and additionally minimize nuisance impacts by improving control of excessive fugitive dust emissions from unpaved parking lots.
Article 5: Nonattainment area rules; stabilization for residential parking and drives	Establishes rules for stabilizing residential properties.
Article 6: Restrictions on vehicle parking and use on vacant lots	Establishes rules for unpaved or unstable vacant lots.
Article 7: Construction sites in nonattainment areas – fugitive dust	Establishes rules to avoid violations of the prevailing PM_{10} standard and additionally minimize nuisance impacts by improving control of excessive fugitive dust emissions from activities associated with construction, earthwork, or land development.

Article Number & Title	Description
Article 8: Nonattainment area rules, requirement for stabilization of disturbed areas at vacant lots	Establishes rules for stabilizing disturbed areas at vacant lots.

5.1.3 PM_{10} Rule Effectiveness

MCAQD analyzed the effectiveness of its fugitive dust rules (Rules 310, 310.01 and 316) in terms of permit compliance rates. This rule effectiveness (RE) study was designed to assess how many sources regulated by MCAQD during the subject time period received no PM_{10} emissions-related violations. As a basis for comparison, the percentage of permitted sources in compliance during calendar year 2007 was 76% for sources subject to Rule 310, 85% for Rule 310.01 sources, and 40% for Rule 316 sources. In early 2008, Rules 310, 310.01, and 316 were strengthened, and new ordinances (covering additional source categories such as leaf blowers, vacant lots, and off-road vehicles) were adopted. These enhancements resulted from MCAQD's obligations under such agreements as the 2005 Revised PM_{10} State Implementation Plan for the Salt River Area and the Maricopa Association of Governments 2007 Five Percent Plan for PM_{10} for the Maricopa County Nonattainment Area to reduce PM_{10} emissions throughout the county. Three major areas that contributed to increased compliance were an increase in departmental staffing (especially inspectors), a robust training program, and regulatory changes that broadened and strengthened control measures under Rules 310, 310.01, and 316.

Source compliance rates were re-assessed for FY 2009 (July 2008–June 2009), a period that allowed time for the new and revised regulations to take effect. The results showed significant increases in compliance compared with the earlier period: to 90% (from 76%) for Rule 310 sources, 95% compliance (from 85%) for Rule 310.01 sources, and 65% (from 40%) for Rule 316 sources. These improvements continued into calendar year 2010 with compliance rates of 94% for Rule 310 sources, 96% for Rule 310.01 sources, and 73% for Rule 316 sources. The timeline below (**Figure 5-1**) illustrates the improvements in RE over the last several years; it also points out significant revisions to previous rules, as well as newly adopted rules and ordinances.

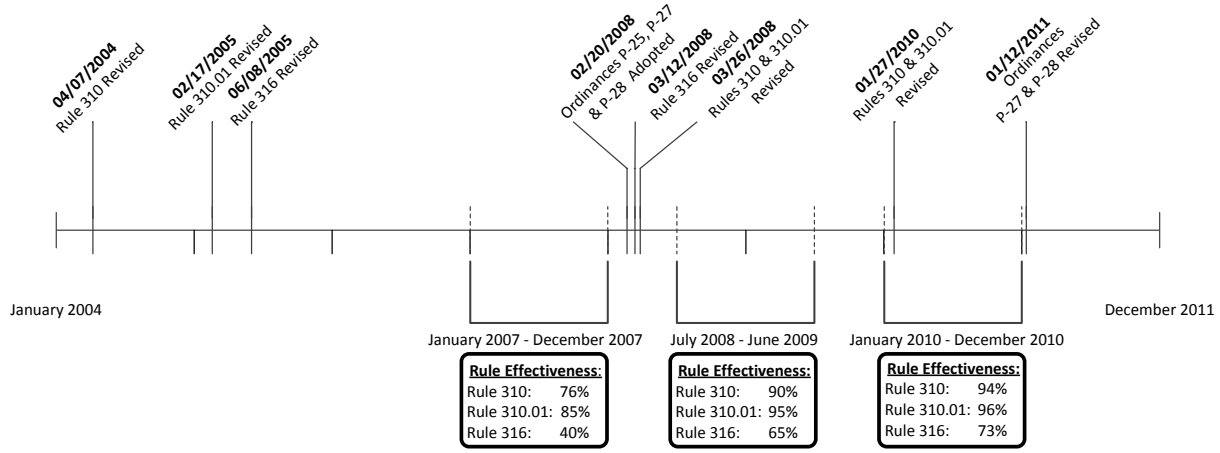

Figure 5-1. Timeline of Maricopa County fugitive dust rules and ordinances.

5.1.4 Compliance and Enforcement Activities

MCAQD is prepared to proactively respond to high wind events and protect human health and well-being. MCAQD 's approach consists of two primary components: proactive inspections conducted routinely, as well as surveillance inspections conducted during and after significant air quality events. MCAQD routinely inspects dust control-permitted sites and increases the frequency of inspections for permits covering areas of 10 acres or more. Rule 316 sources are also regularly inspected multiple times every year. Maricopa County responds to the majority of complaints within 24 hours.

Maricopa County monitors the ADEQ Five-Day Dust Control Forecast to identify the potential for elevated PM_{10} pollution levels due to high winds or stagnant conditions. When a High Pollution Advisory (HPA) is issued for Maricopa County, MCAQD conducts increased surveillance before, during, and after the forecast event(s). MCAQD also conducts event surveillance and post-event activities during exceedance days that had not been forecast (i.e., those instances in which an HPA had not been issued).

Pre-event surveillance consists of surveying high-risk areas for any dust-generating activities, educating sources of the impending HPA event, and issuing violations for failure to comply with local, state, or federal regulations. During the event, MCAQD inspectors survey high-risk areas to confirm that control measures are in place, document any violations, and contact other regulatory agencies if necessary. Post-event activities include continued surveys of high-risk areas, re-inspecting sources that had incurred violations within two business days, and an internal MCAQD debriefing of event activities.

During 2011 and 2012, a total of 17 MCAQD air monitoring sites were upgraded with new equipment that allows the monitoring sites to automatically report measured readings at 5-minute intervals. Previously, only hourly readings were available. The real-time data reporting system includes a mechanism to alert MCAQD field staff when PM concentrations are

elevated. The system allows MCAQD responders to review concentrations at the monitors and to consult the National Weather Service website to check for weather event activity. This capability allows the MCAQD responder to identify regional events and monitor specific issues. If necessary, the MCAQD responders can inform nearby stakeholders and local governments of the elevated PM_{10} concentrations.

5.1.5 Review of Source-Permitted Inspections and Public Complaints

ADEQ's Arizona Unified Repository for Information Tracking of the Environment (AZURITE) database and Maricopa County's Environmental Management System were queried to compile a list of inspections for the permitted sources in the Maricopa area around the time of the August 14, 2012, PM_{10} exceedances. An evaluation of all inspection reports, air quality complaints, compliance reports, and other documentation did not indicate any evidence of unusual anthropogenic-based PM_{10} emissions. During the period of August 11-17, 2012, MCAQD inspectors conducted a total of 230 inspections of permitted facilities, of which 148 were at fugitive dust sources. Additionally, MCAQD conducted 41 inspections on vacant lots and unpaved parking lots. During this seven-day period, a total of 30 violations were issued countywide for PM_{10} and non-PM_{10} related violations. No violations were issued for PM_{10} emissions within a four-mile radius of an exceedance monitor.

MCAQD was prepared for any complaints received due to the high wind event. During the seven-day period from August 11-17, 2012, MCAQD received 25 complaints, of which 14 were related to windblown dust. Each complaint was assigned to, and investigated by, a MCAQD inspector. A review of all pertinent records from this period indicates that MCAQD inspectors did not observe any PM_{10} emission violations of local, state, or federal regulations within a four-mile radius of an exceedance monitor.

In addition to MCAQD's efforts in pre-event surveillance and proactive inspections, ADEQ's Ag BMP inspector also monitors the ADEQ Five-Day Dust Control Forecast and the MCAQD air monitoring sites that include real-time data. The ADEQ Ag BMP inspector uses specific knowledge of seasonal activities and associations with the local growers and dairymen to communicate the importance of limiting dust-generating activities, especially during high wind events. Additional outreach is conducted with facility representatives prior to forecast high wind alert days. Should the PM_{10} readings at a MCAQD air monitoring site show a notable increase, the ADEQ Ag BMP inspector is dispatched to contact the owners and operators of agricultural fields in the area to discern whether their activities are causing negative impacts. The Ag BMP inspector is prepared to respond to most agriculture complaints within 24 hours.

Based on a review of the inspection reports and site visit documentation, there is no evidence to suggest that agricultural activities produced unusual PM_{10} emissions on August 14, 2012. The ADEQ Ag BMP inspector did not receive any complaints in the two days prior to the event.

5.2 Forecasts and Warnings

Dust forecasts and statements were released prior to the event by both ADEQ and the NWS office in Phoenix (Appendix D). On August 13, 2012, ADEQ issued a Maricopa County

Dust Control Forecast for August 14, 2012, indicating a moderate risk level for unhealthy PM_{10}. The Dust Control Forecast also indicated a potential for westerly winds of 10-20 mph with higher gusts and strong winds possible during the afternoon due to outflow from thunderstorms.

At 2141 LST on August 14, 2012, the NWS office in Phoenix issued Blowing Dust Advisories for portions of Pinal and Maricopa counties during the period of gusty outflow winds and high PM_{10} concentrations in the Phoenix area. These advisories warned residents of the potential for gusty winds to 40 mph and visibilities reduced below one mile due to blowing dust.

5.3 Wind Observations

Wind data during the event (Figure 3-2, Figure 3-3, and Appendix A) showed sustained wind speeds of over 20 mph and wind gusts of over 40 mph coincident with the high PM_{10} concentrations. While gusty winds were reported throughout the region, they were particularly strong in the vicinity of the Durango Complex and West 43rd Avenue monitors; these strong winds likely overwhelmed all available control measures.

5.4 Summary

The thunderstorm outflow event of August 14, 2012, produced strong winds that transported dust and PM_{10} into the Phoenix PM_{10} nonattainment area. The source region of the outflows that caused the exceedances was largely located in areas outside the Phoenix PM_{10} nonattainment area, primarily the deserts south of Maricopa County. The Phoenix area is designated as a serious nonattainment area for PM_{10} and is required to have BACM for all significant sources of PM_{10}. BACM on significant anthropogenic sources were in place and enforced during the events, and proactive tracking and response to the events by regulatory agencies and local governments confirmed the uncontrollable nature of the dust emissions; therefore, these pre-existing prior-approved required controls are adequate for meeting the requirements of an exceptional event and should be considered “reasonable” for these purposes.

Despite the deployment of comprehensive control measures and sophisticated response programs, high wind conditions associated with the thunderstorm outflow transported high concentrations of PM_{10} into, and also overwhelmed controls within, the Phoenix PM_{10} nonattainment area. Widespread sustained winds in excess of 20 mph with gusts over 40 mph were strong enough to overwhelm available efforts to limit PM_{10} concentrations during the event. The fact that these were natural events involving strong winds that transported PM_{10} emissions into and across Maricopa County, with a majority of the PM_{10} emissions recorded by Maricopa County area monitors coming from sources outside of the Phoenix PM_{10} nonattainment area, provides strong evidence that the exceedances of August 14, 2012, recorded within the Phoenix PM_{10} nonattainment area were not reasonably controllable or preventable.

6. But-For Analysis

6.1 Discussion

Section 50.14(c)(3)(iv)(D) in 40 CFR Part 50 requires that an exceptional event demonstration satisfy the condition that "[t]here would have been no exceedance or violation but for the event." The prior sections of this submittal have provided detailed information that, in regard to the PM_{10} exceedances at Phoenix area monitors on August 14, 2012,

- the exceedance was not reasonably controllable or preventable, and
- there was a clear causal relationship between PM_{10} transported strong winds originating in desert areas outside the Phoenix PM_{10} nonattainment area and the measured PM_{10} exceedances in the Phoenix PM_{10} nonattainment area.

The weight of evidence in these sections demonstrates that, but for the existence of dust emissions generated by strong winds and the associated transport of PM_{10}, there would have been no exceedance of the NAAQS for 24-hr average PM_{10}.

As shown in Section 3, maps and time-series plots of PM_{10} and wind speeds establish a clear causal relationship between windblown dust due to thunderstorm outflow and elevated PM_{10} concentrations at Phoenix-area monitors. Multiple independent measurements of wind speed, wind direction, and visibility point to the presence of gusty winds generated by thunderstorm outflow as the mechanism for transport of PM_{10} into the Phoenix nonattainment area. In addition, PM_{10} concentrations were well below the NAAQS on days immediately before and after the windblown dust event. The source region for the PM_{10} is clearly identified as desert areas south of the Phoenix PM_{10} nonattainment area. The weight of evidence presented in this submittal provides no alternative that could tie the exceedance of August 14, 2012, to any causal source except PM_{10} transported by strong winds, confirming that there would have been no exceedance but for the presence of this uncontrollable natural event.

As detailed in Section 5, all reasonable control measures were in place and/or implemented on a continual basis. Air quality-related inspection and compliance data revealed no violations or complaints in the vicinity of an exceedance monitor within three days before and after the time of the event. Local regulatory agencies, industry, and the general public were alerted to the possibility of dust storms due to strong winds via daily forecasts and media reports. Winds were particularly strong in the vicinity of the two exceedance monitors, which likely overwhelmed all available control measures.

6.2 Summary

The weight of evidence presented in this submittal provides no alternative that could tie the exceedance of August 14, 2012, to any causal source other than PM_{10} transported by gusty winds due to thunderstorm outflow, confirming that there would have been no exceedance but for the presence of this uncontrollable natural event.

7. Conclusions

The PM_{10} exceedances that occurred on August 14, 2012, satisfy the criteria of the EER, which states that in order to justify the exclusion of air quality monitoring data, evidence must be provided for the following elements:

- The event satisfies the criteria set forth in 40 CFR 50.1 (j) that
  a. the event affected air quality,
  b. the event was not reasonably controllable or preventable, and
  c. the event was caused by human activity unlikely to recur in a particular location or was a natural event;
- There is a clear causal relationship between the measurement(s) under consideration and the event;
- The event is associated with a measured concentration(s) in excess of normal historical fluctuations; and
- There would have been no exceedance or violation but for the event.

7.1 Affects Air Quality

As stated in the preamble to the EER, the event in question is considered to have affected air quality if it can be shown that there is a clear causal relationship between the monitored exceedances and the event, and that the event is associated with a measured concentration in excess of normal historical fluctuations. Given the information presented in Sections 2, 3, 4, and 5, we can reasonably conclude that the event in question affected air quality.

7.2 Not Reasonably Controllable or Preventable

Section 50.1(j) of 40 CFR Part 50 requires that an event must be “not reasonably controllable or preventable” in order to be defined as an exceptional event. This requirement is met by demonstrating that despite reasonable control measures in place within Maricopa County, high winds overwhelmed all reasonably available controls (Section 5). The PM_{10} exceedances discussed in this report were caused by naturally occurring gusty winds associated with thunderstorm outflow that transported dust into the Phoenix area from areas largely outside the Phoenix PM_{10} nonattainment area. These facts provide strong evidence that the PM_{10} exceedances on August 14, 2012, were not reasonably controllable or preventable.

7.3 Natural Event

As discussed above, the PM_{10} exceedances in the Phoenix area on August 14, 2012, were shown to be caused by transport of PM_{10} into the Phoenix area from gusty winds associated with thunderstorm outflow. The event therefore qualifies as a natural event.

7.4 Clear Causal Relationship

The following points demonstrate that the high PM_{10} concentrations were caused by windblown dust:

- Time-series graphs of PM_{10} concentrations show that the timing of high PM_{10} at Phoenix area monitors was consistent with gusty winds and low visibilities at Phoenix-area meteorological stations (Section 3).
- High PM_{10} concentrations and gusty winds were reported at several monitors throughout the Phoenix metropolitan area (Sections 3 and 5).
- PM_{10} concentrations were well below the NAAQS on days immediately before and after the windblown dust event (Section 3).
- Dry conditions preceding the event resulted in soils that were particularly susceptible to particulate suspension by high winds (Section 3).
- Wind directions, thunderstorm generated outflow boundary propagation, and concentration patterns showing elevated levels of PM_{10} in Pinal County prior to levels increasing in Maricopa County illustrate that a vast majority of the dust that impacted the nonattainment area monitors originated outside of Maricopa County and was transported to the nonattainment area. While winds were gusty throughout the region, winds were particularly strong (in excess of 40 mph) near the two exceedance monitors. Thus, the wind magnitudes and wind direction, combined with the proximity of the exceedance monitors to open and desert areas of northwestern Pinal County, provide solid evidence as to why only two monitors within the Maricopa County nonattainment area recorded an exceedance (Section 3).
- Visibility cameras clearly illustrate the arrival of dust and significant reductions in visibility in the Phoenix area coinciding with the sharp increases in PM_{10} concentrations.

7.5 Historical Norm

The 24-hr average PM_{10} values measured at Phoenix area monitors were historically unusual compared to a multi-year data set (Section 4).

7.6 But For

On the basis of the weight of evidence described above and in Section 6, the exceedances of the federal 24-hr PM_{10} standard on August 14, 2012, in the Phoenix PM_{10} nonattainment area would not have occurred but for the high winds and transport of dust from areas largely outside the Phoenix PM_{10} nonattainment area.

Appendix A:
Air Quality and Meteorological Data for Maricopa County

This section contains tables of meteorological data from NWS sites in the Phoenix area for August 14, 2012. Reduced visibilities, gusty winds, and blowing dust or dust storms were reported coincident with the arrival of thunderstorm outflow and high PM_{10} concentrations.

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 (08/2012)

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

Elevation: 1107 ft. above sea level
Latitude: 33.427
Longitude: -112.003

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
14	0051	11	FEW110 SCT160 BKN210	10.00		99	37.2	70	21.1	54	12.2	22	6	340		28.60			29.70	AA		29.77
14	0151	11	FEW110 SCT160 BKN210	10.00		98	36.7	69	20.5	52	11.1	21	7	330		28.61	1	009	29.70	AA		29.78
14	0204	11	FEW110CB SCT160 BKN210	10.00	TS	99	37.0	70	21.1	54	12.0	22	5	350		28.61			M	SP		29.78
14	0244	11	FEW110 SCT160 BKN210	10.00		97	36.0	70	20.8	54	12.0	24	13	080	18	28.60			M	SP		29.77
14	0251	11	FEW110 SCT160 BKN210	10.00		96	35.6	70	21.2	56	13.3	26	11	060		28.60			29.69	AA	T	29.77
14	0351	11	SCT160 BKN210	10.00		95	35.0	70	21.3	57	13.9	28	6	100		28.58	5	006	29.68	AA		29.75
14	0451	11	SCT160 BKN210	10.00		94	34.4	70	20.8	56	13.3	28	5	120		28.59			29.68	AA		29.76
14	0551	11	FEW160 BKN210	10.00		92	33.3	69	20.5	56	13.3	30	0	000		28.60			29.70	AA		29.77
14	0651	11	FEW160 SCT210 SCT250	10.00		94	34.4	69	20.3	54	12.2	26	0	000		28.61	3	015	29.71	AA		29.78
14	0751	11	SCT170 BKN210	10.00		96	35.6	69	20.7	54	12.2	24	0	000		28.63			29.73	AA		29.80
14	0851	11	FEW170 SCT210	10.00		98	36.7	70	21.2	55	12.8	24	3	090		28.64			29.74	AA		29.81
14	0951	11	FEW170 SCT210	10.00		101	38.3	71	21.7	55	12.8	22	5	060		28.64	8	001	29.74	AA		29.81
14	1051	11	FEW170 SCT210	10.00		103	39.4	71	21.8	54	12.2	20	3	080		28.63			29.73	AA		29.80
14	1151	11	FEW120 SCT170 SCT210	10.00		107	41.7	71	21.7	51	10.6	15	3	VR		28.61			29.70	AA		29.78
14	1251	11	FEW120 SCT170 SCT250	10.00		108	42.2	71	21.8	51	10.6	15	0	000		28.58	8	024	29.67	AA		29.75
14	1351	11	FEW120 SCT170 SCT250	10.00		109	42.8	71	21.8	50	10.0	14	7	340		28.56			29.65	AA		29.73
14	1451	11	FEW120 SCT170 SCT250	10.00		112	44.4	72	22.4	51	10.6	13	9	210		28.53			29.62	AA		29.70
14	1551	11	FEW120 SCT170 SCT250	10.00		110	43.3	72	22.1	51	10.6	14	8	290	18	28.50	6	025	29.59	AA		29.67
14	1651	11	FEW120 SCT170 SCT250	10.00		111	43.9	71	21.6	48	8.9	12	11	290	22	28.48			29.57	AA		29.65
14	1751	11	FEW120 SCT170 SCT250	10.00		110	43.3	70	21.3	47	8.3	12	9	290		28.45			29.55	AA		29.62
14	1851	11	FEW120 SCT170 SCT250	10.00		109	42.8	71	21.3	48	8.9	13	10	230		28.47	5	004	29.56	AA		29.64
14	1951	11	FEW120 SCT170 SCT250	10.00		107	41.7	70	21.0	48	8.9	14	8	240		28.47			29.57	AA		29.64
14	2051	11	FEW120 SCT170 SCT250	10.00		105	40.6	70	21.1	50	10.0	16	5	220		28.49			29.59	AA		29.66
14	2151	11	BKN130	10.00		104	40.0	70	21.2	51	10.6	17	3	VR		28.53			29.62	AA		29.70
14	2226	11	BKN130CB	2.50	TS BLDU	95	35.0	72	22.3	61	16.0	32	23	150	33	28.57			M	SP		29.74
14	2242	11	BKN130CB	5.00	TS BLDU	88	31.0	72	22.1	64	18.0	45	21	170	36	28.57	3	042	M	SP		29.74
14	2251	11	BKN130CB	10.00	TS	88	31.1	72	22.1	64	17.8	45	10	160	31	28.59			29.70	AA		29.76
14	2332	11	BKN130CB	10.00	-TSRA	84	29.0	74	23.5	70	21.0	63	15	170	23	28.59			M	SP		29.76
14	2351	11	BKN130CB	10.00	TS	84	28.9	73	22.8	68	20.0	59	16	210	31	28.61			29.72	AA	0.05	29.78

Figure A-1. Quality controlled local climatological data hourly observations table for Phoenix Sky Harbor International Airport, Phoenix, Arizona (08/14/2012). Note in the Weather Type column that BLDU (blowing dust) was reported around the time of the high PM_{10} concentrations. For a more detailed explanation of the weather codes shown in the table above, please see http://www.nws.noaa.gov/oso/oso1/oso12/document/guide.shtml. Data dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

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QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)
HOURLY OBSERVATIONS TABLE
PHOENIX DEER VALLEY ARPT (03184)
PHOENIX, AZ (08/2012)

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

Elevation: 1455 ft. above sea level
Latitude: 33.688
Longitude: -112.081
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
14	0053	12	CLR	10.00		95	35.0	69	20.4	54	12.2	25	9	010		28.25	1	010	29.72	AA		29.81
14	0153	12	CLR	10.00		94	34.4	68	20.0	53	11.7	25	5	030		28.26			29.72	AA		29.82
14	0253	12	CLR	10.00		95	35.0	68	19.7	51	10.6	22	10	040		28.23			29.70	AA		29.79
14	0353	12	CLR	10.00		95	35.0	68	19.9	52	11.1	23	9	090		28.21	5	011	29.68	AA		29.77
14	0453	12	CLR	10.00		95	35.0	68	19.7	51	10.6	22	0	000		28.23			29.69	AA		29.79
14	0553	12	CLR	10.00		92	33.3	67	19.2	51	10.6	25	0	000		28.24			29.70	AA		29.80
14	0653	12	CLR	10.00		91	32.8	67	19.3	52	11.1	26	3	010		28.25	3	013	29.71	AA		29.81
14	0753	12	CLR	10.00		93	33.9	68	19.9	53	11.7	26	0	000		28.27			29.73	AA		29.83
14	0853	12	CLR	10.00		96	35.6	69	20.4	53	11.7	23	0	000		28.28			29.74	AA		29.84
14	0953	12	CLR	10.00		99	37.2	69	20.6	52	11.1	21	5	160		28.27	8	000	29.74	AA		29.83
14	1053	12	CLR	10.00		102	38.9	70	21.1	52	11.1	19	3	200		28.27			29.73	AA		29.83
14	1153	12	CLR	10.00		105	40.6	70	21.3	51	10.6	16	7	250		28.24			29.71	AA		29.80
14	1253	12	CLR	10.00		106	41.1	70	21.2	50	10.0	15	6	230		28.22	8	023	29.68	AA		29.78
14	1353	12	CLR	10.00		107	41.7	71	21.6	51	10.6	15	6	VR		28.20			29.66	AA		29.76
14	1453	12	CLR	10.00		108	42.2	71	21.5	50	10.0	14	8	250		28.17			29.63	AA		29.73
14	1553	12	CLR	10.00		109	42.8	71	21.7	50	10.0	14	11	220		28.15	8	027	29.60	AA		29.70
14	1653	12	CLR	10.00		108	42.2	71	21.5	50	10.0	14	9	280	20	28.12			29.57	AA		29.67
14	1753	12	CLR	10.00		108	42.2	70	21.3	49	9.4	14	7	240		28.10			29.56	AA		29.65
14	1853	12	CLR	10.00		107	41.7	69	20.8	47	8.3	13	9	250		28.11	5	002	29.56	AA		29.66
14	1953	12	CLR	10.00		105	40.6	70	21.3	51	10.6	16	10	220		28.12			29.57	AA		29.67
14	2028	12	CLR	10.00		102	39.0	70	21.1	52	11.0	19	7	230		28.13			M	SP		29.68
14	2053	12	CLR	10.00		103	39.4	70	21.0	51	10.6	18	0	000		28.14			29.60	AA		29.69
14	2153	12	CLR	10.00		102	38.9	69	20.6	50	10.0	17	6	070		28.17			29.63	AA		29.73
14	2238	12	CLR	10.00	TS	99	37.0	69	20.6	52	11.0	21	18	030	25	28.18	1	024	M	SP		29.74
14	2253	12	CLR	10.00	TS	98	36.7	69	20.4	52	11.1	21	20	060	28	28.18			29.65	AA		29.74
14	2306	12	SCT043	3.00	VCTS -RA	93	34.0	71	21.4	59	15.0	32	26	130	33	28.20			M	SP		29.76
14	2308	12	SCT045	3.00	-RA	93	34.0	72	22.0	61	16.0	34	26	130	33	28.20			M	SP		29.76
14	2353	12	CLR	10.00		86	30.0	72	22.1	65	18.3	50	14	160	24	28.25			29.72	AA	T	29.81

Figure A-2. Quality controlled local climatological data hourly observations table for Phoenix Deer Valley Airport, Phoenix, Arizona (08/14/2012). Note that visibilities were reduced with gusty winds after 2200 LST, coincident with high PM_{10} concentrations in the Phoenix area. Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

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

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)
WILLIAMS GATEWAY AIRPORT (23104), PHOENIX, AZ (08/2012)

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

Elevation: 1382 ft. above sea level
Latitude: 33.3, Longitude: -111.666

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
14	0015	0	CLR	10.00		100	38.0	70	21.3	54	12.0	21	0	000		28.37			M	AA		29.83
14	0035	0	CLR	10.00		100	38.0	70	21.3	54	12.0	21	0	000		28.37			M	AA		29.83
14	0055	0	CLR	10.00		97	36.0	69	20.3	52	11.0	22	3	240		28.37			M	AA		29.83
14	0115	0	CLR	10.00		97	36.0	69	20.8	54	12.0	24	3	240		28.36			M	AA		29.82
14	0135	0	CLR	10.00		97	36.0	69	20.8	54	12.0	24	0	000		28.36			M	AA		29.82
14	0155	0	CLR	10.00		93	34.0	68	20.1	54	12.0	27	3	100		28.36			M	AA		29.82
14	0215	0	CLR	10.00		93	34.0	68	20.1	54	12.0	27	5	090		28.36			M	AA		29.82
14	0335	0	CLR	7.00		93	34.0	68	20.1	54	12.0	27	5	060		28.36			M	AA		29.82
14	0355	0	CLR	10.00		93	34.0	68	20.1	54	12.0	27	6	060		28.35			M	AA		29.81
14	0415	0	CLR	10.00		91	33.0	67	19.3	52	11.0	26	6	110		28.34			M	AA		29.80
14	0435	0	CLR	10.00		88	31.0	67	19.3	54	12.0	31	5	110		28.34			M	AA		29.80
14	0515	0	CLR	10.00		91	33.0	67	19.3	52	11.0	26	9	120		28.34			M	AA		29.80
14	0547	0	SCT120 BKN250	20.00		97	36.0	69	20.8	54	12.0	24	3	110		28.35			M	AA		29.81
14	0647	0	SCT120 BKN200	30.00		90	32.0	67	19.1	52	11.0	27	5	100		28.36			M	AA		29.82
14	0747	0	SCT120 BKN200	30.00		97	36.0	69	20.8	54	12.0	24	3	170		28.38			M	AA		29.84
14	0847	0	SCT120 BKN200	30.00		100	38.0	70	21.3	54	12.0	21	6	100		28.39			M	AA		29.85
14	0947	0	SCT150 BKN200	30.00		104	40.0	71	21.9	54	12.0	19	6	100		28.40			M	AA		29.86
14	1047	0	SCT150 BKN200	30.00		108	42.0	72	22.0	52	11.0	16	7	250		28.38			M	AA		29.84
14	1147	0	FEW150 SCT200	30.00		108	42.0	71	21.6	50	10.0	14	9	200		28.36			M	AA		29.82
14	1247	0	FEW120	30.00		109	43.0	72	22.1	52	11.0	15	11	270		28.34			M	AA		29.80
14	1347	0	FEW120	30.00		109	43.0	70	21.3	48	9.0	13	6	220		28.32			M	AA		29.78
14	1447	0	FEW120 FEW250	30.00		109	43.0	70	21.3	48	9.0	13	7	230		28.29			M	AA		29.75
14	1547	0	FEW120 FEW250	30.00		111	44.0	71	21.6	48	9.0	12	5	260		28.26			M	AA		29.72
14	1647	0	SCT120 SCT250	30.00		111	44.0	70	21.2	46	8.0	11	11	330		28.23			M	AA		29.69
14	1747	0	FEW120 SCT200	30.00		111	44.0	70	21.2	46	8.0	11	9	290		28.22			M	AA		29.68
14	1847	0	FEW120 BKN250	20.00		109	43.0	69	20.7	45	7.0	12	6	280		28.23			M	AA		29.69
14	1947	0	BKN	20.00		108	42.0	M	M	46	8.0	M	6	260		M			M	AA		29.69
14	1955	0	CLR	10.00		106	41.0	69	20.2	45	7.0	13	6	270		28.25			M	AA		29.70
14	2015	0	CLR	10.00		106	41.0	69	20.4	46	8.0	13	3	260		28.25			M	AA		29.70
14	2035	0	CLR	10.00		104	40.0	68	20.1	46	8.0	14	0	000		28.25			M	AA		29.71
14	2047	0	BKN	20.00		106	41.0	M	M	48	9.0	M	3	280		M			M	AA		29.71
14	2055	0	CLR	10.00		100	38.0	69	20.3	50	10.0	19	0	000		28.26			M	AA		29.72
14	2115	0	CLR	10.00		100	38.0	69	20.3	50	10.0	19	0	000		28.27			M	AA		29.73
14	2132	0	FEW002 BKN100	0.75	DS	102	39.0	71	21.5	54	12.0	20	23	150		28.31			M	AA		29.77
14	2135	0	CLR	4.00	HZ	100	38.0	72	22.0	57	14.0	24	24	150	33	28.31			M	AA		29.77
14	2155	0	SCT001 SCT070 SCT110	3.00	HZ	97	36.0	72	22.1	59	15.0	28	24	170	33	28.34			M	AA		29.80
14	2215	0	CLR	3.00	VCTSHZ	97	36.0	71	21.5	57	14.0	26	24	180	32	28.34			M	AA		29.80
14	2335	0	CLR	10.00		86	30.0	71	21.8	64	18.0	48	0s	000		28.40			M	AA		29.86

Figure A-3. Quality controlled local climatological data hourly observations table for Williams Gateway Airport, Phoenix, Arizona (08/14/2012). Note in the Weather Type column that DS (dust) and HZ (haze) with reduced visibilities and gusty winds were reported between 2132 and 2215 LST, coincident with high PM_{10} concentrations in the Phoenix area. Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

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

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final) HOURLY OBSERVATIONS TABLE LUKE AFB AIRPORT (23111), GLENDALE, AZ (08/2012)

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

Elevation: 1085 ft. above sea level
Latitude: 33.55, Longitude: -112.366

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
14	0034	0	SCT150	10.00		97	36.0	71	21.6	57	14.0	26	14	030		28.62			29.67	AA		29.77
14	0055	0	BKN140	10.00		98	36.8	70	21.2	55	12.8	24	16	010		28.62			29.67	AA		29.77
14	0103	0	FEW090CB BKN140	10.00	TS	99	37.0	70	21.1	54	12.0	22	13	360		28.61			M	AA	T	29.76
14	0119	0	FEW090CB BKN140	10.00	-TSRA	99	37.0	71	21.4	55	13.0	23	15	010	24	28.62			29.67	AA	T	29.77
14	0137	0	FEW007 SCT140 SCT180	10.00		97	36.0	70	20.8	54	12.0	24	20	350	28	28.61	8	001	29.66	AA	T	29.76
14	0155	0	CLR	10.00		97	36.3	70	20.8	54	12.3	24	14	030		28.61			29.66	AA		29.76
14	0255	0	CLR	10.00		96	35.7	70	20.9	55	12.6	25	10	040		28.61			29.66	AA		29.76
14	0355	0	BKN220	10.00		95	35.0	69	20.7	55	12.6	26	7	040		28.61	3	002	29.66	AA		29.76
14	0455	0	FEW150	10.00		92	33.5	69	20.8	57	13.8	31	6	310		28.61			29.67	AA		29.76
14	0555	0	FEW160	10.00		92	33.1	69	20.8	57	14.1	31	0	000		28.63			29.68	AA		29.78
14	0655	0	CLR	10.00		90	32.2	69	20.7	58	14.7	34	7	350		28.64	3	015	29.69	AA		29.79
14	0755	0	CLR	10.00		97	35.9	71	21.8	58	14.4	27	0	000		28.66			29.71	AA		29.81
14	0855	0	CLR	10.00		100	37.5	72	22.3	58	14.2	25	5	050		28.66			29.72	AA		29.81
14	0955	0	CLR	10.00		103	39.5	72	22.0	55	13.0	20	3	150		28.66	8	003	29.72	AA		29.81
14	1055	0	CLR	10.00		105	40.4	72	22.1	54	12.2	18	0	000		28.65			29.71	AA		29.80
14	1155	0	CLR	10.00		106	41.3	72	22.0	53	11.5	17	8	160		28.63			29.69	AA		29.78
14	1255	0	CLR	10.00		108	42.3	73	22.5	54	12.0	17	10	220		28.60	8	023	29.66	AA		29.75
14	1355	0	CLR	10.00		109	42.9	73	22.6	54	12.3	16	11	190		28.58			29.63	AA		29.73
14	1455	0	CLR	10.00		110	43.5	73	22.8	54	12.0	16	0	000		28.55			29.60	AA		29.70
14	1555	0	CLR	10.00		112	44.2	73	22.8	53	11.5	14	11	210		28.52	6	027	29.57	AA		29.67
14	1655	0	CLR	10.00		111	44.1	72	22.3	51	10.4	14	9	250		28.50			29.55	AA		29.65
14	1755	0	CLR	10.00		111	43.8	71	21.6	48	8.7	12	9	230		28.47			29.53	AA		29.62
14	1855	0	CLR	10.00		109	42.7	72	22.2	52	11.3	15	10	230		28.48	5	003	29.54	AA		29.63
14	1955	0	CLR	10.00		105	40.7	72	22.0	54	12.4	18	8	210		28.49			29.55	AA		29.64
14	2055	0	CLR	10.00		101	38.6	71	21.7	55	13.0	22	8	230		28.51			29.57	AA		29.66
14	2155	0	SCT170	10.00		101	38.3	71	21.7	55	12.7	22	8	260		28.54	3	025	29.59	AA		29.69
14	2255	0	FEW140	10.00		101	38.5	70	21.2	53	11.6	20	8	010		28.57			29.62	AA		29.72
14	2306	0	FEW006 BKN130	0.50s	BLDUs	100	38.0	72	22.0	57	14.0	24	29	120	39	28.57			29.62	AA		29.72
14	2323	0	BKN130	5.00	HZ	95	35.0	73	22.9	63	17.0	35	24	120	30	28.59			29.65	AA		29.74
14	2331	0	BKN005 BKN130	4.00	HZ	95	35.0	73	22.9	63	17.0	35	31	130	43	28.60			29.66	AA		29.75
14	2337	0	BKN005	2.50	HZ	93	34.0	73	22.9	64	18.0	38	25	130	43	28.60			29.66	AA		29.75
14	2338	0	BKN005	3.00	HZ	93	34.0	73	22.9	64	18.0	38	28	130	43	28.60			29.66	AA		29.75
14	2347	0	BKN005	2.50	HZ	91	33.0	73	22.6	64	18.0	41	34	140	41	28.62			29.67	AA		29.77
14	2350	0	SCT005	2.00	HZ	91	33.0	73	22.6	64	18.0	41	33	140	41	28.62			29.68	AA		29.77
14	2355	0	SCT005	2.50	VCTS HZ	91	32.5	73	22.9	65	18.2	42	32	140	41	28.63			29.69	AA		29.78
14	2357	0	SCT005	3.00	VCTS HZ	90	32.0	73	22.5	64	18.0	42	30	140	41	28.63			29.69	AA		29.78

Figure A-4. Quality controlled local climatological data hourly observations table for Luke Air Force Base, Glendale, Arizona (08/14/2012). Note in the Weather Type column that HZ (haze) and BLDU (blowing dust) with reduced visibilities and gusty winds were reported coincident with high PM_{10} concentrations in the Phoenix area. Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

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

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final) HOURLY OBSERVATIONS TABLE SCOTTSDALE AIRPORT (03192) SCOTTSDALE, AZ (08/2012)

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

Elevation: 1473 ft. above sea level
Latitude: 33.622
Longitude: -111.910
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
14	0053	12	CLR	10.00		96	35.6	70	20.9	55	12.8	25	7	010		28.24			29.73	AA		29.83
14	0153	12	CLR	10.00		96	35.6	69	20.6	54	12.2	24	6	030		28.23	0	000	29.72	AA		29.82
14	0253	12	FEW065 SCT080 SCT100	10.00	-RA	90	32.2	74	23.4	67	19.4	47	13	050		28.25			29.74	AA	T	29.84
14	0353	12	CLR	10.00		94	34.4	70	21.3	58	14.4	30	3	070		28.20			29.69	AA		29.79
14	0453	12	CLR	10.00		92	33.3	70	21.3	59	15.0	33	0	000		28.21	8	009	29.70	AA		29.80
14	0553	12	CLR	10.00		91	32.8	70	20.8	58	14.4	33	0	000		28.22			29.71	AA		29.81
14	0653	12	CLR	10.00		92	33.3	69	20.5	56	13.3	30	0	000		28.23			29.72	AA		29.82
14	0753	12	CLR	10.00		94	34.4	70	20.8	56	13.3	28	0	000		28.26	3	017	29.75	AA		29.85
14	0853	12	CLR	10.00		97	36.1	69	20.5	53	11.7	23	0	000		28.27			29.76	AA		29.86
14	0953	12	CLR	10.00		100	37.8	70	21.0	53	11.7	21	3	VR		28.26			29.75	AA		29.85
14	1053	12	CLR	10.00		103	39.4	70	21.0	51	10.6	18	3	180		28.25	8	002	29.74	AA		29.84
14	1153	12	CLR	10.00		105	40.6	70	21.3	51	10.6	16	6	200		28.23			29.72	AA		29.82
14	1253	12	CLR	10.00		106	41.1	70	21.2	50	10.0	15	6	VR		28.20			29.70	AA		29.79
14	1353	12	CLR	10.00		108	42.2	71	21.5	50	10.0	14	5	250		28.18	8	023	29.67	AA		29.77
14	1453	12	CLR	10.00		111	43.9	72	22.0	50	10.0	13	3	VR		28.16			29.65	AA		29.75
14	1553	12	CLR	10.00		109	42.8	71	21.7	50	10.0	14	7	230	17	28.12			29.62	AA		29.71
14	1653	12	CLR	10.00		109	42.8	70	21.3	48	8.9	13	7	260		28.10	6	026	29.59	AA		29.69
14	1753	12	CLR	10.00		109	42.8	71	21.7	50	10.0	14	7	250		28.08			29.57	AA		29.67
14	1853	12	CLR	10.00		107	41.7	71	21.4	50	10.0	15	7	220		28.08			29.57	AA		29.67
14	1953	12	CLR	10.00		105	40.6	70	21.1	50	10.0	16	7	240		28.10	5	001	29.59	AA		29.69
14	2053	12	CLR	10.00		103	39.4	69	20.5	49	9.4	16	6	080		28.13			29.62	AA		29.72
14	2153	12	CLR	10.00		102	38.9	69	20.4	49	9.4	17	11	060		28.15			29.64	AA		29.74
14	2237	12	SCT029	2.50	VCTS HZ	95	35.0	71	21.7	59	15.0	30	14	170	29	28.21			M	SP		29.80
14	2243	12	BKN027	3.00	VCTS HZ	93	34.0	71	21.4	59	15.0	32	5	VR	29	28.22			M	SP		29.81
14	2253	12	BKN027	4.00	VCTS HZ	94	34.4	71	21.9	60	15.6	32	15	190	22	28.23	3	044	29.73	AA	T	29.82
14	2315	12	SCT027	8.00		91	33.0	72	22.3	63	17.0	39	9	130	20	28.24			M	SP		29.83
14	2353	12	FEW075 BKN100	10.00		88	31.1	71	21.5	62	16.7	42	11	130	22	28.24			29.73	AA	T	29.83

Figure A-5. Quality controlled local climatological data hourly observations table for Scottsdale Airport, Scottsdale, Arizona (08/14/2012). Note in the Weather Type column that HZ (haze) with reduced visibilities and gusty winds were reported coincident with high PM_{10} concentrations in the Phoenix area. Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

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

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final) HOURLY OBSERVATIONS TABLE CASA GRANDE MUNICIPAL ARPT (03914) CASA GRANDE, AZ (08/2012)

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

Elevation: 1462 ft. above sea level
Latitude: 32.95
Longitude: -111.766
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
14	0015	0	CLR	10.00		93	34.0	68	20.1	54	12.0	27	8	040		28.28			M	AA		29.83
14	0035	0	CLR	10.00		93	34.0	68	20.1	54	12.0	27	6	040		28.28			M	AA		29.83
14	0055	0	CLR	10.00		93	34.0	68	20.1	54	12.0	27	7	350		28.28			M	AA		29.83
14	0115	0	CLR	10.00		91	33.0	68	19.8	54	12.0	29	7	010		28.27			M	AA		29.82
14	0135	0	CLR	10.00		91	33.0	68	19.8	54	12.0	29	5	350		28.27			M	AA		29.82
14	0155	0	CLR	10.00		91	33.0	68	19.8	54	12.0	29	7	360		28.27	2	007	M	AA		29.82
14	0215	0	CLR	10.00		91	33.0	68	19.8	54	12.0	29	9	360		28.27			M	AA		29.82
14	0235	0	CLR	10.00		91	33.0	68	19.8	54	12.0	29	8	010		28.27			M	AA		29.81
14	0255	0	CLR	10.00		90	32.0	67	19.6	54	12.0	29	7	360		28.27			M	AA		29.81
14	0315	0	CLR	10.00		91	33.0	67	19.3	52	11.0	26	8	040		28.27			M	AA		29.81
14	0335	0	CLR	10.00		91	33.0	67	19.3	52	11.0	26	10	040		28.25			M	AA		29.80
14	0355	0	CLR	10.00		91	33.0	67	19.3	52	11.0	26	8	020		28.27			M	AA		29.81
14	0415	0	CLR	10.00		91	33.0	67	19.3	52	11.0	26	9	040		28.27			M	AA		29.81
14	0435	0	CLR	10.00		90	32.0	66	19.1	52	11.0	27	8	040		28.25			M	AA		29.80
14	0455	0	CLR	10.00		90	32.0	66	19.1	52	11.0	27	8	060		28.25	7	007	M	AA		29.80
14	0515	0	CLR	10.00		88	31.0	66	18.8	52	11.0	29	7	070		28.25			M	AA		29.80
14	0535	0	CLR	10.00		88	31.0	66	18.8	52	11.0	29	3	060		28.27			M	AA		29.81
14	0555	0	CLR	10.00		86	30.0	65	18.4	52	11.0	31	7	260		28.27			M	AA		29.82
14	0615	0	CLR	10.00		84	29.0	65	18.0	52	11.0	33	5	250		28.27			M	AA		29.82
14	0635	0	CLR	10.00		84	29.0	65	18.0	52	11.0	33	6	230		28.28			M	AA		29.83
14	0655	0	CLR	10.00		84	29.0	65	18.6	54	12.0	36	0	000		28.28			M	AA		29.83
14	0715	0	CLR	10.00		86	30.0	66	18.9	54	12.0	33	3	170		28.29			M	AA		29.84
14	0735	0	CLR	10.00		88	31.0	67	19.5	55	13.0	33	3	160		28.30			M	AA		29.85
14	0755	0	CLR	10.00		90	32.0	67	19.6	54	12.0	29	0	000		28.30	2	017	M	AA		29.85
14	0815	0	CLR	10.00		91	33.0	68	19.8	54	12.0	29	7	080		28.30			M	AA		29.85
14	0835	0	CLR	10.00		93	34.0	68	20.1	54	12.0	27	9	110		28.30			M	AA		29.85
14	0855	0	CLR	10.00		93	34.0	68	20.1	54	12.0	27	5	140		28.30			M	AA		29.85
14	0915	0	CLR	10.00		97	36.0	69	20.8	54	12.0	24	9	120		28.30			M	AA		29.85
14	0935	0	CLR	10.00		99	37.0	70	21.1	54	12.0	22	7	140		28.30			M	AA		29.85
14	0955	0	CLR	10.00		100	38.0	71	21.5	55	13.0	22	8	140		28.30			M	AA		29.85
14	1015	0	CLR	10.00		100	38.0	71	21.5	55	13.0	22	8	150		28.30			M	AA		29.85
14	1035	0	CLR	10.00		100	38.0	71	21.5	55	13.0	22	13	210		28.30			M	AA		29.85
14	1055	0	CLR	10.00		102	39.0	71	21.5	54	12.0	20	9	180		28.29	7	003	M	AA		29.84
14	1115	0	CLR	10.00		102	39.0	71	21.8	55	13.0	21	3	220		28.29			M	AA		29.84

14	1135	0	CLR	10.00		104	40.0	71	21.8	54	12.0	19	8	230		28.28			M	AA		29.83
14	1155	0	CLR	10.00		104	40.0	71	21.8	54	12.0	19	0	000		28.27			M	AA		29.82
14	1215	0	CLR	10.00		106	41.0	72	22.1	54	12.0	18	0	000		28.27			M	AA		29.81
14	1235	0	CLR	10.00		106	41.0	72	22.1	54	12.0	18	6	260		28.25			M	AA		29.80
14	1255	0	CLR	10.00		108	42.0	72	22.4	54	12.0	17	10	270	16	28.25			M	AA		29.80
14	1315	0	CLR	10.00		108	42.0	72	22.4	54	12.0	17	11	260		28.25			M	AA		29.79
14	1335	0	CLR	10.00		108	42.0	72	22.4	54	12.0	17	10	300		28.25			M	AA		29.79
14	1355	0	CLR	10.00		108	42.0	72	22.4	54	12.0	17	13	220		28.24	7	020	M	AA		29.78
14	1415	0	CLR	10.00		108	42.0	72	22.4	54	12.0	17	3	330		28.23			M	AA		29.77
14	1435	0	CLR	10.00		108	42.0	72	22.0	52	11.0	16	9	320		28.22			M	AA		29.76
14	1455	0	CLR	10.00		108	42.0	72	22.0	52	11.0	16	9	300		28.21			M	AA		29.75
14	1515	0	CLR	10.00		108	42.0	72	22.0	52	11.0	16	9	290	20	28.20			M	AA		29.74
14	1535	0	CLR	10.00		109	43.0	72	22.1	52	11.0	15	7	320		28.19			M	AA		29.73
14	1555	0	CLR	10.00		109	43.0	72	22.1	52	11.0	15	6	240		28.18			M	AA		29.72
14	1615	0	CLR	10.00		109	43.0	73	22.6	54	12.0	16	11	270		28.18			M	AA		29.72
14	1635	0	CLR	10.00		109	43.0	73	22.6	54	12.0	16	10	260	20	28.17			M	AA		29.71
14	1655	0	CLR	10.00		109	43.0	73	22.5	54	12.0	16	16	260	21	28.15	7	030	M	AA		29.69
14	1715	0	CLR	10.00		109	43.0	73	22.5	54	12.0	16	14	260	20	28.15			M	AA		29.69
14	1735	0	CLR	10.00		108	42.0	72	22.4	54	12.0	17	15	250	22	28.14			M	AA		29.68
14	1755	0	CLR	10.00		108	42.0	72	22.4	54	12.0	17	14	250	20	28.14			M	AA		29.68
14	1815	0	CLR	10.00		108	42.0	72	22.4	54	12.0	17	14	250	18	28.15			M	AA		29.69
14	1835	0	CLR	10.00		106	41.0	72	22.1	54	12.0	18	10	260		28.15			M	AA		29.69
14	1855	0	CLR	10.00		106	41.0	72	22.1	54	12.0	18	11	260		28.16			M	AA		29.70
14	1915	0	CLR	10.00		106	41.0	72	22.1	54	12.0	18	9	260		28.16			M	AA		29.70
14	1935	0	CLR	10.00		104	40.0	71	21.8	54	12.0	19	6	250		28.16			M	AA		29.70
14	1955	0	CLR	10.00		102	39.0	71	21.5	54	12.0	20	6	280		28.16	2	003	M	AA		29.70
14	2015	0	CLR	10.00		102	39.0	71	21.8	55	13.0	21	6	250		28.17			M	AA		29.71
14	2035	0	CLR	10.00		102	39.0	71	21.5	54	12.0	20	6	250		28.18			M	AA		29.72
14	2055	0	CLR	10.00		100	38.0	70	21.2	54	12.0	21	5	210		28.20			M	AA		29.74
14	2115	0	CLR	1.75		93	34.0	70	20.9	57	14.0	30	31s	150	40	28.23			M	AA		29.77
14	2135	0	CLR	7.00		91	33.0	69	20.6	57	14.0	32	29	160	36	28.24			M	AA		29.78
14	2155	0	CLR	10.00	VCTS	91	33.0	69	20.6	57	14.0	32	23	160	29	28.25			M	AA		29.80
14	2215	0	CLR	10.00		91	33.0	69	20.6	57	14.0	32	18	140		28.28			M	AA	0.03	29.83
14	2235	0	SCT050 BKN070 BKN120	10.00	TS	91	33.0	69	20.6	57	14.0	32	24	130	30	28.27			M	AA	0.03	29.82
14	2255	0	FEW030 BKN047 OVC120	9.00	TS	86	30.0	71	21.5	63	17.0	46	28	130	32	28.28	2	044	M	AA	0.03	29.83
14	2315	0	SCT029 BKN048 OVC065	10.00	TS	77	25.0	70	20.9	66	19.0	69	21	140	28	28.32			M	AA	0.25	29.87
14	2335	0	SCT021 BKN031 OVC110	8.00	TS	73	23.0	68	20.2	66	19.0	79	17	240	24	28.30			M	AA	0.25	29.85
14	2355	0	FEW021 SCT040 BKN060	10.00	TS	75	24.0	68	19.9	64	18.0	69	18	220	24	28.31			M	AA	0.25	29.86

Figure A-6. Quality controlled local climatological data hourly observations table for Casa Grande Municipal Airport, Casa Grande, Arizona (08/14/2012). Note that reduced visibilities and gusty winds were reported coincident with high PM_{10} concentrations after 2100 LST in the Casa Grande area. Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

Appendix B: Media Coverage, Videos, and Images

Video Links

ADEQ visibility cameras in the Phoenix area:

South Mountain: www.phoenixvis.net/videos/mpeg4/SOMT_08142012.mp4

Estrella Mountains: www.phoenixvis.net/videos/mpeg4/ESMO_08142012.mp4

Camelback Mountains: www.phoenixvis.net/videos/mpeg4/CAME_08142012.mp4

Superstition Mountains: www.phoenixvis.net/videos/mpeg4/SUPM_08142012.mp4

Local citizens often create videos during storms, documenting their observations. Here are some links to these videos.

Arizona Monsoon - August 14th, 2012
http://www.youtube.com/watch?v=Za4IL9iW65k

Arizona Thunder Storm 8/14/2012
http://www.youtube.com/watch?v=FFUe2A-rAtk

Articles and Image Links

http://www.azfamily.com/news/Photos-Overnight-storm-brings-rain-morning-haze-and-airport-delays-166277196.html (see video at link)

Photos: Overnight storm brings rain, morning haze and airport delays

By Mike Gertzman
Posted on August 15, 2012 at 10:00 AM
Azfamily.com

PHOENIX -- Monsoon storms rolled through the Valley overnight. The storms brought rain, thunder and plenty of lightning.

Parts of the Valley, from central Phoenix to Ahwatukee, got heavy rain. Enough rain fell in some areas to cause street flooding. More than 1.5 inches of rain fell in Maricopa, Ariz. The north side of the Valley, including Scottsdale and all the way to the northwest side of town, barely got any rain.

A power outage around 7th and Glendale Avenues was likely caused by the storm. That neighborhood was dark and the traffic lights were not working. More than 1,000 SRP customers were left without electricity. Utility crews went to work on the problem right away and the power was quickly restored.

The most severe weather was seen in the town of Maricopa, Ariz. where lightning hit a house at about 3:00 a.m. and caused a fire.

Lightning sparks house fire in Maricopa

The streets were dry by morning, but the sunrise revealed a very hazy sky. Tower cameras and ADOT traffic cameras that normally show miles of visibility were only offering very limited views on Wednesday morning.

Visibility was so poor that there were flight delays at Sky Harbor Airport. Airport officials reported delays of 10 to 20 minutes.

The air was so thick that it appeared to be filled with smoke, fog or smog. But 3TV meteorologist April Warnecke explained that it was actually dust suspended in the air because it was hanging on to all the moisture particles that came with the overnight rain.

Also, the Valley cooled off overnight creating an inversion that trapped all of that particulate pollution near the ground.

Temperatures around the Valley dropped into the 80's for the first time in several days. The National Weather Service has canceled the Excessive Heat Warning a day before it was set to expire.

With more moisture coming into the Valley this week, we could some much more monsoon storm activity over the next few days.
The forecast high for Wednesday is 106 degrees -- the first day in the past 10 days that the high will be below 110 degrees.

http://www.azfamily.com/news/Photos-Overnight-storm-brings-rain-morning-haze-and-airport-delays-166277196.html?gallery=y&img=0&c=y#/news/Photos-Overnight-storm-brings-rain-morning-haze-and-airport-delays-166277196.html?gallery=y&img=0&c=y
Selected pictures (more at link above):

Appendix C: Historical Fluctuation Time-Series Graphs

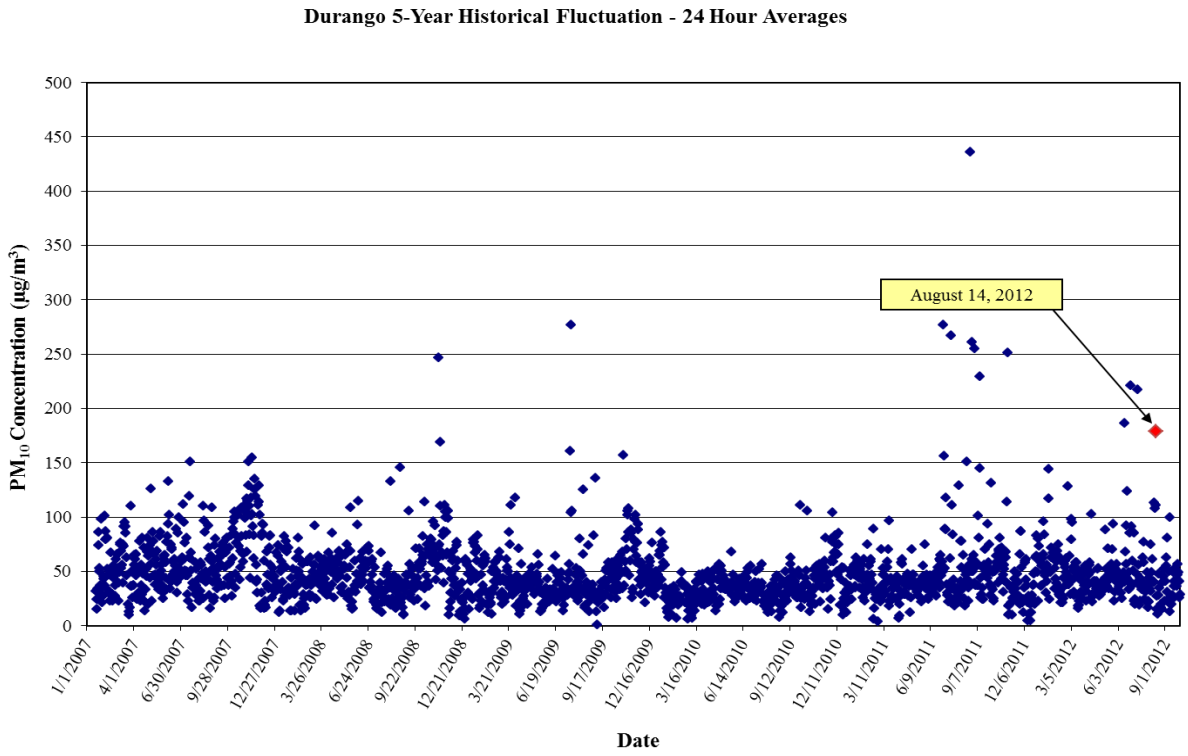

Figure C-1. 24-hr average PM_{10} concentrations at the Durango monitor (2007-2012). The 24-hr average PM_{10} concentration on August 14, 2012, is shown in red.

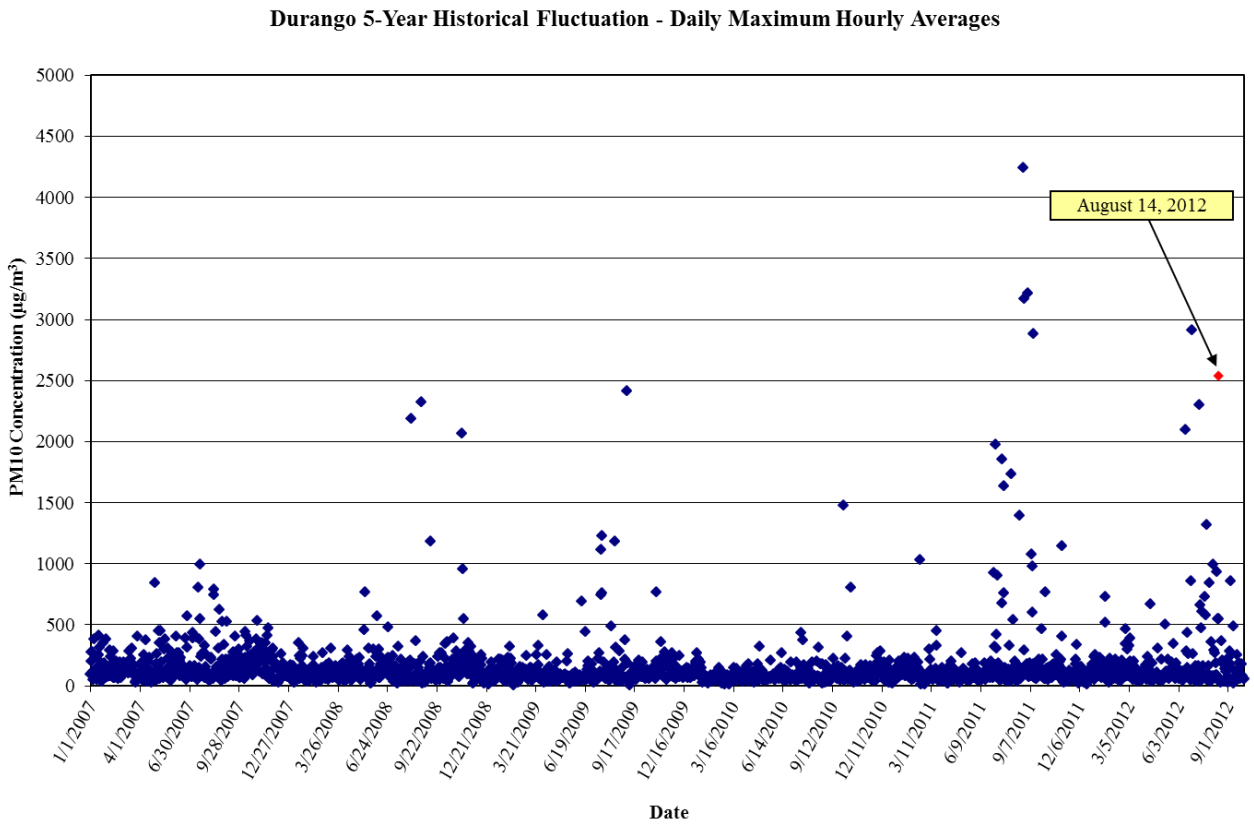

Figure C-2. Daily maximum hourly average PM_{10} concentrations at the Durango monitor (2007-2012). The maximum hourly average PM_{10} concentration on August 14, 2012, is shown in red.

Appendix D:
ADEQ and NWS Forecast Products

ADEQ Arizona Department of Environmental Quality

MARICOPA COUNTY DUST CONTROL FORECAST

ISSUED Monday, August 13, 2012

Three-day weather outlook:

NOTE: DURING THE ACTIVE SUMMER MONSOON PERIODS, STRONG OUTFLOW WINDS FROM EVEN DISTANT THUNDERSTORMS CAN GENERATE PERIODS OF DENSE BLOWING DUST

Although a low-grade summer monsoon period is forecast for the next few days, summer monsoon moisture will remain sufficient for a chance for showers and thunderstorms in proximity to the Phoenix metro area until a more significant return of moisture by Wednesday. As a result, there will also be the potential for periods of dense blowing dust generated by strong thunderstorm winds and a resulting moderate risk for unhealthy PM-10 concentrations.

R I S K F A C T O R S

	WINDS		STAGNATION		UNHEALTHY PM-10 RISK LEVEL
Day 1: Tue. 8/14/2012	Westerly 10-20 mph with a few higher gusts possible during the afternoon except strong and gusty due to outflow from	+	No significant stagnation is expected.	=	***MODERATE***
Day 2: Wed. 8/15/2012	WNW 10-25 mph with a few higher gusts possible during the afternoon except strong and gusty due to outflow from thunderstorms.	+	No significant stagnation is expected.	=	***MODERATE***
Day 3: Thu. 8/16/2012	Westerly 10-20 mph with a few higher gusts possible during the afternoon except strong and gusty due to outflow from thunderstorms.	+	No significant stagnation is expected.	=	***MODERATE***

EXTENDED OUTLOOK

Day 4: Fri. 8/17/2012	Westerly 10-20 mph with a few higher gusts possible during the afternoon except strong and gusty due to outflow from thunderstorms.	+	No significant stagnation is expected.	=	***MODERATE***
Day 5: Sat. 8/18/2012	Westerly 10-20 mph with a few higher gusts possible during the afternoon except strong and gusty due to outflow from thunderstorms.	+	No significant stagnation is expected.	=	***MODERATE***

The Maricopa County Dust Control Action Forecast is issued to assist in the planning of work activities to help reduce dust pollution. A recorded message of this forecast can be accessed at 602-771-2368. To review the complete air quality forecast for the Phoenix metropolitan area, as well as the health impacts and reduction methods for different air pollutants, call 602-771-2367 for recorded forecast information or click on ADEQ's Air Quality Forecast at http://www.azdeq.gov/environ/air/ozone/ensemble.pdf.

JRP 04/28/2011

ADEQ Arizona Department of Environmental Quality

VERY UNHEALTHY (201-300)

UNHEALTHY (151-200)

UNHEALTHY FOR SENSITIVE GROUPS (101-150)

MODERATE (51-100)

GOOD (0-50)

For more information visit:
http://www.airnow.gov/index.cfm?action=aqibasics.aqi

LINK TO 2012 AIR POLLUTION EXCEEDANCE GRAPH

AIR QUALITY FORECAST FOR Tuesday, August 14, 2012, 2012

This report is updated by 1:00 p.m. Sunday thru Friday and is valid
for areas within and bordering Maricopa County in Arizona

FORECAST DATE **NOTICES** (*SEE BELOW FOR DETAILS) **AIR POLLUTANT**	YESTERDAY Sun 08/12/2012 Highest AQI Reading/Site (*Preliminary data only*)	TODAY Mon 08/13/2012 **Ozone Health Watch** **Dust**	TOMORROW Tue 08/14/2012 **Dust**	EXTENDED Wed 08/15/2012 **Dust**
O3*	**101** **North Phoenix**	**97** ***Moderate***	**71** ***Moderate***	**64** ***Moderate***
CO*	**7** **West Phoenix**	**6** ***Good***	**6** ***Good***	**6** ***Good***
PM-10*	**59** **Dysart**	**65** ***Moderate***	**65** ***Moderate***	**75** ***Moderate***
PM-2.5*	**44** **West Phoenix**	**42** ***Good***	**44** ***Good***	**47** ***Good***

* O3 = Ozone CO = Carbon Monoxide PM-10 = Particles 10 microns & smaller PM-2.5 = Particles smaller than 2.5 microns

*"Ozone Health Watch" means that the highest concentration of OZONE may approach the federal health standard.
"PM-10 or PM-2.5 Health Watch" means that the highest concentration of PM-10 or PM-2.5 may approach the federal health standard.
"High Pollution Advisory" means that the highest concentration of OZONE, PM-10, or PM-2.5 may exceed the federal health standard.
"DUST" means that short periods of high PM-10 concentrations caused by outflow from thunderstorms are possible.

Health Statements	
Monday, 08/13/2012	**Unusually sensitive people should consider reducing prolonged or heavy exertion outdoors.**
Tuesday, 08/14/2012	**Unusually sensitive people should consider reducing prolonged or heavy exertion outdoors.**

SYNOPSIS AND DISCUSSION

AN OZONE HEALTH WATCH REMAINS IN EFFECT UNTIL LATE THIS EVENING

OZONE: Although another exceedance occurred on Sunday, the local ozone concentration trend has started downward and this should continue for the next few days at least. The biggest factor causing this decrease will be the daytime surface winds which – due to the combination of gradient and upslope flow – should become westerly for the foreseeable future with gusts over 20 mph possible by Tuesday. This situation helps to disperse the local ozone plume and lessens the potential for high concentrations over a large area. Still have to get thru today, however, and an Ozone Health Watch remains in effect.

PARTICLES: Although a low-grade summer monsoon period is forecast for the next few days, moisture will remain sufficient for a chance for showers and thunderstorms in proximity to the Phoenix metro area until a more significant return of moisture by Wednesday. As a result, the possibility for periods of dense blowing and transported dust generated by strong thunderstorm outflow boundary winds have resulted in a forecast for elevated PM-10 (coarse particle) concentrations – with potential for locally much higher readings depending on winds and volume of dust. Otherwise, particle pollution levels will be low.

Check back tomorrow for the latest. Until then, have a good day! -C.Reith

MONITORING SITE MAPS	
STATIC MAP	http://www.azdeq.gov/environ/air/monitoring/images/map.jpg
INTERACTIVE MAPS	http://aqwww.maricopa.gov/AirMonitoring/SitePollutionMap.aspx http://156.42.96.39/alert/Google/air.html http://www.airnow.gov/

POLLUTION MONITOR READINGS FOR Sunday, August 12, 2012

O3 (OZONE)

Info on current 8-hour ozone standard: http://www.epa.gov/air/ozonepollution/pdfs/2008_03_aqi_changes.pdf
For archived AQI maps go to: http://www.airnow.gov/index.cfm?action=airnow.maps

SITE NAME	MAX 8-HR VALUE (PPB)	MAX AQI	AQI COLOR CODE
Alamo Lake	60	51	
Apache Junction	61	54	
Blue Point	63	61	
Buckeye	62	58	
Casa Grande	62	58	
Cave Creek	62	58	
Central Phoenix	68	77	
Dysart	69	80	
Falcon Field	61	54	
Fountain Hills	60	51	
Glendale	62	58	
Humboldt Mountain	63	61	
Phoenix Supersite	69	80	
North Phoenix	76	101	
Pinal Air Park	62	58	

Pinnacle Peak	70	84	
Queen Valley	62	58	
Rio Verde	59	50	
South Phoenix	70	84	
South Scottsdale	73	93	
Tempe	64	64	
Tonto Nat'l Mon.	61	54	
West Chandler	62	58	
West Phoenix	71	87	
Yuma	63	61	

CO (CARBON MONOXIDE)

SITE NAME	MAX 8-HR VALUE (PPM)	MAX AQI	AQI COLOR CODE
Central Phoenix	0.3	3	
Greenwood	0.4	5	
West Phoenix	0.6	7	

PM-10 (PARTICLES)

SITE NAME	MAX 24-HR VALUE (µg/m3)	MAX AQI	AQI COLOR CODE
Apache Junction	41.9	39	
Buckeye	61.9	54	
Central Phoenix	48.7	44	
Combs School (Pinal County)	49.3	46	
Durango	40.7	37	
Dysart	71.7	59	
Glendale	65.7	56	
Greenwood	44.5	41	
Higley	45.5	41	
Maricopa (Pinal County)	44.7	41	
North Phoenix	53.3	49	
Phoenix Supersite	50.3	46	
South Phoenix	48.6	44	
Tempe	45.1	41	
West Chandler	45.4	41	
West Forty Third	37.7	34	
West Phoenix	48.3	44	
Zuni Hills	71.2	59	

PM-2.5 (PARTICLES)

(Some data derived from light-scattering equipment)

For maps go to: http://www.airnow.gov/

SITE NAME	MAX 24-HR VALUE (µg/m3)	MAX AQI	AQI COLOR CODE
Durango	10.2	33	
Dysart	10.0	32	
Estrella Mountain Park	6.7	22	
Glendale	11.3	37	
Phoenix Supersite	7.8	25	
North Phoenix	11.5	37	
South Phoenix	7.2	23	
Tempe	9.0	29	
Vehicle Emissions Lab	6.0	19	
West Phoenix	13.5	44	

Statements, Advisories, and Warnings issued by the National Weather Service office in Phoenix, AZ pertaining to this dust storm event:

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SHORT TERM FORECAST
NATIONAL WEATHER SERVICE PHOENIX AZ
823 PM MST TUE AUG 14 2012

AZZ028-150500-
NORTHWEST AND NORTH CENTRAL PINAL COUNTY-
INCLUDING THE CITIES OF...APACHE JUNCTION...CASA GRANDE...COOLIDGE...
AND FLORENCE
823 PM MST TUE AUG 14 2012

.NOW...
GUSTY SOUTHEAST WINDS 20 TO 30 MPH WILL OVERSPREAD MUCH OF NORTHWEST
PINAL COUNTY THROUGH 10 PM. SOME BLOWING DUST WILL BE POSSIBLE.
LOCATIONS LIKELY TO EXPERIENCE GUSTY WINDS AND SOME BLOWING DUST
INCLUDE COOLIDGE...FLORENCE...AND CASA GRANDE. THERE WILL BE A SLIGHT
CHANCE FOR A THUNDERSTORM THIS EVENING.


SHORT TERM FORECAST
NATIONAL WEATHER SERVICE PHOENIX AZ
918 PM MST TUE AUG 14 2012

AZZ023-150700-
GREATER PHOENIX AREA-
INCLUDING THE CITIES OF...BUCKEYE...CAREFREE...CAVE CREEK...
CHANDLER...FOUNTAIN HILLS...GILBERT...GLENDALE...MESA...PEORIA...
PHOENIX...SCOTTSDALE...SUN CITY...AND TEMPE
918 PM MST TUE AUG 14 2012

.NOW...
SOUTHEAST WINDS 20 TO 30 MPH...WITH GUSTS TO 35 MPH...WILL OVERSPREAD
THE GREATER PHOENIX METROPOLITAN AREA THROUGH 11 PM. SOME BLOWING
DUST WILL LIKELY ACCOMPANY THE ONSET OF THE GUSTY WINDS...ESPECIALLY
OVER THE SOUTHEAST VALLEY BETWEEN 915 PM AND 945 PM...WHERE VISIBILITY
COULD BRIEFLY DROP BELOW 2 MILES. AN ISOLATED THUNDERSTORM WILL BE
POSSIBLE THROUGH MIDNIGHT.

$$

AZZ027-150700-
SOUTHWEST MARICOPA COUNTY-
INCLUDING THE CITY OF...GILA BEND
918 PM MST TUE AUG 14 2012

.NOW...
SOUTHEAST WINDS 15 TO 30 MPH...WITH GUSTS TO 35 MPH...WILL
OVERSPREAD MUCH OF SOUTHWEST MARICOPA COUNTY THROUGH 11 PM. SOME
BLOWING DUST WILL LIKELY ACCOMPANY THE ONSET OF THE GUSTY
WINDS...WITH VISIBILITY BRIEFLY DROPPING BELOW 2 MILES. AN ISOLATED
THUNDERSTORM WILL BE POSSIBLE THROUGH MIDNIGHT.
```

AZZ022-150700-
NORTHWEST MARICOPA COUNTY-
INCLUDING THE CITIES OF...BUCKEYE...LAKE PLEASANT...MORRISTOWN...
NEW RIVER...TONOPAH...AND WICKENBURG
918 PM MST TUE AUG 14 2012

.NOW...
SOUTHEAST WIND 15 TO 25 MPH...WITH GUSTS TO 30 MPH...WILL OVERSPREAD NORTHWEST MARICOPA COUNTY BETWEEN 10 PM AND MIDNIGHT. SOME BLOWING DUST WILL LIKELY ACCOMPANY THE ONSET OF GUSTY WINDS...WITH VISIBILITY BRIEFLY DROPPING BELOW 2 MILES. AN ISOLATED THUNDERSTORM WILL BE POSSIBLE THROUGH MIDNIGHT.

URGENT - WEATHER MESSAGE
NATIONAL WEATHER SERVICE PHOENIX AZ
941 PM MST TUE AUG 14 2012

AZZ023-150600-
/O.NEW.KPSR.DU.Y.0034.120815T0441Z-120815T0600Z/
/O.CON.KPSR.EH.W.0011.000000T0000Z-120816T0300Z/
GREATER PHOENIX AREA-
INCLUDING THE CITIES OF...BUCKEYE...MESA...PHOENIX
941 PM MST TUE AUG 14 2012

...BLOWING DUST ADVISORY IN EFFECT UNTIL 11 PM MST THIS EVENING...
...EXCESSIVE HEAT WARNING REMAINS IN EFFECT UNTIL 8 PM MST WEDNESDAY...

THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED A BLOWING DUST ADVISORY...WHICH IS IN EFFECT UNTIL 11 PM MST THIS EVENING. AN EXCESSIVE HEAT WARNING REMAINS IN EFFECT UNTIL 8 PM MST WEDNESDAY.

* AFFECTED AREA...PHOENIX METROPOLITAN AREA...ESPECIALLY THE SOUTHEAST VALLEY.

* TIMING...UNTIL 11 PM.

* WINDS...SOUTHEAST 20 TO 30 MPH...WITH GUSTS TO NEAR 40 MPH.

* VISIBILITY...BELOW 1 MILE AT TIMES MAINLY SOUTHEAST VALLEY

* IMPACTS...SUDDENLY REDUCED VISIBILITIES ON ROADWAYS WILL CREATE DANGEROUS DRIVING CONDITIONS. MULTI-CAR PILEUPS ARE MORE LIKELY DURING BLOWING DUST EVENTS.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

BE READY FOR A SUDDEN DROP IN VISIBILITY. IF YOU ENCOUNTER BLOWING DUST ON THE ROADWAY OR SEE IT APPROACHING...PULL OFF THE ROAD AS FAR AS POSSIBLE AND PUT YOUR VEHICLE IN PARK. TURN THE LIGHTS ALL THE WAY OFF AND KEEP YOUR FOOT OFF THE BRAKE PEDAL.

Appendix E:
Affidavit of Public Notice

AFFIDAVIT OF PUBLICATION

ADEQ
AIR QUALITY DIVISION
13 JAN 18 PM 12:49

THE ARIZONA REPUBLIC

STATE OF ARIZONA
COUNTY OF MARICOPA } SS.

Tabitha Weaver, being first duly sworn, upon oath deposes and says: That she is a legal advertising representative of the Arizona Business Gazette, a newspaper of general circulation in the county of Maricopa, State of Arizona, published at Phoenix, Arizona, by Phoenix Newspapers Inc., which also publishes The Arizona Republic, and that the copy hereto attached is a true copy of the advertisement published in the said paper on the dates as indicated.

The Arizona Republic

January 14, 2013

Request for Public Comments on Exceptional Events in the Greater Phoenix Area

In 2005, Congress identified a need to account for events that result in exceedances of the National Ambient Air Quality Standards (NAAQS) that are exceptional in nature (e.g., not expected to reoccur or caused by acts of nature beyond man-made controls.) In response, EPA promulgated the Exceptional Events Rule (EER) to address exceptional events in 40 CFR Parts 50 and 51 on March 22, 2007 (72 FR 13560). On May 2, 2011, EPA released draft guidance documents on the implementation of the EER to State, tribal and local air agencies for review. The EER allows for states and tribes to "flag" air quality monitoring data as an exceptional event. If flagged, these data can be excluded from consideration in air quality planning if EPA concurs with the demonstration submitted by the flagging agency documenting that all procedural and technical requirements have been met.

Pursuant to 40 CFR 50.14(c)(3)(i), the Arizona Department of Environmental Quality (ADEQ) is soliciting comments on its final demonstrations of events that have caused elevated concentrations of PM10 in the Greater Phoenix area on September 11 & 12, 2011 and June 16; June 27; July 11; August 11; August 14; and September 6, 2012. ADEQ has decided to flag these episodes based on these analyses. Copies of the demonstrations can be viewed online beginning Monday, January 14, 2013, on the ADEQ website at http://www.azdeq.gov/environ/plan/index.html by selecting Air Quality, Public Notices, Meetings and Hearings. Interested parties can submit written comments throughout the comment period which will end at 5:00 p.m. on Tuesday, February 12, 2013. Any comments received will be responded to and forwarded to EPA with the final demonstrations.

Written comments should be addressed, faxed, or e-mailed to:

Andra Juniel, Air Assessment Section, Arizona Department of Environmental Quality, 1110 W. Washington Street, 3415-A, Phoenix, AZ 85007, PHONE: (602) 771-4417; FAX: (602) 771-2366, E-mail: juniel.andra@azdeq.gov.

In addition to being available on-line, copies of the analyses are available for review, Monday through Friday, 8:30 a.m. to 4:30 p.m., at the ADEQ Records Management Center, 1110 W. Washington St., Phoenix, AZ, 85007, Attn: Records Center, (602) 771-4380, email: recordscenter@azdeq.gov.

Persons with a disability may request reasonable accommodations by contacting Linda Morrison at (602) 771-4793 or 1-800-234-5677 ext. 771-4793. This document is available in alternative formats by contacting ADEQ TDD phone number at (602) 771-4829.

Pub: January 14, 2013

Sworn to before me this
14st day of
January A.D. 2013

MANUEL VARGAS
Notary Public - State of Arizona
MARICOPA COUNTY
My Commission Expires
November 30, 2015

Notary Public

ADEQ Arizona Department of Environmental Quality
Janice K. Brewer, Governor
Henry R. Darwin, Director

PUBLIC NOTICE

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