Sonoma Technology, Inc.
Air Quality Research and Innovative Solutions

State of Arizona
Exceptional Event Documentation for the Event of August 11, 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 11, 2012, for the Phoenix PM_{10} Nonattainment Area

Final Report
STI-912096-5569-FR

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Cover image depicts an approaching dust storm generated by thunderstorm outflow in the Phoenix area on August 11, 2012.

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 11, 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 11, 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 11, 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 11, 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 11, 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 11, 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 for Maricopa County on August 11, 2012, advising citizens of the potential for high wind dust events due to outflow from distant thunderstorms. More information on ADEQ's forecasts can be found in Section 5.2 of this report. The forecast products that were issued for August 11, 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 11, 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 11, 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 11, 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 11, 2012. The monitors in the figure 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 PM_{10} exceedances on August 11, 2012, were recorded at the Higley and West Chandler monitors. The primary NWS sites used in this demonstration package were the Phoenix Sky Harbor International Airport (KPHX) and the Chandler Municipal Airport (KCHD) sites because of those sites' high data quality, data completeness, proximity to the air quality monitors with high PM_{10} concentrations, and representativeness of meteorological conditions in the Phoenix area. **Figure 2-2** shows the locations of PM_{10} monitors statewide on August 11, 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.

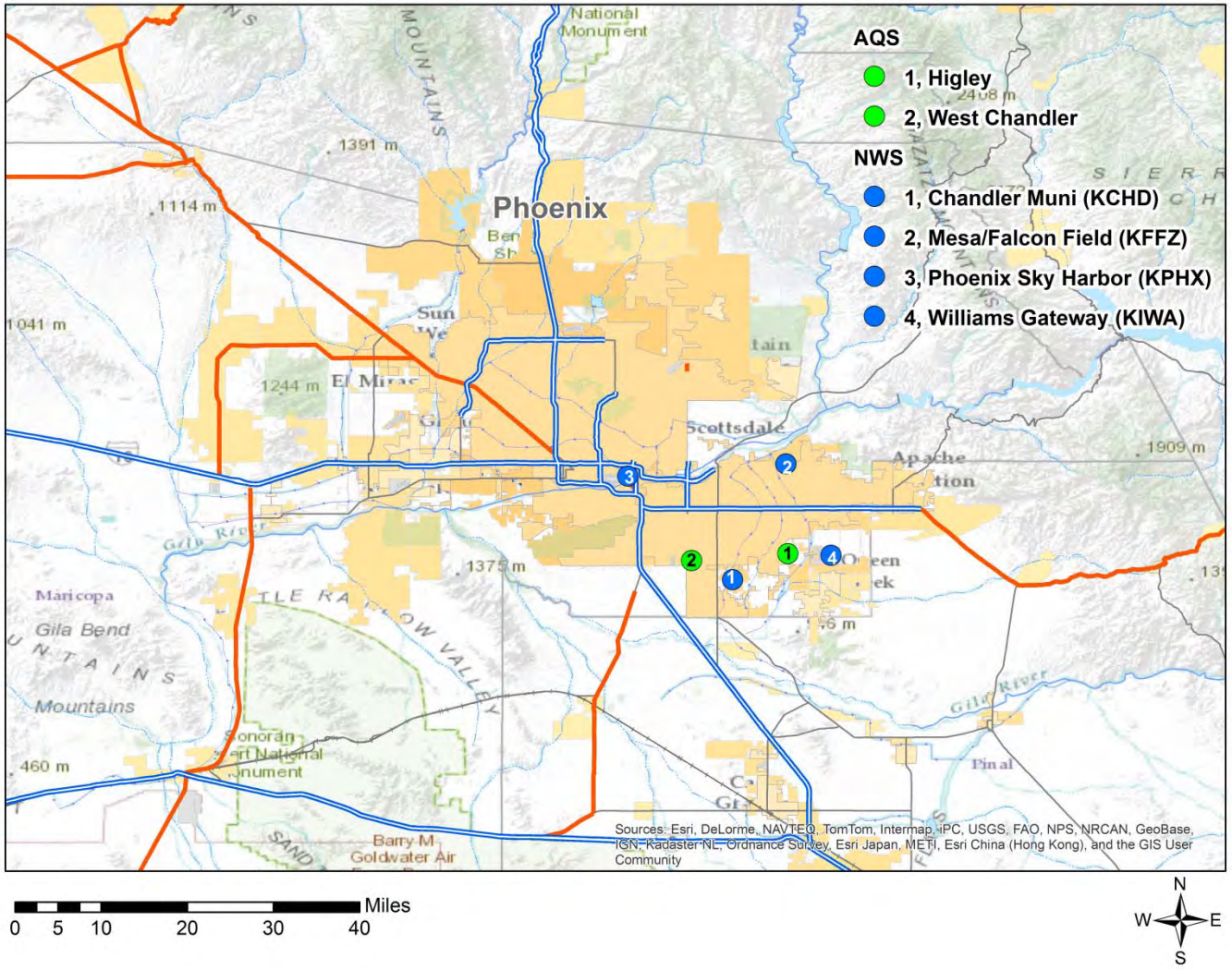


Figure 2-1. Locations of air quality monitors that recorded exceedances of the 24-hr PM_{10} NAAQS and NWS monitors primarily used in this report.

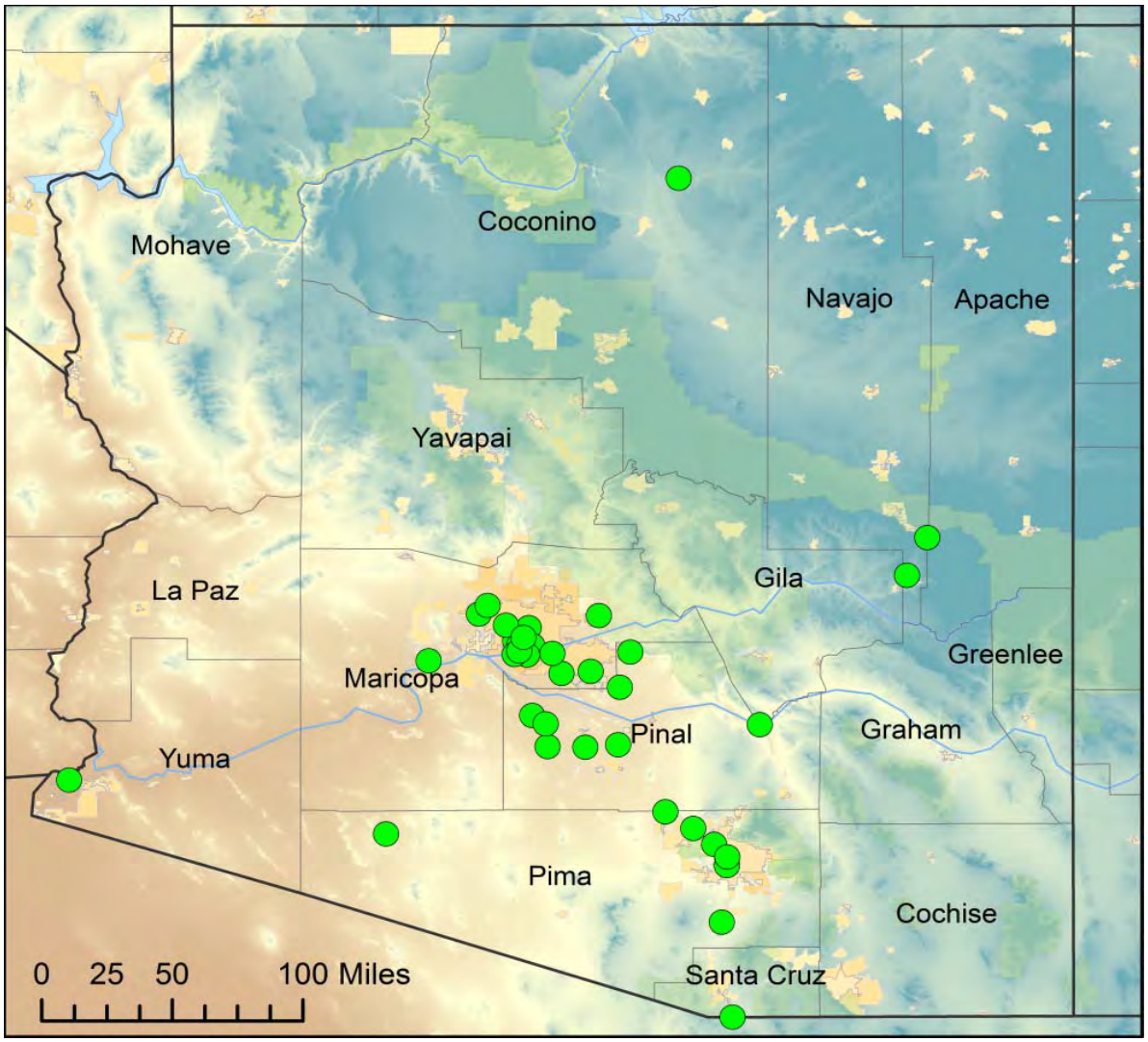


Figure 2-2. Location of sites monitoring PM_{10} in Arizona on August 11, 2012.

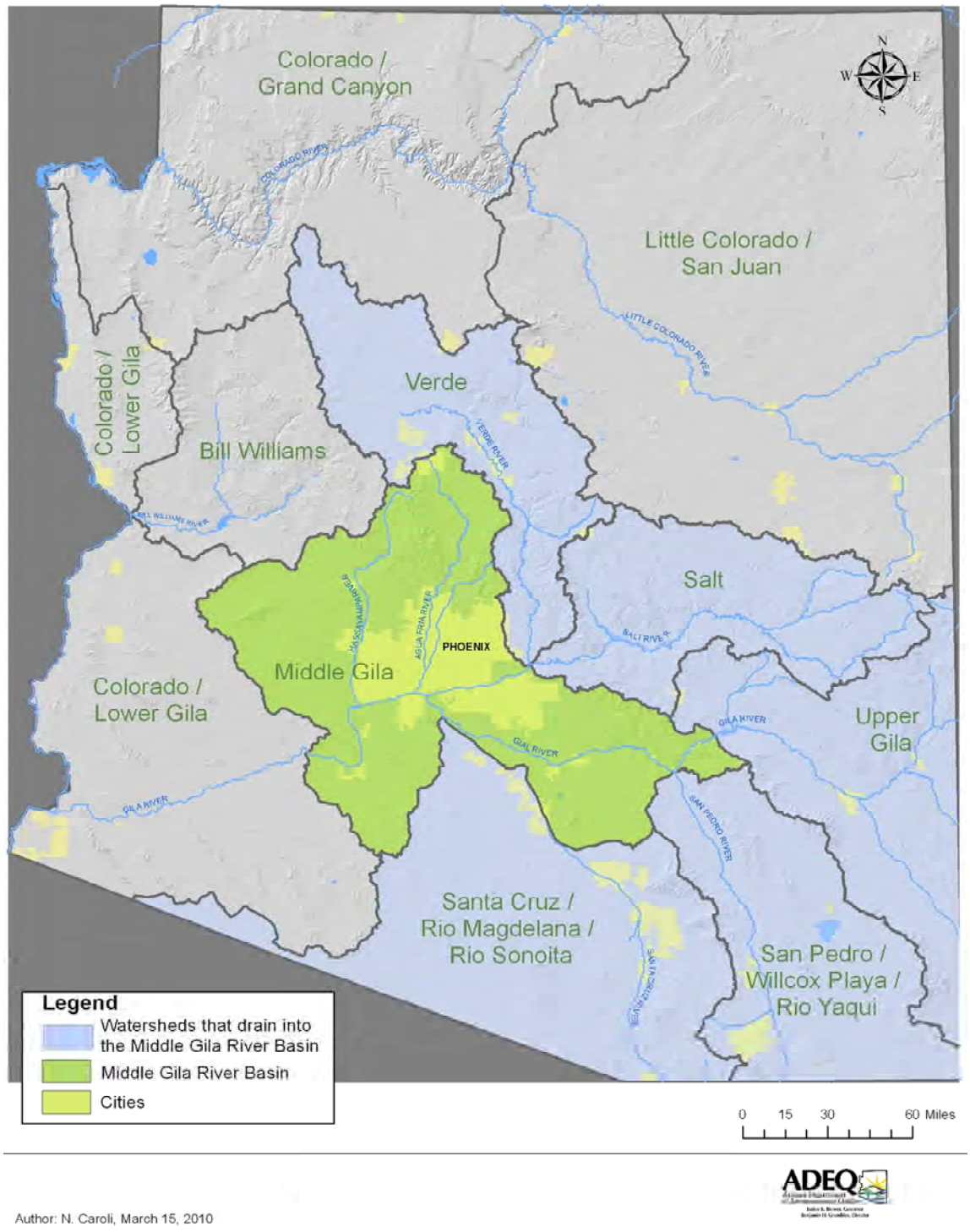


Figure 2-3. Drainage system of Phoenix, Arizona.

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.

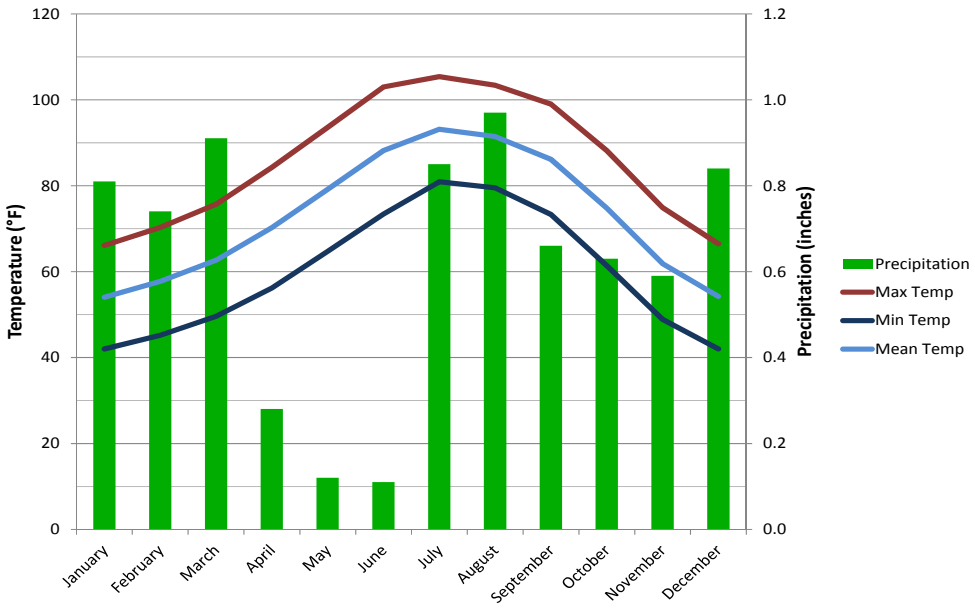
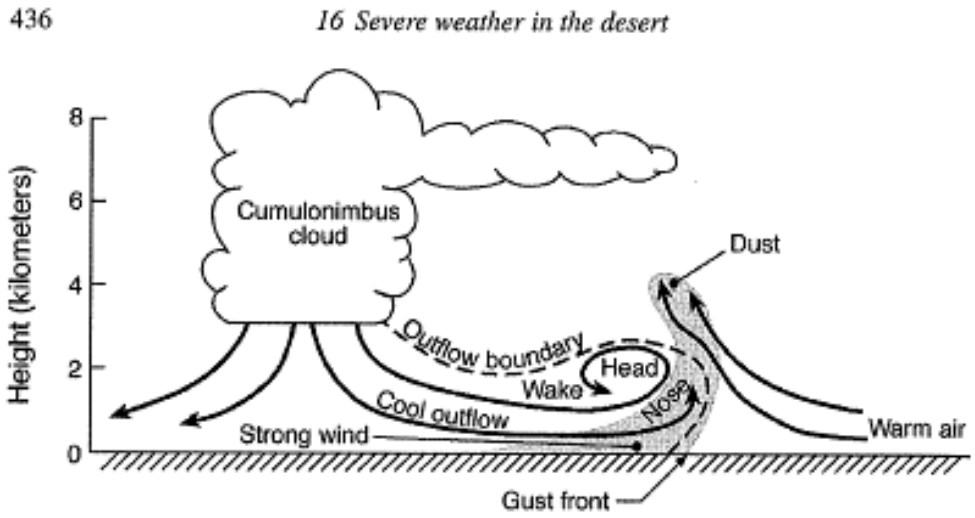


Figure 2-4. Average monthly temperatures and precipitation for Phoenix, 1981-2010.

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 of August 11, 2012, thunderstorms developed over Pima and Pinal counties. These storms moved north and weakened, but generated an outflow boundary with gusty winds that transported dust northward into the Phoenix area (**Figure 2-6**). The windblown dust resulted in 24-hr average PM_{10} concentrations in exceedance of the NAAQS at the two southernmost air quality monitors in the Phoenix PM_{10} nonattainment area (**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 mph overwhelmed reasonable dust

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

control measures. While only two monitors in Maricopa County recorded PM_{10} concentrations in exceedance of the NAAQS, several monitors across Maricopa and Pinal counties recorded elevated PM_{10} concentrations during this dust storm.

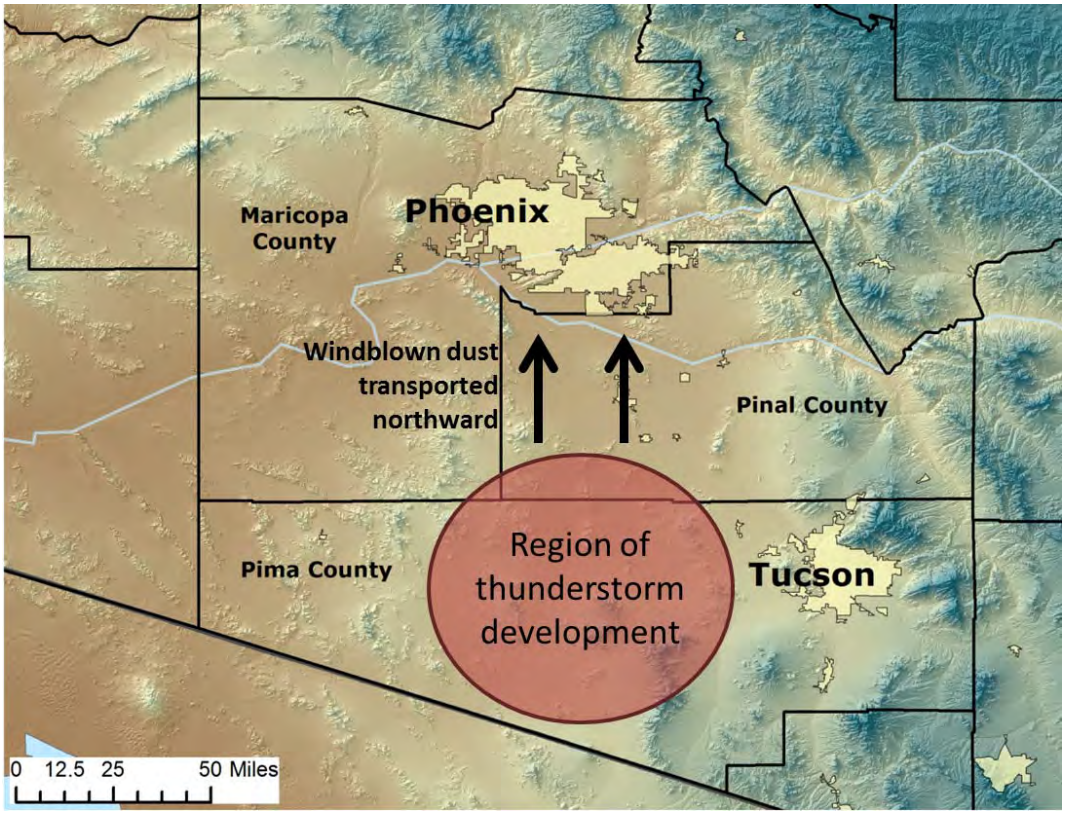


Figure 2-6. Thunderstorms over Pima and Pinal counties produced an outflow boundary that transported dust northward to the Phoenix area on August 11, 2012.

Table 2-1. Arizona PM_{10} measurements on August 11, 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	17	24	600	
Coconino County							
N/A	N/A	ADEQ	04-005-1237-81102-1	N/A	N/A	N/A	
Gila County							
Hayden Old Jail	TEOM	ADEQ	04-007-1001-81102-3	46	129	2300	

Table 2-1. Arizona PM_{10} measurements on August 11, 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
Maricopa County							
West Phoenix	BAM	MC	04-013-0019-81102-1	102	1026	1800	
North Phoenix	BAM	MC	04-013-1004-81102-1	127	1479	1800	
Glendale	TEOM	MC	04-013-2001-81102-1	76	309	1800	
Central Phoenix	TEOM	MC	04-013-3002-81102-4	120	1224	1800	
Greenwood	TEOM	MC	04-013-3010-81102-1	101	939	1800	
South Phoenix	TEOM	MC	04-013-4003-81102-1	132	891	1700	
West Chandler	**TEOM**	**MC**	**04-013-4004-81102-1**	**219**	**3351**	**1700**	**RJ**
Tempe	TEOM	MC	04-013-4005-81102-1	146	1588	1700	
Higley	**TEOM**	**MC**	**04-013-4006-81102-1**	**159**	**1534**	**1700**	**RJ**
West 43rd Ave	TEOM	MC	04-013-4009-81102-1	93	518	1800	
Dysart	TEOM	MC	04-013-4010-81102-1	85	232	700	
Buckeye	TEOM	MC	04-013-4011-81102-1	77	286	300	
Zuni Hills	TEOM	MC	04-013-4016-81102-1	84	193	700	
Fort McDowell/Yuma Frank	TEOM	FMIR	04-013-5100-81102-3	125	N/A	N/A	
Durango Complex	TEOM	MC	04-013-9812-81102-1	113	933	1800	
JLG Supersite	BAM	ADEQ	04-013-9997-81102-3	95	902	1800	
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	12	68	1900	
Pima County							
Ajo	TEOM	ADEQ	04-019-0001-81102-3	N/A	N/A	N/A	
Rillito	TEOM	ADEQ	04-019-0020-81102-3	32	53	0000	
Orange Grove	FRM	PCDEQ	04-019-0011-81102-2	22	N/A	N/A	
South Tucson	FRM	PCDEQ	04-019-1001-81102-1	24	N/A	N/A	
Green Valley	TEOM	PCDEQ	04-019-1030-81102-1	15	26	1900	
Geronimo	TEOM	PCDEQ	04-019-1113-81102-1	20	36	1800	
Pinal County							
Apache Junction Fire Station	FRM	PCAQCD	04-021-3002-81102-3	54	540	1800	
Casa Grande Downtown	TEOM	PCAQCD	04-021-0001-81102-3	128	2118	1600	
Stanfield	TEOM	PCAQCD	04-021-3008-81102-3	169	2915	1600	RJ
Combs School	TEOM	PCAQCD	04-021-3009-81102-3	61	536	1700	
Maricopa	TEOM	PCAQCD	04-021-3010-81102-3	86	1075	1700	

Table 2-1. Arizona PM_{10} measurements on August 11, 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
Pinal County Housing	TEOM	PCAQCD	04-021-3011-81102-3	80	626	1600	
Cowtown	TEOM	PCAQCD	04-021-3013-81102-3	199	2561	1600	RJ
Santa Cruz County							
Nogales Post Office	BAM	ADEQ	04-023-0004-81102-3	33	129	2300	
Yuma County							
Yuma Supersite	TEOM	ADEQ	04-027-8011-81102-3	41	118	0600	

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 11, 2012. On the afternoon of August 11, thunderstorms developed over Pima and Pinal counties, south of the Phoenix area (**Figure 3-1**). These thunderstorms generated a dust-carrying outflow boundary that propagated northward into the Phoenix area. The outflow boundary most strongly affected the southeast side of the Phoenix PM_{10} nonattainment 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 11, 2012, event was the deserts south of Maricopa County. 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.

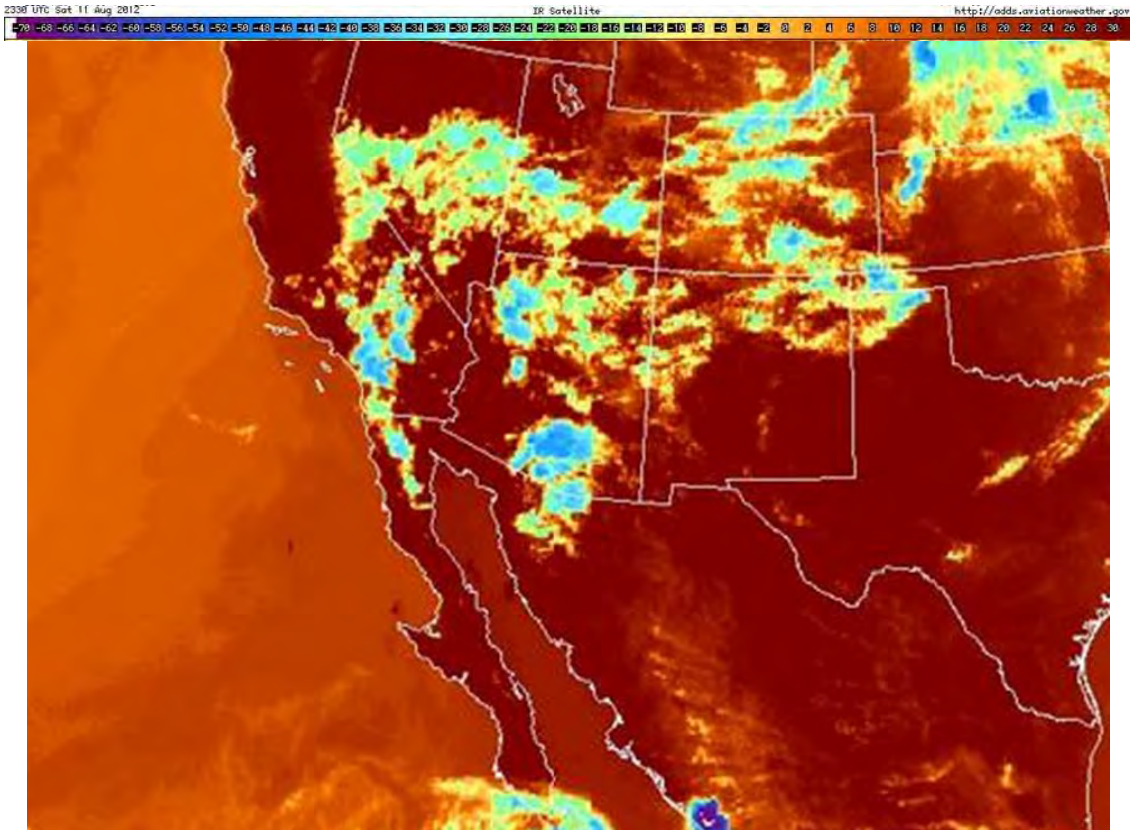

Figure 3-1. Infrared satellite image from 1630 LST on August 11, 2012 (GOES-West). Colder temperatures (blues, purples, and white) indicate tall, convective (thunderstorm) clouds. Thunderstorms over south-central Arizona generated an outflow boundary that carried dust northward into Arizona.

The first effects of the thunderstorm outflow and associated windblown dust were evident at Pinal County monitors during the 1600 LST hour on August 11, 2012, with sharp increases in PM_{10} at several monitors (**Figure 3-2**). The dust-laden outflow continued northward and arrived in the Phoenix area with significant reductions in visibility at KCHD about one hour later (**Figure 3-3**). PM_{10} concentrations at the West Chandler (**Figure 3-4**) and Higley (**Figure 3-5**) monitors increased sharply over this time period, with 1-hr PM_{10} concentrations exceeding 3,000 µg/m^3 at the West Chandler and 1,500 µg/m^3 at Higley. Collocated wind observations showed wind gusts in excess of 30 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, including sustained winds of 32 mph and a wind gust of 41 mph at KCHD (Appendix A). Visibility cameras in the Phoenix area also clearly showed a significant reduction in visibility and blowing dust as the outflow arrived around 1700 LST on August 11, 2012 (**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 before the abrupt increase in PM_{10} in the Phoenix area, winds were lighter and PM_{10} concentrations were much lower, illustrating a correlation between the high winds and the dust. In response to the approaching thunderstorm outflow and associated dust and low visibilities, the NWS office in Phoenix issued a Dust Storm Warning (Appendix D). Local storm spotters also reported visibilities below one quarter mile, coincident with the high PM_{10} concentrations.

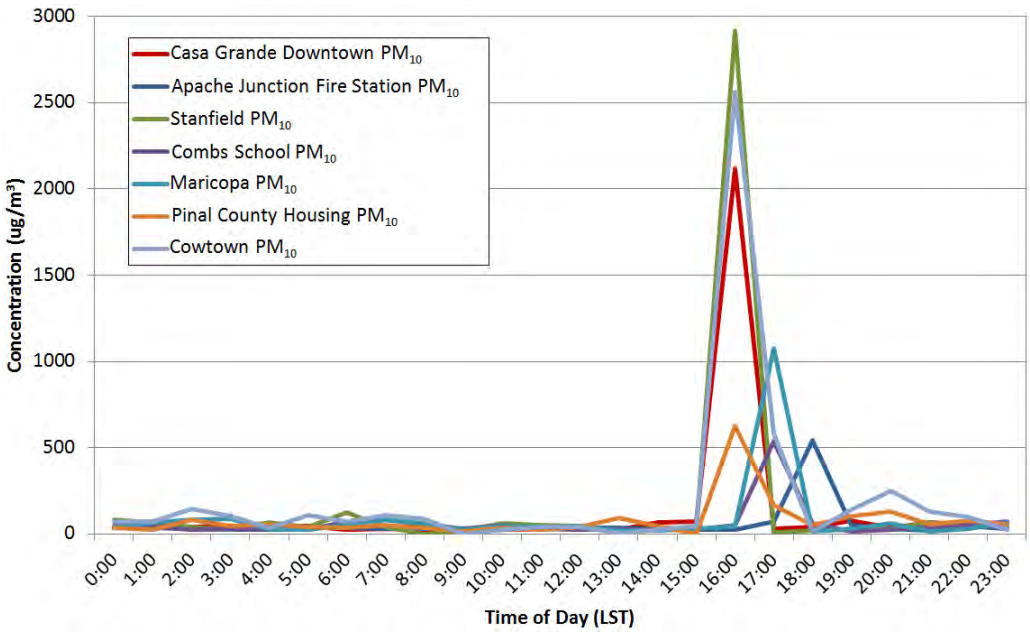

Figure 3-2. Hourly PM_{10} concentrations at Pinal County monitors on August 11, 2012. PM_{10} concentrations sharply increased between 1600 and 1800 LST coinciding with the arrival of windblown dust.

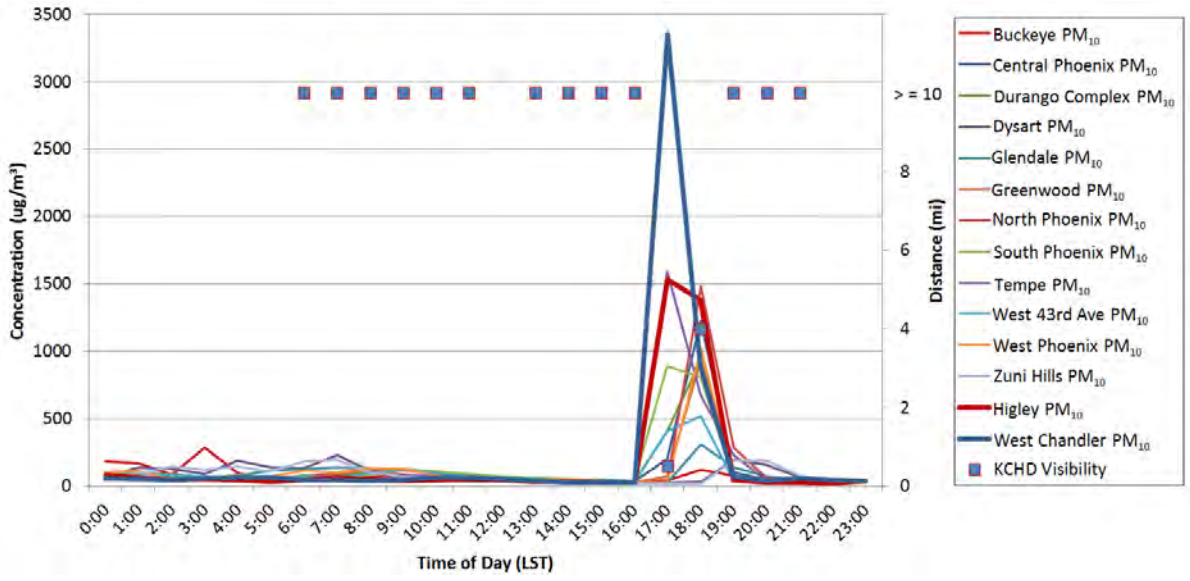

Figure 3-3. Hourly PM_{10} concentrations at Maricopa County monitors and visibility at KCHD on August 11, 2012. Monitors that measured PM_{10} exceedances on August 11, 2012 are highlighted by a thicker line. Visibility was greatly reduced between 1700 and 1900 LST coinciding with the sharp increase in PM_{10} concentrations at Phoenix area monitors, indicating the arrival of windblown dust.

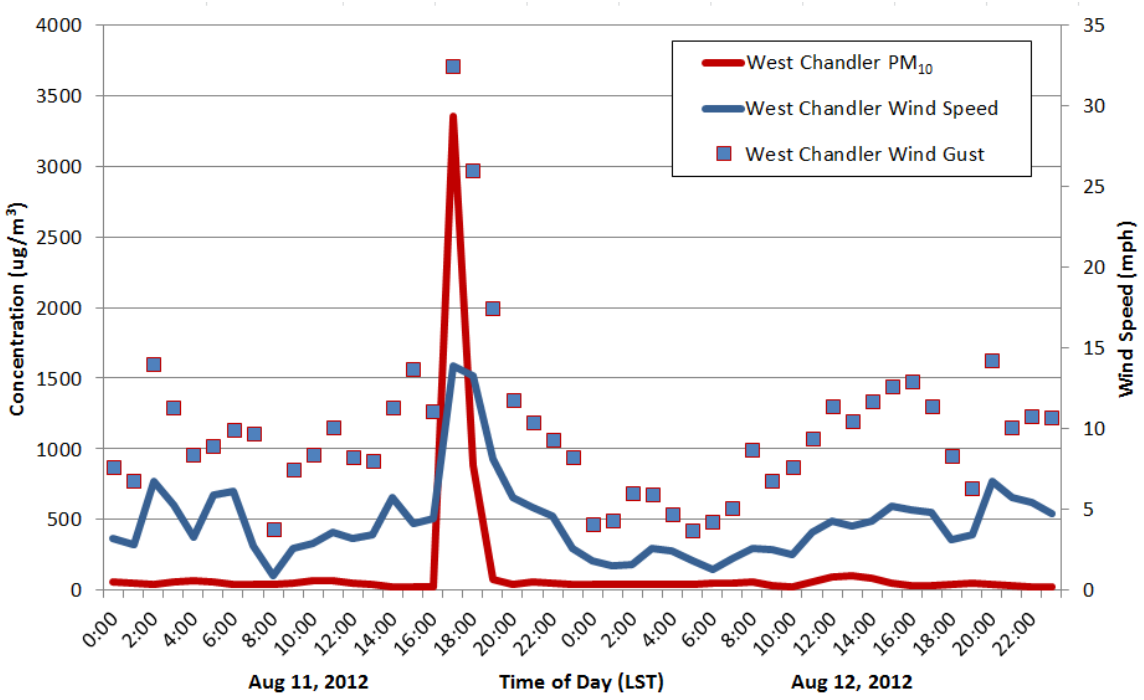

Figure 3-4. Hourly PM_{10} concentrations and wind speeds at the West Chandler monitor on August 11 and 12, 2012. PM_{10} concentrations and wind speeds sharply increased at 1700 LST on August 11, 2012, indicating the arrival of windblown dust.

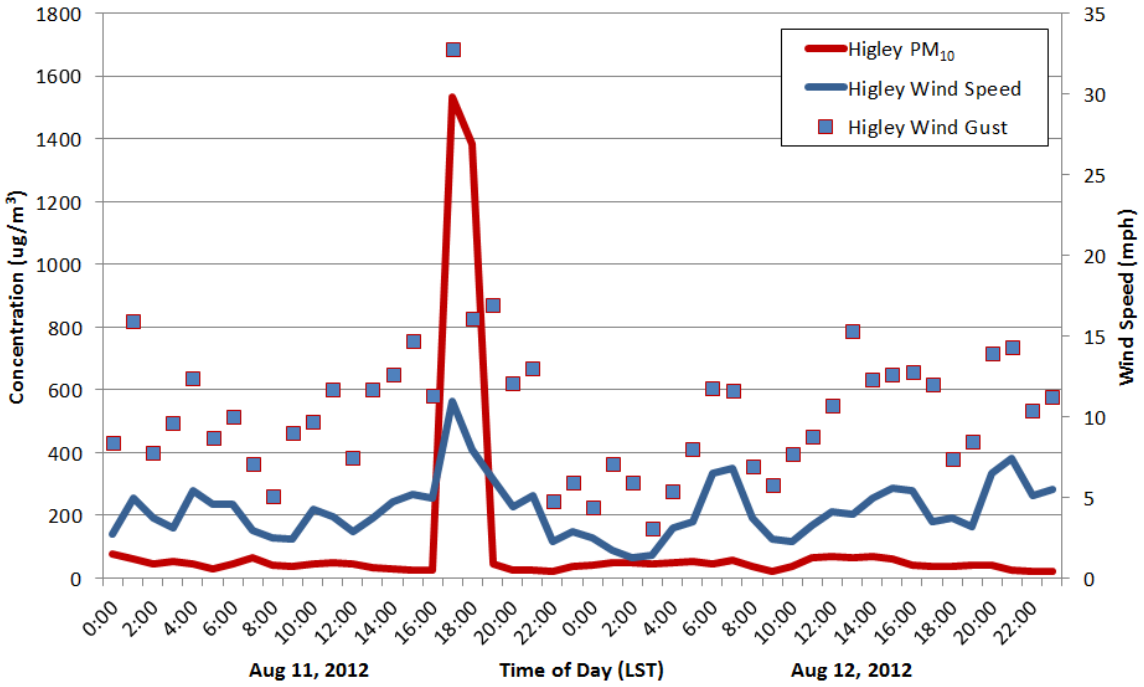

Figure 3-5. Hourly PM_{10} concentrations and wind speeds at the Higley monitor on August 11 and 12, 2012. PM_{10} concentrations and wind speeds sharply increased at 1700 LST on August 11, 2012, indicating the arrival of windblown dust.

Figure 3-6. Image from an ADEQ visibility camera on North Mountain facing south toward downtown Phoenix and the South Mountains. Windblown dust associated with thunderstorm outflow caused reduced visibilities in the Phoenix area, obscuring the downtown skyline and South mountains.

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

1630-1700 LST (Figure 3-7)

Between 1630 and 1700 LST, the outflow boundary was located over western Pinal County, south of the Phoenix area. South of the outflow boundary, PM_{10} concentrations exceeded 1500 µg/m^3 at some Pinal County monitors with wind gusts over 30 mph. In addition, visibility was reduced to 2 miles at Casa Grande in Pinal County near the outflow boundary with wind gusts in the area were over 30 mph. Monitors throughout Maricopa County, which were yet unaffected by the thunderstorm outflow, reported higher visibilities, lighter winds, and lower PM_{10} concentrations compared to monitors in western Pinal County.

1730-1800 LST (Figure 3-8)

Doppler radar clearly showed the outflow boundary advancing northward into Maricopa County during the 1700 hour. By 1730 LST, the boundary had moved through and north of the West Chandler and Higley monitors, where PM_{10} concentrations exceeded 1,500 µg/m^3 and gusty south to southwesterly winds were reported. Nearby airports also reported significant reductions in visibility, including 0.75 miles at KCHD. PM_{10} concentrations also increased at monitors in central and eastern portions of Phoenix as the outflow boundary moved through. However, concentrations were highest at the West Chandler and Higley monitors due to their closer proximity to the source of the outflow boundary and associated dust (outside the Phoenix PM_{10} nonattainment area). Thus, these monitors were subject to greater quantities of transported PM_{10} compared to other monitors in Maricopa County. As the outflow and associated dust moved away from Pinal County monitors, PM_{10} concentrations and wind speeds decreased and visibilities improved.

1830-1900 LST (Figure 3-9)

By 1830 LST, Doppler radar showed that the outflow boundary continued to move north of Phoenix. As the boundary moved north, visibilities decreased and south to southwesterly winds increased in areas of north Phoenix while visibilities increased and winds diminished in areas of south and southeast of Phoenix. PM_{10} concentrations at the West Chandler and Higley monitors also sharply decreased as the outflow moved north out of the area, illustrating that relationship between the location of the outflow boundary and the high PM_{10} concentrations.

1930-2000 LST (Figure 3-10)

By 1930 LST, the outflow boundary had moved well north of Phoenix. PM_{10} concentrations and wind speeds were much lower and visibilities had improved across most of the PM_{10} nonattainment area.

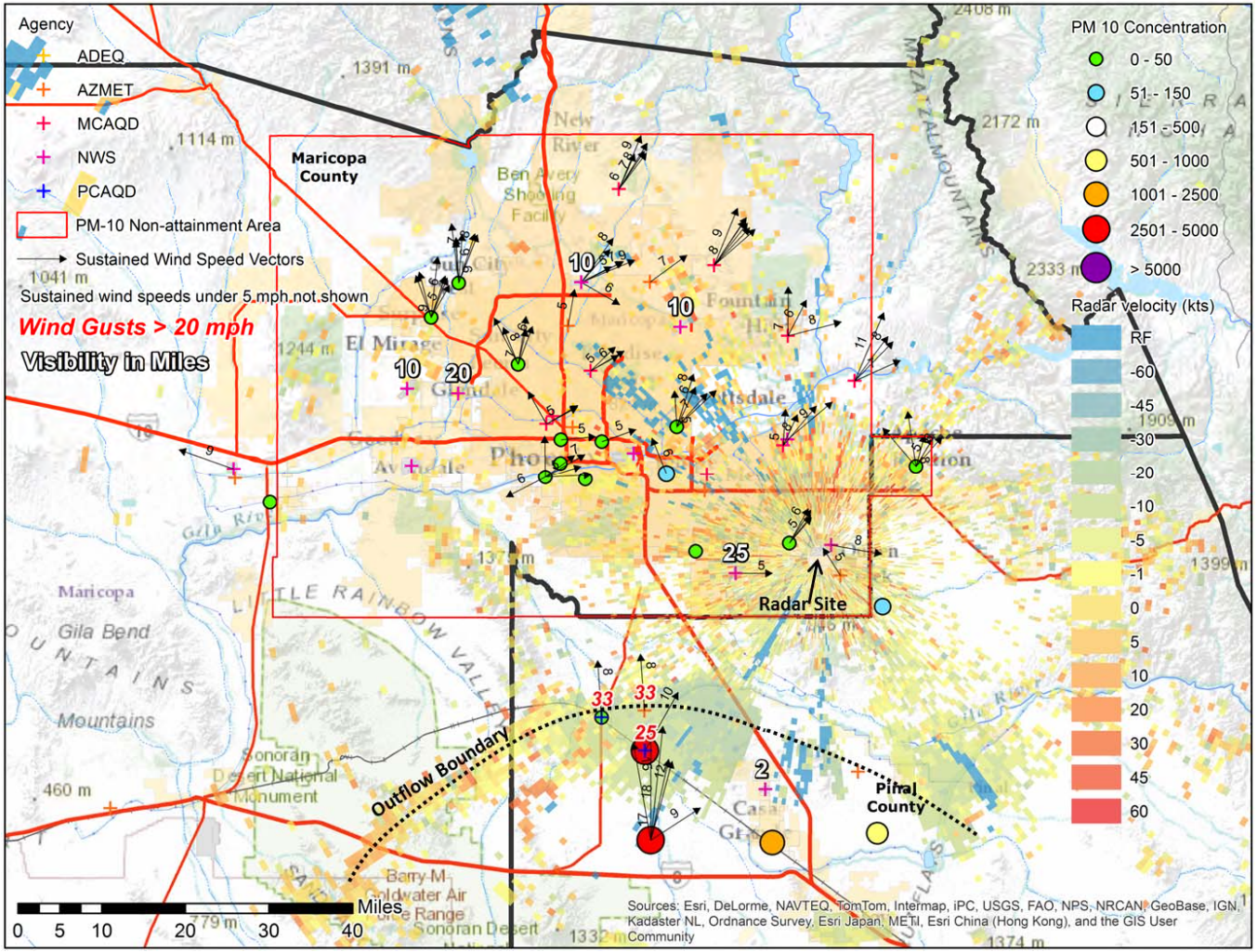

Figure 3-7. Maximum 5-minute PM_{10} concentrations (colored circles), 5-minute wind speed and direction, maximum wind gusts, and minimum visibility observations at Maricopa and Pinal County monitors between 1630 and 1700 LST on August 11, 2012. Where 5-minute data are not available (e.g., PM_{10} concentrations in Pinal County), 1-hr data are used. Underlying are Doppler radar velocity data at 1645 LST, where greens indicate motion toward the radar and oranges/reds indicate motion away from the radar.

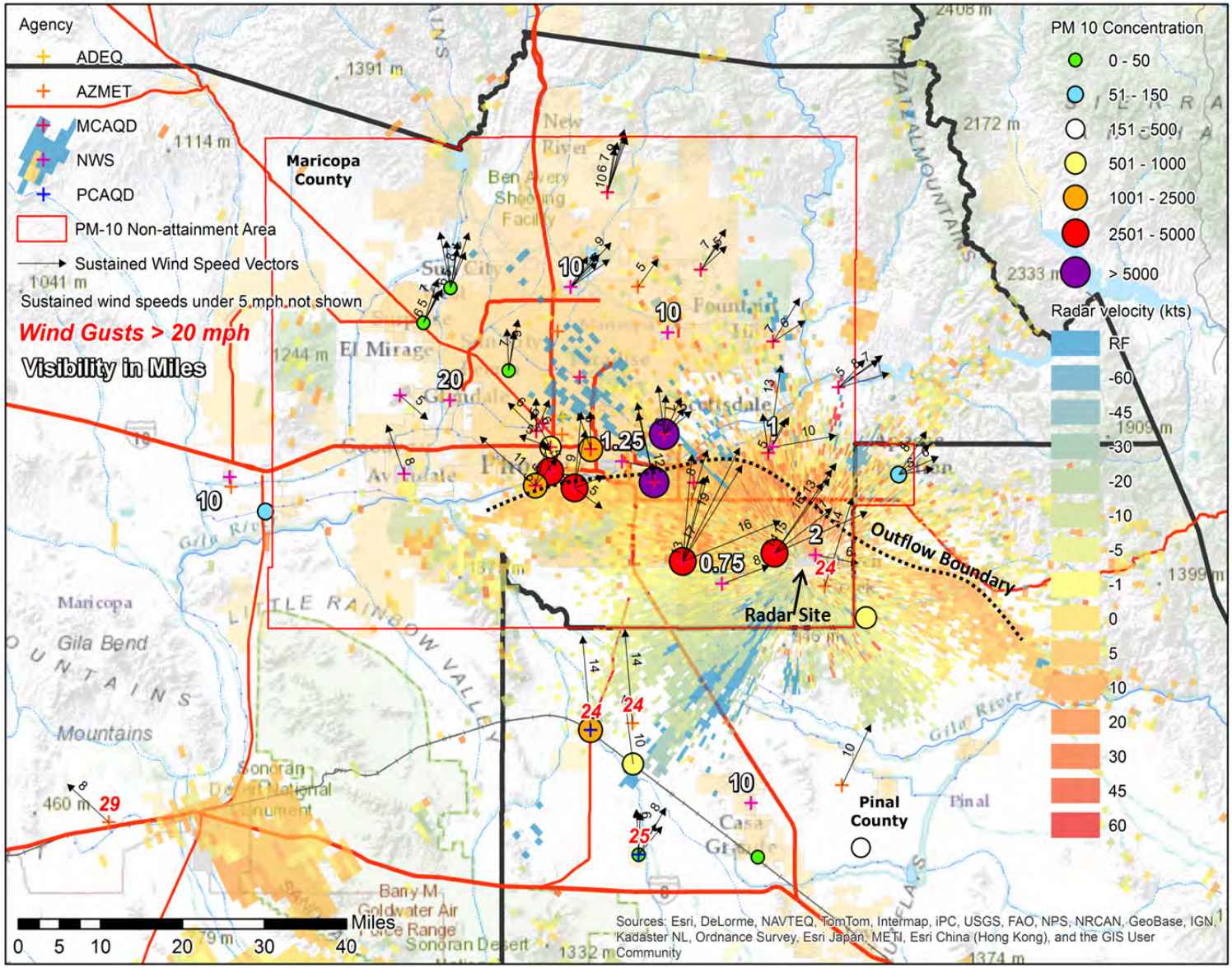

Figure 3-8. Similar to Figure 3-7, but representing observations from 1730 to 1800 LST. Doppler radar data are from 1736 LST.

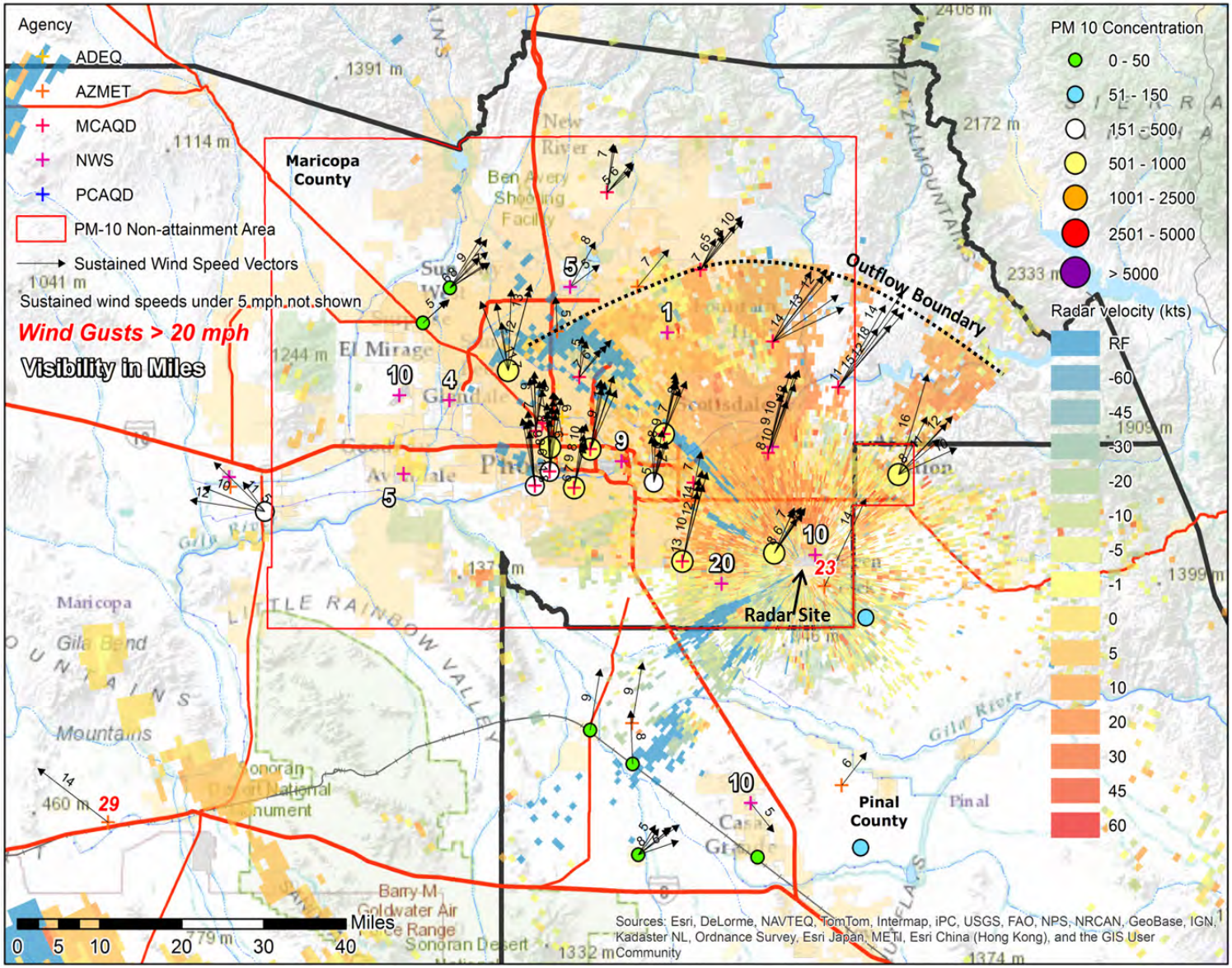

Figure 3-9. Similar to Figure 3-7, but representing observations from 1830 to 1900 LST. Doppler radar data are from 1830 LST.

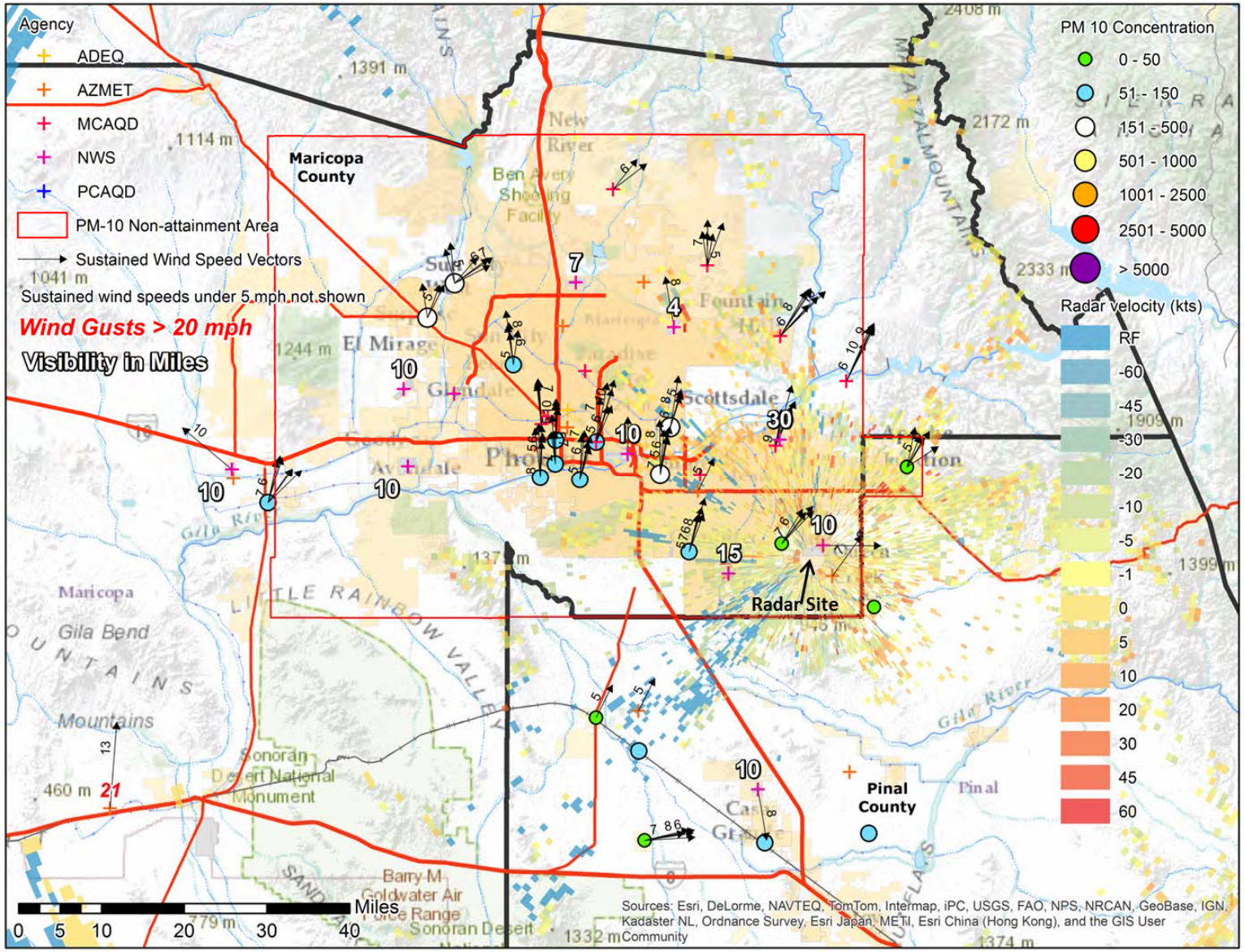

Figure 3-10. Similar to Figure 3-7, but representing observations from 1930 to 2000 LST. Doppler radar data are from 1931 LST.

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 11, 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 gusty winds, low visibilities, and airport observer reports of blowing dust. The fact that PM_{10} concentrations in Pinal County peaked prior to PM_{10} concentrations peaking in Maricopa County illustrates 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 exceeding monitors (Higley and West Chandler) to open and desert areas of Pinal County provide solid evidence as to why only 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 11, 2012, were unusual and in excess of normal historical fluctuations. To establish the severity of this event, PM_{10} concentrations measured on August 11, 2012, were compared to a historical 2007-2012 six-year annual data set at each monitor. The PM_{10} concentrations measured at the West Chandler monitor on August 11, 2012, resulted in some of the highest 24-hr averages (**Figure 4-1**) and daily maximum hourly averages (**Figure 4-2**) measured over the five-year period. Similar time-series plots for the other monitors are shown in Appendix C.

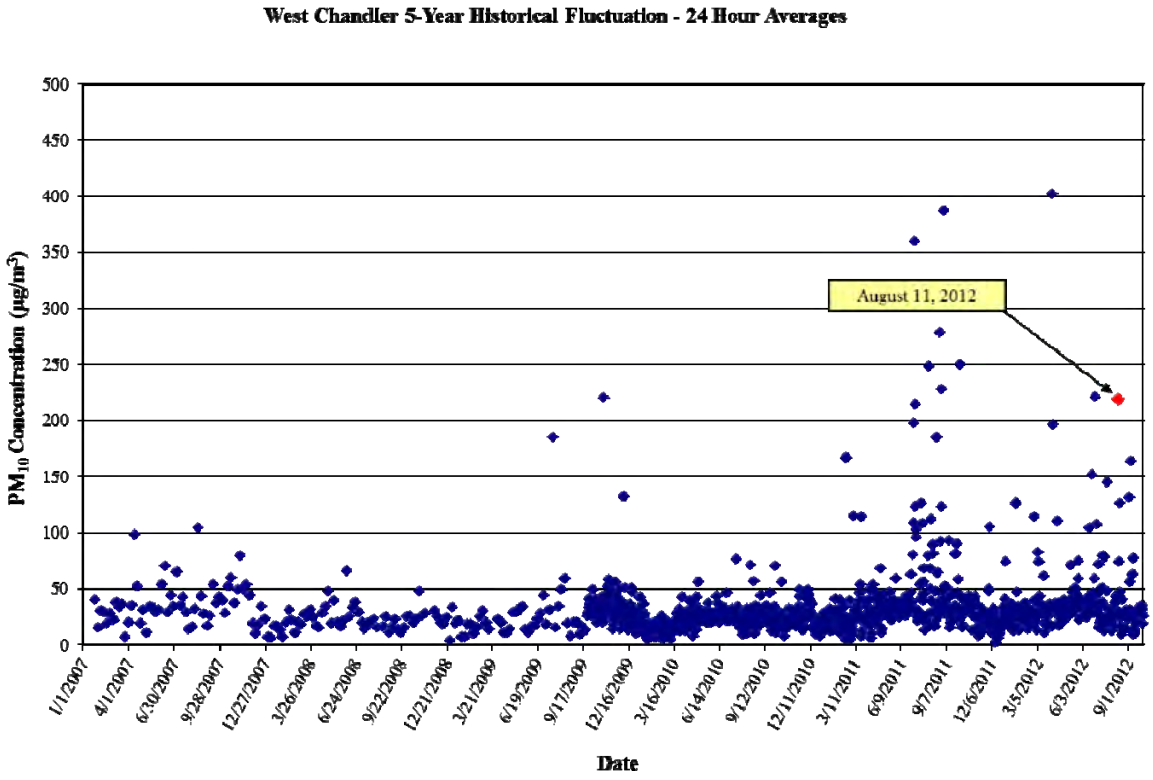

Figure 4-1. 24-hr average PM_{10} concentrations at the West Chandler monitor (2007-2011). The 24-hr average PM_{10} concentration on August 11, 2012, is shown in red and highlighted by the arrow.

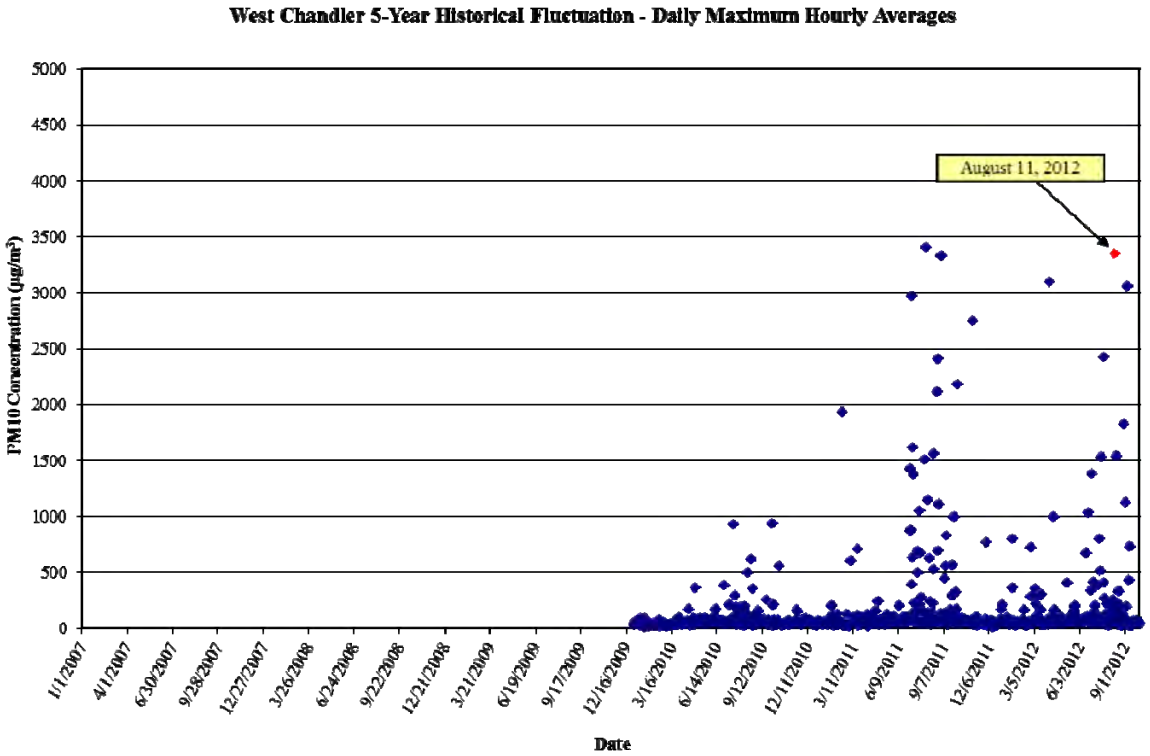

Figure 4-2. Daily maximum hourly average PM_{10} concentrations at the West Chandler monitor (2007-2011). The daily maximum hourly average PM_{10} concentration on August 11, 2012, is shown in red and highlighted by the arrow.

4.2 Summary

Given the recorded values and using a methodology similar to the one accepted by EPA, it is clear that the PM_{10} levels on August 11, 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 PM_{10} General Permit for Crop Operations** and R18-2-611.01 **Animal Operations PM_{10} 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.

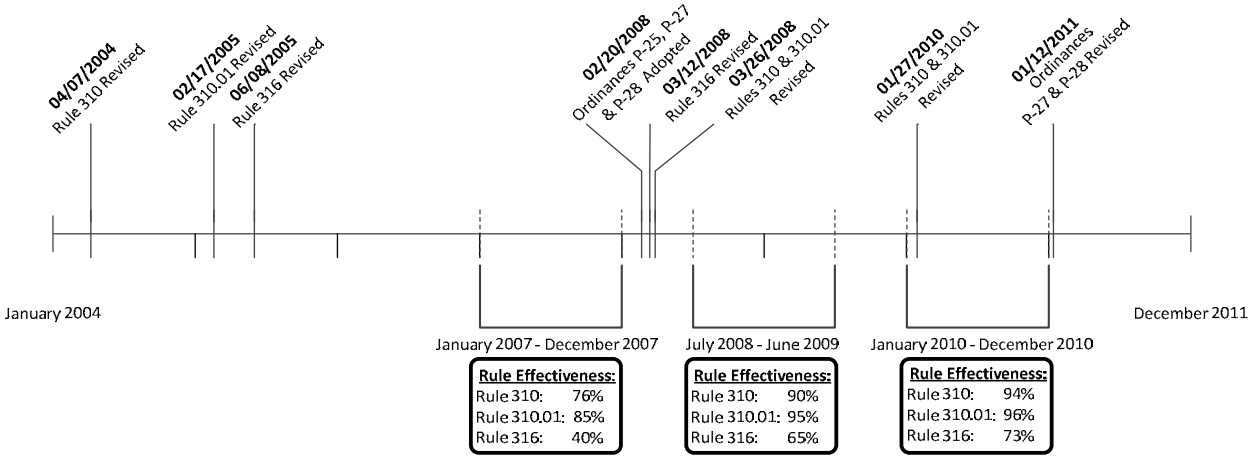

Figure 5-1. Timeline of Maricopa County fugitive dust rules and ordinances.

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 11, 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 8-14, 2012, MCAQD inspectors conducted a total of 213 inspections of permitted facilities, of which 142 were at fugitive dust sources. Additionally, MCAQD conducted 209 inspections on vacant lots and unpaved parking lots. During this seven-day period, a total of 43 violations were issued countywide for PM_{10} and non-PM_{10} related violations. One violation was issued for PM_{10} emissions within a four-mile radius of an exceedance monitor (Higley).

On August 9, 2012, a violation was issued to a permitted earthmoving site for being underpermitted by 0.14 acres. No unstable areas were observed during the routine inspection on August 9, 2012. A permit acreage increase was completed on August 15, 2012, to bring the total permitted area to 13.00 acres. The site is located 0.4 miles northeast of the Higley monitor. No unstable areas were observed during the inspection, and southerly winds during the thunderstorm outflow event on August 11, 2012, would have transported any PM_{10} emissions away from the Higley monitor. Therefore, the violation would not have contributed to the exceedance on August 11, 2012.

MCAQD was prepared for any complaints received due to the high wind event. During the seven-day period from August 8-14, 2012, MCAQD received 36 complaints, of which 22 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} violations of local, state, or federal regulations within a four-mile radius of the exceeding monitors.

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 11,

2012. The ADEQ Ag BMP inspector received one dust complaint on August 9 in the area of Citrus Road and Northern Avenue. The complaint was determined to be a normal agricultural operation after discussion with facility representatives.

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 10, 2012, ADEQ issued a Maricopa County Dust Control Forecast for August 11, 2012, indicating a low risk level for unhealthy PM_{10}. The Dust Control Forecast stated that light winds were expected, but that "during the active summer monsoon period, strong outflow winds from even distant thunderstorms can generate periods of dense blowing dust."

At 1622 LST, the NWS office in Phoenix issued a Dust Storm Warning 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 of 40 mph and visibilities reduced below one quarter mile due to blowing dust. Local storm reports issued by the NWS also indicated dust storm activity in Maricopa and Pinal counties coincident with the high PM_{10} concentrations.

5.3 Wind Observations

Wind data during the event (Figure 3-3, Figure 3-4, and Appendix A) showed winds gusts of over 30 mph coincident with the high PM_{10} concentrations.

5.4 Summary

The thunderstorm outflow event of August 11, 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 30 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 11, 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 11, 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 11, 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 one violation with 4 miles of an exceedance monitor and one dust complaint within three days before and after the time of the event; however, the sources behind the violation and complaint do not explain and could not have resulted in the very high PM_{10} concentrations observed on August 11, 2012. 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.

6.2 Summary

The weight of evidence presented in this submittal provides no alternative that could tie the exceedance of August 11, 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 11, 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. Visibility camera images also help to illustrate the magnitude and scale of this event. These facts provide strong evidence that the PM_{10} exceedances on August 11, 2012, were not reasonably controllable or preventable.

7.3 Natural Event

As discussed above, the PM_{10} exceedances in the Phoenix area on August 11, 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 and hours 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. The particular wind magnitudes and wind direction, and the proximity of the exceeding monitors to open and desert areas of 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} and daily maximum hourly average PM_{10} values measured at the exceedance 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 11, 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:
Additional Meteorological Data for Maricopa County

This section contains tables of meteorological data from NWS sites in the Phoenix area for August 11, 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
Data Version: VER3

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
11	0051	11	FEW160	10.00		100	37.8	70	21.3	54	12.2	21	0	000		28.54			29.64	AA		29.71
11	0151	11	FEW160	10.00		98	36.7	70	21.2	55	12.8	24	5	050		28.55	1	006	29.65	AA		29.72
11	0251	11	FEW160	10.00		94	34.4	70	21.1	57	13.9	29	6	120		28.57			29.67	AA		29.74
11	0351	11	FEW160	10.00		93	33.9	70	20.9	57	13.9	30	7	080		28.58			29.67	AA		29.75
11	0451	11	CLR	10.00		92	33.3	69	20.8	57	13.9	31	8	030		28.60	1	016	29.70	AA		29.77
11	0551	11	FEW160 SCT200	10.00		92	33.3	69	20.8	57	13.9	31	6	050		28.62			29.72	AA		29.79
11	0651	11	FEW120 SCT160 BKN250	10.00		94	34.4	70	21.1	57	13.9	29	3	VR		28.63			29.73	AA		29.80
11	0751	11	FEW120 SCT160 BKN250	10.00		97	36.1	71	21.6	57	13.9	26	0	000		28.66	1	019	29.75	AA		29.83
11	0851	11	FEW120 SCT160 BKN250	10.00		97	36.1	71	21.6	57	13.9	26	0	000		28.66			29.75	AA		29.83
11	0951	11	FEW120 SCT160 BKN250	10.00		99	37.2	71	21.9	57	13.9	25	5	VR		28.66			29.76	AA		29.83
11	1051	11	FEW120 SCT160 BKN250	10.00		101	38.3	72	21.9	56	13.3	22	6	280		28.65	8	002	29.75	AA		29.82
11	1151	11	FEW120 SCT160 SCT250	10.00		104	40.0	72	22.1	55	12.8	20	0	000		28.63			29.72	AA		29.80
11	1251	11	FEW120 SCT160 BKN210	10.00		107	41.7	73	22.6	55	12.8	18	6	180		28.60			29.70	AA		29.77
11	1351	11	FEW120 SCT160 BKN210	10.00		107	41.7	72	22.3	54	12.2	17	3	VR		28.58	8	024	29.67	AA		29.75
11	1451	11	FEW120 SCT160 BKN200	10.00		108	42.2	73	22.5	54	12.2	17	7	210		28.55			29.65	AA		29.72
11	1551	11	FEW120 SCT160 BKN210	10.00		110	43.3	73	22.8	54	12.2	16	5	VR		28.52			29.62	AA		29.69
11	1651	11	FEW120 SCT180 BKN210	10.00		108	42.2	72	22.3	53	11.7	16	5	VR		28.52	6	019	29.62	AA		29.69
11	1749	11	SCT120 SCT180 BKN210	2.00	BLDU	108	42.0	73	22.7	55	13.0	17	17	190	26	28.52			M	SP		29.69
11	1751	11	SCT120 SCT180 BKN210	1.25	BLDU	107	41.7	73	22.8	56	13.3	19	21	190	26	28.52			29.62	AA		29.69
11	1800	11	SCT120 BKN180 BKN210	0.75	BLDU	106	41.0	72	22.4	55	13.0	19	16	190	26	28.52			M	SP		29.69
11	1808	11	SCT120 BKN180 BKN210	1.25	BLDU	106	41.0	72	22.4	55	13.0	19	13	190	23	28.52			M	SP		29.69
11	1817	11	SCT120 BKN180 BKN210	2.00	BLDU	106	41.0	72	22.2	54	12.0	18	16	180	22	28.52			M	SP		29.69
11	1829	11	SCT120 BKN180 BKN210	4.00	BLDU	108	42.0	72	22.0	52	11.0	16	17	190	22	28.52			M	SP		29.69
11	1851	11	SCT120 SCT180 BKN210	9.00		106	41.1	70	20.9	48	8.9	14	16	190		28.53			29.63	AA		29.70
11	1951	11	FEW120 SCT180 BKN210	10.00		104	40.0	70	20.8	49	9.4	16	7	180		28.55	3	009	29.65	AA		29.72
11	2051	11	FEW120 SCT180 BKN210	10.00		102	38.9	69	20.7	50	10.0	17	5	180		28.56			29.66	AA		29.73
11	2151	11	FEW120 SCT180 BKN210	10.00		103	39.4	70	20.8	50	10.0	17	7	310		28.58			29.67	AA		29.75
11	2251	11	FEW120 SCT180 BKN210	10.00		100	37.8	70	21.0	53	11.7	21	5	060		28.58	1	013	29.68	AA		29.75
11	2351	11	FEW180 SCT210	10.00		98	36.7	70	21.0	54	12.2	23	3	050		28.59			29.69	AA		29.76

Figure A-1. Quality-controlled local climatological data hourly observations table for Phoenix Sky Harbor International Airport, Phoenix, Arizona (08/11/2012). Note in the Weather Type column that BLDU (blowing dust) with reduced visibilities and gusty winds were reported for several hours. 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.

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

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final) HOURLY OBSERVATIONS TABLE CHANDLER MUNICIPAL AIRPORT (53128) CHANDLER, AZ (08/2012)

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

Elevation: 1243 ft. above sea level
Latitude: 33.268
Longitude: -111.812
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
11	0547	0	SCT200	30.00		84	29.0	68	20.0	59	15.0	43	9	050		28.48			M	AA		29.80
11	0647	0	BKN200	30.00		88	31.0	69	20.7	59	15.0	38	9	080		28.51			M	AA		29.83
11	0747	0	BKN200	30.00		91	33.0	70	21.1	59	15.0	34	3	VR		28.52			M	AA		29.84
11	0847	0	BKN200	30.00		95	35.0	71	21.8	59	15.0	30	6	270		28.52			M	AA		29.84
11	0947	0	FEW150 BKN200	30.00		97	36.0	71	21.6	57	14.0	26	6	270		28.52			M	AA		29.84
11	1047	0	FEW150 BKN200	35.00		100	38.0	71	21.5	55	13.0	22	8	250		28.52			M	AA		29.84
11	1247	0	FEW120 SCT160 BKN250	30.00		106	41.0	72	22.4	55	13.0	19	3	210		28.47			M	AA		29.79
11	1347	0	SCT150 BKN200	30.00		109	43.0	72	22.2	52	11.0	15	8	230		28.44			M	AA		29.76
11	1447	0	FEW150 BKN200	30.00		108	42.0	72	22.0	52	11.0	16	6	260		28.43			M	AA		29.74
11	1555	0	FEW150 SCT200	30.00		109	43.0	72	22.2	52	11.0	15	5	230		28.40			M	AA		29.71
11	1647	0	SCT150 BKN200	25.00	BLDUs	109	43.0	72	22.2	52	11.0	15	9	230		28.40			M	AA		29.71
11	1710	0	SCT150 BKN200	0.50s	BLDU	109	43.0	73	22.6	54	12.0	16	32	180	41	28.40			M	AA		29.71
11	1747	0	SCT150 BKN210	0.75	BLDU	102	39.0	71	21.6	54	12.0	20	28	180		28.40			M	AA		29.72
11	1804	0	SCT150 BKN210	4.00		102	39.0	70	21.1	52	11.0	19	20	180		28.40			M	AA		29.71
11	1847	0	SCT130 BKN210	20.00		100	38.0	70	20.8	52	11.0	20	17	180		28.40			M	AA		29.72
11	1947	0	SCT150	15.00		99	37.0	69	20.6	52	11.0	21	10	200		28.43			M	AA		29.74
11	2047	0	SCT150	15.00		95	35.0	68	20.0	52	11.0	23	7	160		28.46			M	AA		29.77

Figure A-2. Quality-controlled local climatological data hourly observations table for Chandler Municipal Airport, Chandler, Arizona (08/11/2012). Note in the Weather Type column that BLDU (blowing dust) with reduced visibilities and gusty winds were reported after 1700 LST, coincident with high PM_{10} concentrations at nearby air quality monitors. 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
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
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
11	0015	0	CLR	10.00		95	35.0	70	21.2	57	14.0	28	8	120		28.31			M	AA		29.77
11	0035	0	CLR	10.00		93	34.0	70	20.9	57	14.0	30	6	120		28.31			M	AA		29.77
11	0155	0	CLR	10.00		90	32.0	69	20.4	57	14.0	33	10	140		28.32			M	AA		29.78
11	0215	0	CLR	10.00		90	32.0	68	19.9	55	13.0	31	10	150		28.32			M	AA		29.78
11	0235	0	CLR	10.00		90	32.0	69	20.4	57	14.0	33	8	140		28.33			M	AA		29.79
11	0335	0	CLR	10.00		90	32.0	68	19.9	55	13.0	31	5	120		28.34			M	AA		29.80
11	0355	0	CLR	10.00		88	31.0	67	19.5	55	13.0	33	6	090		28.34			M	AA		29.80
11	0415	0	CLR	10.00		90	32.0	67	19.6	54	12.0	29	6	100		28.34			M	AA		29.80
11	0435	0	CLR	10.00		90	32.0	67	19.6	54	12.0	29	8	100		28.35			M	AA		29.81
11	0455	0	CLR	10.00		90	32.0	67	19.6	54	12.0	29	7	110		28.36			M	AA		29.82
11	0515	0	CLR	10.00		90	32.0	67	19.6	54	12.0	29	7	100		28.37			M	AA		29.83
11	0547	0	FEW120 SCT200	35.00		90	32.0	68	19.9	55	13.0	31	6	100		28.38			M	AA		29.84
11	0647	0	FEW120 SCT200	35.00		90	32.0	69	20.4	57	14.0	33	8	130		28.40			M	AA		29.86
11	0747	0	FEW150 SCT200	35.00		93	34.0	72	22.0	61	16.0	34	6	120		28.40			M	AA		29.86
11	0847	0	FEW150 SCT200	35.00		97	36.0	73	22.6	61	16.0	30	0	000		28.41			M	AA		29.87
11	0947	0	FEW150 SCT200	35.00		102	39.0	72	22.3	57	14.0	23	8	280		28.41			M	AA		29.87
11	1047	0	FEW150 SCT200	35.00		102	39.0	72	22.3	57	14.0	23	7	280		28.41			M	AA		29.87
11	1147	0	SCT150 BKN200	30.00		106	41.0	72	22.4	55	13.0	19	3	VR		28.39			M	AA		29.85
11	1247	0	SCT150 BKN200	30.00		108	42.0	72	22.4	54	12.0	17	9	270		28.36			M	AA		29.82
11	1347	0	SCT150 BKN200	30.00		109	43.0	73	22.6	54	12.0	16	10	270		28.33			M	AA		29.79
11	1447	0	SCT150 BKN200	30.00		111	44.0	72	22.4	52	11.0	14	5	260		28.30			M	AA		29.76
11	1547	0	SCT150 BKN200	30.00		111	44.0	72	22.4	52	11.0	14	11	220		28.28			M	AA		29.74
11	1647	0	SCT150 BKN200	30.00		113	45.0	72	21.9	48	9.0	12	6	VR		28.27			M	AA		29.73
11	1725	0	SCT150 BKN200	0.50s	DSs	111	44.0	72	22.0	50	10.0	13	23	220		28.27			M	AA		29.73
11	1747	0	SCT150 BKN200	2.00	BLDU	108	42.0	72	22.4	54	12.0	17	17	220	31	28.29			M	AA		29.75
11	1811	0	SCT150 BKN200	5.00	BLDU	106	41.0	72	22.1	54	12.0	18	17	230		28.29			M	AA		29.75
11	1847	0	BKN150	10.00		106	41.0	70	20.8	48	9.0	14	11	220		28.29			M	AA		29.75
11	1947	0	BKN	20.00		102	39.0	M	M	48	9.0	M	7	250		M			M	AA		29.77
11	1955	0	CLR	10.00		100	38.0	69	20.3	50	10.0	19	7	270		28.32			M	AA		29.78
11	2015	0	CLR	10.00		100	38.0	69	20.8	52	11.0	20	7	260		28.32			M	AA		29.78
11	2035	0	CLR	10.00		100	38.0	69	20.8	52	11.0	20	5	250		28.33			M	AA		29.79
11	2047	0	BKN	20.00		102	39.0	M	M	54	12.0	M	5	220		M			M	AA		29.79
11	2055	0	CLR	10.00		99	37.0	69	20.6	52	11.0	21	7	180		28.34			M	AA		29.80
11	2115	0	CLR	10.00		97	36.0	69	20.3	52	11.0	22	0	000		28.35			M	AA		29.81
11	2135	0	CLR	10.00		97	36.0	69	20.3	52	11.0	22	0	000		28.35			M	AA		29.81
11	2155	0	CLR	10.00		100	38.0	69	20.8	52	11.0	20	0	000		28.35			M	AA		29.81
11	2215	0	CLR	10.00		97	36.0	68	19.8	50	10.0	20	0	000		28.34			M	AA		29.80

11	2235	0	CLR	10.00		97	36.0	68	19.8	50	10.0	20	5	120		28.34			M	AA		29.80
11	2255	0	CLR	10.00		97	36.0	68	19.8	50	10.0	20	6	090		28.34			M	AA		29.80
11	2315	0	CLR	10.00		97	36.0	68	19.8	50	10.0	20	3	080		28.35			M	AA		29.81
11	2335	0	CLR	10.00		91	33.0	67	19.3	52	11.0	26	6	150		28.35			M	AA		29.81
11	2355	0	CLR	10.00		93	34.0	67	19.6	52	11.0	25	5	150		28.35			M	AA		29.81

Figure A-3. Quality-controlled local climatological data hourly observations table for Williams Gateway Airport, Phoenix, Arizona (08/11/2012). Note in the Weather Type column that BLDU (blowing dust) and DS (dust storm) with reduced visibilities and gusty winds were reported after 1700 LST, coincident with high PM_{10} concentrations at nearby air quality monitors. 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 FALCON FIELD AIRPORT (03185) MESA, AZ (08/2012)

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

Elevation: 1380 ft. above sea level
Latitude: 33.466
Longitude: -111.733
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
11	0518	0	SCT200	30.00		90	32.0	68	19.9	55	13.0	31	5	060		28.33			M	AA		29.80
11	0647	0	SCT160 BKN200	35.00		90	32.0	68	19.9	55	13.0	31	8	050		28.37			M	AA		29.84
11	0947	0	SCT150 BKN180	40.00		97	36.0	71	21.5	57	14.0	26	9	230		28.38			M	AA		29.85
11	1047	0	BKN200	35.00		99	37.0	71	21.8	57	14.0	25	10	260		28.37			M	AA		29.84
11	1147	0	BKN180	35.00		104	40.0	72	22.1	55	13.0	20	10	200		28.35			M	AA		29.82
11	1547	0	FEW120 SCT150	35.00		109	43.0	72	22.1	52	11.0	15	9	190		28.25			M	AA		29.72
11	1750	0	FEW120	1.00	BLDU	106	41.0	72	22.4	55	13.0	19	17	270	29	28.24			M	AA		29.71
11	1952	0	BKN200	30.00		100	38.0	69	20.3	50	10.0	19	8	190		28.28			M	AA		29.75

Figure A-4. Quality-controlled local climatological data hourly observations table for Falcon Field Airport, Mesa, Arizona (08/11/2012). Note in the Weather Type column that BLDU (blowing dust) with reduced visibilities and gusty winds were reported after 1700 LST, coincident with high PM_{10} concentrations at nearby air quality monitors. 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
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
11	0055	0	CLR	10.00		96	35.6	71	21.7	58	14.2	28	10	210		28.57			29.62	AA		29.72
11	0155	0	CLR	10.00		95	35.2	70	21.3	57	13.9	28	10	220		28.57	3	004	29.63	AA		29.72
11	0255	0	CLR	10.00		94	34.5	71	21.4	58	14.4	30	10	210		28.58			29.63	AA		29.73
11	0355	0	CLR	10.00		92	33.5	71	21.6	60	15.5	34	14	240		28.60			29.66	AA		29.75
11	0455	0	CLR	10.00		91	32.7	70	21.2	59	15.2	34	9	220		28.61	2	013	29.67	AA		29.76
11	0555	0	CLR	10.00		89	31.9	70	20.8	59	14.9	36	9	010		28.63			29.69	AA		29.78
11	0655	0	CLR	10.00		91	32.7	70	21.2	59	14.9	34	8	050		28.65			29.71	AA		29.80
11	0755	0	CLR	10.00		94	34.6	72	22.2	61	16.0	33	3	VR		28.68	3	022	29.74	AA		29.83
11	0855	0	CLR	10.00		98	36.9	72	22.3	59	14.9	27	7	320		28.68			29.74	AA		29.83
11	0955	0	CLR	10.00		100	37.6	73	22.6	59	14.8	26	3	270		28.68			29.74	AA		29.83
11	1055	0	CLR	10.00		104	39.8	73	22.9	58	14.2	22	6	310		28.66	8	005	29.72	AA		29.81
11	1155	0	FEW120	10.00		106	41.0	73	22.7	56	13.5	19	3	VR		28.64			29.69	AA		29.79
11	1255	0	CLR	10.00		108	42.3	74	23.2	57	13.8	19	5	030		28.61			29.67	AA		29.76
11	1355	0	CLR	10.00		109	42.6	74	23.1	56	13.1	18	8	200		28.59	6	024	29.64	AA		29.74
11	1455	0	FEW200	10.00		109	42.9	73	22.9	55	13.0	17	7	VR		28.57			29.62	AA		29.72
11	1555	0	CLR	10.00		110	43.3	73	22.5	53	11.6	15	7	VR		28.55			29.60	AA		29.70
11	1655	0	CLR	10.00		108	42.3	72	22.3	53	11.6	16	7	180		28.54	6	016	29.59	AA		29.69
11	1755	0	SCT160 SCT210	10.00		107	41.9	72	22.3	54	12.0	17	0	000		28.54			29.60	AA		29.69
11	1855	0	SCT210	10.00		108	42.0	73	22.7	55	12.6	17	6	220		28.54			29.60	AA		29.69
11	1955	0	SCT170	10.00		103	39.5	73	23.0	59	15.1	23	10	240		28.57	3	009	29.63	AA		29.72
11	2055	0	BKN200	10.00		102	38.9	73	22.6	58	14.6	23	14	230		28.58			29.64	AA		29.73
11	2155	0	CLR	10.00		97	36.1	72	22.1	59	15.2	28	11	230		28.61			29.67	AA		29.76
11	2255	0	CLR	10.00		97	36.3	72	22.1	59	14.8	28	9	200		28.60	0	009	29.65	AA		29.75
11	2355	0	BKN190	10.00		97	36.2	71	21.6	57	14.0	26	6	020		28.61			29.67	AA		29.76

Figure A-5. Quality-controlled local climatological data hourly observations table for Luke Air Force Base, Glendale, Arizona (08/11/2012). 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
11	0015	0	CLR	10.00		90	32.0	67	19.6	54	12.0	29	0	000		28.23			M	AA		29.77
11	0035	0	CLR	10.00		90	32.0	67	19.6	54	12.0	29	0	000		28.23			M	AA		29.77
11	0055	0	CLR	10.00		91	33.0	68	19.8	54	12.0	29	3	100		28.24			M	AA		29.78
11	0115	0	CLR	10.00		91	33.0	68	20.0	55	13.0	30	3	130		28.24			M	AA		29.78
11	0135	0	CLR	10.00		91	33.0	68	20.0	55	13.0	30	7	170		28.25			M	AA		29.79
11	0155	0	CLR	10.00		90	32.0	68	19.9	55	13.0	31	3	230		28.25	2	014	M	AA		29.80
11	0215	0	CLR	10.00		88	31.0	67	19.5	55	13.0	33	0	000		28.25			M	AA		29.80
11	0235	0	CLR	10.00		90	32.0	68	19.9	55	13.0	31	6	170		28.25			M	AA		29.80
11	0255	0	CLR	10.00		90	32.0	69	20.4	57	14.0	33	3	230		28.25			M	AA		29.80
11	0315	0	CLR	10.00		88	31.0	67	19.5	55	13.0	33	0	000		28.25			M	AA		29.80
11	0335	0	CLR	10.00		86	30.0	67	19.2	55	13.0	35	0	000		28.25			M	AA		29.80
11	0355	0	CLR	10.00		86	30.0	67	19.2	55	13.0	35	3	350		28.25			M	AA		29.80
11	0415	0	CLR	10.00		84	29.0	66	18.8	55	13.0	37	0	000		28.25			M	AA		29.80
11	0435	0	CLR	10.00		86	30.0	67	19.2	55	13.0	35	6	060		28.25			M	AA		29.80
11	0455	0	CLR	10.00		84	29.0	66	18.8	55	13.0	37	8	030		28.27	2	003	M	AA		29.81
11	0515	0	CLR	10.00		84	29.0	66	18.8	55	13.0	37	0	000		28.27			M	AA		29.82
11	0535	0	CLR	10.00		84	29.0	66	18.8	55	13.0	37	5	070		28.27			M	AA		29.82
11	0555	0	CLR	10.00		84	29.0	68	19.9	59	15.0	43	9	120		28.28			M	AA		29.83
11	0615	0	CLR	10.00		84	29.0	69	20.5	61	16.0	46	10	120		28.29			M	AA		29.84
11	0635	0	CLR	10.00		84	29.0	69	20.5	61	16.0	46	8	120		28.30			M	AA		29.85
11	0655	0	CLR	10.00		86	30.0	70	20.9	61	16.0	43	6	090		28.30			M	AA		29.85
11	0715	0	CLR	10.00		84	29.0	69	20.5	61	16.0	46	5	030		28.31			M	AA		29.86
11	0735	0	CLR	10.00		88	31.0	70	21.2	61	16.0	40	5	050		28.30			M	AA		29.85
11	0755	0	CLR	10.00		90	32.0	71	21.5	61	16.0	38	0	000		28.32	2	020	M	AA		29.87
11	0815	0	CLR	10.00		91	33.0	71	21.7	61	16.0	37	6	160		28.32			M	AA		29.87
11	0835	0	CLR	10.00		93	34.0	72	22.0	61	16.0	34	8	170		28.32			M	AA		29.87
11	0855	0	CLR	10.00		95	35.0	72	22.3	61	16.0	32	8	190		28.32			M	AA		29.87
11	0915	0	CLR	10.00		97	36.0	72	22.1	59	15.0	28	0	000		28.32			M	AA		29.87
11	0935	0	CLR	10.00		97	36.0	71	21.5	57	14.0	26	0	000		28.32			M	AA		29.87
11	0955	0	CLR	10.00		97	36.0	71	21.5	57	14.0	26	0	000		28.32			M	AA		29.87
11	1015	0	CLR	10.00		97	36.0	72	22.1	59	15.0	28	0	000		28.32			M	AA		29.87
11	1035	0	CLR	10.00		97	36.0	71	21.5	57	14.0	26	0	000		28.32			M	AA		29.87
11	1055	0	CLR	10.00		99	37.0	71	21.8	57	14.0	25	0	000		28.32	4	000	M	AA		29.87
11	1115	0	CLR	10.00		99	37.0	71	21.8	57	14.0	25	8	320		28.31			M	AA		29.86
11	1135	0	CLR	10.00		100	38.0	72	22.0	57	14.0	24	6	320		28.30			M	AA		29.85

11	1155	0	CLR	10.00		100	38.0	72	22.0	57	14.0	24	0	000		28.29			M	AA		29.84
11	1215	0	CLR	10.00		100	38.0	72	22.0	57	14.0	24	9	320		28.28			M	AA		29.83
11	1235	0	CLR	10.00		100	38.0	72	22.0	57	14.0	24	8	350		28.27			M	AA		29.82
11	1255	0	CLR	10.00		102	39.0	72	22.3	57	14.0	23	5	320	16	28.27			M	AA		29.81
11	1315	0	CLR	10.00		104	40.0	73	22.6	57	14.0	21	5	320		28.27			M	AA		29.81
11	1335	0	CLR	10.00		104	40.0	73	22.6	57	14.0	21	6	320		28.25			M	AA		29.80
11	1355	0	CLR	10.00		106	41.0	73	22.8	57	14.0	20	6	340		28.25	7	024	M	AA		29.80
11	1415	0	CLR	10.00		108	42.0	74	23.1	57	14.0	19	3	110		28.25			M	AA		29.79
11	1435	0	CLR	10.00		108	42.0	74	23.1	57	14.0	19	8	070		28.23			M	AA		29.77
11	1455	0	CLR	10.00		108	42.0	73	22.6	55	13.0	17	9	130	17	28.22			M	AA		29.76
11	1515	0	CLR	10.00		108	42.0	73	22.6	55	13.0	17	7	140		28.21			M	AA		29.75
11	1535	0	CLR	10.00		108	42.0	73	22.6	55	13.0	17	0	000		28.21			M	AA		29.75
11	1555	0	CLR	10.00		108	42.0	73	22.6	55	13.0	17	0	000		28.20			M	AA		29.74
11	1615	0	CLR	10.00		109	43.0	73	22.8	55	13.0	17	11	140		28.20			M	AA		29.74
11	1635	0	SCT010	2.00		106	41.0	72	22.4	55	13.0	19	25	170	36	28.22			M	AA		29.76
11	1655	0	FEW010	3.00		100	38.0	71	21.5	55	13.0	22	25	180	36	28.23	7	010	M	AA		29.77
11	1715	0	CLR	5.00		100	38.0	71	21.5	55	13.0	22	18	190	28	28.22			M	AA		29.76
11	1735	0	CLR	10.00		100	38.0	71	21.5	55	13.0	22	18	190	25	28.21			M	AA		29.75
11	1755	0	CLR	10.00		100	38.0	70	21.2	54	12.0	21	17	180	23	28.21			M	AA		29.75
11	1815	0	CLR	10.00		100	38.0	69	20.8	52	11.0	20	15	180		28.21			M	AA		29.75
11	1835	0	CLR	10.00		100	38.0	69	20.8	52	11.0	20	11	210		28.21			M	AA		29.75
11	1855	0	CLR	10.00		99	37.0	69	20.6	52	11.0	21	9	230		28.21			M	AA		29.75
11	1915	0	CLR	10.00		99	37.0	69	20.6	52	11.0	21	8	250		28.22			M	AA		29.76
11	1935	0	CLR	10.00		99	37.0	68	20.1	50	10.0	19	10	230		28.22			M	AA		29.76
11	1955	0	CLR	10.00		97	36.0	69	20.3	52	11.0	22	7	170		28.24	2	003	M	AA		29.78
11	2015	0	CLR	10.00		97	36.0	69	20.3	52	11.0	22	7	160		28.25			M	AA		29.79
11	2035	0	CLR	10.00		95	35.0	69	20.4	54	12.0	25	6	160		28.25			M	AA		29.79
11	2055	0	CLR	10.00		95	35.0	69	20.4	54	12.0	25	0	000		28.25			M	AA		29.79
11	2115	0	CLR	10.00		93	34.0	67	19.6	52	11.0	25	6	040		28.25			M	AA		29.80
11	2135	0	CLR	10.00		93	34.0	67	19.6	52	11.0	25	5	050		28.25			M	AA		29.80
11	2155	0	CLR	10.00		93	34.0	68	20.1	54	12.0	27	5	090		28.25			M	AA		29.80
11	2215	0	CLR	10.00		93	34.0	68	20.1	54	12.0	27	6	110		28.25			M	AA		29.80
11	2235	0	CLR	10.00		91	33.0	68	19.8	54	12.0	29	6	030		28.27			M	AA		29.81
11	2255	0	CLR	10.00		91	33.0	68	20.0	55	13.0	30	8	090		28.27	2	010	M	AA		29.81
11	2315	0	CLR	10.00		91	33.0	68	20.0	55	13.0	30	6	130		28.27			M	AA		29.82
11	2335	0	CLR	10.00		90	32.0	68	19.9	55	13.0	31	0	000		28.27			M	AA		29.82
11	2355	0	CLR	10.00		88	31.0	67	19.5	55	13.0	33	0	000		28.27			M	AA		29.82

Figure A-6. Quality-controlled local climatological data hourly observations table for Casa Grande Municipal Airport, Casa Grande, Arizona (08/11/2012). Reduced visibilities and gusty winds were reported after 1600 LST, coincident with high PM_{10} concentrations. 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 GLENDALE MUNICIPAL AIRPORT (53126) GLENDALE, AZ (08/2012)

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

Elevation: 1066 ft. above sea level
Latitude: 33.527
Longitude: -112.295
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
11	0647	0	SCT150 BKN250	20.00		91	33.0	70	21.2	59	15.0	34	8	040		28.69			M	AA		29.82
11	0747	0	SCT150 BKN250	20.00		95	35.0	71	21.8	59	15.0	30	0	000		28.71			M	AA		29.84
11	0848	0	SCT150 BKN250	20.00		99	37.0	71	21.9	57	14.0	25	6	300		28.71			M	AA		29.84
11	0947	0	SCT150 BKN250	20.00		100	38.0	72	22.0	57	14.0	24	5	320		28.71			M	AA		29.84
11	1047	0	FEW150 BKN250	20.00		104	40.0	73	22.6	57	14.0	21	6	VR		28.70			M	AA		29.83
11	1150	0	FEW150 BKN250	20.00		106	41.0	72	22.4	55	13.0	19	6	VR		28.67			M	AA		29.80
11	1247	0	SCT150 BKN250	20.00		108	42.0	73	22.5	54	12.0	17	5	050		28.65			M	AA		29.78
11	1347	0	BKN150 BKN250	20.00		109	43.0	73	22.6	54	12.0	16	7	160		28.63			M	AA		29.76
11	1447	0	BKN150 BKN250	20.00		108	42.0	73	22.5	54	12.0	17	7	140		28.61			M	AA		29.74
11	1547	0	FEW150 SCT250	20.00		109	43.0	72	22.2	52	11.0	15	7	140		28.59			M	AA		29.72
11	1653	0	SCT150 BKN250	20.00		111	44.0	72	22.1	50	10.0	13	6	140		28.57			M	AA		29.70
11	1747	0	SCT150 BKN250	20.00		111	44.0	73	22.5	52	11.0	14	7	130		28.57			M	AA		29.70
11	1847	0	SCT150 BKN250	4.00	BLDUs	106	41.0	72	22.4	55	13.0	19	8s	130		28.58			M	AA		29.71

Figure A-7. Quality-controlled local climatological data hourly observations table for Glendale Municipal Airport, Glendale, Arizona (08/11/2012). Blowing dust (BLDU) and reduced visibilities were reported after 1800 LST, coincident with high PM_{10} concentrations. 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 PHOENIX GOODYEAR AIRPORT (03186) GOODYEAR, AZ (08/2012)

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

Elevation: 968 ft. above sea level
Latitude: 33.416
Longitude: -112.383
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
11	0547	0	FEW150 BKN200	10.00		90	32.0	71	21.6	61	16.0	38	6	220		28.76			M	AA		29.79
11	0647	0	SCT150 BKN200	10.00		91	33.0	71	21.7	61	16.0	37	6	120		28.79			M	AA		29.82
11	0747	0	BKN180 BKN250	10.00		97	36.0	73	22.7	61	16.0	30	8	120		28.82			M	AA		29.85
11	0847	0	SCT180 BKN250	10.00		99	37.0	73	23.0	61	16.0	29	7	060		28.81			M	AA		29.84
11	0947	0	SCT180 BKN250	10.00		100	38.0	74	23.1	61	16.0	28	6	VR		28.81			M	AA		29.84
11	1047	0	SCT180 BKN250	10.00		102	39.0	74	23.4	61	16.0	26	8	160		28.80			M	AA		29.83
11	1147	0	FEW120 SCT180 BKN250	10.00		106	41.0	74	23.4	59	15.0	21	6	VR		28.78			M	AA		29.81
11	1247	0	FEW120 SCT180 BKN250	10.00		108	42.0	74	23.2	57	14.0	19	6	VR		28.76			M	AA		29.79
11	1355	0	FEW100 SCT180 BKN250	10.00		108	42.0	74	23.2	57	14.0	19	6	VR		28.73			M	AA		29.76
11	1447	0	FEW100 SCT170 BKN250	10.00		108	42.0	74	23.2	57	14.0	19	6	VR		28.71			M	AA		29.74
11	1547	0	FEW100 SCT180 SCT250	10.00		109	43.0	74	23.3	57	14.0	18	7	VR		28.69			M	AA		29.72
11	1647	0	FEW100 SCT180 BKN250	10.00		109	43.0	73	22.9	55	13.0	17	6	VR		28.68			M	AA		29.71
11	1747	0	FEW100 SCT180 BKN250	10.00	VCBLDUs BLDU	109	43.0	73	22.9	55	13.0	17	6s	VR		28.68			M	AA		29.71
11	1847	0	FEW100 SCT180 BKN250	5.00		106	41.0	73	22.9	57	14.0	20	11	180		28.68			M	AA		29.71
11	1947	0	FEW100 SCT180 BKN250	10.00		102	39.0	73	22.9	59	15.0	24	11	200		28.70			M	AA		29.73
11	2047	0	FEW100 SCT180 BKN250	10.00		102	39.0	71	21.9	55	13.0	21	8	210		28.71			M	AA		29.74

Figure A-8. Quality-controlled local climatological data hourly observations table for Phoenix Goodyear Airport, Phoenix, Arizona (08/11/2012). Blowing dust (BLDU) and reduced visibilities were reported after 1700 LST, coincident with high PM_{10} concentrations. 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_08112012.mp4

Estrella Mountains: www.phoenixvis.net/videos/mpeg4/ESMO_08112012.mp4

Camelback Mountains: www.phoenixvis.net/videos/mpeg4/CAME_08112012.mp4

Superstition Mountains: www.phoenixvis.net/videos/mpeg4/SUPM_08112012.mp4

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

Plane Flies Through Dust Storm/Haboob in Phoenix, AZ August 11, 2012
http://www.youtube.com/watch?v=oHV_ewwFITE

Driving into Haboob - Phoenix, AZ Dust Storm - Aug 11, 2012
http://www.youtube.com/watch?v=mlHkdOXxo-s

CNN iReport: Dust Storm Hits Phoenix (8-11-12)
http://ireport.cnn.com/docs/DOC-827945

Phoenix Monsoon Dust Storm “Haboob” Time Lapse
http://www.youtube.com/watch?v=n5v_BtJM-Oc

Articles and Image Links

http://www.azcentral.com/news/articles/2012/08/11/20120811phoenix-dust-storm-warning-effect.html

Dust storm passes through Phoenix area

by Cecilia Chan – Aug. 11, 2012 07:03 PM
The Republic

A dust storm blowing across parts of the Valley was expected to last until around 7 p.m., according to the National Weather Service in Phoenix.

The blowing dust closed down State Route 347 at Riggs Road, west of Sun Lakes, the Arizona Department of Transportation reported.

"As dry as it is after these years of drought it doesn't take much to cause a dust storm," meteorologist Mike Bruce said. "It will kind of spread across the metro area right now and will go for another hour or so and the winds will die down."

Bruce said the dust storm blowing through the Phoenix metropolitan area was coming from Pinal County.

He said the average wind gust was about 25 mph with some gusts as high as 40 mph. A wind gust is considered severe when it hits 60 mph, Bruce said.

He said reports of visibility ranged from quarter of a mile to half a mile in some areas.

He said there was a slight chance of a thunderstorms or showers tonight.

http://www.flickr.com/photos/crmarks/8024185912/

Flickr photo: Phoenix Arizona Dust Storm Haboob – August 11, 2012

5:43 PM on a Wednesday afternoon, standing on the edge of a quiet rooftop.

By Christopher Marks

This photo was taken on August 11, 2012 in Phoenix, Arizona, US, using a Fujifilm FinePix X100.

http://www.azfamily.com/younews/165933986.html

AZ Family photos: Dust Storm 8/11/12

By pilgrim2az176911

Location: Mesa, near Higley and Brown

Looking SW from my back yard near Higley and Brown in Mesa. This dust storm moved in quick.

Images provided by ADEQ

Taken August 11, 2012 around 5:20-5:30 pm

Appendix C: Historical Fluctuation Time-Series Graphs

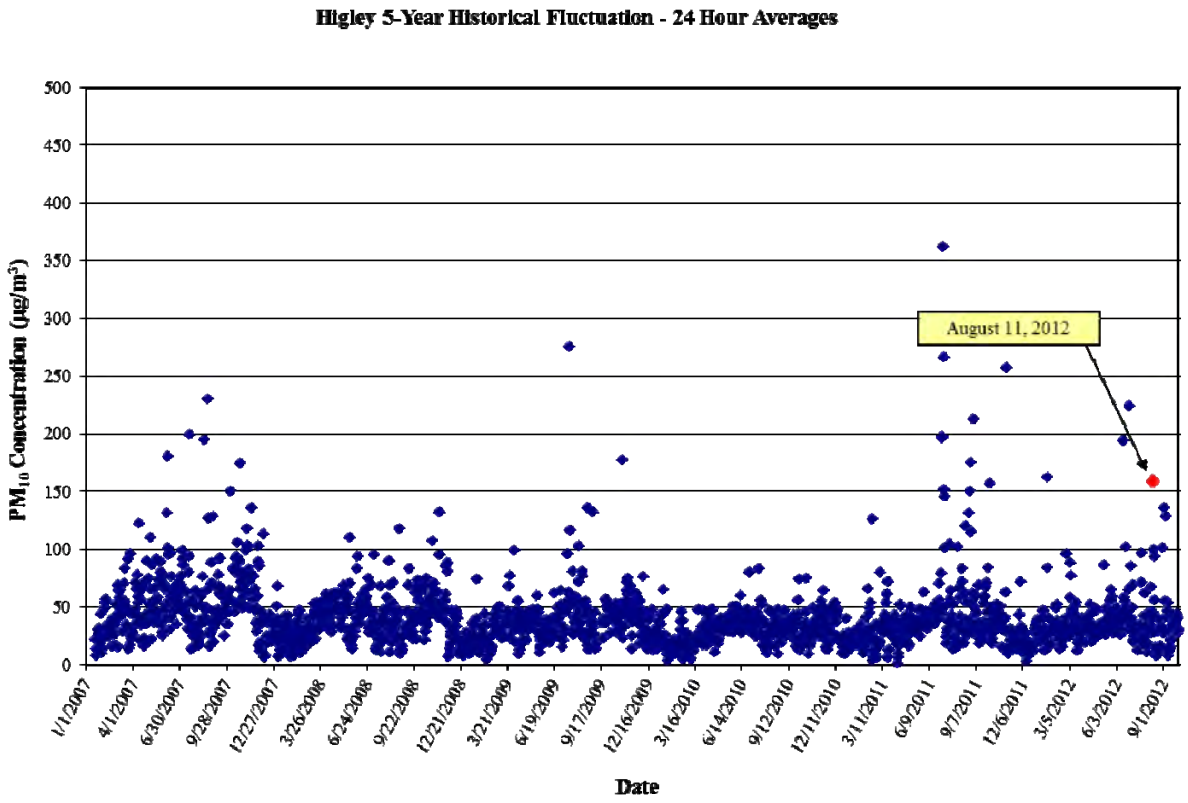

Figure C-1. 24-hr average PM_{10} concentrations at the Higley monitor (2007-2012). The 24-hr average PM_{10} concentration on August 11, 2012, is shown in red and highlighted by the arrow.

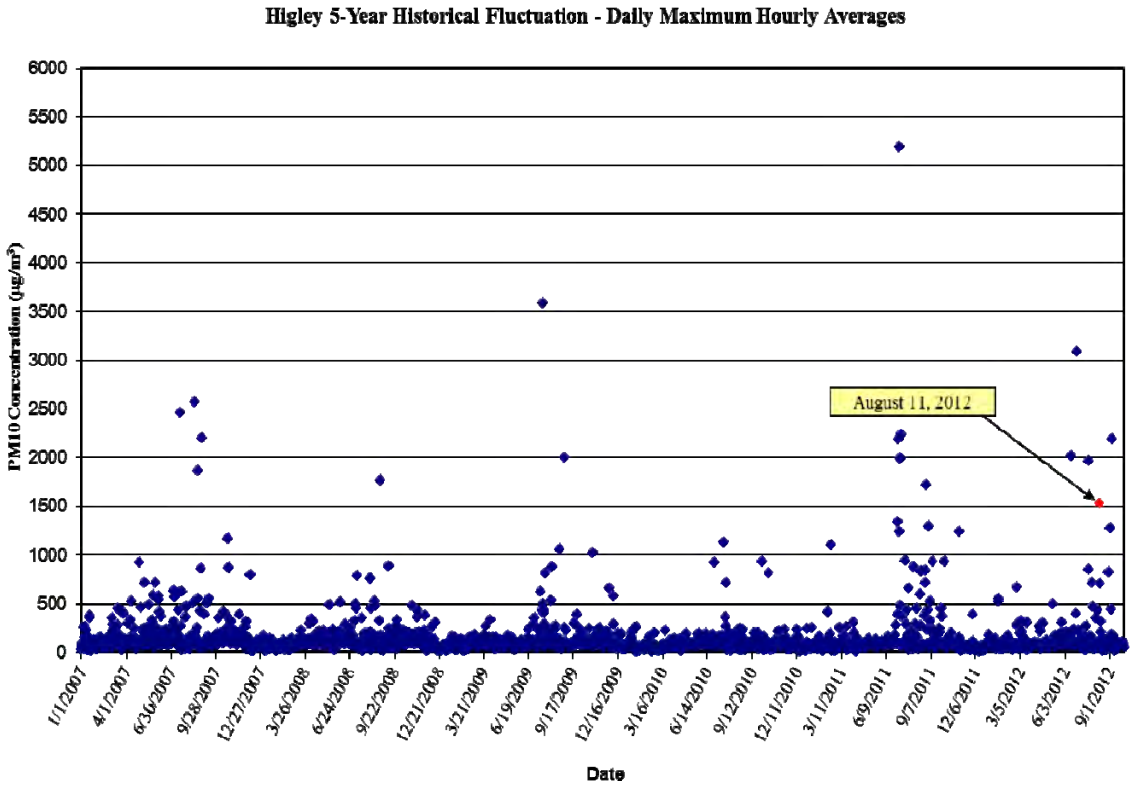

Figure C-2. Daily maximum hourly average PM_{10} concentrations at the Higley monitor (2007-2011). The daily maximum hourly average PM_{10} concentration on August 11, 2012, shown in red and highlighted by the arrow.

Appendix D:
ADEQ and NWS Forecast Products

MARICOPA COUNTY DUST CONTROL FORECAST

ISSUED Friday, August 10, 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

Daytime highs will remain at or above 110°F in the Phoenix forecast area through the middle of next week. Thunderstorm activity has been fairly quiet the past few days. We will see a slight increase in chances Sunday through next week. Blowing dust is more likely than rain. Thus, the risk of exceeding the 24-hr PM10 health standard in Phoenix will increase to Moderate Monday through Wednesday.

R I S K F A C T O R S

	WINDS		STAGNATION		UNHEALTHY PM-10 RISK LEVEL
Day 1: Sat. 8/11/2012	Mostly light winds are expected much of the day.	+	No significant stagnation is expected.	=	***LOW***
Day 2: Sun. 8/12/2012	Mostly light winds are expected except gusty near thunderstorm out flow (10% chance of showers).	+	No significant stagnation is expected.	=	***LOW***
Day 3: Mon. 8/13/2012	Mostly light winds are expected except gusty near thunderstorm out flow (10-20% chance of showers).	+	No significant stagnation is expected.	=	***MODERATE***
EXTENDED OUTLOOK					
Day 4: Tue. 8/14/2012	Mostly light winds are expected except gusty near thunderstorm out flow (10-20% chance of showers).	+	No significant stagnation is expected.	=	***MODERATE***
Day 5: Wed. 8/15/2012	Mostly light winds are expected except gusty near thunderstorm out flow (20% chance of showers).	+	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 Saturday, August 11, 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 Thu 08/09/2012 **Ozone HPA** **Dust** Highest AQI Reading/Site (*Preliminary data only*)	TODAY Fri 08/10/2012 **Ozone HPA**	TOMORROW Sat 08/11/2012 **Ozone Health Watch**	EXTENDED Sun 08/12/2012
O3*	**135** **North Phoenix**	**122** ***Unhealthy for Sensitive Groups***	**93** ***Moderate***	**87** ***Moderate***
CO*	**8** **West Phoenix**	**6** ***Good***	**7** ***Good***	**7** ***Good***
PM-10*	**61** **Buckeye**	**47** ***Good***	**45** ***Good***	**50** ***Good***
PM-2.5*	**27** **Tempe**	**38** ***Good***	**30** ***Good***	**35** ***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	
Friday, 08/10/2012	**Active children and adults and people with respiratory disease such as asthma should limit prolonged exertion outdoors.**
Saturday, 08/11/2012	**Unusually sensitive people should consider reducing prolonged or heavy exertion outdoors.**

SYNOPSIS AND DISCUSSION

An Ozone High Pollution Advisory remains in effect for Friday, August 10, 2012
An Ozone Health Watch has been issued for Saturday, August 11, 2012

Daytime highs will remain at or above 110°F in the Phoenix forecast area through the middle of next week. Thunderstorm activity has been fairly quiet the past few days. We will see a slight increase in chances Sunday through next week. However, blowing dust is more likely than rain. Thus, we will likely see PM10 concentrations move into the Moderate range early next week.

The big story this week is ozone. Thursday posted the second highest ozone concentrations of the season with North Phoenix reaching 135 AQI. There were 11 sites that exceeded the standard with another 4 reaching 100 AQI, barely clinging to the Moderate range. Concentrations are starting out high Friday morning. Models show the invisible plume over Phoenix streaming to the west and northwest this afternoon. This puts the west Valley sites (Dysart, Glendale, North Phoenix) as the target for the highest levels in the forecast area Friday. Though lower levels are expected Saturday and Sunday with the flow turning out of the south, an Ozone Health Watch is being issued for Saturday as north Valley monitors (North Phoenix, Cave Creek, Humboldt Mountain, Pinnacle Peak, etc.) may see levels appraoch the health standard. The good news is that ozone levels considerably decline in the month of September.

Check back on Sunday for a look ahead at next week's weather and air quality. Until then, have a great weekend! -J.Paul

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 Thursday, August 9, 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	62	58	
Apache Junction	77	104	
Blue Point	77	104	
Buckeye	64	64	
Casa Grande	68	77	
Cave Creek	81	114	
Central Phoenix	82	116	
Dysart	78	106	
Falcon Field	75	100	
Fountain Hills	75	100	
Glendale	71	87	
Humboldt Mountain	77	104	
Phoenix Supersite	84	122	

USG

North Phoenix	89	135	
Pinal Air Park	68	77	
Pinnacle Peak	82	116	
Queen Valley	75	100	
Rio Verde	76	101	
South Phoenix	NOT AVBL	NOT AVBL	NOT AVBL
South Scottsdale	83	119	
Tempe	73	93	
Tonto Nat'l Mon.	72	90	
West Chandler	75	100	
West Phoenix	84	122	
Yuma	60	51	

CO (CARBON MONOXIDE)

SITE NAME	MAX 8-HR VALUE (PPM)	MAX AQI	AQI COLOR CODE
Central Phoenix	0.2	2	
Greenwood	0.4	5	
West Phoenix	0.7	8	

PM-10 (PARTICLES)

SITE NAME	MAX 24-HR VALUE (µg/m3)	MAX AQI	AQI COLOR CODE
Apache Junction	16.0	15	
Buckeye	75.0	61	
Central Phoenix	36.1	33	
Combs School (Pinal County)	38.3	35	
Durango	40.5	37	
Dysart	43.3	39	
Glendale	41.7	38	
Greenwood	39.8	36	
Higley	28.3	26	
Maricopa (Pinal County)	48.6	45	
North Phoenix	NOT AVBL	NOT AVBL	NOT AVBL
Phoenix Supersite	33.0	30	
South Phoenix	35.3	32	
Tempe	31.8	29	
West Chandler	31.2	28	
West Forty Third	37.2	34	
West Phoenix	NOT AVBL	NOT AVBL	NOT AVBL
Zuni Hills	53.0	48	

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	NOT AVBL	NOT AVBL	NOT AVBL
Dysart	7.6	25	
Estrella Mountain Park	6.8	22	
Glendale	NOT AVBL	NOT AVBL	NOT AVBL
Phoenix Supersite	6.3	20	
North Phoenix	NOT AVBL	NOT AVBL	NOT AVBL
South Phoenix	5.9	19	
Tempe	8.2	27	
Vehicle Emissions Lab	4.7	15	
West Phoenix	NOT AVBL	NOT AVBL	NOT AVBL

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

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URGENT - WEATHER MESSAGE
NATIONAL WEATHER SERVICE PHOENIX AZ
422 PM MST SAT AUG 11 2012

AZZ027-028-120100-
/O.UPG.KPSR.DU.Y.0025.000000T0000Z-120812T0100Z/
/O.NEW.KPSR.DS.W.0013.120811T2322Z-120812T0100Z/
/O.CON.KPSR.EH.W.0011.000000T0000Z-120814T0300Z/
SOUTHWEST MARICOPA COUNTY-
NORTHWEST AND NORTH CENTRAL PINAL COUNTY-
INCLUDING THE CITIES OF...GILA BEND...APACHE JUNCTION...
CASA GRANDE...FLORENCE
422 PM MST SAT AUG 11 2012

...DUST STORM WARNING IN EFFECT UNTIL 6 PM MST THIS EVENING...
...EXCESSIVE HEAT WARNING REMAINS IN EFFECT UNTIL 8 PM MST
MONDAY...

THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED A DUST STORM
WARNING...WHICH IS IN EFFECT UNTIL 6 PM MST THIS EVENING. THE
BLOWING DUST ADVISORY IS NO LONGER IN EFFECT. AN EXCESSIVE HEAT
WARNING REMAINS IN EFFECT UNTIL 8 PM MST MONDAY.

* AFFECTED AREA...SOUTHWEST MARICOPA COUNTY...AND WESTERN PINAL
  COUNTY...INCLUDING GILA BEND...CASA GRANDE...MARICOPA...AND
  INTERSTATES 10 AND 8

* TIMING...AREAS OF DENSE BLOWING DUST WILL OVERSPREAD THE AREA FROM
  SOUTH TO NORTH BETWEEN 415 PM AND 6 PM.

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

* VISIBILITY...ONE QUARTER MILE OR LESS.

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

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A DUST STORM WARNING IS ISSUED WHEN WINDS HAVE GENERATED LARGE
AREAS OF BLOWING DUST OR BLOWING SAND THAT HAVE SUBSTANTIALLY
REDUCED VISIBILITIES...TO 1/4 MILE OR LESS...RESULTING IN
HAZARDOUS DRIVING CONDITIONS IN SOME AREAS. BE READY FOR A SUDDEN
DROP IN VISIBILITY TO NEAR ZERO. USE EXTRA CAUTION AND SLOW DOWN
WHILE DRIVING...AS OBJECTS ON AND NEAR ROADWAYS WILL BE SEEN ONLY
AT CLOSE RANGE. IF YOU ENCOUNTER BLOWING DUST OR BLOWING SAND 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.
```

SHORT TERM FORECAST
NATIONAL WEATHER SERVICE PHOENIX AZ
453 PM MST SAT AUG 11 2012

AZZ027-028-120200-
SOUTHWEST MARICOPA COUNTY-NORTHWEST AND NORTH CENTRAL PINAL COUNTY-
INCLUDING THE CITIES OF...GILA BEND...APACHE JUNCTION...
CASA GRANDE...COOLIDGE...AND FLORENCE
453 PM MST SAT AUG 11 2012

.NOW...
AN AREA OF SCATTERED SHOWERS AND THUNDERSTORMS WILL AFFECT SOUTHWEST MARICOPA AND NORTHERN PINAL COUNTIES THROUGH 6:55 PM. EXPECT BRIEF HEAVY RAINFALL...BLOWING DUST WITH REDUCED VISIBILITIES AND WIND GUSTS FROM OUTFLOWS OF 35 TO 40 MPH. MOTORISTS ON INTERSTATES 8 AND 10 SHOULD EXERCISE CAUTION IN RAPIDLY CHANGING CONDITIONS. AFFECTED LOCATIONS INCLUDE CASA GRANDE...GILA BEND...COOLIDGE...FLORENCE...SUN LAKES AND SAN TAN VALLEY.

PRELIMINARY LOCAL STORM REPORT
NATIONAL WEATHER SERVICE PHOENIX AZ
438 PM MST SAT AUG 11 2012

..TIME...	...EVENT...	...CITY LOCATION...		...LAT.LON...
..DATE...	....MAG....	..COUNTY LOCATION	..ST..	...SOURCE....
	..REMARKS..			
0436 PM	DUST STORM	3 WSW ARIZOLA		32.83N 111.76W
08/11/2012		PINAL	AZ	LAW ENFORCEMENT
	200 FOOT VISIBILITY NEAR MILE MARKER 172 ON INTERSTATE 8.			

PRELIMINARY LOCAL STORM REPORT
NATIONAL WEATHER SERVICE PHOENIX AZ
445 PM MST SAT AUG 11 2012

..TIME...	...EVENT...	...CITY LOCATION...		...LAT.LON...
..DATE...	....MAG....	..COUNTY LOCATION	..ST..	...SOURCE....
	..REMARKS..			
0444 PM	DUST STORM	6 NNW CASA GRANDE		32.97N 111.76W
08/11/2012		PINAL	AZ	LAW ENFORCEMENT
	VISIBILITY LESS THAN AN EIGHTH OF A MILE JUST NORTH OF CASA GRANDE AIRPORT			

```
PRELIMINARY LOCAL STORM REPORT
NATIONAL WEATHER SERVICE PHOENIX AZ
500 PM MST SAT AUG 11 2012

..TIME...   ...EVENT...      ...CITY LOCATION...     ...LAT.LON...
..DATE...   ....MAG....      ..COUNTY LOCATION..ST.. ...SOURCE....
            ..REMARKS..

0459 PM     DUST STORM       2 NNE MARICOPA          33.08N 112.04W
08/11/2012                   PINAL              AZ   NWS EMPLOYEE

            VISIBILITY DOWN TO 0.25 MILE


PRELIMINARY LOCAL STORM REPORT
NATIONAL WEATHER SERVICE PHOENIX AZ
501 PM MST SAT AUG 11 2012

..TIME...   ...EVENT...      ...CITY LOCATION...     ...LAT.LON...
..DATE...   ....MAG....      ..COUNTY LOCATION..ST.. ...SOURCE....
            ..REMARKS..

0500 PM     DUST STORM       4 SSE TUMBLEWEED PARK   33.22N 111.80W
08/11/2012                   MARICOPA           AZ   TRAINED SPOTTER

            VISIBILITY DOWN TO 0.25 MILE NEAR GILBERT AND RIGGS


PRELIMINARY LOCAL STORM REPORT
NATIONAL WEATHER SERVICE PHOENIX AZ
531 PM MST SAT AUG 11 2012

..TIME...   ...EVENT...      ...CITY LOCATION...     ...LAT.LON...
..DATE...   ....MAG....      ..COUNTY LOCATION..ST.. ...SOURCE....
            ..REMARKS..

0529 PM     DUST STORM       3 SSW SOUTH MOUNTAIN PA 33.29N 112.09W
08/11/2012                   MARICOPA           AZ   NWS EMPLOYEE

            VISIBILITY DOWN TO 500 FEET


PRELIMINARY LOCAL STORM REPORT
NATIONAL WEATHER SERVICE PHOENIX AZ
532 PM MST SAT AUG 11 2012

..TIME...   ...EVENT...      ...CITY LOCATION...     ...LAT.LON...
..DATE...   ....MAG....      ..COUNTY LOCATION..ST.. ...SOURCE....
            ..REMARKS..

0532 PM     DUST STORM       3 ESE GUADALUPE         33.35N 111.92W
08/11/2012                   MARICOPA           AZ   TRAINED SPOTTER

            VISIBILITY DOWN TO 0.25 MILE NEAR MCCLINTOCK AND ELLIOT
```

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PRELIMINARY LOCAL STORM REPORT
NATIONAL WEATHER SERVICE PHOENIX AZ
549 PM MST SAT AUG 11 2012

..TIME...   ...EVENT...      ...CITY LOCATION...     ...LAT.LON...
..DATE...   ....MAG....      ..COUNTY LOCATION..ST.. ...SOURCE....
            ..REMARKS..

0549 PM     DUST STORM       1 S SKY HARBOR AIRPORT  33.42N 112.02W
08/11/2012                   MARICOPA           AZ   TRAINED SPOTTER

            VISIBILITY DOWN TO 0.25 MILE
```

Appendix E:
Affidavit of Public Notice

ADEQ
AIR QUALITY DIVISION
13 JAN 18 PM 12:49

AFFIDAVIT OF PUBLICATION

THE ARIZONA REPUBLIC

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

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

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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