Sonoma Technology, Inc.
Air Quality Research and Innovative Solutions

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

Final Report
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Prepared by

Daniel Alrick
Angela Ekstrand
Briana Gordon
Hilary Hafner
Clinton MacDonald
Hilary Minor
Ashley Russell
Sonoma Technology, Inc.
1455 N. McDowell Blvd., Suite D
Petaluma, CA 94954-6503
Ph 707.665.9900 | F 707.665.9800
sonomatech.com

Prepared for

Theresa Rigney
Air Quality Assessment Section Manager
1110 W. Washington Street
Phoenix, AZ 85007
602.771.2274

February 13, 2013

Cover image illustrates windblown dust and haze with reduced visibility in the Phoenix area at 2245 LST on July 11, 2012. This photo was taken by an ADEQ visibility camera near downtown Phoenix looking northeast toward Camelback Mountain.

Acknowledgments

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

Table of Contents

Section **Page**

List of Figures

Figure **Page**

List of Tables

1. Introduction

On July 11, 2012, four 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) of 150 µg/m^3. The purpose of this report is to demonstrate that these exceedances were due to naturally occurring windblown dust, were historically unusual, were not reasonably controllable or preventable, and would not have occurred "but for" the windblown dust and, therefore, are Exceptional Events 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 wind-blown dust event that transpired on July 11, 2012, and provides a background narrative of the exceptional event and an overall explanation of how 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 July 11, 2012, and the exceedances of the 24-hr PM_{10} standard at the four monitoring stations. The evidence in this section also confirms that the event in question both affected air quality and was the result of natural events.

Section 4 of this assessment illustrates that the event of July 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 July 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 July 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. **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 contains the requirements of the EER and associated guidance, and discusses how ADEQ addressed those requirements.

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

ADEQ issued Dust Control Action Forecasts and Air Quality Forecasts for Maricopa County, advising citizens of the potential for high-wind dust events on July 11, 2012. More information on ADEQ's forecasting program can be found in Section 5 of this report. The forecast products that were issued pertaining to this event 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 (or another agency operating monitors in Arizona) suspects that data may be influenced by an exceptional event, ADEQ (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 (or the other operating agency) also submits data from continuous monitors into AQS after quality assurance is complete.

If ADEQ (or other operating air quality agencies) have determined that the potential exists that a monitor's reading(s) have been influenced by an exceptional event, a preliminary flag is submitted for those measurement(s) in AQS. The data are not official until they undergo 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 flags on the July 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 at four monitors on July 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 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 501(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 July 11, 2012, in the Phoenix area. Elements described in this section include

- A description and map of the geographic settings 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 msl) to the northeast, the foothills of the Bradshaw (~7,900 ft msl) and Mazataal (~7,900 ft msl) ranges to the north, the White Tank Mountains (~4,500 ft msl) to the west, the Sierra Estrella (~4,450 ft msl) to the southwest, and the Superstition Mountains (~5,000 ft msl) far to the east. Within the City are the Phoenix Mountains (~2,600 ft msl) and South Mountain (~2,600 ft 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 meteorological monitors and the PM_{10} monitors that recorded exceedances on July 11, 2012. AQS monitors typically measure both air quality and meteorological data. 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 July 11, 2012, were recorded at the Durango Complex, West 43rd Avenue, South Phoenix, and Greenwood monitors. The National Weather Service (NWS) monitors measure meteorological data only. Phoenix Sky Harbor International Airport (KPHX) and Phoenix Deer Valley Airport (KDVT) were the primary NWS sites used in this demonstration package because of those sites' high data quality, data completeness, proximity to AQS sites, and representativeness of meteorological conditions in the Phoenix area. **Figure 2-2** shows monitors statewide measuring PM_{10} on July 11, 2012. Please note that NWS data were unavailable for most other Phoenix area airports during the time of this dust storm event.

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 in the air 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.

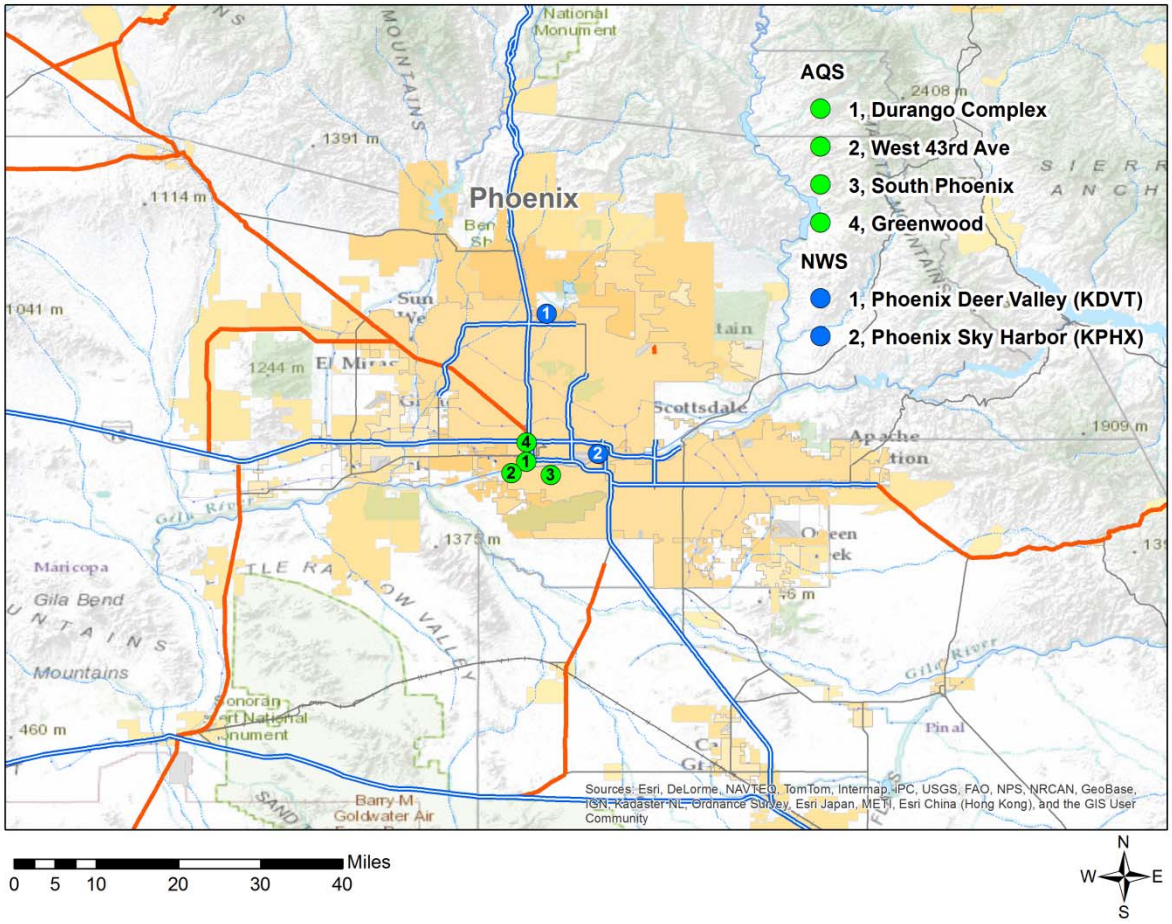


Figure 2-1. Locations of air quality monitors (green) that recorded exceedances of the 24-hr PM_{10} NAAQS on July 11, 2012, and selected NWS monitors (blue) in the Phoenix area.

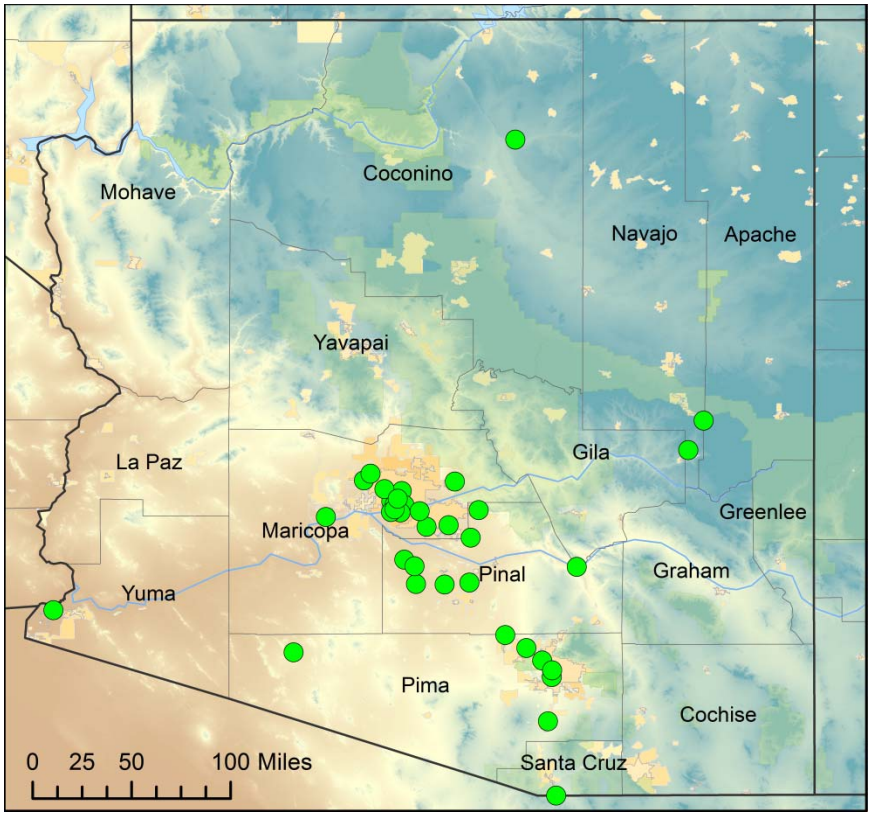


Figure 2-2. Location of sites monitoring PM_{10} in Arizona on July 11, 2012.

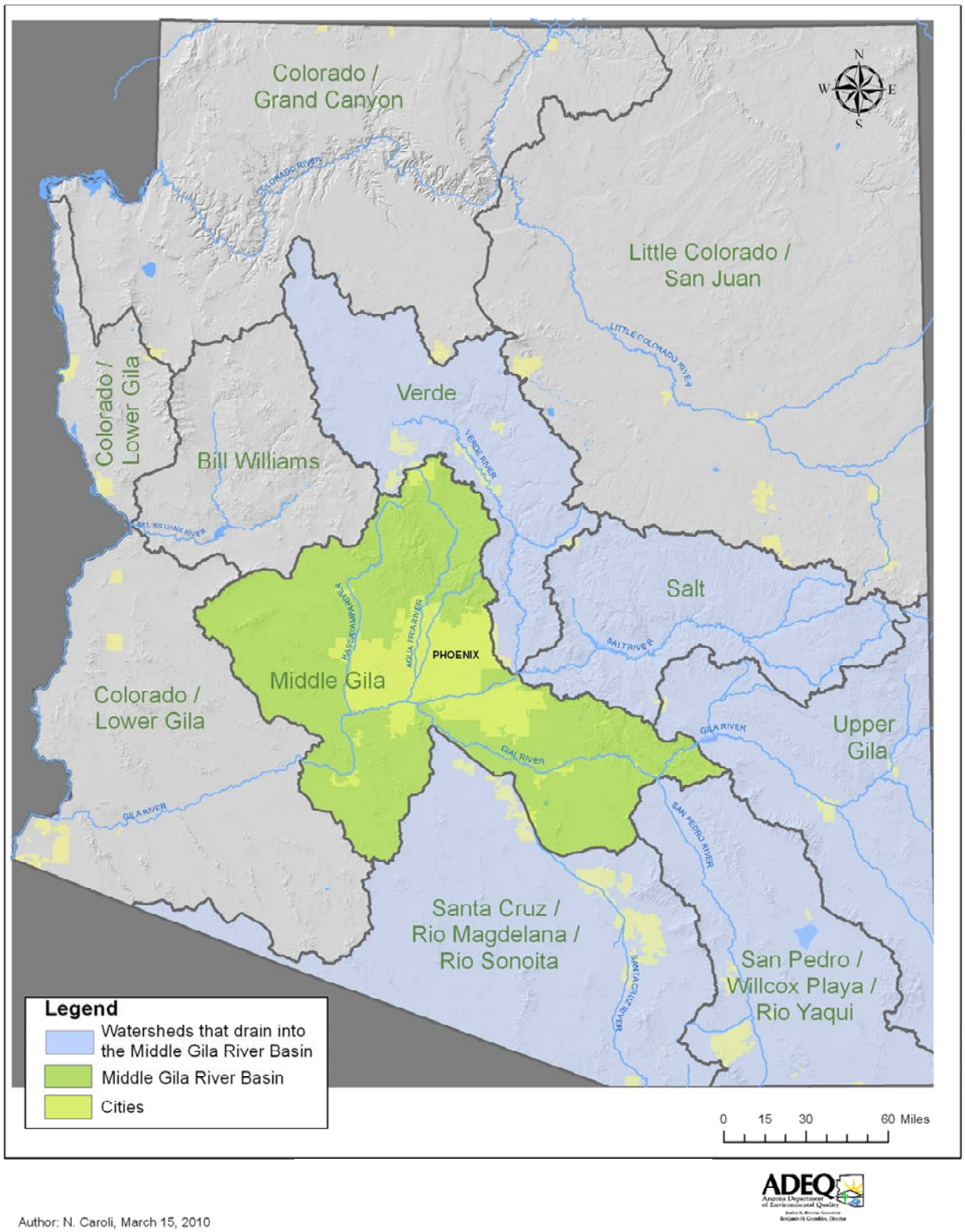


Figure 2-3. Drainage system of Phoenix, Arizona.

2.2 Climate, Monsoon, and Thunderstorms

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-summertime 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.

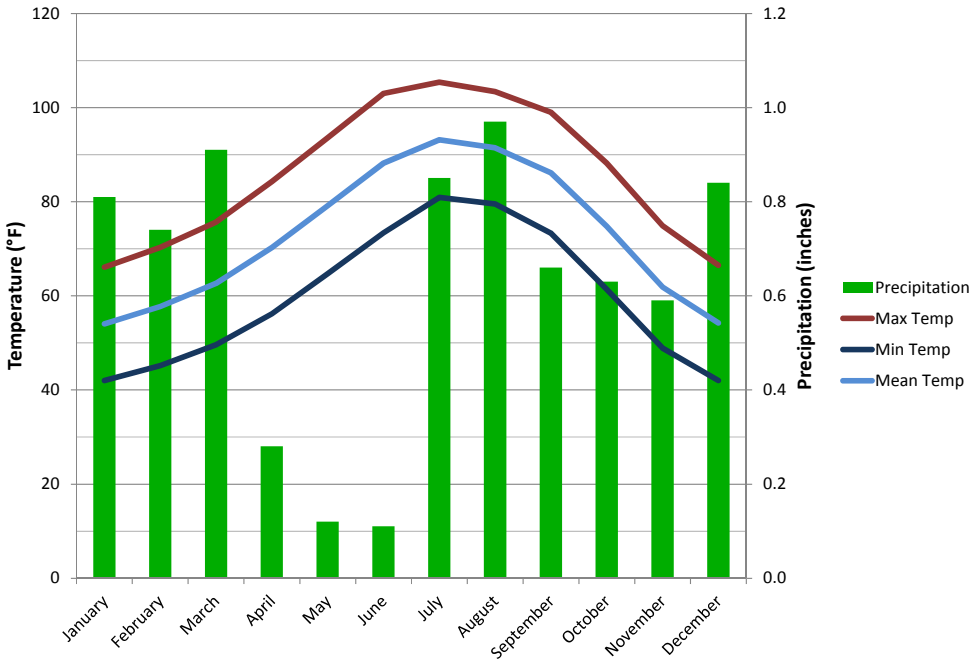
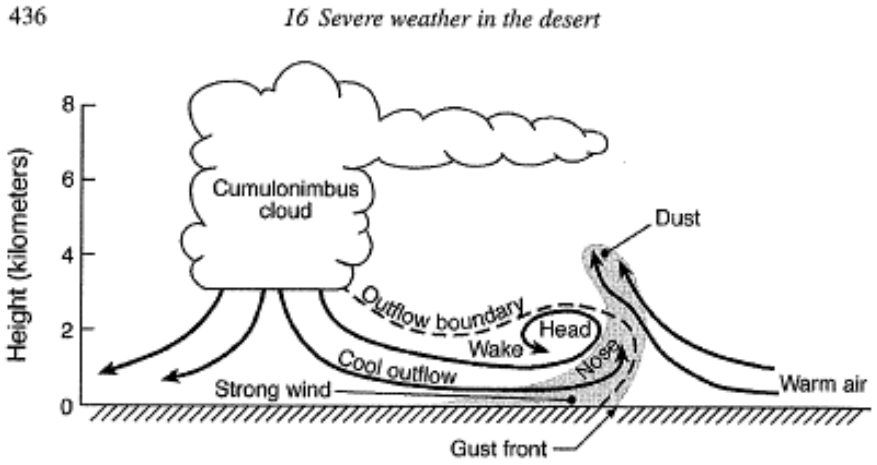


Figure 2-4. Average monthly temperatures and precipitation for Phoenix, 1981–2010.

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. (Source: Desert Meteorology, Thomas T. Warner, 2004.)

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 evening of July 11, 2012, strong winds generated by thunderstorms over central and eastern Arizona 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 four air quality monitors (**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 the Phoenix area, and wind speeds over 20 mph, with gusts over 30 mph, overwhelmed reasonable dust control measures. Monitors across Maricopa and Pinal counties recorded high PM_{10} concentrations during this dust storm, illustrating the widespread, regional nature of the event.

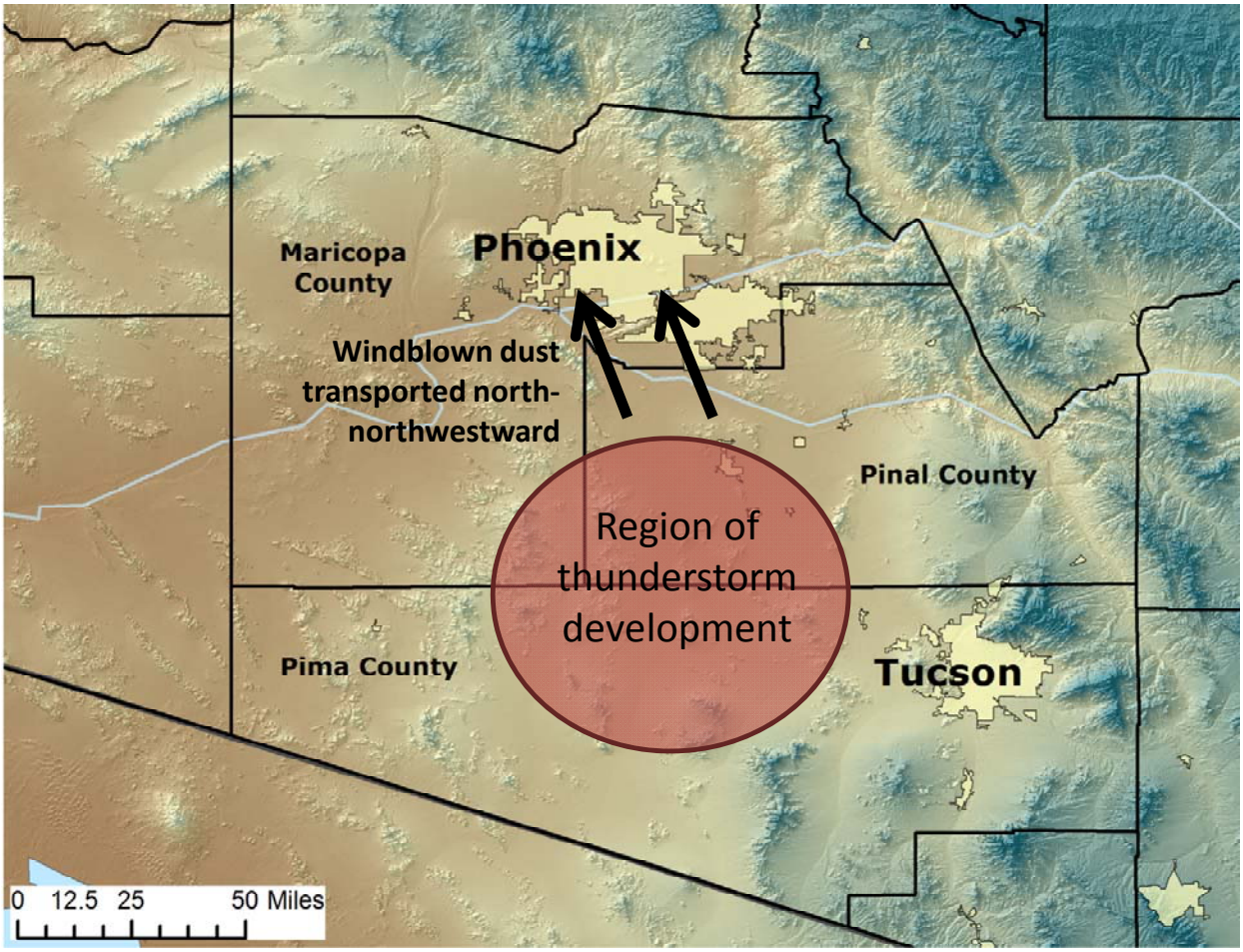


Figure 2-6. Outflow boundaries from thunderstorms over south-central Arizona moved north-northwestward and transported dust into the Phoenix area late on July 11, 2012.

Table 2-1. PM_{10} measurements on July 11, 2012. The four Phoenix-area monitors discussed in this report are 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
Apache County							
N/A	TEOM	WMAT	04-001-1003-81102-1	10	19	1900	
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	23	85	1900	
Maricopa County							
West Phoenix	TEOM	MC	04-013-0019-81102-1	123	956	2300	
North Phoenix	TEOM	MC	04-013-1004-81102-1	19	36	2300	
Glendale	TEOM	MC	04-013-2001-81102-1	89	1433	2300	
Central Phoenix	TEOM	MC	04-013-3002-81102-4	120	1412	2200	
Greenwood	**TEOM**	**MC**	**04-013-3010-81102-1**	**212**	**1875**	**2200**	**RJ**
South Phoenix	**TEOM**	**MC**	**04-013-4003-81102-1**	**285**	**3701**	**2200**	**RJ**
West Chandler	TEOM	MC	04-013-4004-81102-1	52	381	2200	
Tempe	TEOM	MC	04-013-4005-81102-1	96	1413	2300	
Higley	TEOM	MC	04-013-4006-81102-1	24	76	2300	
West 43rd Ave	**TEOM**	**MC**	**04-013-4009-81102-1**	**172**	**1644**	**2200**	**RJ**
Dysart	TEOM	MC	04-013-4010-81102-1	84	1126	2300	
Buckeye	TEOM	MC	04-013-4011-81102-1	150	480	2300	
Zuni Hills	TEOM	MC	04-013-4016-81102-1	56	912	2300	
Fort McDowell/Yuma Frank	TEOM	FMIR	04-013-5100-81102-3	25	N/A	N/A	
Durango Complex	**TEOM**	**MC**	**04-013-9812-81102-1**	**217**	**2301**	**2200**	**RJ**
JLG Supersite	BAM	ADEQ	04-013-9997-81102-3	51	581	2200	
JLG Supersite	TEOM	ADEQ	04-013-9997-81102-4	49	540	2200	
Navajo County							
N/A	TEOM	WMAT	04-017-1002-81102-1	10	33	1400	
Pima County							
Ajo	TEOM	ADEQ	04-019-0001-81102-3	33	134	0200	
Rillito	TEOM	ADEQ	04-019-0020-81102-3	35	182	2200	
Orange Grove	FRM	PCDEQ	04-019-0011-81102-2	14	N/A	N/A	
South Tucson	FRM	PCDEQ	04-019-1001-81102-1	14	N/A	N/A	
Green Valley	TEOM	PCDEQ	04-019-1030-81102-1	10	21	2000	
Geronimo	TEOM	PCDEQ	04-019-1113-81102-1	14	73	2100	

Table 2-1. PM_{10} measurements on July 11, 2012. The four Phoenix-area monitors discussed in this report are 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							
Apache Junction Fire Station	TEOM	PCAQCD	04-021-3002-81102-3	N/A	N/A	N/A	
Casa Grande Downtown	TEOM	PCAQCD	04-021-0001-81102-3	41	326	0000	
Combs School	TEOM	PCAQCD	04-021-3009-81102-3	28	125	2000	
Cowtown	TEOM	PCAQCD	04-021-3013-81102-3	273	1688	2200	RJ
Maricopa	TEOM	PCAQCD	04-021-3010-81102-3	145	877	0000	RJ
Pinal County Housing	TEOM	PCAQCD	04-021-3011-81102-3	39	323	0000	
Stanfield	TEOM	PCAQCD	04-021-3008-81102-3	313	2826	0000	RJ
Santa Cruz County							
Nogales Post Office	BAM	ADEQ	04-023-0004-81102-3	17	41	0600	
Yuma County							
Yuma Supersite	TEOM	ADEQ	04-027-8011-81102-3	79	311	0900	

TEOM: Tapered element oscillating microbalance monitor
BAM: Beta attenuation monitor
FRM: Federal reference method
WMAT: White Mountain Apache Tribe of Fort Apache Reservation, AZ
ADEQ: Arizona Department of Environmental Quality
MC: Maricopa County Air Quality Department
FMIR: Fort McDowell Indian Reservation
PCAQCD: Pinal County Air Quality Control District
PCDEQ: Pima County Department of Environmental Quality
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 July 11, 2012. Late in the evening on July 10, 2012, thunderstorms developed over the higher terrain of central and eastern Arizona, just east of the Phoenix area, generating weak outflow boundaries that carried dust westward into the Phoenix area. This outflow caused elevated PM_{10} concentrations at several Maricopa County monitors and high PM_{10} concentrations (over 2500 $\mu g/m^3$ at one monitor) in Pinal County very late on July 10, 2012, into early July 11, 2012 (**Figure 3-1**, **Figure 3-2**, **Figure 3-3, and Figure 3-4**).

Late in the evening on July 11, 2012, a second round of thunderstorms developed over south-central Arizona, just south of the Phoenix area (**Figure 3-5**). Outflow from these later thunderstorms propagated northwestward across western Pinal County and into Maricopa County. This later outflow event had a greater effect on PM_{10} concentrations and wind speeds at Maricopa County monitors compared to the weaker event early on July 11, 2012. As stated in Section 2.2, thunderstorms associated with the summer monsoon season can generate strong winds and blowing dust across Arizona. PM_{10} concentrations increased at Pinal County monitors about one hour before PM_{10} increased at Maricopa County monitors, which is consistent with the location and movement of the outflow boundary and indicates that the likely source regions for PM_{10} during the July 11, 2012, event were the undeveloped, open land areas south of Maricopa County. This region largely consists of natural, undisturbed desert. The last rainfall in the Phoenix area preceding the July 11, 2012, event was minimal, with 0.14 inches recorded at Phoenix-Sky Harbor International Airport (KPHX) on July 4, 2012. The combination of geography and lack of rainfall preceding the event resulted in a large source region of soils that were particularly vulnerable to particulate suspension.

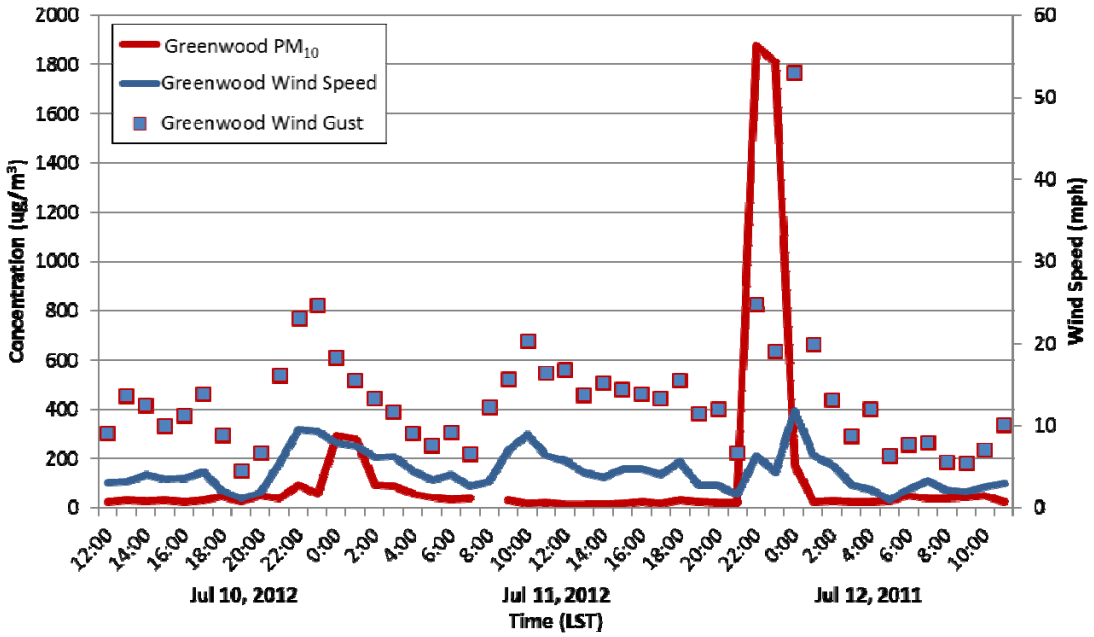


Figure 3-1. Hourly PM_{10} concentrations and wind speeds at the Greenwood monitor on July 10−12, 2012. PM_{10} concentrations and wind gust speeds sharply increased at 2200 LST on July 11, 2012, indicating the arrival of windblown dust. Wind gusts of over 50 mph were measured.

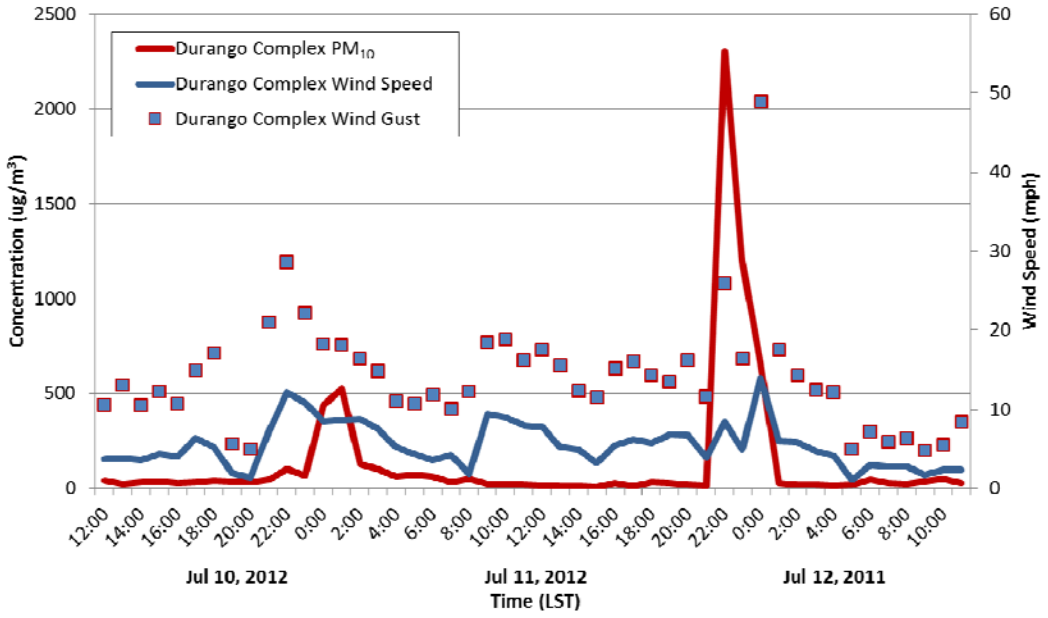


Figure 3-2. Hourly PM_{10} concentrations and wind speeds at the Durango Complex monitor on July 10−12, 2012. PM_{10} concentrations sharply increased at 2200 LST on July 11, 2012, coinciding with wind gusts of nearly 50 mph and indicating the arrival of windblown dust.

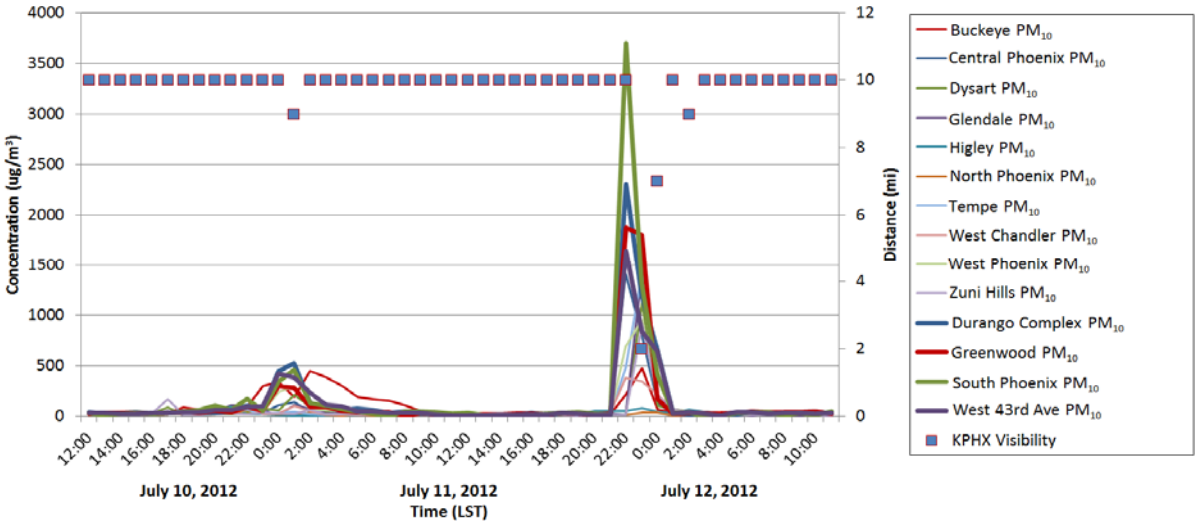


Figure 3-3. Hourly PM_{10} concentrations at the Phoenix-area PM_{10} monitors and visibility at KPHX. Visibility was significantly reduced at KPHX between 2200 LST on July 11, 2012, and 0100 LST on July 12, 2012, coincident with the sharp increase in PM_{10} concentrations at area PM_{10} monitors, indicating the arrival of windblown dust. A smaller reduction in visibility and increase in PM_{10} concentrations was evident around 0100 LST on July 11, 2012, which also contributed to high daily average PM_{10} concentrations at the exceedance monitors.

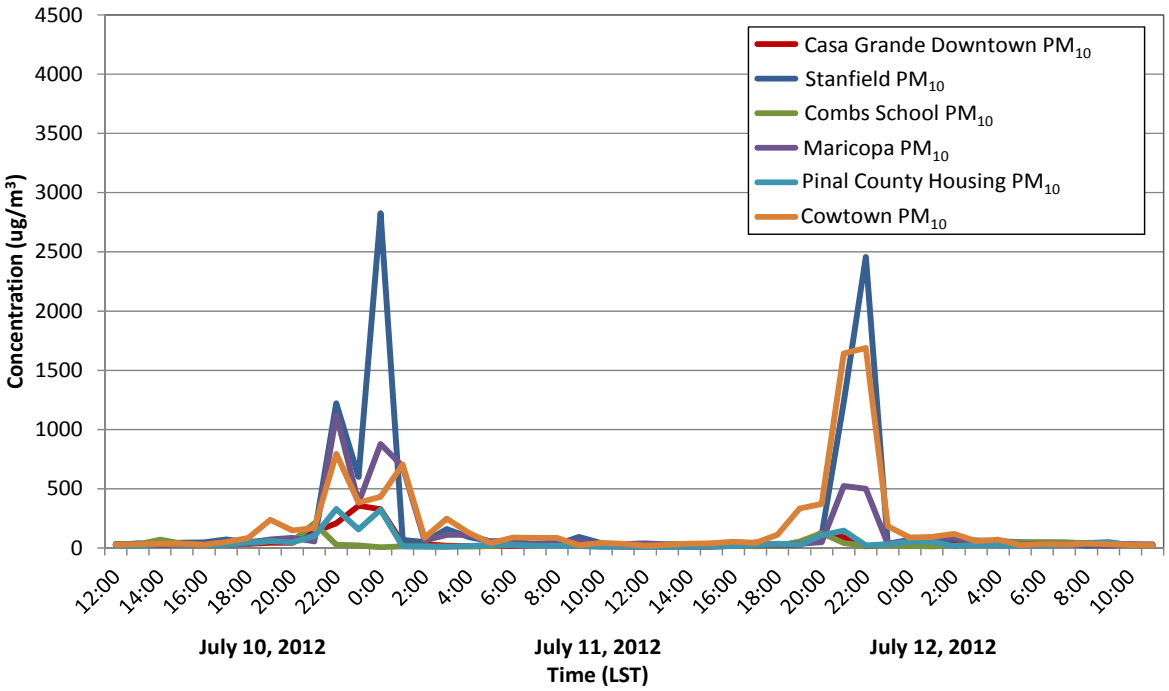


Figure 3-4. Hourly PM_{10} concentrations at Pinal County monitors on July 10−12, 2012. PM_{10} concentrations sharply increased between 2200 LST on July 10, 2012, and 0000 LST on July 11, 2012, and again between 2100 LST and 2300 LST on July 11, 2012, coinciding with the arrival of windblown dust due to thunderstorm outflows.

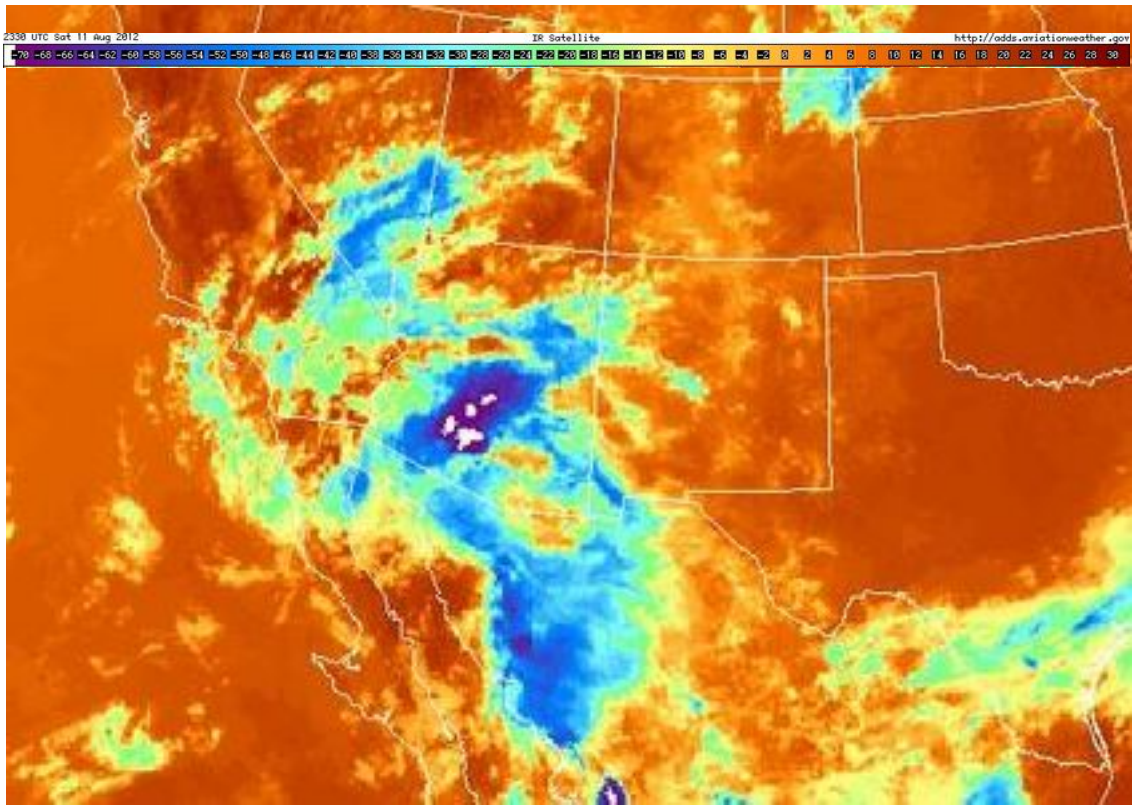


Figure 3-5. Infrared satellite image from 0045 LST on July 12, 2012 (GOES-West). Colder temperatures (blues, purples, and white) indicate tall, convective (thunderstorm) clouds. Thunderstorms over south-central Arizona generated an outflow boundary that carried dust northward into Maricopa County.

Figure 3-6 and **Table 3-1** summarize the progression of the thunderstorm outflow boundary and windblown dust as it moved through southwestern Arizona on the evening of July 11, 2012. The outflow boundary approached the Phoenix area from the southeast, first arriving in the Phoenix area around 2200 LST on July 11. These winds carried windblown dust to the Durango Complex, West 43rd Ave, South Phoenix, and Greenwood monitors. Sustained winds of 23 mph and a peak gust of 33 mph were reported at Phoenix Sky Harbor International Airport (KPHX). The outflow boundary continued northwestward and carried windblown dust to the Buckeye monitor during the 2300 LST hour. **Figure 3-7** shows radar velocity data that illustrate the location of the outflow boundary as it moved into the Phoenix metropolitan area. Other monitors in the Phoenix area also recorded elevated PM_{10} concentrations as the outflow boundary passed, but the concentrations were not high enough at those monitors to result in exceedances of the NAAQS.

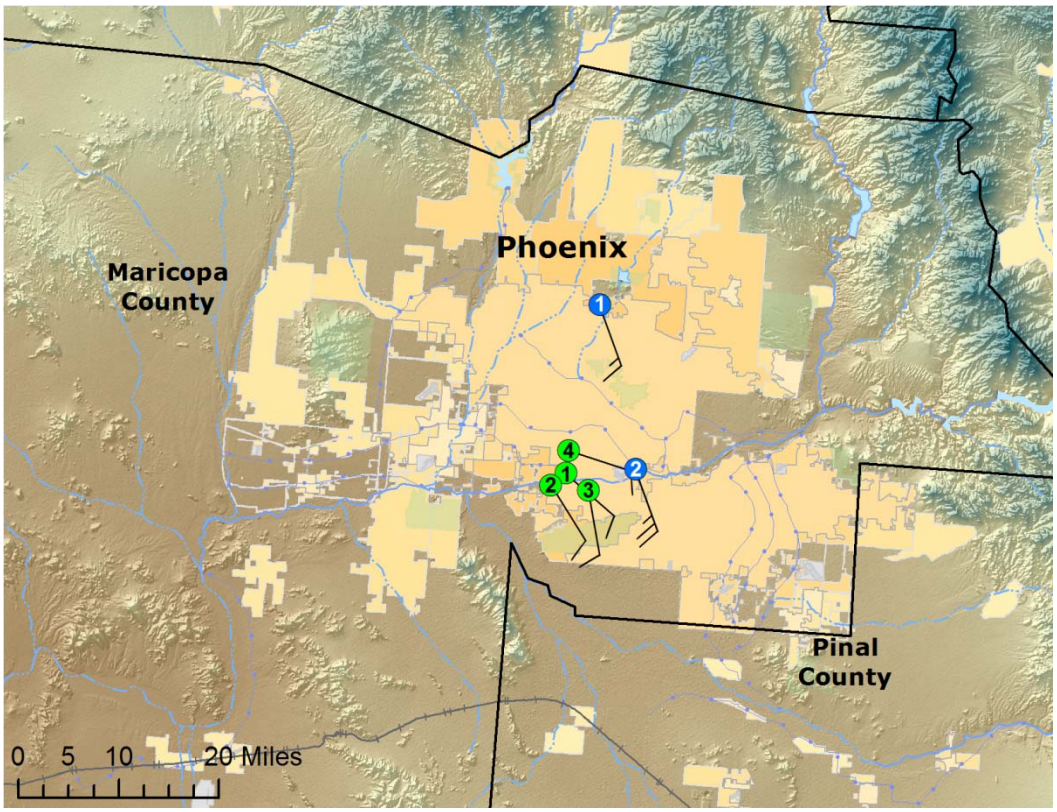


Figure 3-6. Phoenix-area air quality and meteorological monitor and general wind direction. Wind and PM_{10} data for the monitors are shown in Table 3-1, along with the names of the stations. South-southeasterly winds associated with thunderstorm outflow transported dust across the Phoenix area during the late evening hours of July 11, 2012.

Table 3-1. Observed wind speeds and wind gusts at Maricopa County air quality and meteorological monitors on July 11, 2012. All air quality monitors reported high PM_{10} concentrations at 2200 and 2300 LST on July 11, 2012, coincident with gusty winds. Filled circles identify sites shown in Figure 3-6.

Site	Monitor	1-hr Max PM_{10} ($\mu g/m^3$)	Time of Observation (LST)	Wind Speed (mph)	Wind Gust (mph)	Wind Direction (degrees)
1	Durango Complex	2301	2200	8	26	131
2	West 43rd Ave	1644	2200	9	31	148
3	South Phoenix	3701	2200	9	28	170
4	Greenwood	1875	2200	6	24	108
2	KPHX	-	2233	23	33	160
1	KDVT	-	2343	14	29	160

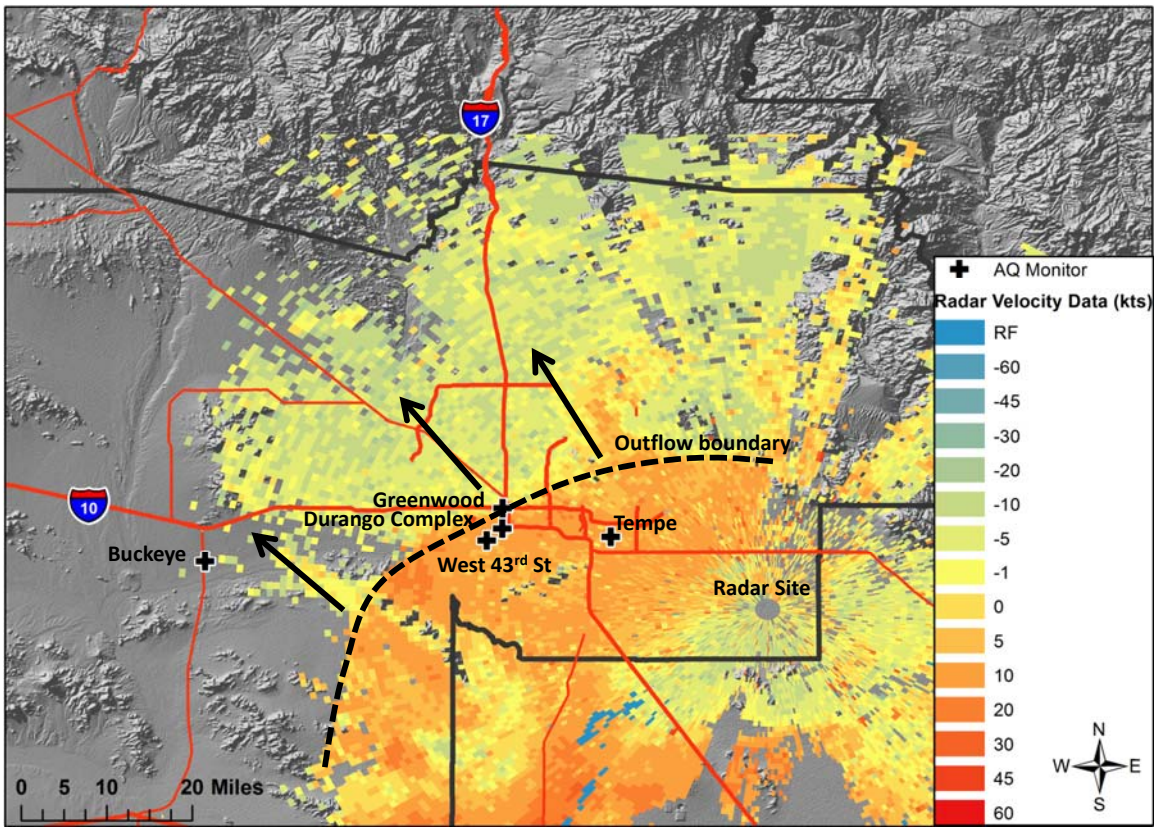


Figure 3-7. Radar base velocity data at 2212 LST on July 11, 2012, from NWS Phoenix Doppler radar. Green indicates flow toward the radar; dark orange and red indicate flow away from the radar, and yellow indicates little motion away from the radar. A well-defined outflow boundary (dashed line) approached the Phoenix area from the southeast. This boundary carried dust northwestward across the Phoenix metropolitan area.

Monitors in the Phoenix area measured sustained winds of over 20 mph and wind gusts in excess of 30 mph, coincident with the sharp increase in PM_{10} concentrations (Figure 3-1, Figure 3-2, and Appendix A). Visibility at KPHX also decreased significantly with the arrival of the dust (Figure 3-3). A similar reduction in visibility was reported at KDVT (north of the Greenwood PM_{10} monitor). Weather observations at KPHX also indicated widespread dust coincident with the high PM_{10} concentrations. It is also noteworthy that, immediately before the abrupt increase in PM_{10} concentrations at each monitor, wind gusts were comparatively much lighter and PM_{10} concentrations were much lower, illustrating the correlation between the gusty winds and the dust. Visibility cameras in the Phoenix area also clearly depict the rapid arrival of dust and the resulting significant reduction in visibility after 2200 LST on July 11, 2012. Links to these videos, other media coverage, and images pertaining to this windblown dust event are shown in Appendix B.

3.2 Summary

The information presented in this section demonstrates a clear causal relationship between the windblown dust and the PM_{10} exceedances measured at four Phoenix-area

monitors on July 11, 2012. The radar and wind data shown in this section illustrate the spatial and temporal extent of the dust storm as it moved through the Phoenix area. In addition, the time-series plots of air quality and meteorological data found in this section and in Appendix A show that the sharp increase in PM_{10} concentrations coincided with the strong wind speeds and wind gusts, and that the strong winds were experienced over a large area.

4. Historical Norm

4.1 Analysis

PM_{10} concentrations measured at the South Phoenix monitor on July 11, 2012, were unusual and in excess of normal historical fluctuations. To establish the severity of this event, PM_{10} concentrations measured on July 11, 2012, were compared to a historical 2007–2012 six-year annual data set at each monitor. The PM_{10} concentrations measured at the South Phoenix monitor on July 11, 2012, were among the highest 24-hr averages (**Figure 4-1**) and among the highest daily maximum hourly average concentrations (**Figure 4-2**) measured over the five-year period. Similar time-series plots for the Durango, Greenwood, and West 43rd monitors are shown in Appendix C.

4.2 Summary

Given the recorded values and using methods for assessing historical air quality similar to those accepted by the EPA, it is clear that the PM_{10} levels on July 11, 2012, were outside of normal historical fluctuations. This analysis provides evidence that the event affected air quality on an historic scale.

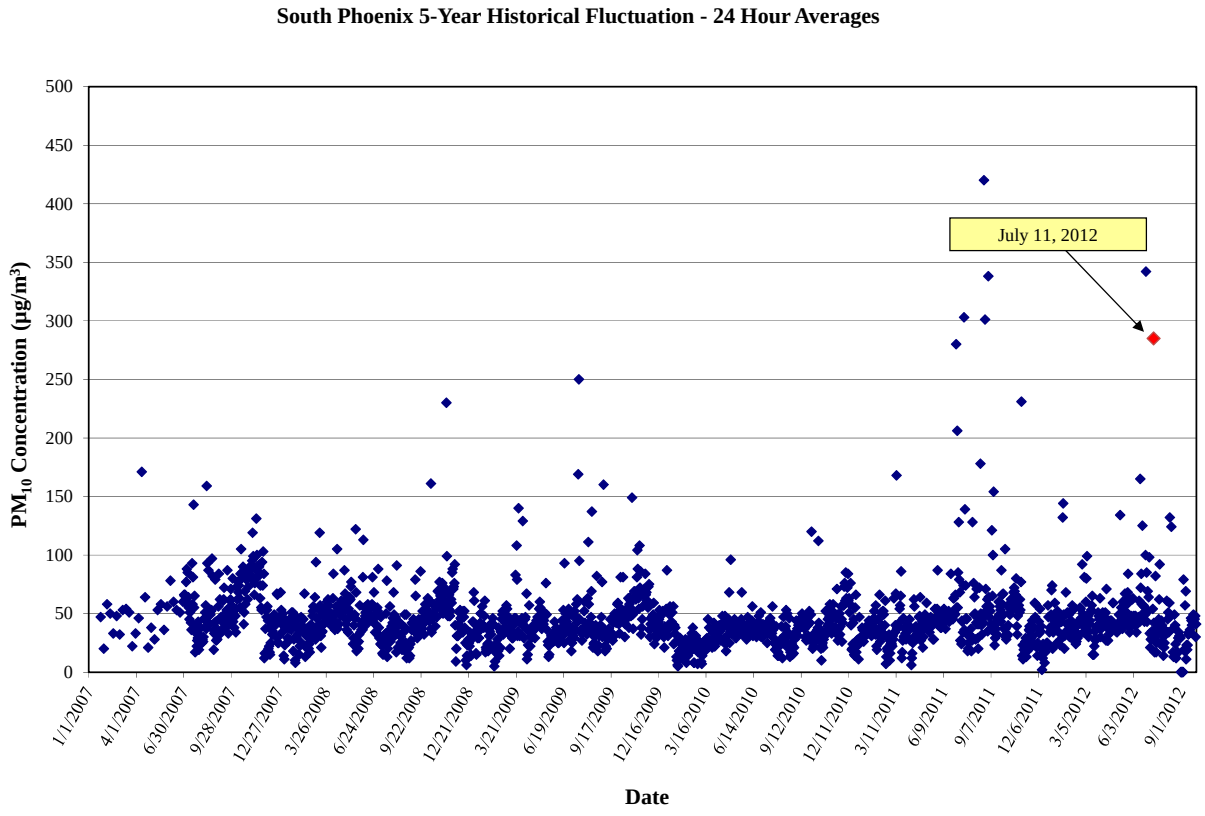


Figure 4-1. Twenty-four-hour average PM_{10} concentrations at the South Phoenix monitor (2007-2012). The 24-hr average PM_{10} concentration on July 11, 2012, is highlighted in red.

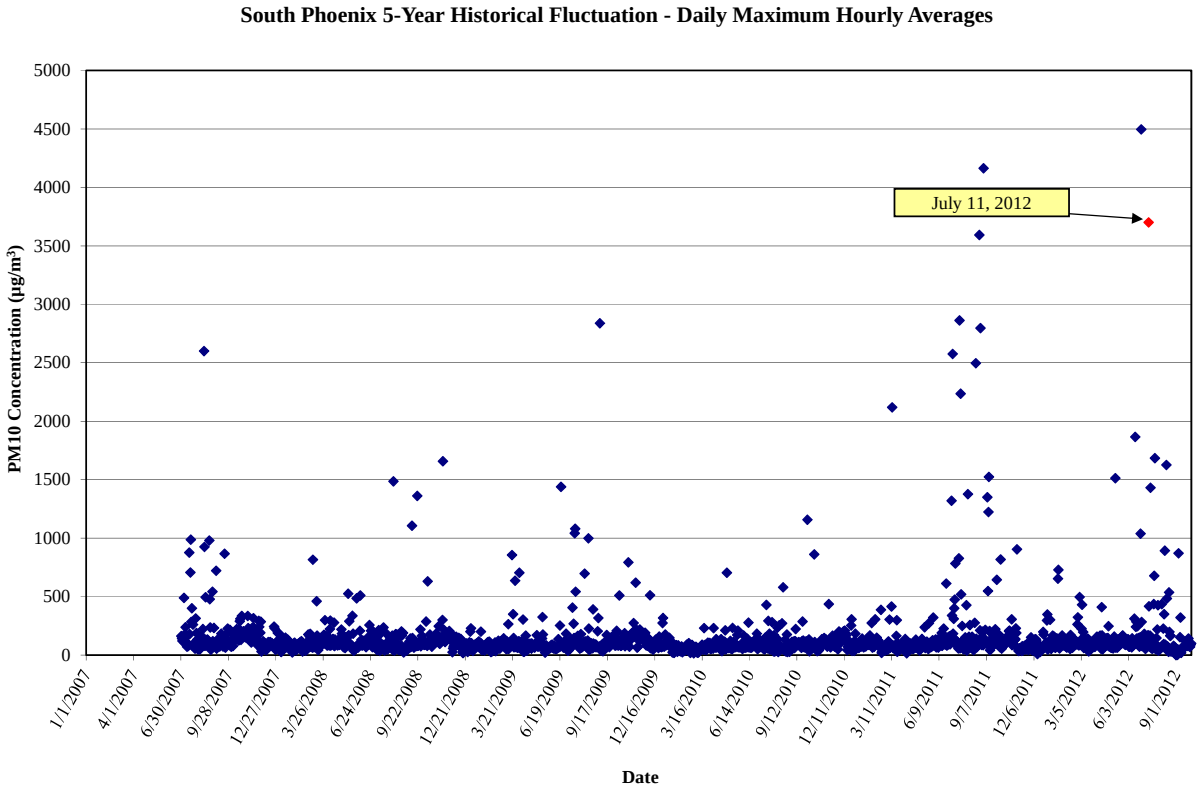


Figure 4-2. Daily maximum hourly average PM_{10} concentrations at the South Phoenix monitor (2007-2012). The daily maximum hourly average concentration on July 11, 2012, is highlighted in red.

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 (AgBMP)
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[1].

5.1.1 Control Measures

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

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

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

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

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 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 department'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.

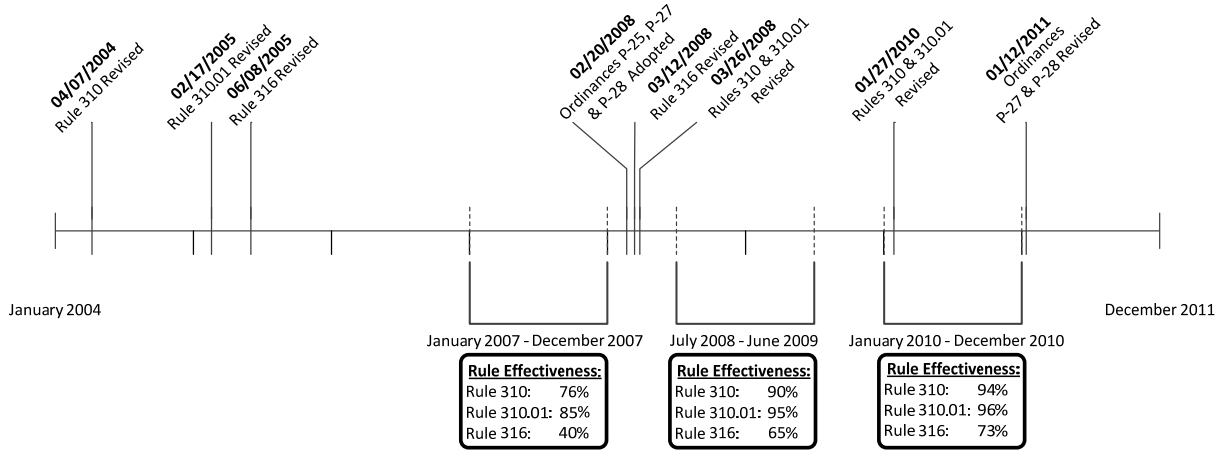


Figure 5-1. Timeline of Maricopa County fugitive dust rules and ordinances.

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: routine proactive inspections and surveillance inspections, conducted both 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 additional 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-inspection of sources that had received 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-min intervals. Previously, 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 NWS 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 Phoenix area around the time of the July 11, 2012, PM_{10} exceedances. An evaluation of all inspection reports, air quality complaints, compliance reports, and other documentation do not indicate any evidence of unusual anthropogenic-based PM_{10} emissions. During the time period of July 8-14, 2012, MCAQD inspectors conducted a total of 188 inspections of permitted facilities, 129 of which were sources of fugitive dust. Additionally, MCAQD conducted 7 inspections on vacant lots and unpaved parking lots during this period. During this 7-day period, a total of 64 violations were issued countywide for PM_{10} and non-PM_{10}-related violations. No violations were issued for PM_{10} emissions within a 4-mile radius of any exceeding monitor.

MCAQD was prepared for any complaints received due to the high wind event. During the 7- day period from July 8 through July 14, 2012, MCAQD received 18 complaints, of which 11 were windblown dust-related. Each complaint was assigned to and investigated by a

MCAQD inspector. A review of all pertinent records from this period indicates that MCAQD inspectors did not observe any PM_{10} emission violations of local, state, or federal regulations within a 4-mile radius of an exceeding monitor.

In addition to MCAQD's efforts in pre-event surveillance and proactive inspections, ADEQ's AgBMP inspector also monitors the ADEQ Five-Day Dust Control Forecast and the MCAQD air monitoring sites that include real-time data. The ADEQ AgBMP 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 AgBMP inspector is dispatched to contact the owners and operators of agricultural fields in the area to discern if their activities are causing negative impacts. The AgBMP 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 July 11, 2012. The ADEQ Ag BMP inspector did not receive any complaints in the three days prior to the event.

5.2 Forecasts and Warnings

Dust forecasts and statements were released prior to the event by both ADEQ and the NWS office in Phoenix (Appendix D). For July 11, 2012, a Maricopa County Dust Control Forecast was issued by ADEQ, indicating a low risk level for unhealthy PM_{10}. The Dust Control Forecast stated that southeast winds between 5 and 10 mph were expected, and that "during the active summer monsoon period, strong outflow winds from even distant thunderstorms can generate periods of dense blowing dust."

The NWS office in Phoenix issued Blowing Dust Advisories for portions of Pinal and Maricopa counties during the period of gusty outflow winds and high PM_{10} concentrations in the Phoenix area. These advisories warned residents of the potential for gusty winds in excess of 40 mph and visibilities reduced below 1 mile due to blowing dust.

5.3 Wind Observations

Wind gusts over 30 mph were measured at several monitors as the outflow boundary moved through the Phoenix area (Figure 3-1, Figure 3-2, and Appendix A).

5.4 Summary

The thunderstorm outflow event of July 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 of Pima, Pinal and southern 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 pro-active 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 thunderstorms and thunderstorm outflows brought high concentrations of PM_{10} emissions into, and also overwhelmed controls within, the Phoenix PM_{10} Nonattainment Area. Widespread thunderstorm outflows with sustained winds in excess of 20 mph with gusts over 30 mph were enough to overwhelm all available efforts to limit PM_{10} concentrations during the event. The fact that these were natural events involving strong thunderstorm outflow winds that transported PM_{10} emissions into and across the Phoenix area, with a majority of the PM_{10} emissions recorded by Phoenix area monitors coming from sources outside of the Phoenix PM_{10} Nonattainment Area, provides strong evidence that the exceedances of July 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 satisfies 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 in the Phoenix PM_{10} Nonattainment Area on July 11, 2012,

- the exceedances were not reasonably controllable or preventable, and
- there was a clear causal relationship between PM_{10} transported from thunderstorm outflow originating in desert areas outside the Phoenix metropolitan area and the measured PM_{10} exceedances.

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

As shown in Section 3, radar velocity data and time-series plots of PM_{10} and wind speeds establish a clear causal relationship between the arrival of dust-laden thunderstorm outflow and elevated PM_{10} concentrations at monitors in the Phoenix area. Multiple independent measurements of wind speed, wind direction, and visibility all show that thunderstorm outflow was the mechanism for transport of PM_{10} into the Phoenix PM_{10} Nonattainment Area. In addition, PM_{10} concentrations were well below the NAAQS on days immediately before and after the windblown dust event. The source regions for the thunderstorm outflow and PM_{10} are clearly identified as desert areas east and south of Phoenix. The weight of evidence presented in this submittal provides no alternative that could tie the exceedances of July 11, 2012, to any causal source except PM_{10} transported by thunderstorm outflow, confirming that there would have been no exceedances but for the presence of this uncontrollable natural event.

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

6.2 Summary

The weight of evidence presented in this submittal provides no alternative that could tie the exceedances of July 11, 2012, to any causal source except PM_{10} transported by thunderstorm outflow, confirming that there would have been no exceedances but for the presence of this uncontrollable natural event.

7. Conclusions

The PM_{10} exceedances that occurred on July 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 501 (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 exceedance 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 thunderstorm outflow that transported dust into the Phoenix area from areas largely outside the Phoenix PM_{10} Nonattainment Area. These facts provide strong evidence that the PM_{10} exceedances on July 11, 2012, were not reasonably controllable or preventable.

7.3 Natural Event

As discussed above, the PM_{10} exceedances on July 11, 2012, were shown to be caused by PM_{10} transported into the Phoenix area by 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 (Section 3).
- High PM_{10} concentrations and gusty winds were reported throughout the Phoenix metropolitan area, illustrating the widespread, regional, and uncontrollable nature of this event (Section 3).
- PM_{10} concentrations were well below the NAAQS on days immediately before and after the windblown dust event (Section 3).
- Dry conditions preceding the event resulted in soils that were particularly susceptible to particulate suspension by high winds (Section 3).
- Visibility camera imagery shows that large quantities of PM_{10} were transported into the Phoenix area on July 11, 2012. The timing of the dust storm depicted in the visibility camera imagery is consistent with the PM_{10} concentration measurements, elevated winds, and reduced visibility.

7.5 Historical Norm

The 24-hr average PM_{10} values measured at the exceedance monitors were in excess of normal historical fluctuations, based on a comparison with 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 July 11, 2012, in the Phoenix PM_{10} Nonattainment Area would not have occurred but for the thunderstorm-driven high winds and transport of dust from areas largely outside of the Phoenix PM_{10} Nonattainment Area.

Appendix A:
Air Quality and Meteorological Data

This section contains time-series graphs of PM_{10} concentrations and wind data for Phoenix-area monitors on July 10-12, 2012. The data show a region-wide increase in wind speeds and wind gusts coincident with the arrival of dust and high PM_{10}.

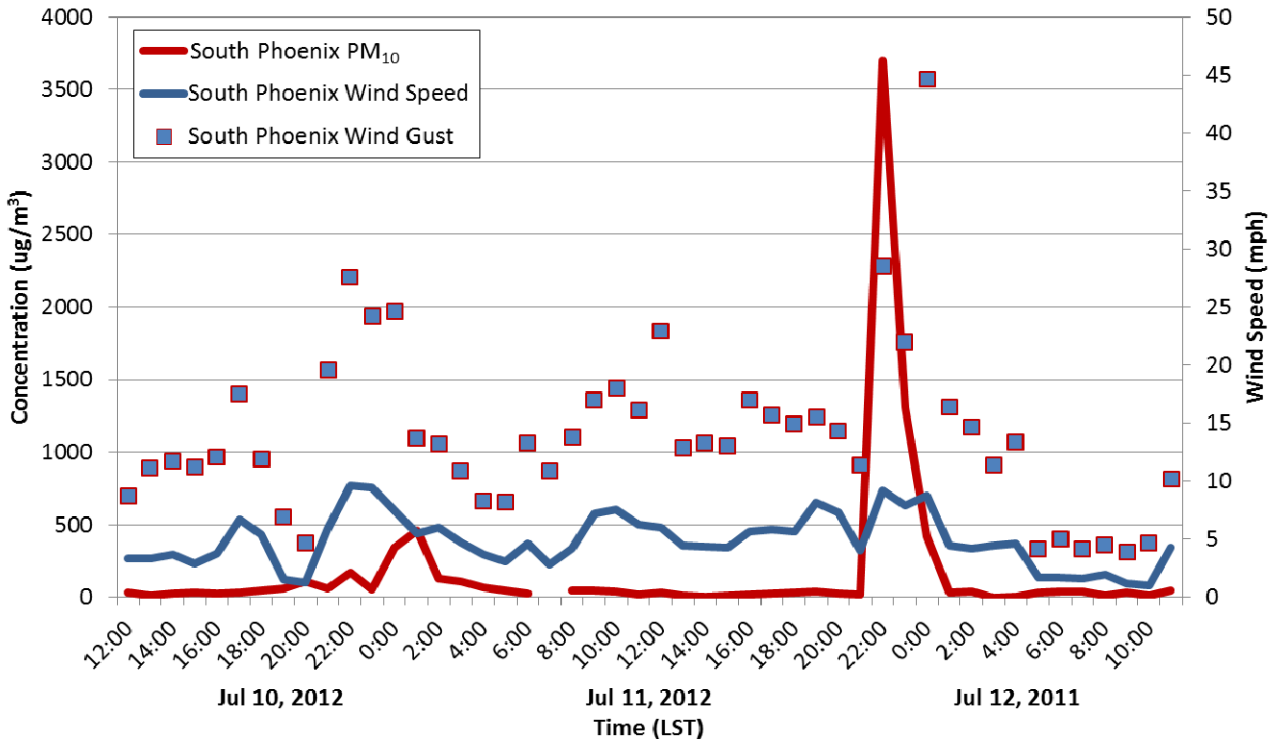


Figure A-1. Hourly PM_{10} concentrations and wind speeds at the South Phoenix monitor on July 10−12, 2012. PM_{10} concentrations and wind gusts sharply increased at 2200 LST on July 11, 2012, indicating the arrival of windblown dust.

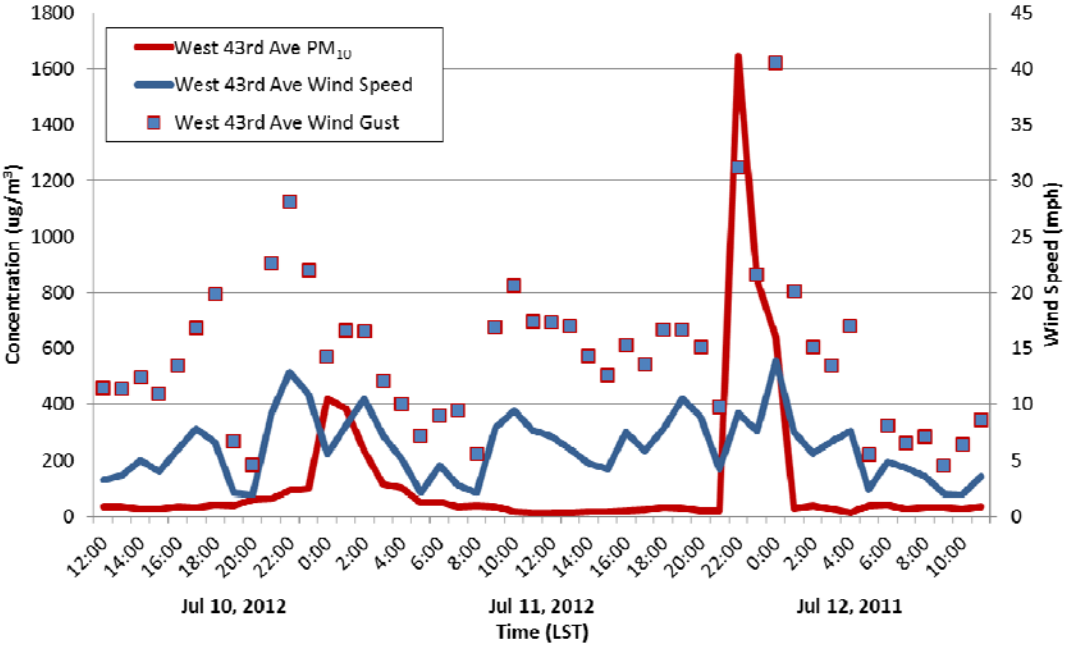


Figure A-2. Hourly PM_{10} concentrations and wind speeds at the West 43rd Avenue monitor on July 10−12, 2012. PM_{10} concentrations and wind gusts sharply increased at 2200 LST on July 11, 2012, indicating the arrival of windblown dust.

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 (07/2012)

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	SCT160 BKN180 BKN240	9.00		93	33.9	71	21.8	60	15.6	33	11	130		28.63	1	022	29.73	AA		29.80
11	0151	11	SCT160 BKN180 BKN240	10.00		93	33.9	71	21.5	59	15.0	32	11	100		28.64			29.74	AA		29.81
11	0251	11	SCT180 BKN240	10.00		92	33.3	70	21.3	59	15.0	33	8	120		28.65			29.75	AA		29.82
11	0351	11	SCT180 BKN240	10.00		91	32.8	71	21.7	61	16.1	37	6	100		28.66	1	007	29.76	AA		29.83
11	0451	11	FEW140 SCT180 BKN240	10.00		91	32.8	71	21.7	61	16.1	37	9	070		28.66			29.76	AA		29.83
11	0551	11	FEW140 SCT200 BKN240	10.00		90	32.2	70	21.3	60	15.6	37	10	120		28.68			29.78	AA		29.85
11	0651	11	FEW140 SCT180 BKN240	10.00		91	32.8	71	21.4	60	15.6	35	6	180		28.69	1	016	29.80	AA		29.87
11	0751	11	FEW180 BKN240	10.00		93	33.9	71	21.8	60	15.6	33	0	000		28.70			29.81	AA		29.88
11	0851	11	FEW180 BKN240	10.00		98	36.7	73	22.5	60	15.6	28	6	VR		28.71			29.81	AA		29.89
11	0951	11	FEW090 SCT180 BKN240	10.00		100	37.8	73	22.8	60	15.6	27	7	120	18	28.69			29.80	AA		29.87
11	1051	11	FEW095 BKN240	10.00		103	39.4	73	22.7	58	14.4	23	13	140	20	28.69	8	008	29.79	AA		29.86
11	1151	11	FEW110 BKN240	10.00		106	41.1	73	22.9	57	13.9	20	9	170		28.66			29.76	AA		29.83
11	1251	11	FEW100 BKN240	10.00		105	40.6	73	22.5	56	13.3	20	3	VR		28.64			29.74	AA		29.81
11	1351	11	FEW110 BKN240	10.00		109	42.8	74	23.1	56	13.3	18	7	140		28.60	8	029	29.70	AA		29.77
11	1451	11	FEW100 SCT160 BKN250	10.00		108	42.2	73	22.7	55	12.8	17	5	VR		28.56			29.66	AA		29.73
11	1551	11	FEW100 SCT130 SCT200	10.00		108	42.2	73	22.5	54	12.2	17	0	000		28.53			29.63	AA		29.70
11	1651	11	FEW090 SCT130 SCT200	10.00		110	43.3	73	23.0	55	12.8	16	15	310	18	28.52	6	025	29.62	AA		29.69
11	1751	11	FEW090 SCT110 SCT200	10.00		108	42.2	73	22.7	55	12.8	17	9	290		28.51			29.61	AA		29.68
11	1851	11	FEW090 SCT110 SCT200	10.00		107	41.7	73	22.6	55	12.8	18	6	VR		28.52	3	005	29.62	AA		29.69
11	1951	11	FEW110 SCT170 SCT200	10.00		105	40.6	73	22.8	57	13.9	21	13	330		28.54			29.64	AA		29.71
11	2051	11	FEW110 SCT170 SCT200	10.00		105	40.6	73	22.5	56	13.3	20	10	330		28.54			29.64	AA		29.71
11	2151	11	FEW090 BKN130 BKN200	10.00		103	39.4	73	22.5	57	13.9	22	3	010		28.57			29.67	AA		29.74
11	2233	11	SCT014 BKN120 BKN200	2.00	DU	97	36.0	72	22.1	59	15.0	28	23	160	33	28.61			M	SP		29.78
11	2237	11	BKN012 BKN120 BKN200	1.75	DU	97	36.0	72	22.1	59	15.0	28	20	160	32	28.61			M	SP		29.78
11	2251	11	BKN012 BKN075 BKN110	2.00	DU	94	34.4	72	21.9	60	15.6	32	17	150	24	28.60	3	021	29.70	AA	T	29.77
11	2256	11	BKN012CB BKN075CB BKN120	2.00	-TSRA	93	34.0	72	22.0	61	16.0	34	14	170	23	28.61			M	SP		29.78
11	2315	11	BKN005CB BKN020 BKN070	3.00	TSDU	93	34.0	72	22.0	61	16.0	34	14	320	25	28.63			M	SP		29.80
11	2347	11	BKN018CB BKN070CB BKN120	6.00	TSDU	93	34.0	73	22.6	63	17.0	37	14	290		28.62			M	SP		29.79
11	2351	11	BKN018CB BKN070CB BKN120	7.00		94	34.4	73	22.5	62	16.7	35	14	280		28.62			29.71	AA	T	29.79

Figure A-4. Quality-controlled local climatological data hourly observations table for Phoenix Sky Harbor International Airport, Phoenix, AZ (07/11/2012). Note that visibilities were reduced with gusty winds and DU (widespread dust) reported after 2200 LST coincident with high PM_{10} concentrations in the Phoenix area. Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

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

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)
HOURLY OBSERVATIONS TABLE
PHOENIX DEER VALLEY ARPT (03184)
PHOENIX, AZ (07/2012)

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

Elevation: 1455 ft. above sea level
Latitude: 33.688
Longitude: -112.081
Data Version: VER2

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
11	0053	12	CLR	10.00		92	33.3	70	21.3	59	15.0	33	8	160		28.27	1	027	29.73	AA		29.83
11	0153	12	CLR	10.00		91	32.8	70	21.1	59	15.0	34	9	140		28.28			29.75	AA		29.84
11	0253	12	CLR	10.00		91	32.8	69	20.6	57	13.9	32	5	100		28.28			29.75	AA		29.84
11	0353	12	CLR	10.00		90	32.2	70	21.0	59	15.0	35	10	100		28.29	3	006	29.76	AA		29.85
11	0453	12	CLR	10.00		89	31.7	70	21.1	60	15.6	38	8	090		28.30			29.77	AA		29.86
11	0553	12	CLR	10.00		89	31.7	70	21.1	60	15.6	38	6	080		28.32			29.79	AA		29.88
11	0653	12	CLR	10.00		91	32.8	71	21.4	60	15.6	35	0	000		28.33	1	014	29.80	AA		29.89
11	0753	12	CLR	10.00		93	33.9	71	21.7	60	15.6	33	5	120		28.35			29.81	AA		29.91
11	0853	12	CLR	10.00		96	35.6	72	22.2	60	15.6	30	5	VR		28.35			29.82	AA		29.91
11	0953	12	CLR	10.00		98	36.7	72	22.2	59	15.0	27	9	150	16	28.34	8	008	29.80	AA		29.90
11	1053	12	CLR	10.00		101	38.3	73	22.7	59	15.0	25	11	140		28.32			29.79	AA		29.88
11	1153	12	CLR	10.00		102	38.9	73	22.5	58	14.4	23	9	180		28.30			29.76	AA		29.86
11	1253	12	CLR	10.00		103	39.4	72	22.4	57	13.9	22	7	VR		28.27	8	028	29.74	AA		29.83
11	1353	12	CLR	10.00		103	39.4	72	22.2	56	13.3	21	0	000		28.23			29.70	AA		29.79
11	1453	12	CLR	10.00		104	40.0	72	22.3	56	13.3	20	9	240		28.20			29.67	AA		29.76
11	1553	12	CLR	10.00		104	40.0	72	22.3	56	13.3	20	5	VR		28.18	6	022	29.65	AA		29.74
11	1653	12	CLR	10.00		106	41.1	73	22.8	57	13.9	20	3	340		28.17			29.63	AA		29.72
11	1753	12	CLR	10.00		103	39.4	73	22.7	58	14.4	23	15	310		28.17			29.63	AA		29.72
11	1853	12	CLR	10.00		102	38.9	72	22.3	57	13.9	23	11	330		28.17	3	006	29.64	AA		29.73
11	1953	12	CLR	10.00		100	37.8	72	22.0	57	13.9	24	11	330		28.18			29.65	AA		29.74
11	2053	12	CLR	10.00		99	37.2	71	21.6	56	13.3	24	8	330		28.20			29.66	AA		29.75
11	2153	12	CLR	10.00		99	37.2	71	21.6	56	13.3	24	7	010		28.21	3	012	29.67	AA		29.77
11	2253	12	SCT120	4.00	HZ	98	36.7	71	21.4	56	13.3	25	10	120		28.22			29.69	AA		29.78
11	2343	12	FEW046 BKN095 OVC110	2.50	+RA	90	32.0	70	21.0	59	15.0	35	14	160	29	28.25			M	SP		29.81
11	2346	12	FEW044 SCT070 BKN110	3.00	+RA	88	31.0	70	21.2	61	16.0	40	11	150	29	28.25			M	SP		29.81
11	2353	12	FEW042 SCT070 BKN100	7.00	RA	85	29.4	72	22.3	66	18.9	53	13	180	21	28.25			29.72	AA	0.21	29.81

Figure A-5. Quality-controlled local climatological data hourly observations table for Phoenix Deer Valley Airport, Phoenix, AZ (07/11/2012). Note in the Weather Type column that HZ (haze) was reported with reduced visibilities and gusty winds coincident with the arrival of high PM_{10} concentrations in the Phoenix area. Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

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

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)
HOURLY OBSERVATIONS TABLE
CASA GRANDE MUNICIPAL ARPT (03914)
CASA GRANDE, AZ
(07/2012)

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		88	31.0	71	21.8	63	17.0	43	22	160	30	28.28			M	AA		29.83
11	0035	0	CLR	10.00		86	30.0	70	20.9	61	16.0	43	20	170	31	28.27			M	AA		29.82
11	0055	0	CLR	10.00		84	29.0	70	21.2	63	17.0	49	7	200		28.28			M	AA		29.83
11	0115	0	CLR	10.00		88	31.0	71	21.8	63	17.0	43	0	000		28.28			M	AA		29.83
11	0135	0	CLR	10.00		88	31.0	70	21.2	61	16.0	40	6	140		28.30			M	AA		29.85
11	0155	0	CLR	10.00		88	31.0	71	21.8	63	17.0	43	8	090		28.31	2	003	M	AA		29.86
11	0215	0	FEW065 FEW080 SCT090	10.00		86	30.0	71	21.8	64	18.0	48	9	070		28.31			M	AA		29.86
11	0235	0	CLR	10.00		84	29.0	71	21.5	64	18.0	51	5	040		28.32			M	AA		29.87
11	0255	0	CLR	10.00		84	29.0	72	22.1	66	19.0	55	5	020		28.32			M	AA		29.87
11	0315	0	CLR	10.00		84	29.0	70	21.2	63	17.0	49	8	080		28.32			M	AA		29.87
11	0335	0	CLR	10.00		84	29.0	70	21.2	63	17.0	49	10	090		28.32			M	AA		29.87
11	0355	0	CLR	10.00		84	29.0	70	21.2	63	17.0	49	9	090		28.32			M	AA		29.87
11	0415	0	CLR	10.00		82	28.0	70	20.8	63	17.0	53	13	080		28.33			M	AA		29.88
11	0435	0	CLR	10.00		84	29.0	70	21.2	63	17.0	49	9	110		28.33			M	AA		29.88
11	0455	0	CLR	10.00		84	29.0	70	21.2	63	17.0	49	7	110		28.34	2	010	M	AA		29.89
11	0515	0	CLR	10.00		84	29.0	70	21.2	63	17.0	49	8	090		28.34			M	AA		29.89
11	0535	0	CLR	10.00		82	28.0	70	20.8	63	17.0	53	5	100		28.34			M	AA		29.89
11	0555	0	CLR	10.00		84	29.0	70	21.2	63	17.0	49	5	100		28.35			M	AA		29.90
11	0615	0	CLR	10.00		84	29.0	70	21.2	63	17.0	49	0	000		28.35			M	AA		29.90
11	0635	0	CLR	10.00		86	30.0	71	21.5	63	17.0	46	6	080		28.35			M	AA		29.90
11	0655	0	CLR	10.00		88	31.0	71	21.8	63	17.0	43	5	060		28.36			M	AA		29.91
11	0715	0	CLR	10.00		88	31.0	71	21.8	63	17.0	43	6	140		28.36			M	AA		29.91
11	0735	0	CLR	10.00		88	31.0	71	21.8	63	17.0	43	6	160		28.38			M	AA		29.93
11	0755	0	CLR	10.00		88	31.0	72	22.1	64	18.0	45	0	000		28.38	2	014	M	AA		29.93
11	0815	0	CLR	10.00		88	31.0	72	22.1	64	18.0	45	0	000		28.39			M	AA		29.94
11	0835	0	CLR	10.00		88	31.0	71	21.8	63	17.0	43	5	090		28.38			M	AA		29.93
11	0855	0	CLR	10.00		90	32.0	72	22.4	64	18.0	42	0	000		28.38			M	AA		29.93
11	0915	0	CLR	10.00		91	33.0	73	22.6	64	18.0	41	5	180		28.38			M	AA		29.93
11	0935	0	CLR	10.00		93	34.0	73	22.9	64	18.0	38	5	160		28.37			M	AA		29.92
11	0955	0	CLR	10.00		97	36.0	74	23.5	64	18.0	34	5	170		28.37			M	AA		29.92
11	1015	0	CLR	10.00		97	36.0	74	23.5	64	18.0	34	0	000		28.36			M	AA		29.91
11	1035	0	CLR	10.00		97	36.0	74	23.2	63	17.0	33	5	170		28.36			M	AA		29.91
11	1055	0	CLR	10.00		97	36.0	74	23.2	63	17.0	33	7	150		28.36	7	007	M	AA		29.91
11	1115	0	CLR	10.00		99	37.0	73	22.9	61	16.0	29	8	100		28.35			M	AA		29.90

11	1135	0	CLR	10.00		100	38.0	74	23.0	61	16.0	28	9	080	17	28.34			M	AA		29.89
11	1155	0	CLR	10.00		100	38.0	74	23.0	61	16.0	28	5	180		28.33			M	AA		29.88
11	1215	0	CLR	10.00		100	38.0	74	23.0	61	16.0	28	8	090	17	28.32			M	AA		29.87
11	1235	0	CLR	10.00		102	39.0	74	23.3	61	16.0	26	11	150		28.31			M	AA		29.86
11	1255	0	CLR	10.00		102	39.0	74	23.3	61	16.0	26	8	160	18	28.30			M	AA		29.85
11	1315	0	CLR	10.00		104	40.0	75	23.6	61	16.0	24	11	160	21	28.29			M	AA		29.84
11	1335	0	CLR	10.00		104	40.0	75	23.6	61	16.0	24	7	130	21	28.28			M	AA		29.83
11	1355	0	CLR	10.00		104	40.0	74	23.1	59	15.0	23	10	070	16	28.27	7	030	M	AA		29.82
11	1415	0	CLR	10.00		102	39.0	73	22.8	59	15.0	24	5	320		28.27			M	AA		29.81
11	1435	0	CLR	10.00		102	39.0	73	22.8	59	15.0	24	8	160		28.25			M	AA		29.79
11	1455	0	CLR	10.00		102	39.0	73	22.8	59	15.0	24	8	100		28.25			M	AA		29.79
11	1515	0	CLR	10.00		104	40.0	73	22.6	57	14.0	21	6	040		28.23			M	AA		29.77
11	1535	0	CLR	10.00		106	41.0	74	23.3	59	15.0	21	6	110		28.21			M	AA		29.75
11	1555	0	CLR	10.00		106	41.0	73	22.8	57	14.0	20	3	200		28.21			M	AA		29.75
11	1615	0	CLR	10.00		106	41.0	73	22.8	57	14.0	20	7	240		28.20			M	AA		29.74
11	1635	0	CLR	10.00		106	41.0	73	22.8	57	14.0	20	11	270	16	28.21			M	AA		29.75
11	1655	0	CLR	10.00		104	40.0	74	23.1	59	15.0	23	13	280	18	28.20	7	027	M	AA		29.74
11	1715	0	CLR	10.00		106	41.0	74	23.3	59	15.0	21	11	270		28.20			M	AA		29.74
11	1735	0	CLR	10.00		104	40.0	74	23.1	59	15.0	23	13	270	18	28.20			M	AA		29.74
11	1755	0	CLR	10.00		104	40.0	73	22.6	57	14.0	21	11	260		28.20			M	AA		29.74
11	1815	0	CLR	10.00		104	40.0	73	22.6	57	14.0	21	14	260	20	28.19			M	AA		29.73
11	1835	0	CLR	10.00		104	40.0	73	22.6	57	14.0	21	13	250		28.20			M	AA		29.74
11	1855	0	CLR	10.00		102	39.0	72	22.3	57	14.0	23	10	240		28.20			M	AA		29.74
11	1915	0	CLR	10.00		102	39.0	72	22.3	57	14.0	23	9	240		28.20			M	AA		29.74
11	1935	0	CLR	10.00		102	39.0	72	22.3	57	14.0	23	7	240		28.21			M	AA		29.75
11	1955	0	CLR	10.00		102	39.0	72	22.3	57	14.0	23	5	250		28.22	2	007	M	AA		29.76
11	2015	0	SCT120	10.00		100	38.0	72	22.0	57	14.0	24	5	250		28.22			M	AA		29.76
11	2035	0	BKN120	10.00		100	38.0	72	22.0	57	14.0	24	3	260		28.22			M	AA		29.76
11	2055	0	BKN120	10.00		100	38.0	72	22.0	57	14.0	24	0	000		28.24			M	AA		29.78
11	2115	0	FEW095 BKN120	10.00	VCTS	99	37.0	74	23.5	63	17.0	31	13	170		28.27			M	AA	0.03	29.81
11	2135	0	FEW025 SCT055 BKN070	8.00	TS	88	31.0	73	22.7	66	19.0	48	25	060	33	28.32			M	AA	0.03	29.87
11	2155	0	FEW024 SCT055 BKN070	10.00	TS	82	28.0	71	21.8	66	19.0	58	20	020	29	28.36			M	AA	0.03	29.91
11	2215	0	FEW015 SCT021 BKN037	10.00	VCTS	75	24.0	69	20.6	66	19.0	74	11	320		28.30			M	AA	0.10	29.85
11	2235	0	CLR	10.00	TS	79	26.0	69	20.6	64	18.0	60	6	230		28.29			M	AA	0.10	29.84
11	2255	0	CLR	10.00	VCTS	79	26.0	70	21.3	66	19.0	65	9	220		28.27	2	020	M	AA	0.10	29.82
11	2315	0	FEW110	10.00		81	27.0	71	21.6	66	19.0	60	11	210		28.28			M	AA		29.83
11	2335	0	CLR	10.00		81	27.0	71	21.6	66	19.0	60	8	230		28.29			M	AA		29.84
11	2355	0	CLR	10.00		81	27.0	71	21.6	66	19.0	60	7	200		28.30			M	AA		29.85

Figure A-6. Quality-controlled local climatological data hourly observations table for Casa Grande Municipal Airport, Casa Grande, AZ (07/11/2012). Note that reduced visibilities with gusty winds occurred after 2100 LST coincident with the arrival of high PM_{10} concentrations in the Casa Grande area. Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

Appendix B: Media Coverage, Videos, and Images

Video Links

ADEQ visibility cameras in the Phoenix area:

South Mountain: www.phoenixvis.net/videos/mpeg4/SOMT_07112012.mp4

Estrella Mountains: www.phoenixvis.net/videos/mpeg4/ESMO_07112012.mp4

Camelback Mountains: www.phoenixvis.net/videos/mpeg4/CAME_07112012.mp4

Superstition Mountains: www.phoenixvis.net/videos/mpeg4/SUPM_07112012.mp4

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

Lightning Over Phoenix, AZ – July 11, 2012 (clip 1)
http://www.youtube.com/watch?v=zz0Lc9hlKVA

AZ monsoon video – July 11, 2012
http://www.youtube.com/watch?v=20sdQEZka-Q

Media Articles and Images

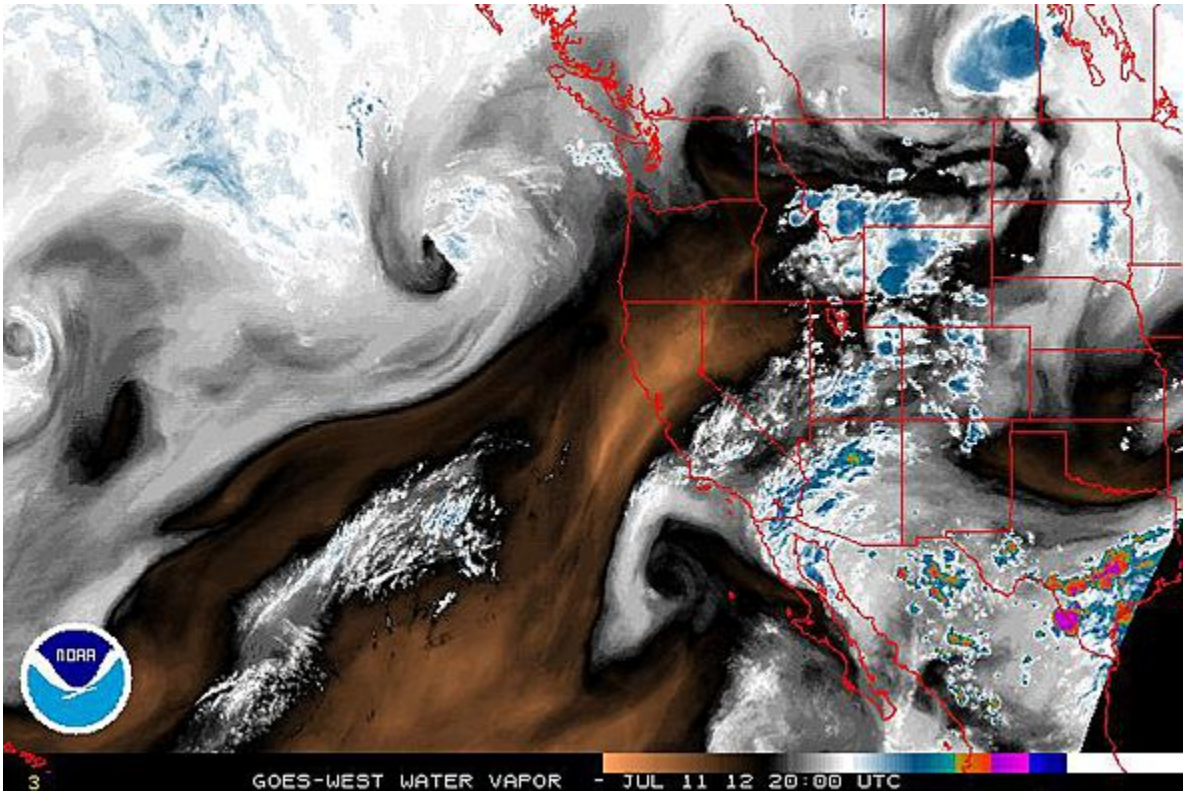
http://www.accuweather.com/en/weather-blogs/clark/another-scorcherthunderstorms-to-increase/67876

Another Scorcher-Thunderstorms to Increase

Ken Clark
July 11, 2012; 12:52 PM

Today has been another sizzler in the Southwest. Many places inland from the cooling effects of the Pacific were at, or well above, 100. An increase in low-level moisture in the southeast deserts of California have kept temperatures lower than yesterday but, of course, the added moisture is making up for that. The AccuWeather RealFeel temperatures are pretty much the same as yesterday in a lot of these areas. I am not sure how hot the tables and slots are in Vegas today in giving up money but I can guarantee you those moving between casinos are hot and giving up a lot of sweat as temperatures on the Strip have risen to between 111 and 114 degrees.

It will stay hot the next couple of days but it probably will not be as hot in all the deserts as the last two days because of increase moisture causing an increase in cloud cover and also the development of thunderstorms. A look at the water vapor satellite picture from early afternoon Wednesday shows moisture moving in from the southeast.



A big increase in available moisture from today to tomorrow will take place over all of Southern California north into southern Nevada and into portions of the Sierra. This will help the development of showers and thunderstorms in all the deserts and mountains. The most active time will be in the afternoon and evening hours. With a lot more water vapor in the air tomorrow expect thunderstorms that develop to bring locally heavy rain that could cause some temporary flash flooding. Friday looks active too then over the weekend moisture will be on the decrease as a trough drops down from the north.

As an interesting side not. The so-called low temperature this morning in Death Valley was a toasty 103 degrees.

http://thetandd.com/news/more-thunderstorms-may-rumble-through/article_66eaea26-cb1c-11e1-80a1-001a4bcf887a.html

More thunderstorms may rumble through

By Gene Zaleski
July 11, 2012 5:30 am

Mother Nature was not so nurturing Tuesday afternoon as downed trees, power outages and nickel-size hail were reported primarily in the southern portion of The Times and Democrat Region.

And there could be more on the way.

“We are expecting a good chance of showers and thunderstorms through the end of this week,” National Weather Service meteorologist Dan Miller said.

Miller said the rain is welcome not only because conditions have been dry, but it has helped reduce the temperatures which have hovered near the century mark.

On Tuesday, the National Weather Service reported trees down from Bamberg to Denmark. Hail was reported near Cope, along with windy conditions.

In Orangeburg County, trees were down from Bowman’s Winter Creek Road to Interstate 26. Trees were also reported down on Vance Road in the Providence area as well as on Bass Drive.

In Bamberg, a couple thousand Edisto Electric Cooperative Inc. customers were without power for about one hour Tuesday afternoon as storms rolled through.

“It has been kind of crazy,” Edisto Electric Manager of Member Services Frank Furtick said. “The storm took a transmission line down that had most of our system around Bamberg and the town of Bamberg.”

Furtick said the transmission line was rerouted and customers had power restored.

As of late Tuesday afternoon, Furtick said there were still scattered outages in the Bamberg, Ehrhardt, Cope and St. George areas.
Sharon Hammond, Bamberg County Emergency Services director, says trees were down throughout the county.

Calhoun County Emergency Services Director Bill Minikiewicz said there were no reports of significant weather-related damage on Tuesday afternoon.

“We are the blessed people,” he said.

The T&D Region is under a hazardous weather outlook, with the forecast calling for more thunderstorms today and through the end of the week.

The chance of rain is 60 percent for today and 50 percent for Thursday. The chance of rainfall over the weekend is about 30 percent.

Appendix C: Historical Fluctuation Time-Series Graphs

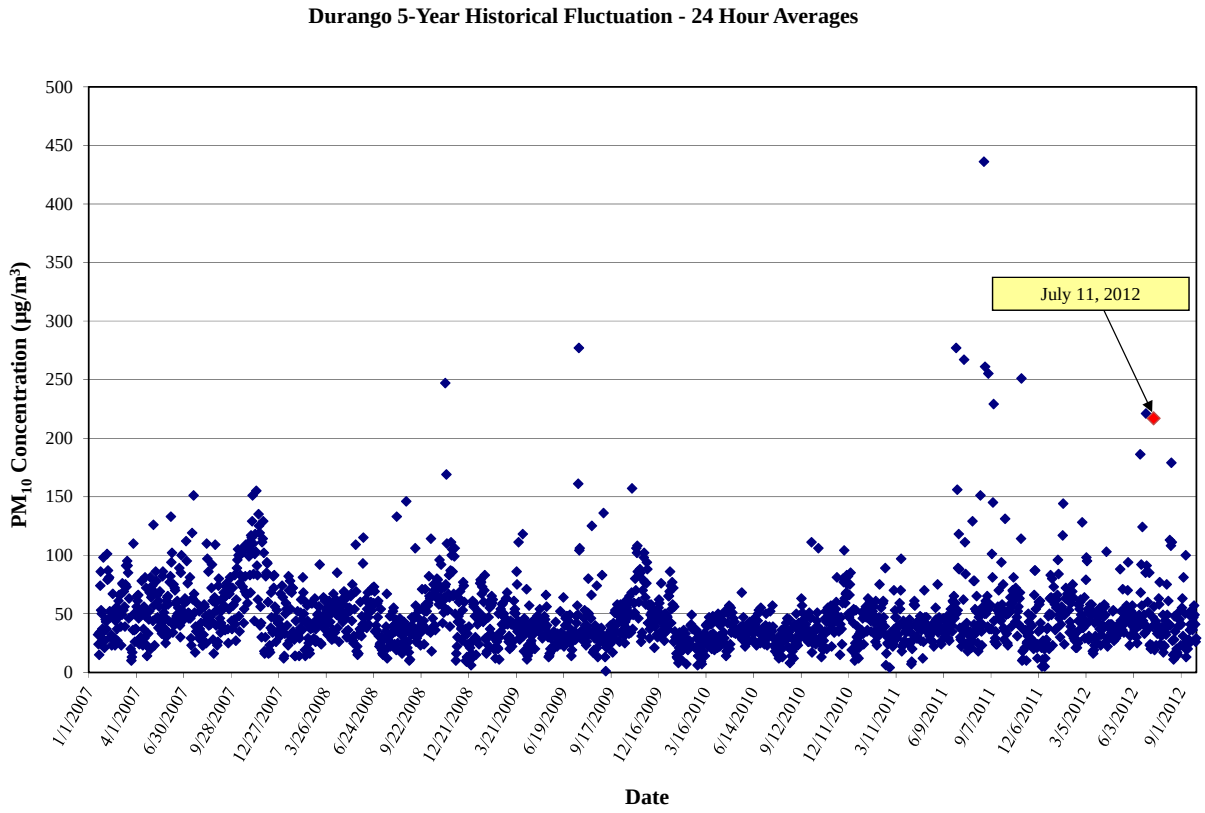


Figure C-1. Twenty-four-hour average PM_{10} concentrations at the Durango monitor (2007–2012). The 24-hr average PM_{10} concentration on July 11, 2012, is shown in red.

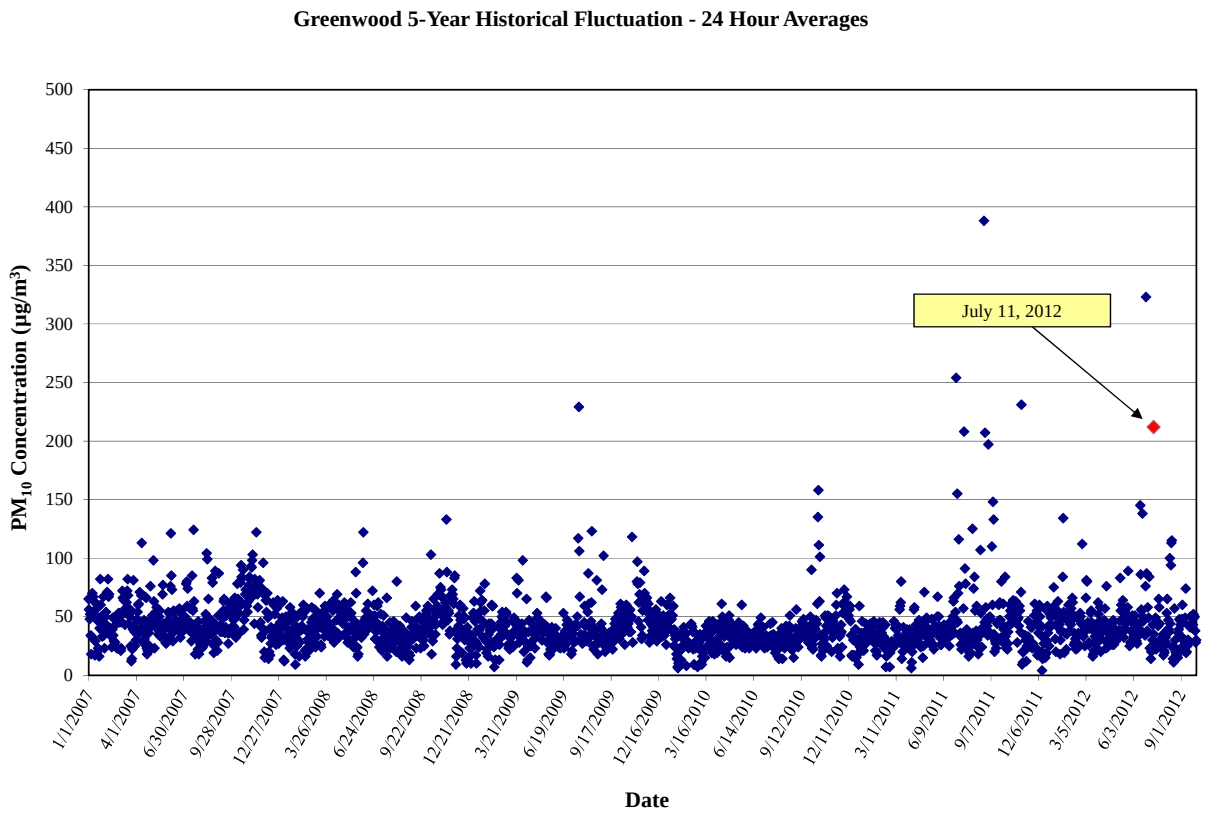


Figure C-2. Twenty-four-hour average PM_{10} concentrations at the Greenwood monitor (2007–2012). The 24-hr average PM_{10} concentration on July 11, 2012, is shown in red.

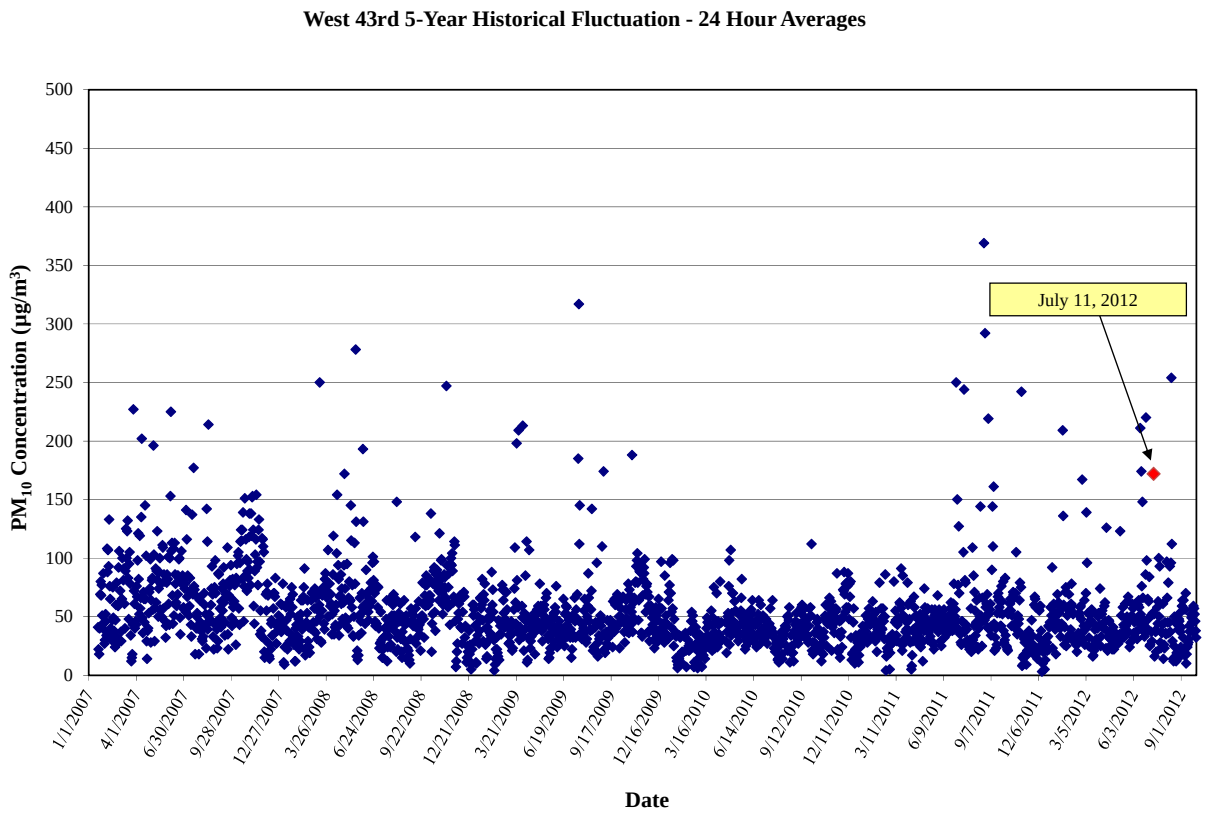


Figure C-3. Twenty-four-hour average PM_{10} concentrations at the West 43rd monitor (2007–2012). The 24-hr average PM_{10} concentration on July 11, 2012, is shown in red.

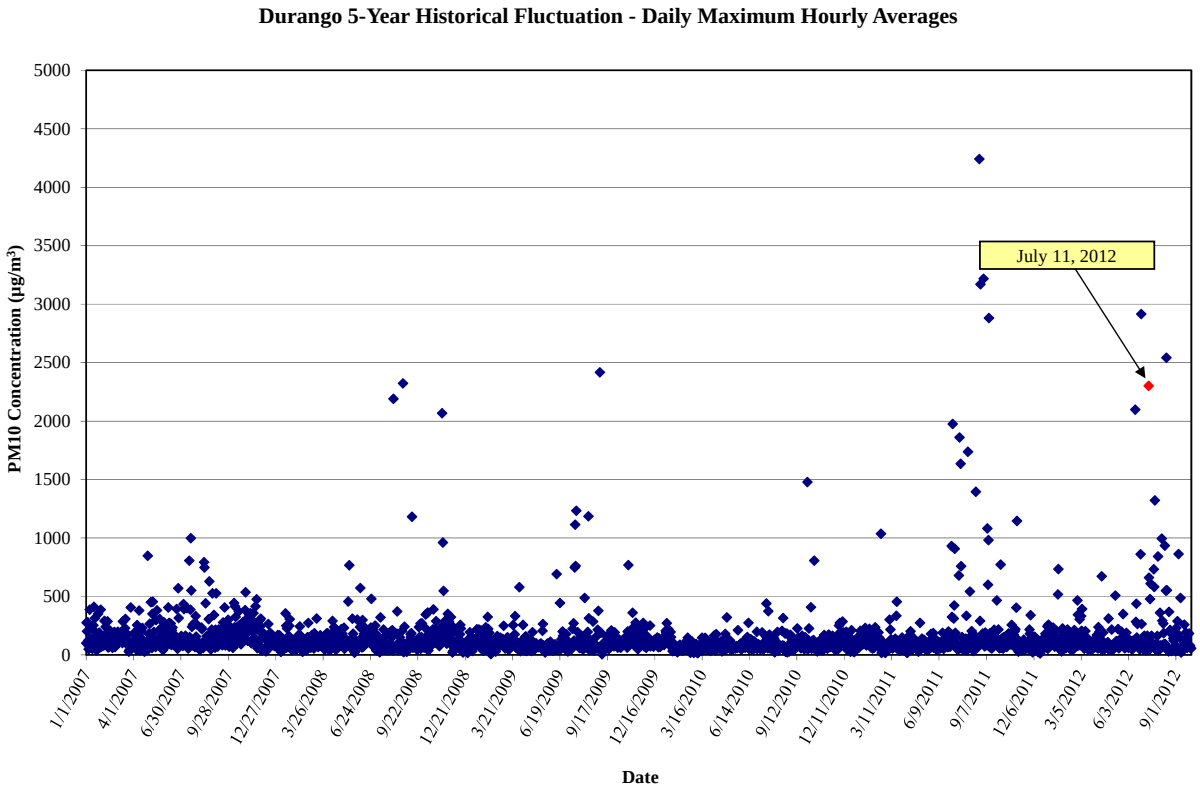


Figure C-4. Daily maximum hourly average PM_{10} concentrations at the Durango monitor (2007–2012). The daily maximum hourly average concentration on July 11, 2012, is shown in red.

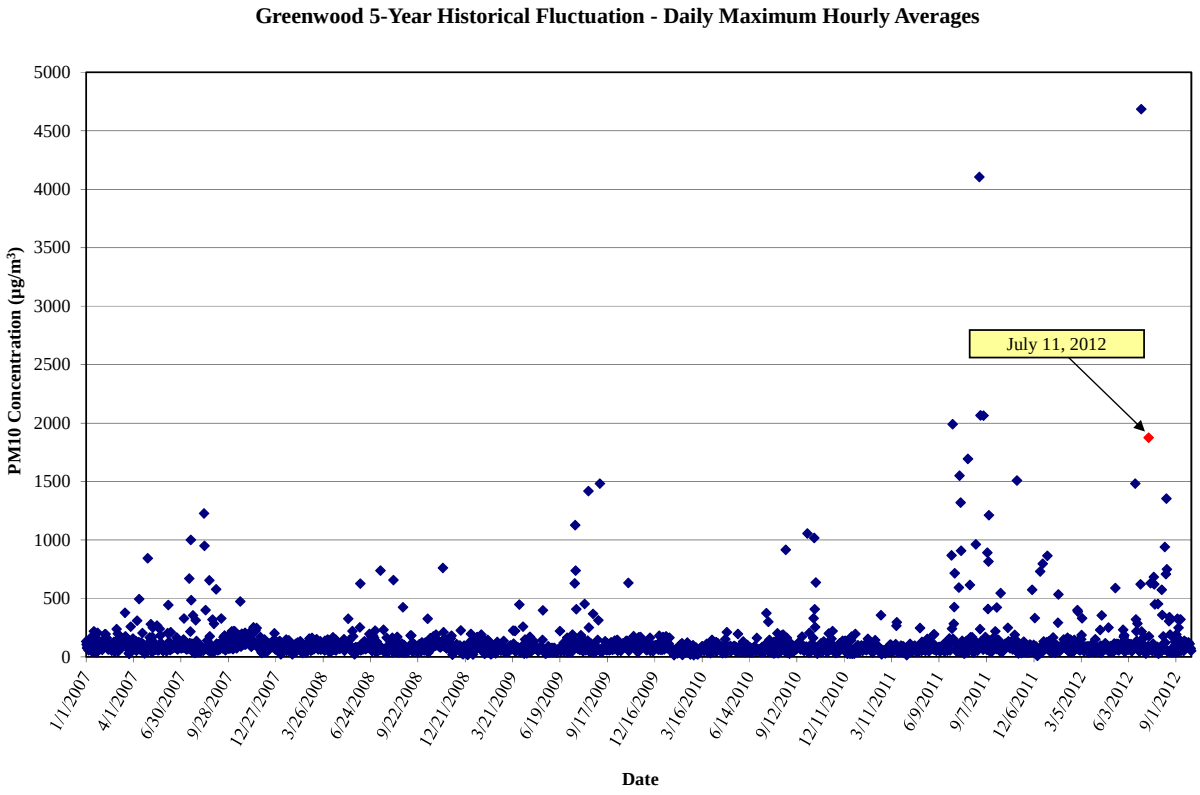


Figure C-5. Daily maximum hourly average PM_{10} concentrations at the Greenwood monitor (2007–2012). The daily maximum hourly average concentration on July 11, 2012, is shown in red.

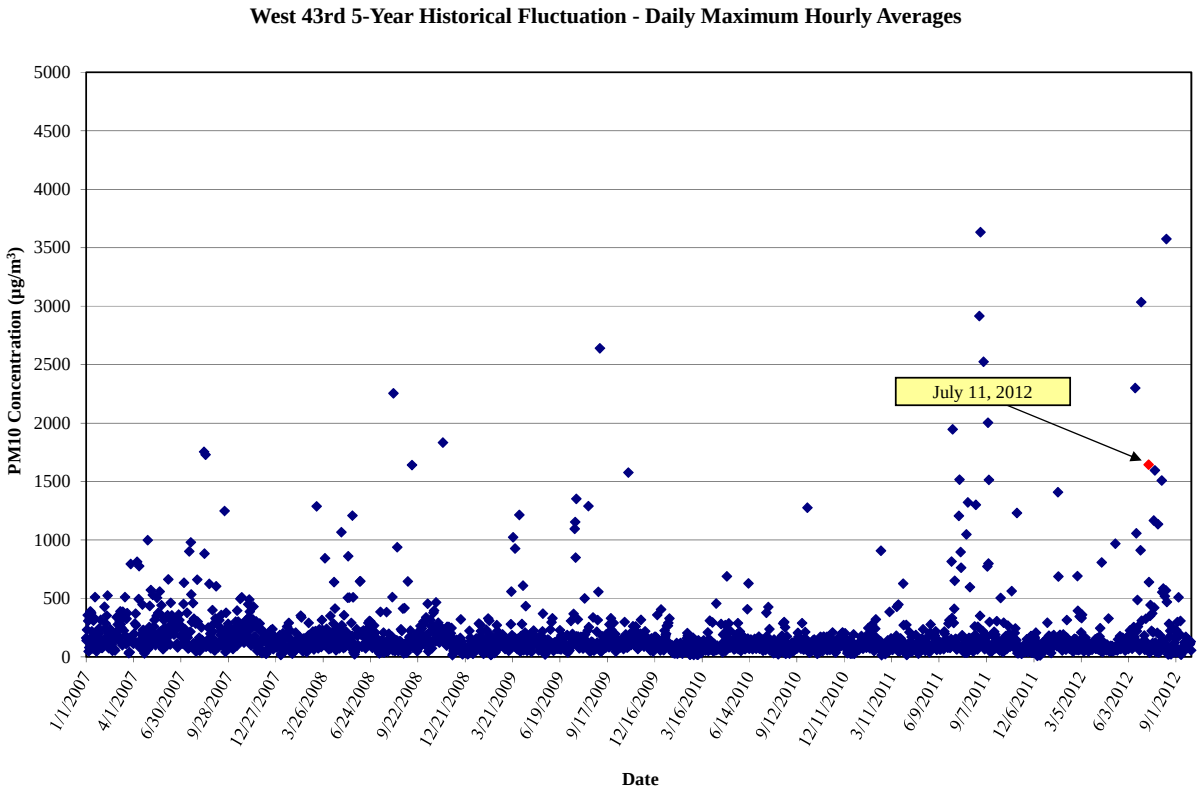


Figure C-6. Daily maximum hourly average PM_{10} concentrations at the West 43rd monitor (2007–2012). The daily maximum hourly average concentration on July 11, 2012, is shown in red.

Appendix D: ADEQ and NWS Forecast Products

MARICOPA COUNTY DUST CONTROL FORECAST

ISSUED TUESDAY, JULY 10, 2012

Three-day weather outlook:

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

The Phoenix forecast area is still looking for its first valley-wide rain event of the monsoon season. Spotty storm across the deserts to southeast have lowered the chances for blowing dust impacting the area. With high pressure now over the Four Corners, the steering flow is out of the northeast. These storms tend to be more electric rather than dust producing. Thus, the risk of exceeding the 24-hr PM10 health standard in Phoenix has been lowered to **Low** through Sunday.

R I S K F A C T O R S

	SURFACE WINDS		STAGNATION		UNHEALTHY PM-10 RISK LEVEL
Day 1: Wed 07/11/2012	Southeast winds between 5 and 10 mph are expected (20% chance of rain).	+	No significant stagnation is expected.	=	***LOW***
Day 2: Thu 07/12/2012	Southeast winds between 5 and 10 mph are expected (20% chance of rain).	+	No significant stagnation is expected.	=	***LOW***
Day 3: Fri 07/13/2012	Southeast winds between 5 and 10 mph are expected (30% chance of rain).	+	No significant stagnation is expected.	=	***LOW***
EXTENDED OUTLOOK					
Day 4: Sat 07/14/2012	Southeast winds between 5 and 10 mph are expected (30% chance of rain).	+	No significant stagnation is likely.	=	***LOW***
Day 5: Sun 07/15/2012	Southeast winds between 5 and 10 mph are expected (30% chance of rain).	+	No significant stagnation is likely.	=	***LOW***

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 WEDNESDAY, JULY 11, 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 MON 07/09/2012 Ozone Health Watch DUST Highest AQI Reading/Site (*Preliminary data only*)	TODAY TUE 07/10/2012 Ozone Health Watch DUST NWS Excessive Heat Warning	TOMORROW WED 07/11/2012 NWS Excessive Heat Warning	EXTENDED THU 07/12/2012
O3*	90 BLUE POINT	97 *MODERATE*	54 *MODERATE*	57 *MODERATE*
CO*	5 CENTRAL PHOENIX	6 *GOOD*	8 *GOOD*	6 *GOOD*
PM-10*	36 DURANGO	65 *MODERATE*	45 *GOOD*	42 *GOOD*
PM-2.5*	27 WEST PHOENIX	38 *GOOD*	43 *GOOD*	31 *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	
Tuesday, 07/10/12	**Unusually sensitive people should consider limiting prolonged or heavy exertion outdoors.**
Wednesday, 07/11/12	**Unusually sensitive people should consider limiting prolonged or heavy exertion outdoors.**

SYNOPSIS AND DISCUSSION

…An Ozone Health Watch remains in effect for today, Tuesday, July 10, 2012…

High pressure is in a favorable position to drive thunderstorms off of the Mogollon Rim and towards the Valley. Such storms tend to be more electrical in nature due to the topography, additional vertical movement and associated friction of the air molecules within the developing storms. Such storms also tend to be less apt to generate wide-spread blowing dust coming off of the more vegetated mountainous areas. Thus, it's less likely that we will see significant PM10 levels over the next few days.

The subtle "shift" we've been waiting for has been underway. Ozone levels reached the upper Moderate range under the east-northeast flow. Today, day 2 of the "shift" reveals lower concentrations than 24-hr earlier. The forecast calls for a continuation of the northeast-to-southwest flow. Thus, ozone concentrations should drop a bit more with highest levels towards the southwest part of the forecast area (Buckeye) on Wednesday.

Check back tomorrow for more. Until then, have a good day. -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 MONDAY, JULY 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	53	45	
Apache Junction	51	43	
Blue Point	72	90	
Buckeye	49	42	
Casa Grande	56	47	
Cave Creek	65	67	
Central Phoenix	59	50	
Dysart	52	44	
Falcon Field	61	54	
Fountain Hills	64	64	
Glendale	56	47	
Humboldt Mountain	63	61	
North Phoenix	63	61	
Phoenix Supersite	60	51	
Pinal Air Park	60	51	
Pinnacle Peak	71	87	
Queen Valley	65	67	
Rio Verde	69	80	
South Phoenix	58	49	

South Scottsdale	67	74	
Tempe	60	51	
Tonto Nat'l Mon.	61	54	
West Chandler	59	50	
West Phoenix	56	47	
Yuma	48	41	

CO (CARBON MONOXIDE)

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

PM-10 (PARTICLES)

SITE NAME	MAX 24-HR VALUE (µg/m3)	MAX AQI	AQI COLOR CODE
Apache Junction	22.3	21	
Buckeye	35.1	32	
Central Phoenix	24.9	23	
Combs School (Pinal County)	45.6	42	
Durango	39.8	36	
Dysart	24.0	22	
Glendale	24.4	22	
Greenwood	30.8	28	
Higley	32.2	29	
Maricopa (Pinal County)	35.5	33	
North Phoenix	21.1	19	
Phoenix Supersite	21.6	20	
South Phoenix	32.6	30	
Tempe	22.4	20	
West Chandler	22.9	21	
West Forty Third	NOT AVBL	NOT AVBL	NOT AVBL
West Phoenix	27.7	25	
Zuni Hills	21.2	19	

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	6.1	20	
Dysart	2.8	9	
Estrella Mountain Park	5.0	16	
Glendale	6.6	21	
Phoenix Supersite	3.4	11	
North Phoenix	6.3	20	
South Phoenix	4.9	16	
Tempe	6.4	21	
Vehicle Emissions Lab	3.0	10	
West Phoenix	8.2	27	

Statements, Advisories, and Warnings issued by the National Weather Service office in Phoenix, AZ, pertaining to the July 11, 2012, dust storm event:

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264
WWUS75 KPSR 120335
NPWPSR

URGENT - WEATHER MESSAGE
NATIONAL WEATHER SERVICE PHOENIX AZ
835 PM MST WED JUL 11 2012

AZZ028-120500-
/O.NEW.KPSR.DU.Y.0011.120712T0335Z-120712T0500Z/
NORTHWEST AND NORTH CENTRAL PINAL COUNTY-
INCLUDING THE CITIES OF...APACHE JUNCTION...CASA GRANDE...
FLORENCE
835 PM MST WED JUL 11 2012

...BLOWING DUST ADVISORY IN EFFECT UNTIL 10 PM MST THIS
EVENING...

THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED A BLOWING DUST
ADVISORY...WHICH IS IN EFFECT UNTIL 10 PM MST THIS EVENING.

* AFFECTED AREA...NORTHERN PINAL COUNTY...INCLUDING FLORENCE...
  COOLIDGE...HIGHWAY 79...INTERSTATE 10...AND CASA GRANDE.

* TIMING...VALID UNTIL 1000 PM MST.

* WINDS...WIDESPREAD WINDS OF 25 MPH...GUSTS TO 40 MPH.

* VISIBILITY...WIDESPREAD VISIBILITIES LESS THAN 3 MILES...LOCALLY BELOW 1
  MILE.

* IMPACTS...RAPID CHANGES IN VISIBILITY ON AREA ROADS.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

BE READY FOR A SUDDEN DROP IN VISIBILITY. 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.

REMEMBER...PULL ASIDE...STAY ALIVE.

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URGENT - WEATHER MESSAGE
NATIONAL WEATHER SERVICE PHOENIX AZ
1027 PM MST WED JUL 11 2012

AZZ023-027-120700-
/O.NEW.KPSR.DU.Y.0012.120712T0527Z-120712T0700Z/
GREATER PHOENIX AREA-SOUTHWEST MARICOPA COUNTY-
INCLUDING THE CITIES OF...MESA...PHOENIX...GILA BEND
1027 PM MST WED JUL 11 2012

...BLOWING DUST ADVISORY IN EFFECT UNTIL MIDNIGHT MST TONIGHT...

THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED A BLOWING DUST ADVISORY...WHICH IS IN EFFECT UNTIL MIDNIGHT MST TONIGHT.

* AFFECTED AREA...SOUTHERN AND SOUTHWESTERN PORTIONS OF THE PHOENIX METROPOLITAN AREA...AND SOUTHWESTERN MARICOPA COUNTY.

* TIMING...THROUGH MIDNIGHT MST.

* WINDS...SUSTAINED 20-30 MPH...GUSTS TO 45 MPH.

* VISIBILITY...WIDESPREAD 2-3 MILES...LOCALLY BELOW 1 MILE.

* IMPACTS...RAPID CHANGES IN VISIBILITY...ESPECIALLY ALONG INTERSTATES 8 AND 10...AND HIGHWAY 85.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

BE READY FOR A SUDDEN DROP IN VISIBILITY. 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.

REMEMBER...PULL ASIDE...STAY ALIVE.

SPECIAL WEATHER STATEMENT
NATIONAL WEATHER SERVICE PHOENIX AZ
1035 PM MST WED JUL 11 2012

AZZ027-028-120615-
PINAL AZ-MARICOPA AZ-
1035 PM MST WED JUL 11 2012

...SIGNIFICANT WEATHER ADVISORY...

THE NATIONAL WEATHER SERVICE IN PHOENIX HAS ISSUED A

SIGNIFICANT WEATHER ADVISORY FOR...
SOUTH CENTRAL MARICOPA COUNTY IN SOUTH CENTRAL ARIZONA
EXTREME WEST CENTRAL PINAL COUNTY IN SOUTH CENTRAL ARIZONA

UNTIL 1115 PM MST

AT 1032 PM MST...NATIONAL WEATHER SERVICE METEOROLOGISTS DETECTED A STRONG THUNDERSTORM 8 MILES SOUTHWEST OF ESTRELLA SAILPORT...MOVING WEST AT 20 MPH.

WIND GUSTS UP TO 50 MPH ARE EXPECTED WITH THIS STORM...ALONG WITH HEAVY RAIN. GUSTY WINDS WILL SPREAD AHEAD OF THE STORM...AND WILL ARRIVE WELL BEFORE THE RAIN.

LOCATIONS IMPACTED INCLUDE...
GILA BEND...
BIG HORN...
ESTRELLA...
SONORAN NATIONAL MONUMENT...
BOSQUE...

IF THIS STORM INTENSIFIES...A WARNING MAY BE NEEDED. STAY TUNED TO NOAA WEATHER RADIO...LOCAL RADIO OR TV FOR THE LATEST UPDATES.

SOME UNSECURED OBJECTS WILL BE BLOWN AROUND...TREE LIMBS COULD BE SNAPPED OFF...AND ISOLATED POWER OUTAGES WILL BE POSSIBLE. SEEK SHELTER INDOORS UNTIL THE STORM PASSES.

BLOWING DUST IS POSSIBLE....ESPECIALLY ALONG INTERSTATE 8 AND HIGHWAY 85. IF YOU ENCOUNTER BLOWING DUST WHILE DRIVING...PULL OVER AS FAR OFF THE ROADWAY AS POSSIBLE AND PARK. TURN OFF YOUR HEADLIGHTS AND KEEP YOUR FOOT OFF THE BRAKE. REMEMBER...PULL ASIDE...AND STAY ALIVE.

Appendix E: Affidavit of Public Notice

AFFIDAVIT OF PUBLICATION

ADEQ
AIR QUALITY DIVISION
13 JAN 18 PM 12:49

THE ARIZONA REPUBLIC

STATE OF ARIZONA
COUNTY OF MARICOPA } SS.

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

The Arizona Republic

January 14, 2013

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

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

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

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

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

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

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

Pub: January 14, 2013

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

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

Notary Public

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

PUBLIC NOTICE

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