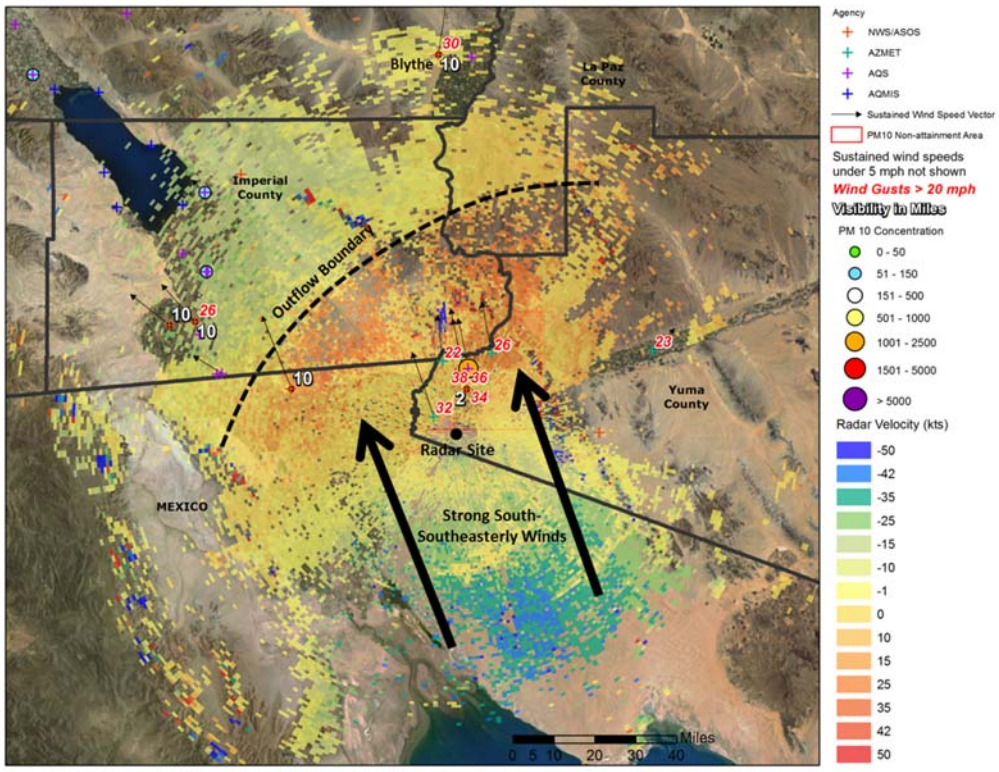
Sonoma Technology, Inc.
Air Quality Research and Innovative Solutions

State of Arizona Exceptional Event Documentation for the Event of August 15, 2012, for the Yuma County PM_{10} Nonattainment Area



Final Report Prepared for

Arizona Department of Environmental Quality
Phoenix, AZ

June 2013

This PDF document contains blank pages to accommodate two-sided printing.

State of Arizona Exceptional Event Documentation for the Event of August 15, 2012, for the Yuma County PM_{10} Nonattainment Area

Final Report
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Cover graphic illustrates radar velocity, wind, and visibility data in the Yuma, AZ, region between midnight and 01:00 MST on August 15, 2012. See Section 3 for more information.

Acknowledgments

The authors would like to acknowledge the Arizona Department of Environmental Quality and the Environmental Protection Agency, Region 9, for helpful discussion and feedback during the preparation of this document.

Table of Contents

Section **Page**

List of Figures

Figure **Page**

List of Tables

Table **Page**

1. Introduction

On August 15, 2012, the Yuma Supersite monitor recorded a 24-hr average PM_{10} concentration of 170 µg/m^3. This value is in exceedance of the National Ambient Air Quality Standard (NAAQS) of 150 µg/m^3 for 24-hr PM_{10}. The purpose of this report is to demonstrate that this exceedance was due to naturally occurring windblown dust, was not reasonably controllable or preventable, was historically unusual, and would not have occurred "but for" the windblown dust and, therefore, is an exceptional event as defined by the U.S. Environmental Protection Agency's (EPA) Exceptional Events Rule (EER).

1.1 Report Contents

Section 2 of this assessment contains a conceptual model of the thunderstorm-driven, windblown dust event that occurred on August 15, 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 August 15, 2012, and the exceedance of the 24-hr PM_{10} standard at the monitoring station. 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 contains data summaries and time-series graphs that help illustrate that the event of August 15, 2012, produced PM_{10} concentrations in excess of normal historical fluctuations.

Section 5 of this assessment details existing dust control measures and demonstrates that, despite the presence and enforcement of these controls, the event of August 15, 2012, was not reasonably controllable or preventable.

Section 6 of this assessment builds upon the demonstration, showing a clear causal connection between the natural event and the exceedance of the 24-hr PM_{10} standard on August 15, 2012, and concludes that the exceedance would not have occurred but for the event.

Appendix A contains time-series graphs and data tables to supplement Section 3. **Appendix B** contains air quality forecasts issued by the Arizona Department of Environmental Quality (ADEQ) and weather statements and warnings issued by the National Weather Service (NWS).

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 for the Greater Yuma area advising citizens of the potential for thunderstorm-driven dust events on August 15, 2012. More information on ADEQ's forecasting program can be found in Section 5.2 of this report. The forecast products that were issued for August 15, 2012, are included in Appendix B.

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

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

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

If ADEQ and/or other operating air quality agencies have determined that the potential exists for a monitor's reading(s) to have been influenced by an exceptional event, a preliminary flag is submitted for the measurement in AQS. The data are not official until they undergo more thorough quality assurance and quality control, leading to certification by May 1 of the year following the calendar year in which the data were collected (40 CFR 58.15(a)(2)). The presence of the flag 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 held informal conversations with EPA during September, 2012, to discuss all the days in calendar year 2012 that ADEQ intended to analyze under the EER. The PM_{10} exceedance that occurred at the Yuma Supersite monitor on August 15, 2012, in the Yuma PM_{10} Nonattainment Area was included in the discussions. 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 July 15, 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).

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

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

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

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

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

2. Conceptual Model

This section provides a narrative background and summarizes the meteorological and air quality conditions in place on August 15, 2012, in Yuma. Elements described in this section include

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

2.1 Geographic Setting and Monitor Locations

Yuma is located in the Sonoran Desert and Lower Colorado River Valley in extreme southwestern Arizona at an elevation of 138 feet above sea level. The Yuma Metropolitan Statistical Area is defined as Yuma County, which reported a population of 195,751 in the 2010 census. Yuma County is bordered by Imperial County, California, to the north and northwest and by the Mexican state of Baja California to the west and south (**Figure 2-1**). Yuma lies just west of the confluence of the Colorado and Gila Rivers. Most of Yuma is located in the Colorado River Floodplain, commonly known as the Yuma Valley. The Yuma Valley follows the course of the Colorado River southward to the Sea of Cortez. Part of Yuma is built on the Yuma Mesa, a prominent land feature extending to the east of Yuma. The Gila Mountains, located roughly 15 to 20 miles east and southeast of Yuma, have a peak elevation of 3,156 feet. South and southeast of the city of Yuma and extending into northwestern Mexico is the Yuma Desert, a subregion of the broader Sonoran Desert. This region largely consists of open, undeveloped desert land.

The air quality and meteorological monitors used in this analysis are shown in Figure 2-1. AQS monitors measure air quality and meteorological data; Arizona Meteorological Network (AZMET) and NWS monitors measure meteorological data only. The PM_{10} exceedance on August 15, 2012, was recorded at the Yuma Supersite monitor, which is in central Yuma and has been operational since January 1, 2010. The Yuma Courthouse monitor shown in Figure 2-1 is inactive but measured PM_{10} prior to January 1, 2010. Data from the Yuma Courthouse monitor were used to supplement the Yuma Supersite data record for the Historical Norm section of this demonstration. Three AZMET sites are in operation in the Yuma area, located northeast, west, and southwest of the city. A NWS monitor is at the Yuma Marine Corps Air Station (MCAS). Additional air quality and meteorological monitors with data relevant to this dust storm event are in adjacent southeastern California and northwestern Mexico (**Figure 2-2**).

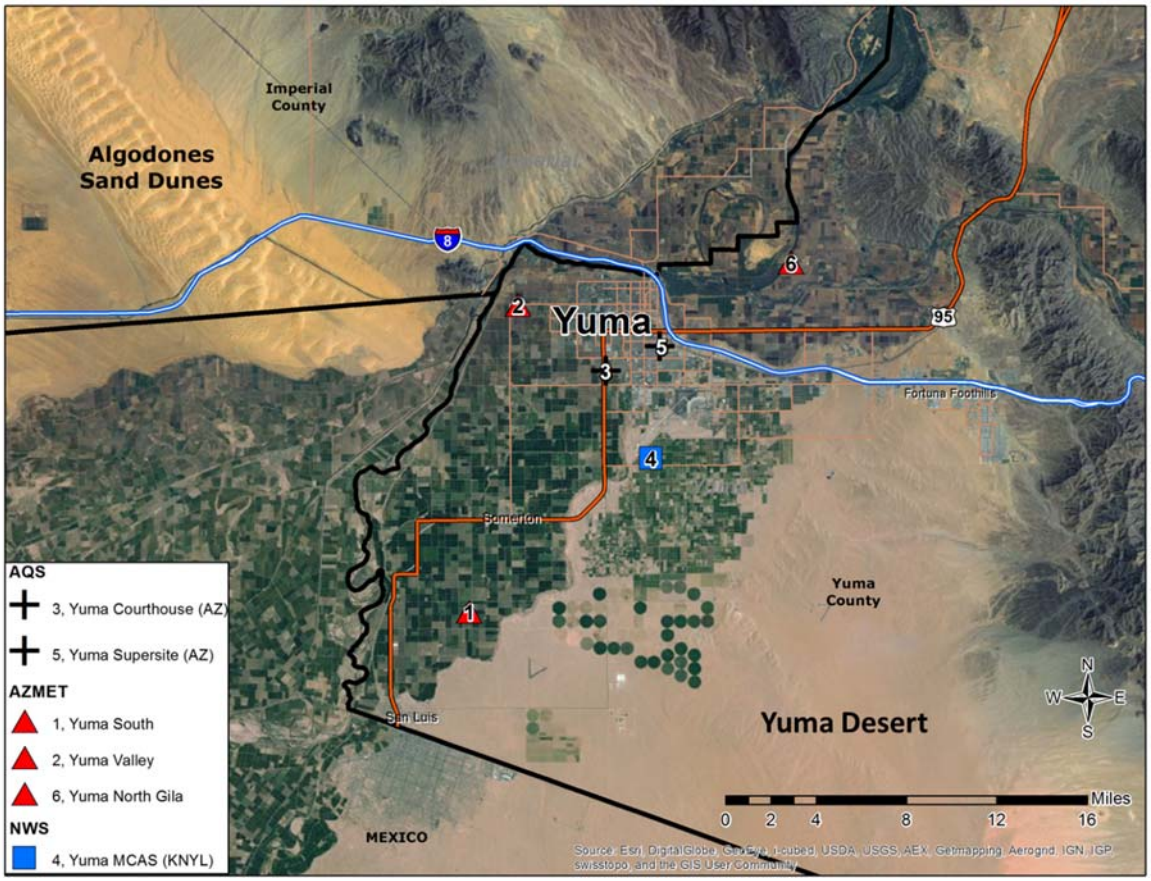


Figure 2-1. Air quality and meteorological monitors in the immediate Yuma region. To the south and southeast of the city of Yuma is the Yuma Desert, a subregion of the larger Sonoran Desert that encompasses much of southwestern Arizona and northwestern Mexico. This area largely consists of open, undeveloped desert land.

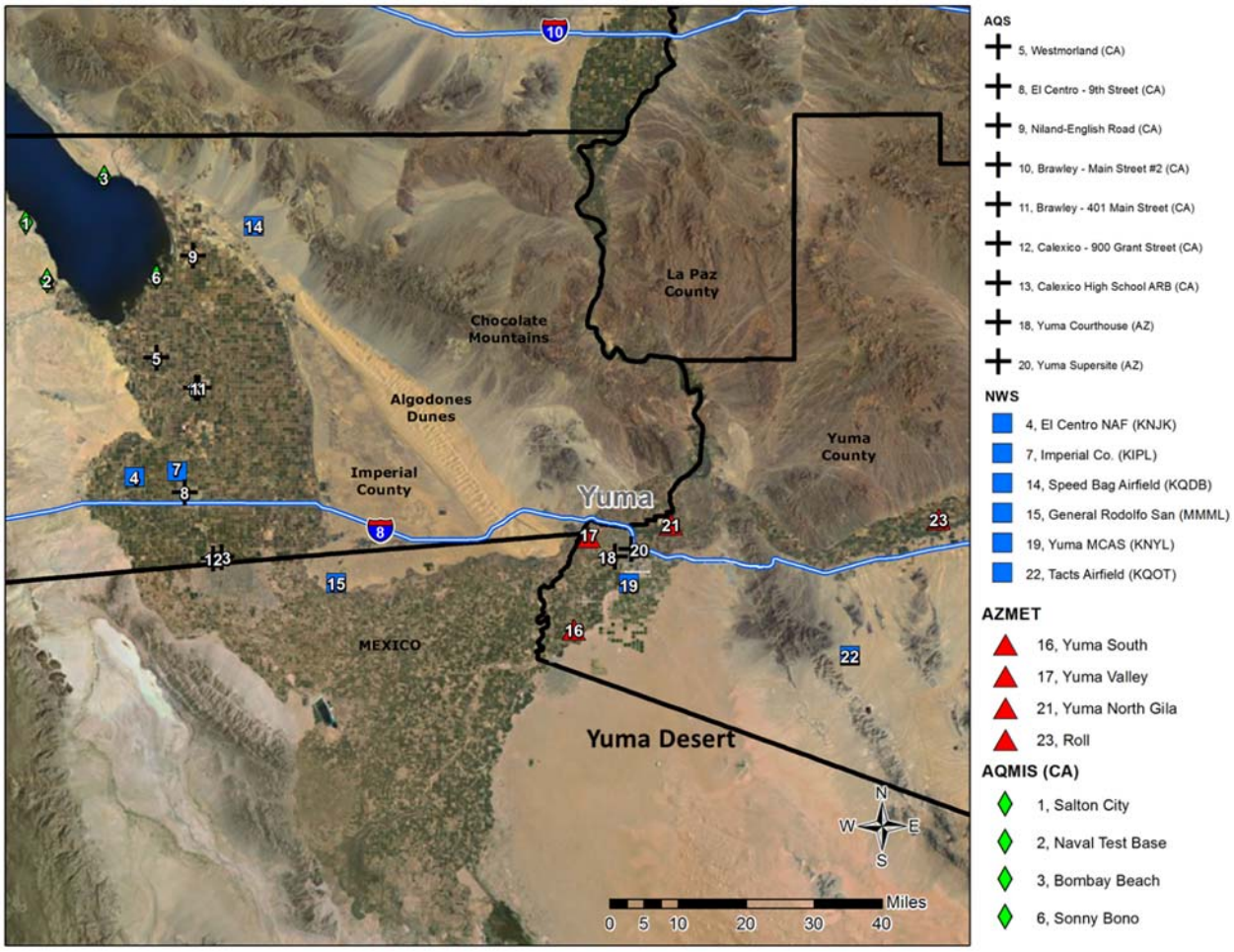


Figure 2-2. Location of air quality and meteorological monitors and relevant geographical features in the Yuma area. The large area of open desert south and southeast of Yuma extending into northwestern Mexico is the Yuma Desert, a subregion of the broader Sonoran Desert.

2.2 Climate, Monsoon, and Thunderstorms

Yuma is one of the hottest cities of any size in the United States, with average high temperatures around 107°F in July and around 70°F in January (**Figure 2-3**). Yuma receives roughly 90% of possible sunshine each year. Yuma is one of the driest cities in the United States, with an average annual rainfall of just over 3 inches. 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 July through August time period, monsoonal moisture originating from the Gulf of California, Gulf of Mexico, and large thunderstorm complexes over the Sierra Madre Occidental Mountains in Mexico move northward into Arizona.

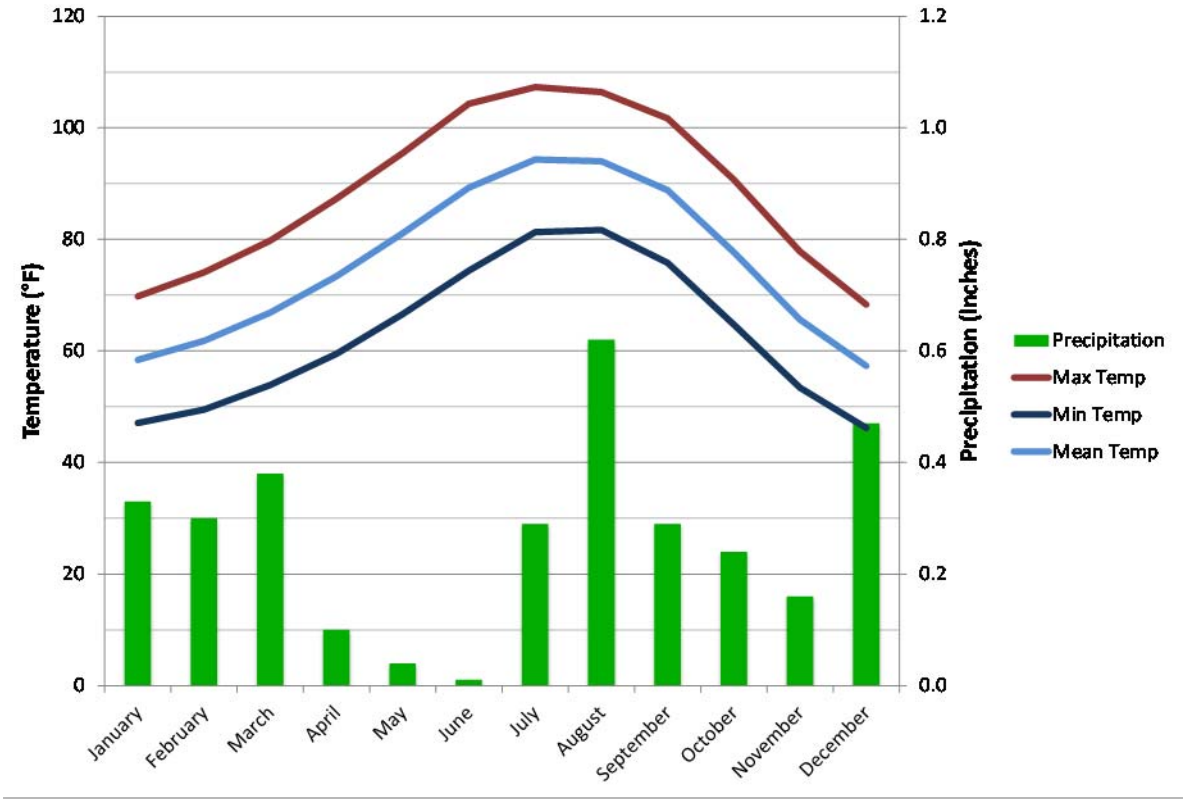
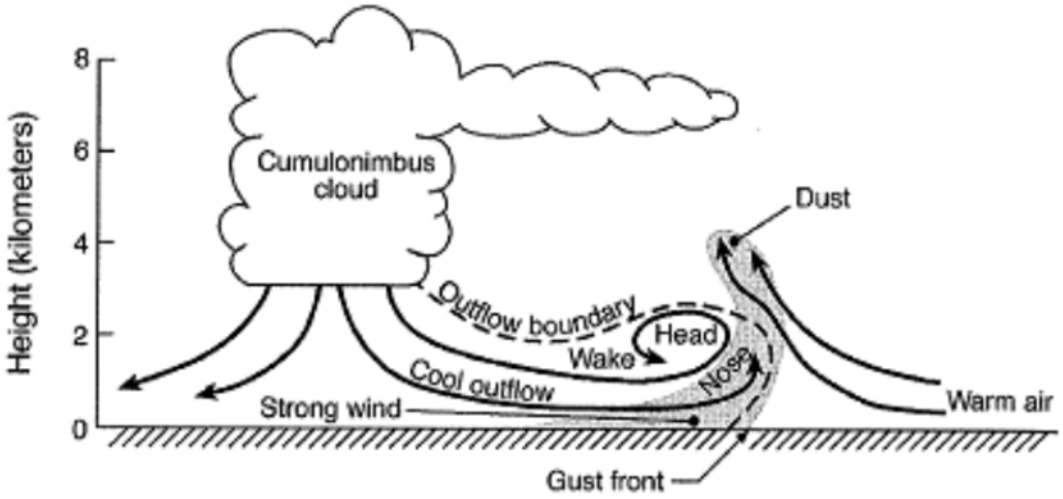


Figure 2-3. Average monthly temperatures and precipitation at Yuma MCAS, 1981–2010.

The influx of moisture associated with a monsoon, combined with strong solar heating, can result in unstable atmospheric conditions favorable for the development of thunderstorms. Heavy precipitation associated with thunderstorms, and the eventual collapse or dissipation of thunderstorms, can generate downbursts. Downbursts are rapid descents of rain-cooled air in a thunderstorm. Upon reaching the surface, this air rapidly disperses horizontally away from the storm as outflow boundaries (also called gust fronts; see **Figure 2-4**). 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 2-4. Cross-section of a thunderstorm creating an outflow boundary and haboob.[1]

Dust storms associated with these thunderstorms typically occur in the early part of the monsoon season (July) before 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, 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 August 14, 2012, a large complex of thunderstorms developed over northwestern Mexico, south of Arizona. These thunderstorms moved northward and weakened, but strong winds generated by these thunderstorms transported dust north and northwestward into Arizona and southeastern California (**Figure 2-5**). The thunderstorm outflow and associated dust arrived in the Yuma area around midnight (00:00 MST) on August 15, 2012, resulting in a 24-hr average PM_{10} concentration of 170 µg/m^3 at the Yuma Supersite monitor

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

(**Tables 2-1 and 2-2**). This value is in exceedance of the NAAQS. The hourly and 24-hr average PM_{10} concentrations measured at the Yuma Supersite monitor were in excess of normal historical fluctuations. The dust was naturally occurring and likely originated over undeveloped lands of northwestern Mexico, outside the city of Yuma, and sustained winds of over 25 mph with wind gusts in excess of 30 mph during these events overwhelmed reasonable dust control measures. Several other PM_{10} monitors in Arizona and southeastern California also recorded high PM_{10} concentrations on August 14 and 15, illustrating the regional nature of this thunderstorm-driven windblown dust event (**Figures 2-6 and 2-7**).

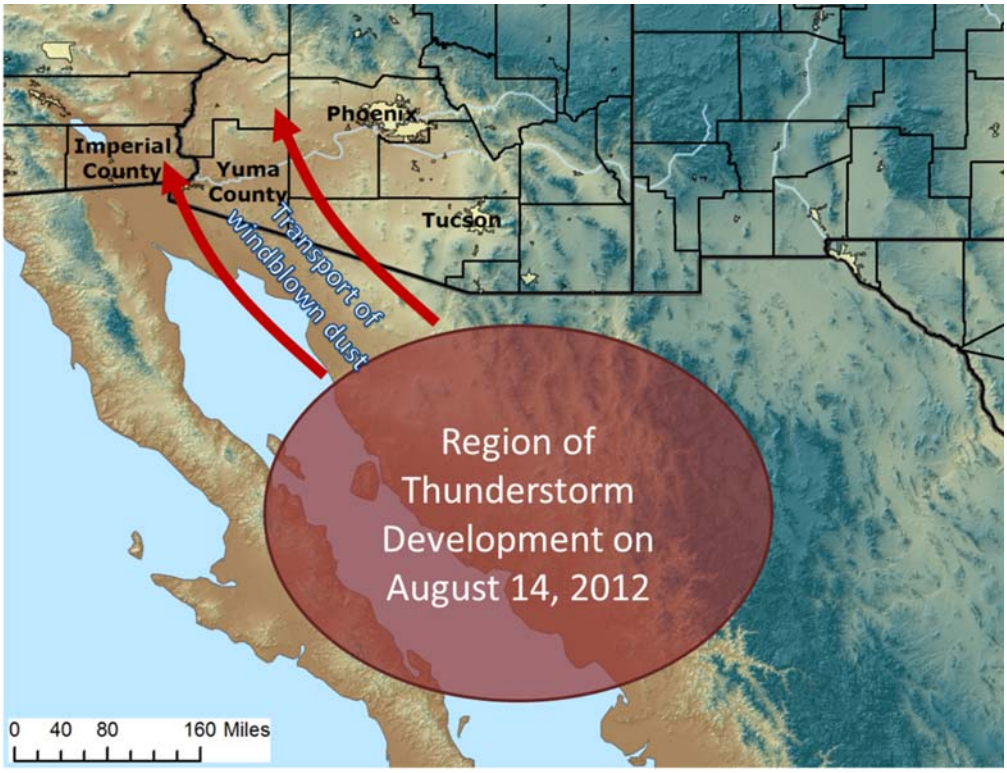


Figure 2-5. Outflow boundaries from thunderstorms over northwestern Mexico moved northwestward and transported dust to the Yuma area late on August 14 and early on August 15, 2012.

Table 2-1. PM_{10} measurements collected in Arizona, southeastern California, and southern Nevada on August 14, 2012. Data from the Yuma Supersite monitor are shown in **bold green**.

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} (MST)	AQS Qualifier Flag
ARIZONA							
Apache County							
N/A	TEOM	WMAT	04-001-1003-81102-1	15	49	1300	
Coconino County							
Flagstaff Middle School	GRAV	ADEQ	04-005-1008-81102-1	17	39	1900	
Gila County							
Hayden Old Jail	TEOM	ADEQ	04-007-1001-81102-3	28	49	1800	
Miami Golf Course	GRAV	ADEQ	04-007-8000-81102-1	26	48	2200	
Maricopa County							
West Phoenix	TEOM	MCAQD	04-013-0019-81102-1	106	1251	2200	RJ
North Phoenix	BAM	MCAQD	04-013-1004-81102-1	44	77	0700	
Glendale	TEOM	MCAQD	04-013-2001-81102-1	62	354	2300	RJ
Central Phoenix	TEOM	MCAQD	04-013-3002-81102-4	84	916	2200	RJ
Greenwood	TEOM	MCAQD	04-013-3010-81102-1	113	1352	2200	RJ
South Phoenix	TEOM	MCAQD	04-013-4003-81102-1	125	1624	2200	RJ
West Chandler	TEOM	MCAQD	04-013-4004-81102-1	126	1535	2200	RJ
Tempe	TEOM	MCAQD	04-013-4005-81102-1	90	978	2200	RJ
Higley	TEOM	MCAQD	04-013-4006-81102-1	95	313	2200	RJ
West 43rd Ave	TEOM	MCAQD	04-013-4009-81102-1	255	3574	2200	RJ
Dysart	TEOM	MCAQD	04-013-4010-81102-1	66	651	2300	RJ
Buckeye	TEOM	MCAQD	04-013-4011-81102-1	68	283	2300	RJ
Zuni Hills	TEOM	MCAQD	04-013-4016-81102-1	44	372	2300	RJ
Fort McDowell/ Yuma Frank	TEOM	FMIR	04-013-5100-81102-3	47	N/A	N/A	
Durango Complex	TEOM	MCAQD	04-013-9812-81102-1	180	2540	2200	RJ
JLG Supersite	BAM	ADEQ	04-013-9997-81102-3	79	724	2200	IJ
Mohave County							
Bullhead City	TEOM	ADEQ	04-015-1003-81102-3	32	94	1300	
Navajo County							
N/A	TEOM	WMAT	04-017-1002-81102-1	20	47	1900	
Pima County							
Ajo	TEOM	ADEQ	04-019-0001-81102-3	49	103	2200	
Orange Grove	FRM	PCDEQ	04-019-0011-81102-2	41	N/A	N/A	
Rillito	TEOM	ADEQ	04-019-0020-81102-3	97	485	1900	
South Tucson	FRM	PCDEQ	04-019-1001-81102-1	32	N/A	N/A	

Green Valley	TEOM	PCAQCD	04-019-1030-81102-1	25	63	1800	
Geronimo	TEOM	PCAQCD	04-019-1113-81102-1	32	57	1800	

Table 2–1. PM_{10} measurements collected in Arizona, southeastern California, and southern Nevada on August 14, 2012. Data from the Yuma Supersite monitor are shown in **bold green**.

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} (MST)	AQS Qualifier Flag
Pinal County							
Casa Grande Downtown	TEOM	PCAQCD	04-021-0001-81102-3	135	773	2200	
Apache Junction Fire Station	TEOM	PCAQCD	04-021-3002-81102-3	55	267	2200	
Stanfield	TEOM	PCAQCD	04-021-3008-81102-3	169	1209	2200	RJ
Combs	TEOM	PCAQCD	04-021-3009-81102-3	115	1163	2200	
Maricopa	TEOM	PCAQCD	04-021-3010-81102-3	207	1500	2300	RJ
Pinal County Housing	TEOM	PCAQCD	04-021-3011-81102-3	132	969	2100	
Cowtown	TEOM	PCAQCD	04-021-3013-81102-3	382	2738	2200	RJ
Santa Cruz County							
Nogales Post Office	BAM	ADEQ	04-023-0004-81102-3	40	78	0000	
Yuma County							
Yuma Supersite	**TEOM**	**ADEQ**	**04-027-8011-81102-3**	**81**	**492**	**2300**	**IJ**
CALIFORNIA							
Imperial County							
Brawley-Main Street #2	BAM	ICAPCD	06-025-0007-85101-3	60	102	2300	
Niland-English Road	BAM	ICAPCD	06-025-4004-85101-3	90	269	2000	
Riverside County							
Torres-Martinez Admin Site	BAM	TMIR	06-065-1999-81102-1	68	169	0900	
San Bernardino County							
North Amer Chem Corp	TEOM	MDAQMD	06-071-1234-81102-2	26	86	1800	

TEOM: Tapered Element Oscillating Microbalance
GRAV: Gravimetric Analysis
BAM: Beta Attenuation Monitor
FRM: Federal Reference Method
WMAT: White Mountain Apache Tribe
ADEQ: Arizona Department of Environmental Quality
MCAQD: Maricopa County Air Quality Department
FMIR: Fort McDowell Indian Reservation
PCDEQ: Pima County Department of Environmental Quality
PCAQCD: Pinal County Air Quality Control District
ICAPCD: Imperial County Air Pollution Control District
TMIR: Torres-Martinez Indian Reservation
MDAQMD: Mojave Desert Air Quality Management District
RJ: qualifier flag for high winds (for data exclusion)
IJ: qualifier flag for high winds (for information only)

Table 2-2. PM_{10} measurements collected in Arizona, southeastern California, and southern Nevada on August 15, 2012. Data from the Yuma Supersite monitor are shown in **bold green**.

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} (MST)	AQS Qualifier Flag
ARIZONA							
Apache County							
N/A	TEOM	WMAT	04-001-1003-81102-1	16	27	0600	
Coconino County							
N/A	TEOM	NNIR	04-005-1237-81102-1	27	74	2000	
Gila County							
Hayden Old Jail	TEOM	ADEQ	04-007-1001-81102-3	53	91	1600	
Miami Golf Course	TEOM	ADEQ	04-007-8000-81102-3	52	120	1500	
Maricopa County							
West Phoenix	TEOM	MCAQD	04-013-0019-81102-1	119	993	0700	
North Phoenix	BAM	MCAQD	04-013-1004-81102-1	111	691	0800	
Glendale	TEOM	MCAQD	04-013-2001-81102-1	118	434	0800	
Central Phoenix	TEOM	MCAQD	04-013-3002-81102-4	118	696	0700	
Greenwood	TEOM	MCAQD	04-013-3010-81102-1	115	748	0700	
West Chandler	TEOM	MCAQD	04-013-4004-81102-1	47	131	0900	
Tempe	TEOM	MCAQD	04-013-4005-81102-1	87	482	0800	
Higley	TEOM	MCAQD	04-013-4006-81102-1	57	202	0900	
West 43rd Ave	TEOM	MCAQD	04-013-4009-81102-1	112	468	0800	
Dysart	TEOM	MCAQD	04-013-4010-81102-1	111	339	0900	
Buckeye	TEOM	MCAQD	04-013-4011-81102-1	139	882	0000	RJ
Zuni Hills	TEOM	MCAQD	04-013-4016-81102-1	125	523	0700	
Fort McDowell/ Yuma Frank	TEOM	FMIR	04-013-5100-81102-3	90	N/A	N/A	
Durango Complex	TEOM	MCAQD	04-013-9812-81102-1	111	551	0700	
JLG Supersite	BAM	ADEQ	04-013-9997-81102-3	118	934	0700	
Mohave County							
Bullhead City	TEOM	ADEQ	04-015-1003-81102-3	185	719	0800	RJ
Navajo County							
N/A	TEOM	WMAT	04-017-1002-81102-1	23	49	1800	
Pima County							
Ajo	TEOM	ADEQ	04-019-0001-81102-3	18	92	0300	
Orange Grove	FRM	PCDEQ	04-019-0011-81102-2	29	N/A	N/A	
Rillito	TEOM	ADEQ	04-019-0020-81102-3	43	73	1300	
South Tucson	FRM	PCDEQ	04-019-1001-81102-1	28	N/A	N/A	
Green Valley	TEOM	PCAQCD	04-019-1030-81102-1	22	44	1900	

Geronimo	TEOM	PCAQCD	04-019-1113-81102-1	27	52	1800	

Table 2–2. PM_{10} measurements collected in Arizona, southeastern California, and southern Nevada on August 15, 2012. Data from the Yuma Supersite monitor are shown in **bold green**.

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} (MST)	AQS Qualifier Flag
Pinal County							
Casa Grande Downtown	TEOM	PCAQCD	04-021-0001-81102-3	48	84	0700	
Apache Junction Fire Station	TEOM	PCAQCD	04-021-3002-81102-3	68	228	1200	
Combs	TEOM	PCAQCD	04-021-3009-81102-3	67	178	1000	
Pinal County Housing	TEOM	PCAQCD	04-021-3011-81102-3	74	185	0100	
Cowtown	TEOM	PCAQCD	04-021-3013-81102-3	196	2859	0000	
Santa Cruz County							
Nogales Post Office	BAM	ADEQ	04-023-0004-81102-3	18	34	1300 1500	
Yuma County							
Yuma Supersite	**TEOM**	**ADEQ**	**04-027-8011-81102-3**	**170**	**1626**	**0100**	**RJ**
CALIFORNIA							
Imperial County							
Brawley-Main Street #2	BAM	ICAPCD	06-025-0007-85101-3	156	542	0400	
Niland-English Road	BAM	ICAPCD	06-025-4004-85101-3	163	776	0200	
Riverside County							
Torres-Martinez Admin Site	BAM	TMIR	06-065-1999-81102-1	204	598	0600	IJ
San Bernardino County							
North Amer Chem Corp	TEOM	MDAQMD	06-071-1234-81102-2	28	53	2000	
NEVADA							
Clark County							
Paul Meyer	BAM	CCDAQEM	32-003-0043-81102-1	32	65	0300	
Palo Verde	BAM	CCDAQEM	32-003-0073-81102-1	26	41	0400	
Joe Neal	BAM	CCDAQEM	32-003-0075-81102-1	32	66	1100	
Green Valley	BAM	CCDAQEM	32-003-0298-81102-1	48	131	1600	
Jerome Mack	BAM	CCDAQEM	32-003-0540-81102-3	64	188	1200	
Sunrise Acres	BAM	CCDAQEM	32-003-0561-81102-1	52	139	1300	
Boulder City	BAM	CCDAQEM	32-003-0601-81102-1	138	466	1100	
Jean	BAM	CCDAQEM	32-003-1019-81102-1	24	46	1300	
JD Smith	BAM	CCDAQEM	32-003-2002-81102-1	57	157	1200	

TEOM: Tapered Element Oscillating Microbalance
BAM: Beta Attenuation Monitor
FRM: Federal Reference Method
WMAT: White Mountain Apache Tribe
NNIR: Navajo Nation Indian Reservation
ADEQ: Arizona Department of Environmental Quality
MCAQD: Maricopa County Air Quality Department
FMIR: Fort McDowell Indian Reservation
PCAQCD: Pinal County Air Quality Control District
PCDEQ: Pima County Department of Environmental Quality
ICAPCD: Imperial County Air Pollution Control District
TMIR: Torres-Martinez Indian Reservation

MDAQMD: Mojave Desert Air Quality Management District IJ: qualifier flag for high wind (for information only)
CCDAQEM: Clark County Department of Air Quality and
Environmental Management
RJ: qualifier flag for high winds (for data exclusion)

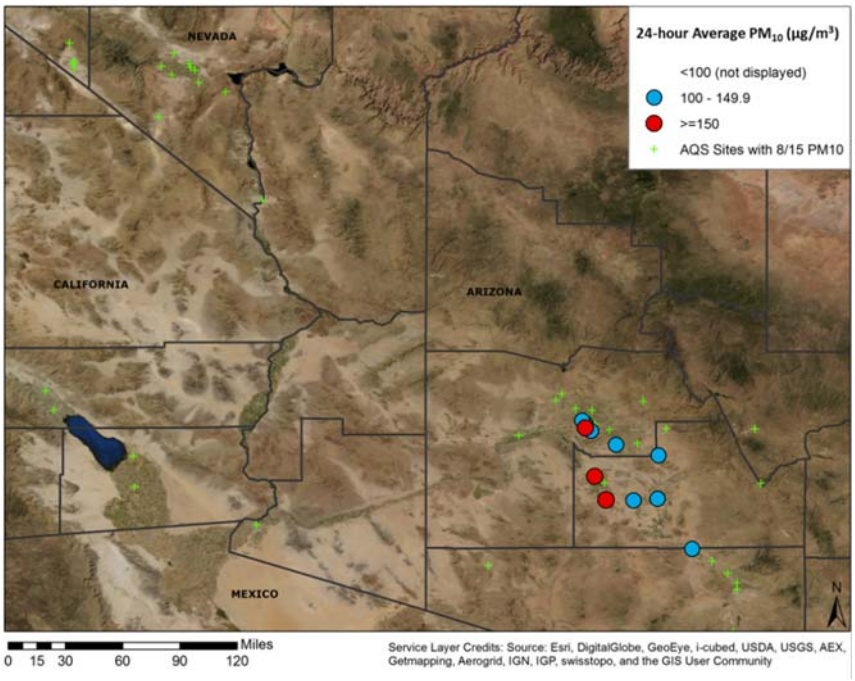


Figure 2-6. Regional monitors with high PM_{10} concentrations on August 14, 2012. Thunderstorm outflow and associated windblown dust caused high PM_{10} concentrations at several monitors in Maricopa and Pinal counties late on August 14.

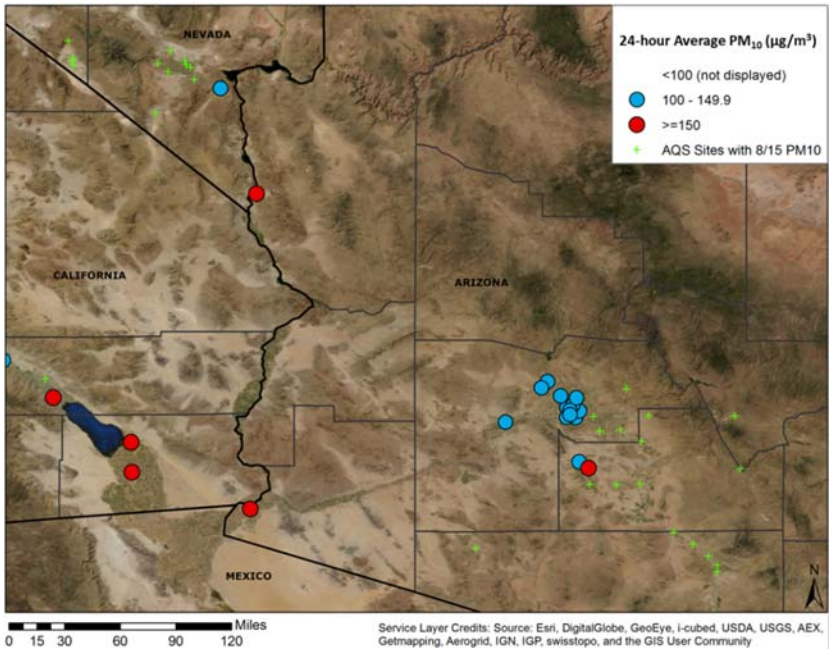


Figure 2-7. Regional monitors with high PM_{10} concentrations on August 15, 2012. Thunderstorm outflow and associated windblown dust caused high PM_{10} concentrations at several monitors in southern and western Arizona, southeastern California, and southern Nevada.

3. Causal Relationship

3.1 Discussion

Meteorological and air quality observations indicate that dust carried by thunderstorm outflows was directly responsible for the high PM_{10} concentrations observed in Yuma early on August 15, 2012. Synoptic scale meteorological conditions at the time were favorable for the development of thunderstorms across southern Arizona and northwestern Mexico. During the afternoon and evening of August 14, a large complex of thunderstorms developed over northwestern Mexico, south of the Arizona border (**Figure 3-1**). These thunderstorms generated strong outflow boundaries that propagated northwestward into Arizona and southeastern California. Gusty winds associated with the outflow easily lofted large amounts of dust and PM_{10} into the lower atmosphere and transported this dust directly into Yuma. In addition, numerous monitors in the Phoenix area also measured high PM_{10} concentrations late on August 14 as thunderstorm outflow affected those regions. The outflow and associated windblown dust that affected Yuma also caused high PM_{10} concentrations in Imperial and Riverside counties in California. The likely source regions for PM_{10} during this event were the open desert areas of northwestern Mexico, south of Yuma and outside the Yuma PM_{10} Nonattainment Area. The last time Yuma recorded any measureable rainfall before the August 15, 2012, thunderstorm outflow event was on July 13, 2012, when thunderstorms produced 1.66 inches of rain at the Yuma MCAS. The combination of geography and several weeks of dry weather preceding the event resulted in a large fetch of soils that were particularly vulnerable to particulate suspension. No measurable rain was reported in Yuma in association with this dust storm event.

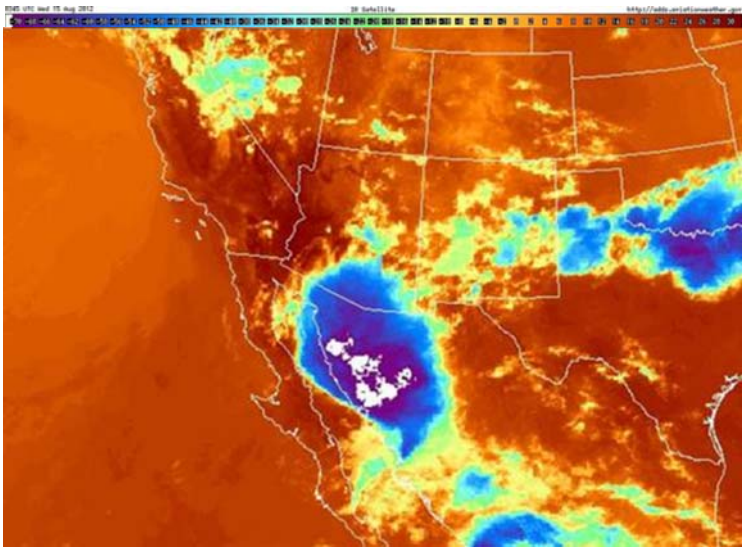


Figure 3-1. Infrared satellite image from 20:45 MST on August 14, 2012 (GOES-West). Colder temperatures (blues, purples, and white) indicate tall, convective (thunderstorm) clouds. A large complex of thunderstorms over northwestern Mexico collapsed and generated outflow boundaries that carried dust northwestward into Arizona.

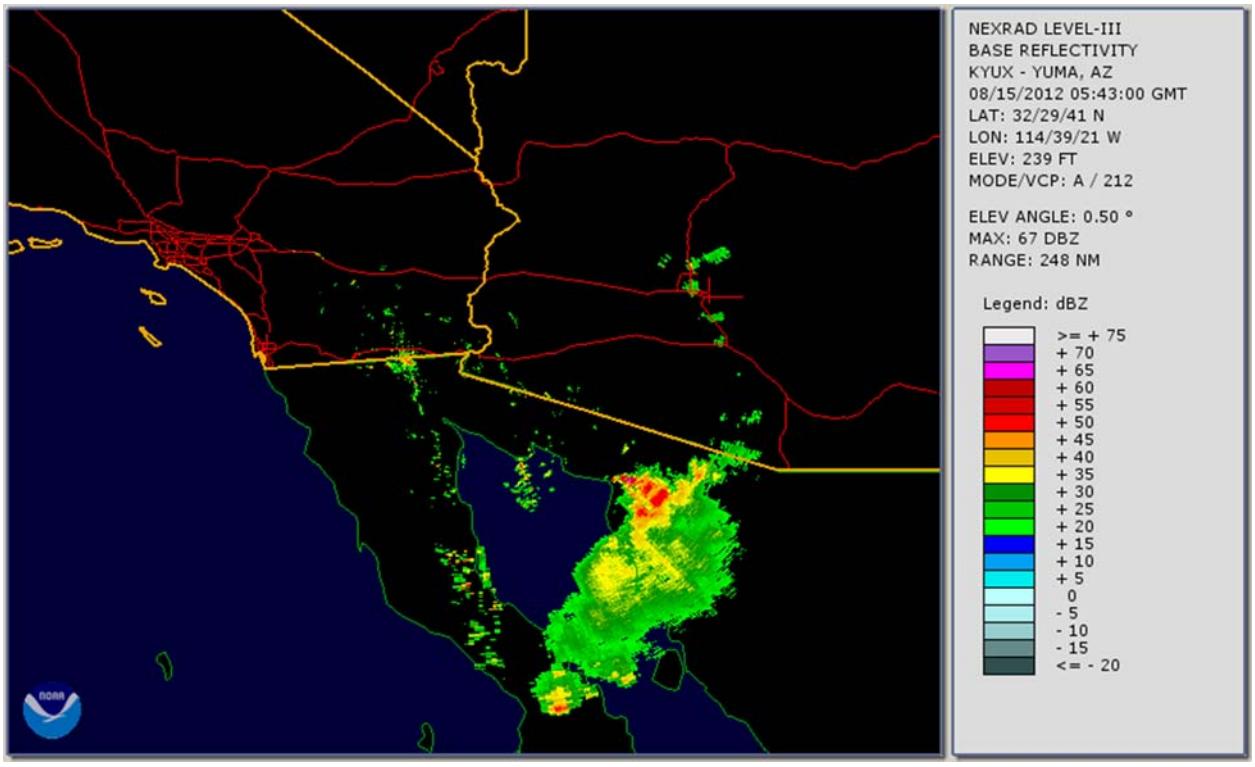


Figure 3-2. Reflectivity data from the Yuma Doppler radar at 22:43 MST on August 14, 2012. A cluster of strong thunderstorms was located over northwestern Mexico and the Gulf of California.

Figures 3-3 through 3-5 illustrate wind, radar velocity, visibility, and PM_{10} data in southwestern Arizona, northwestern Mexico, and southeastern California before, during, and after passage of the thunderstorm outflow. Before arrival of the thunderstorm outflow in Yuma, winds at monitors in Yuma and Imperial counties were generally light to moderate from the south, visibilities were high, and PM_{10} concentrations were low (Figure 3-3). Velocity data from the Yuma Doppler radar showed a large area of strong winds over northwestern Mexico, approaching Yuma. This area of strong winds was associated with the thunderstorm outflow. As the outflow moved into Yuma, winds increased from the south and gusted to over 30 mph, PM_{10} concentrations increased, and visibilities decreased (Figure 3-4). Imperial County monitors continued to show low concentrations and high visibility at this time. The leading edge of the outflow was also indicated on radar as it continued propagating northwestward. In addition, blowing dust was reported at the Yuma MCAS (see Appendix A). By 01:00 MST on August 15, the outflow was affecting Imperial County monitors, as indicated by gusty southeasterly winds and reduced visibilities (Figure 3-5). The outflow and associated windblown dust also reached as far north as Blythe, California, in Riverside County.

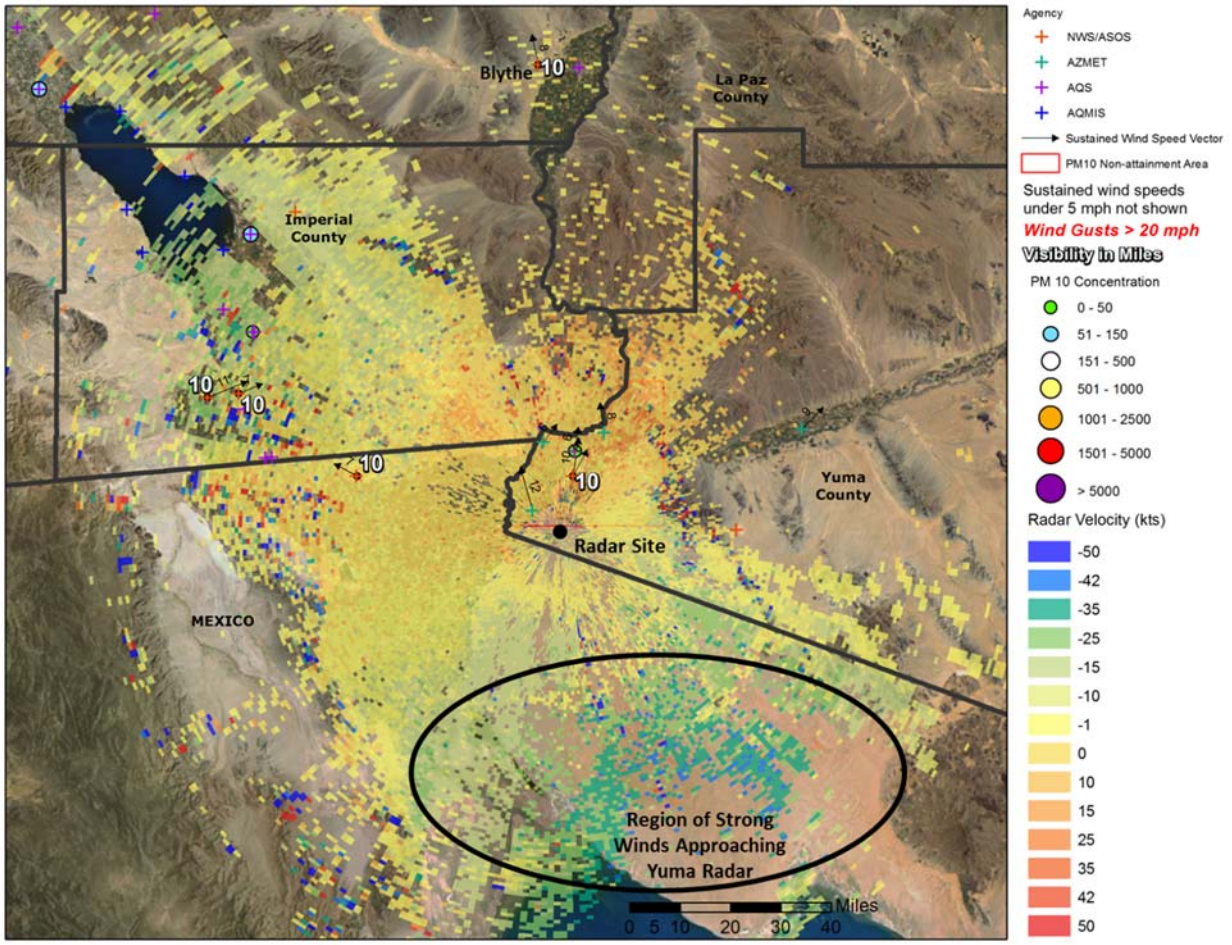


Figure 3-3. Hourly PM_{10} concentrations (colored circles), wind speed and direction, maximum wind gusts, and minimum visibility observations at Yuma and Imperial county monitors between 22:00 and 23:00 MST on August 14, 2012. Underlying are Doppler radar velocity data at 22:47 MST, where blues/greens indicate motion toward the radar and oranges/reds indicate motion away from the radar.

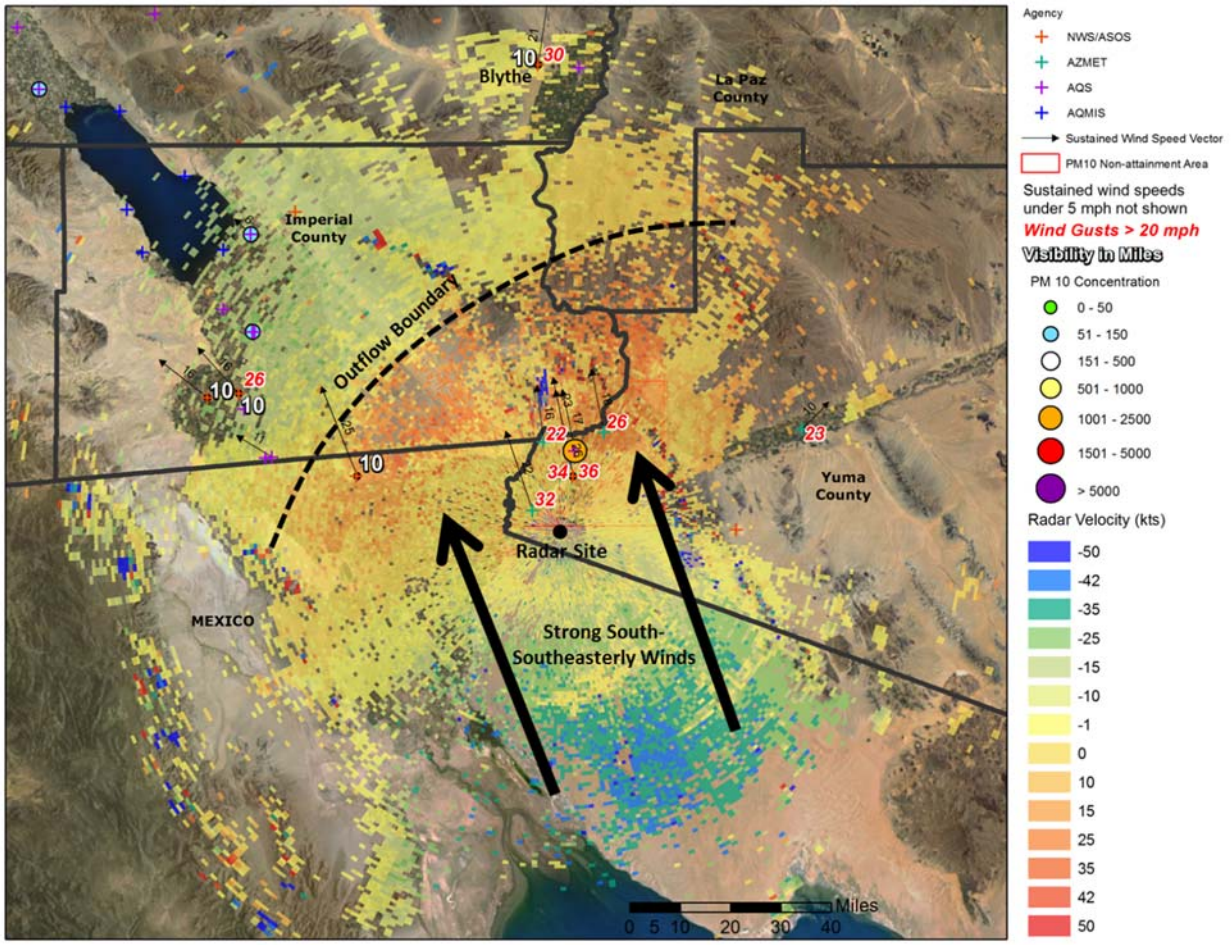


Figure 3-4. Hourly PM_{10} concentrations (colored circles), wind speed and direction, maximum wind gusts, and minimum visibility observations at Yuma and Imperial county monitors between 00:00 and 01:00 MST on August 15, 2012. Underlying are Doppler radar velocity data at 00:04 MST, where blues/greens indicate motion toward the radar and oranges/reds indicate motion away from the radar.

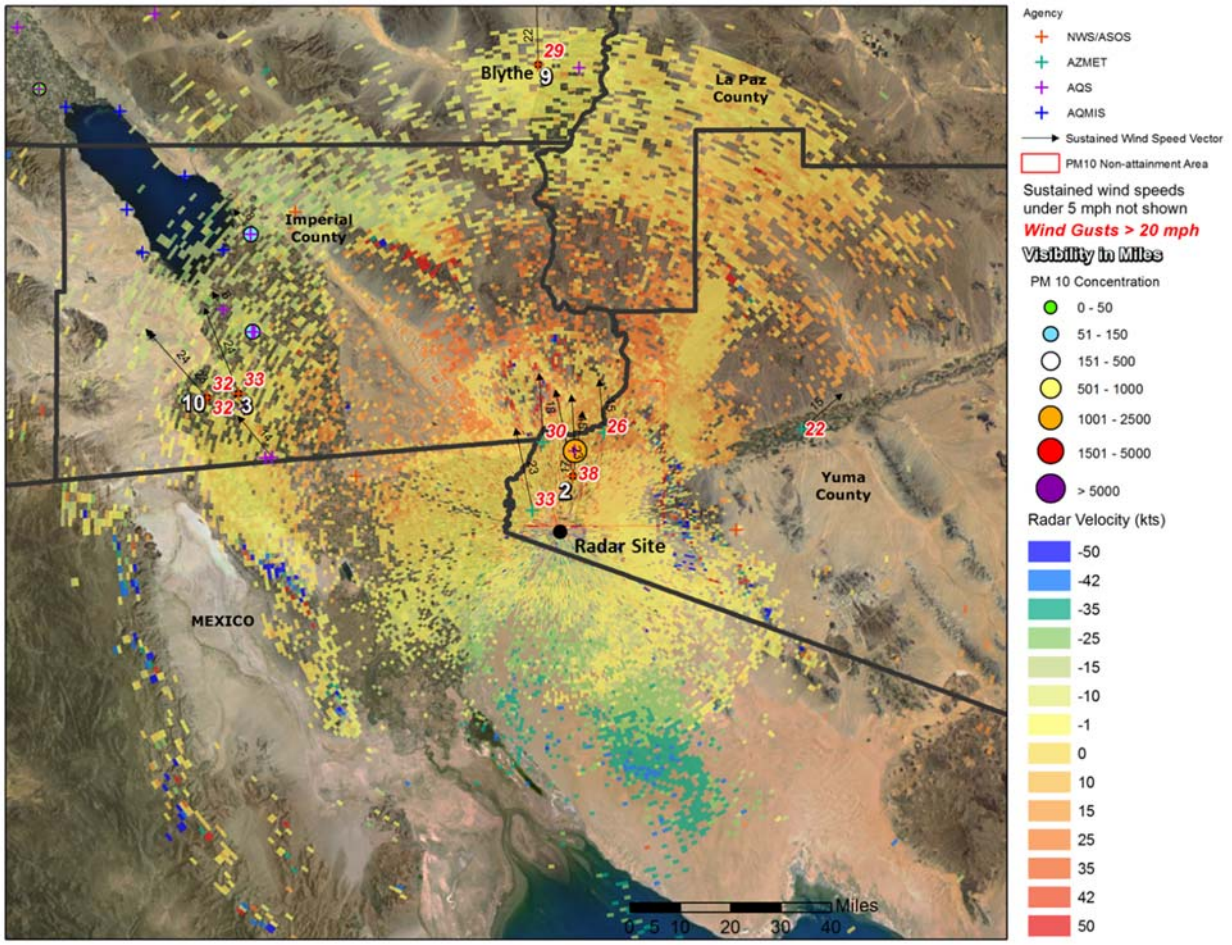


Figure 3-5. Hourly PM_{10} concentrations (colored circles), wind speed and direction, maximum wind gusts, and minimum visibility observations at Yuma and Imperial county monitors between 01:00 and 02:00 MST on August 15, 2012. Underlying are Doppler radar velocity data at 01:38 MST, where blues/greens indicate motion toward the radar and oranges/reds indicate motion away from the radar.

Time-series graphs of wind and PM_{10} data at Yuma and Imperial county monitors illustrate the causal relationship between the strong winds and the increase in PM_{10} concentrations. **Figures 3-6 and 3-7** show hourly wind and PM_{10} data at Yuma monitors, and clearly show the sharp increase in PM_{10} concentrations coincident with gusty winds around midnight MST on August 15. In addition, visibility at the Yuma MCAS decreased to as low as 2 miles coincident with the sharp increase in PM_{10} concentrations early on August 15 (**Figure 3-8**). The NWS in Phoenix issued a Short-Term Forecast for Yuma and Imperial counties due to this windblown dust event, stating that gusty winds and visibilities below 3 miles were possible. Wind gusts of over 30 mph were reported at several Yuma County monitors during this event, including a peak wind gust of 38 mph at the Yuma MCAS. Peak wind measurements at Yuma and Imperial county monitors are summarized in **Table 3-1**. Winds of this strength are sufficient to loft and transport dust from open desert areas.

The outflow and associated windblown dust continued northwestward into Imperial County after affecting Yuma, further illustrating the regional nature of this event (**Figure 3-9**). **Figure 3-10** shows a sharp increase in PM_{10} concentrations at the Niland monitor coincident with gusty winds at the Imperial County Airport. Visibility at the Imperial County Airport also fell to as low as 2 miles during the period of high PM_{10} concentrations (**Figure 3-11**).

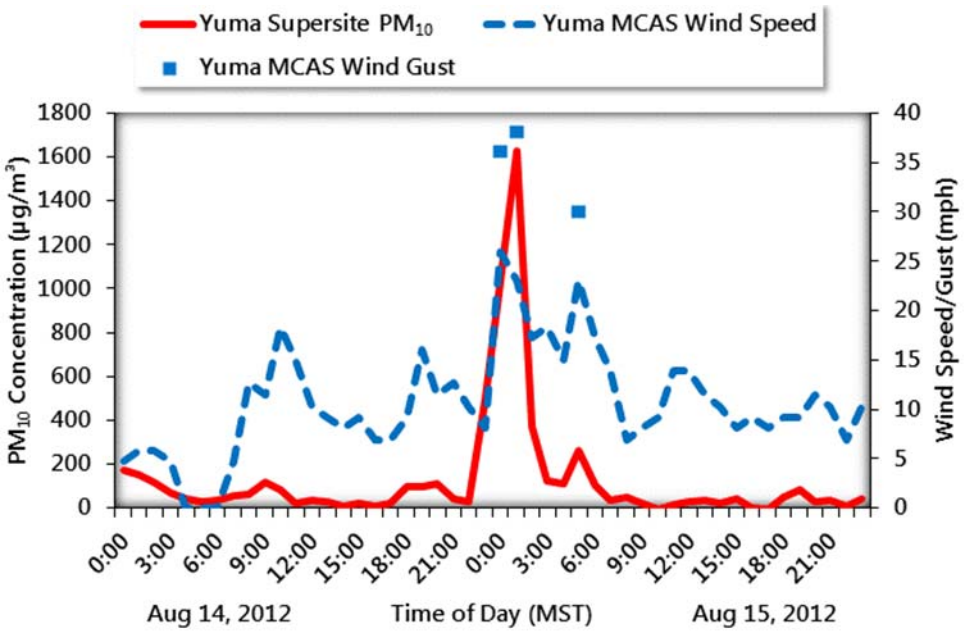


Figure 3-6. Hourly PM_{10} concentrations at the Yuma Supersite monitor and wind speeds and wind gusts at the Yuma MCAS monitor on August 14 and 15, 2012. PM_{10} concentrations and wind speeds sharply increased at midnight MST on August 15, 2012, indicating the arrival of windblown dust.

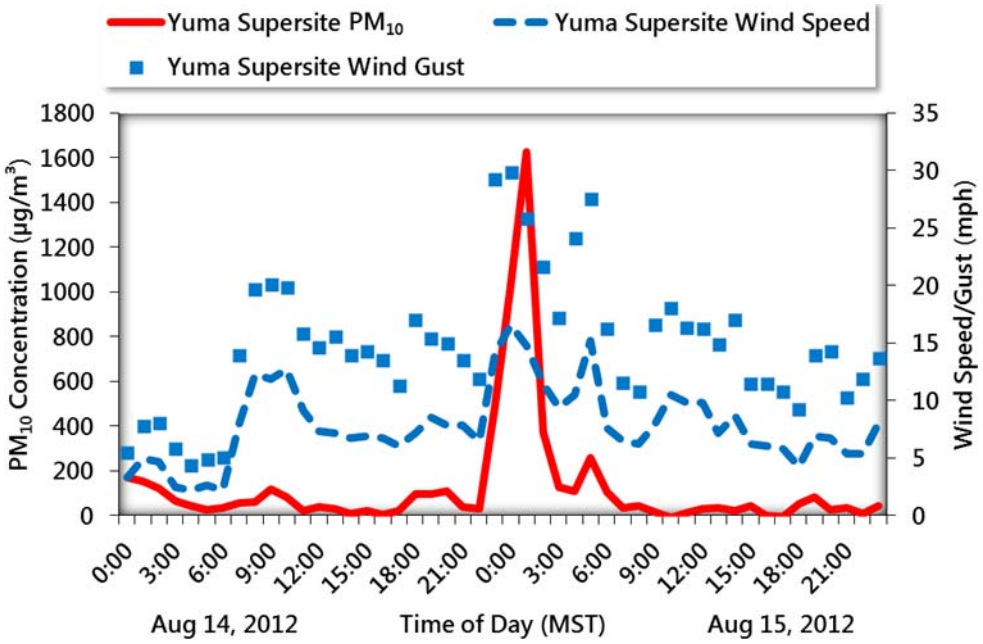


Figure 3-7. Hourly PM_{10} concentrations, wind speeds, and wind gusts at the Yuma Supersite monitor on August 14 and 15, 2012. PM_{10} concentrations and wind speeds sharply increased at around midnight MST on August 15, 2012, indicating the arrival of windblown dust.

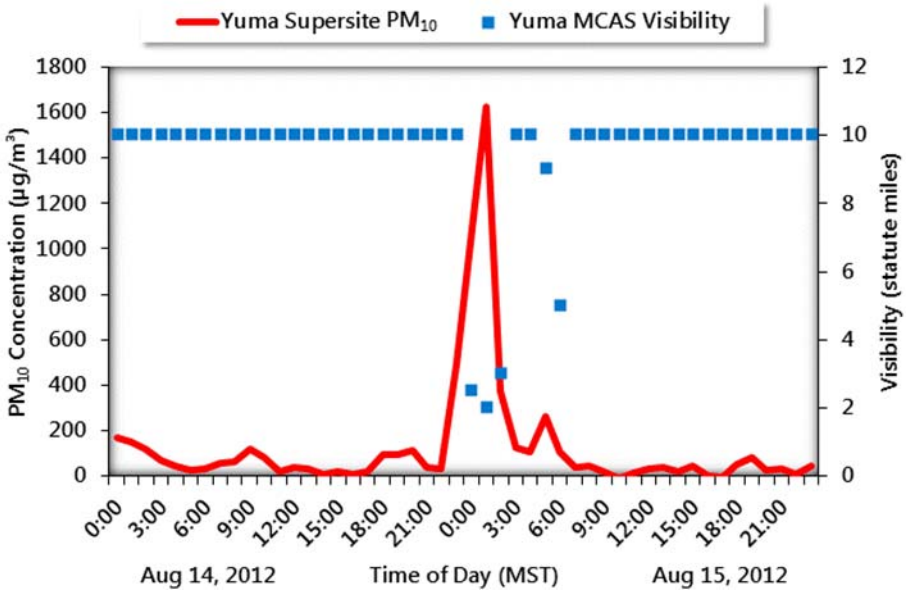


Figure 3-8. Hourly PM_{10} concentrations at the Yuma Supersite monitor and visibility at Yuma MCAS on August 14 and 15, 2012. Visibility was greatly reduced starting at midnight MST on August 15, coincident with the sharp increase in PM_{10} concentrations at the Yuma Supersite monitor, indicating the arrival of windblown dust.

Table 3-1. Observed wind speeds and wind gusts at Yuma and Imperial county monitors on August 15, 2012. The Yuma Supersite monitor reported a PM_{10} concentration of 1626 $\mu g/m^3$ at 01:00 MST on August 15, 2012, coincident with gusty winds in the Yuma area.

Monitor	Maximum Wind Speed (mph)	Wind Direction (degrees)	Date/Time (MST)	Maximum Wind Gust (mph)	Date/Time (MST)
Yuma Supersite	16	170	8/15/2012 0000	29	8/15/2012 0000
Roll	14	230	8/15/2012 0100	23	8/15/2012 0000
Yuma North Gila	17	170	8/15/2012 0000	29	8/14/2012 2300
Yuma South	22	170	8/15/2012 0100	33	8/15/2012 0100
Yuma Valley	18	178	8/15/2012 0100	30	8/15/2012 0100
Yuma MCAS	26	170	8/15/2012 0043	38	8/15/2012 0055
Niland-English Road	17	147	8/15/2012 0100	-	-
Imperial County Airport	24	160	8/15/2012 0153	33	8/15/2012 0153
El Centro NAF	24	140	8/15/2012 0154	32	8/15/2012 0154

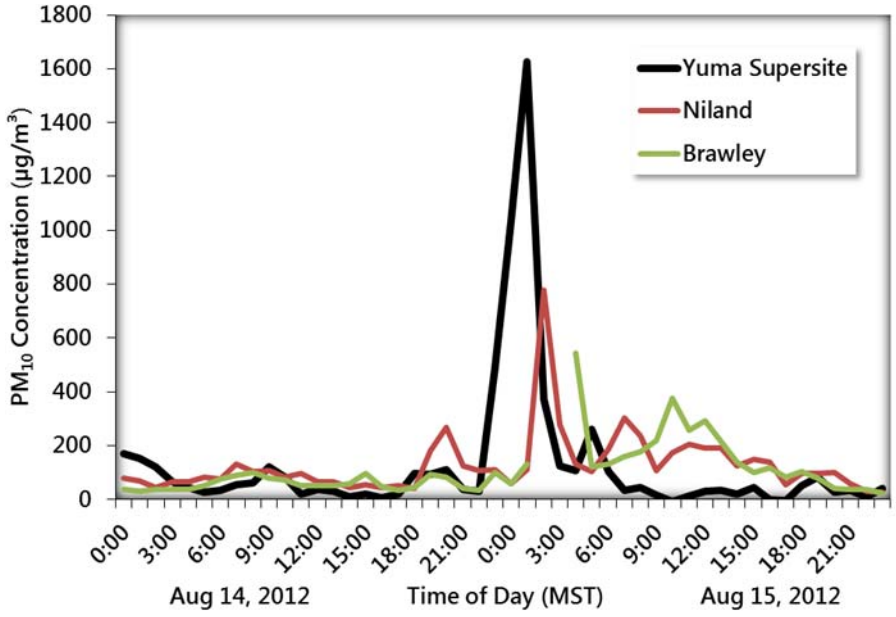


Figure 3-9. Hourly PM_{10} concentrations at the Yuma and Imperial county AQS monitors on August 14 and 15, 2012. High PM_{10} concentrations were reported at all three monitors during the early morning of August 15, 2012.

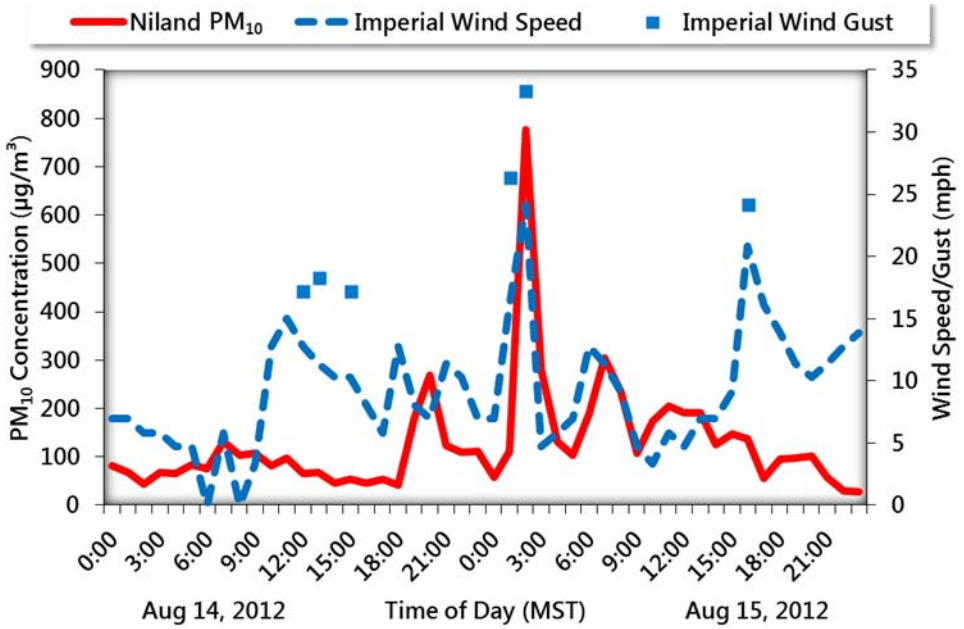


Figure 3-10. Hourly PM_{10} concentrations at the Niland AQS monitor and wind speeds and wind gusts at the Imperial County Airport on August 14 and 15, 2012. PM_{10} concentrations and wind speeds sharply increased at 02:00 MST on August 15, 2012, indicating the arrival of windblown dust.

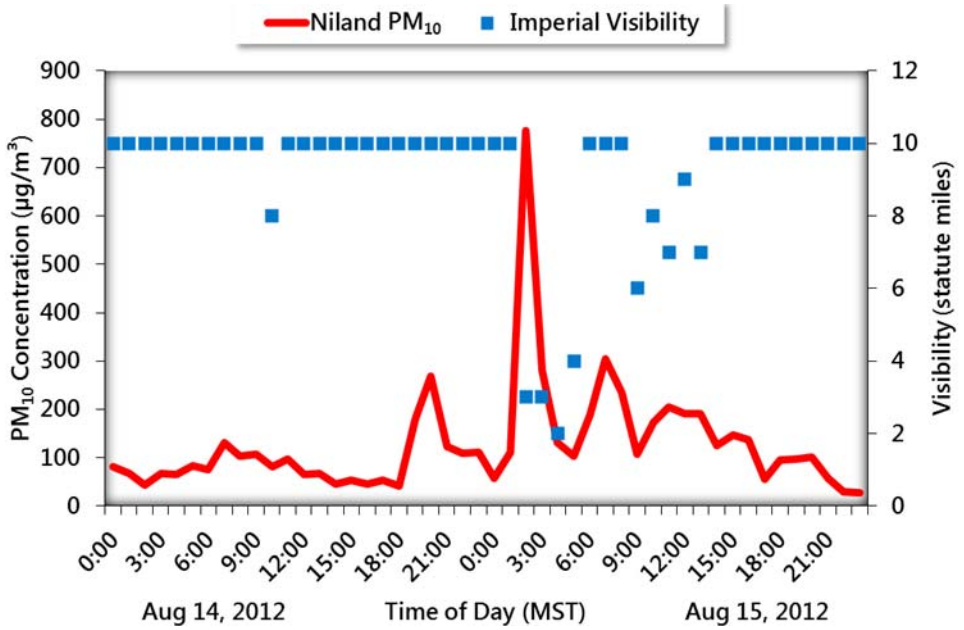


Figure 3-11. Hourly PM_{10} concentrations at the Niland AQS monitor and visibility at the Imperial County airport monitor on August 14 and 15, 2012. PM_{10} concentrations sharply increased at 02:00 MST on August 15, 2012, coincident with a large drop in visibility and indicating the arrival of windblown dust.

3.2 Summary

The information presented in this section demonstrates a clear causal relationship between windblown dust due to thunderstorm outflow and the PM_{10} exceedance measured at the Yuma Supersite monitor on August 15, 2012. The radar and wind data shown in this section illustrate the spatial and temporal representation of the dust storm as it moved through Yuma County. 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. Exceedances of the PM_{10} NAAQS were reported across southern and western Arizona and southeastern California in association with this event, illustrating that this was a long-lived dust storm that affected a large region. In addition, widespread dust originating in the expansive open desert areas south and southeast of Yuma was likely easily lofted by strong wind gusts over 30 mph, overwhelming all reasonably available control measures (RACM). This analysis provides solid evidence that demonstrates why the Yuma Supersite monitor recorded an exceedance on August 15, 2012.

4. Historical Norm

4.1 Analysis

PM_{10} concentrations measured at the Yuma Supersite monitor on August 15, 2012, were unusual and in excess of normal historical fluctuations. The PM_{10} concentrations measured on August 15, 2012, were some of the highest hourly readings and 24-hr averages measured over the last five years, with hourly concentrations exceeding 1,000 µg/m^3. To establish the severity of this event, PM_{10} concentrations measured on August 15, 2012, were compared to a historical 2008–2012 5-year annual data set. Time-series plots of the 24-hr average PM_{10} concentrations for the period January 1, 2008, through December 31, 2012, provide a historical perspective of PM_{10} concentrations (**Figure 4-1**). The 24-hr average PM_{10} concentration on August 15, 2012, is the 18th highest daily average in the last five years.

Additionally, time-series plots of the daily maximum 1-hr PM_{10} concentrations were created to provide a deeper understanding of the frequency with which short-term particulate concentrations affect the Yuma area **(Figure 4-2)**. The daily maximum 1-hr PM_{10} concentration on August 15, 2012, is the 9th highest concentration observed in the last 5 years.

Historical daily cumulative distributions of the 24-hr average and daily maximum 1-hr PM_{10} concentrations were created for the Yuma county monitor for the 2008–2012 period to provide additional evidence in establishing the severity of this event. **Figures 4-3 and 4-4** show histograms of 24-hr average PM_{10} concentrations and daily maximum 1-hr PM_{10} concentrations at the Yuma County monitor and the corresponding 95th percentile. The 24-hr average PM_{10} concentration and daily maximum 1-hr PM_{10} concentration on August 15, 2012, were above the 95th percentile at the Yuma Supersite monitor. Concentrations in excess of the 95th percentile are considered to be unusual.[2]

4.2 Summary

Given the recorded values and using similar methodology to the one accepted by EPA, it is clear that the PM_{10} levels on August 15, 2012, were outside of normal historical fluctuations. This analysis provides evidence that the event affected air quality on a historic scale.

[2] Excluding days on which concentrations caused by exceptional events exceed the 95th percentile threshold employs a general test of statistical significance and has the effect of ensuring that such concentrations would clearly fall beyond the range of normal expectations for air quality during a particular time of year. Source: “The treatment of Data Influenced by Exceptional Events,” 71 FR 12598.

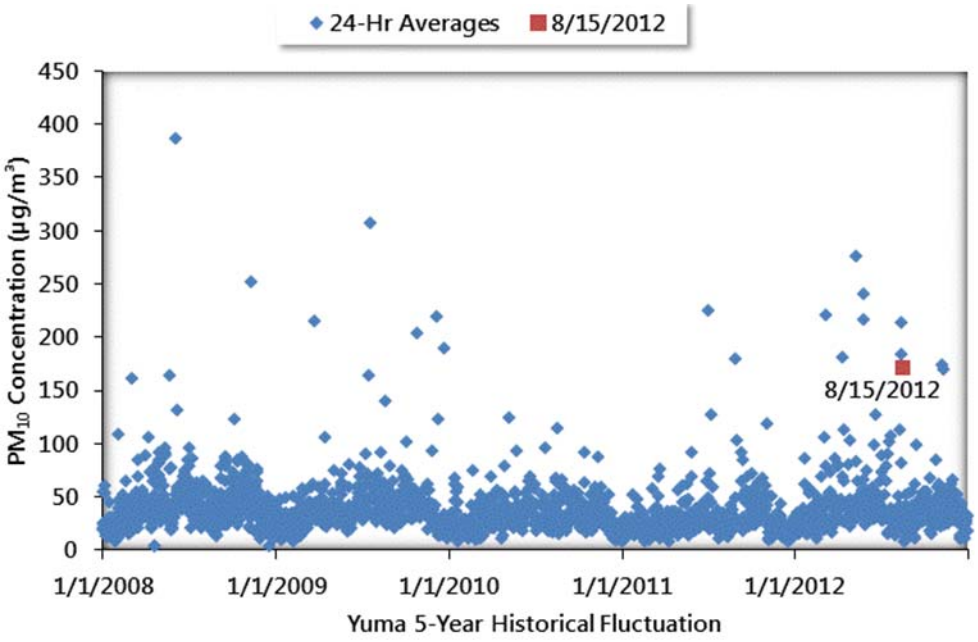


Figure 4-1. 24-hr average PM_{10} concentrations at the Yuma Supersite monitor (2008-2012). The 24-hr average PM_{10} concentration on August 15, 2012, is highlighted by the red square.

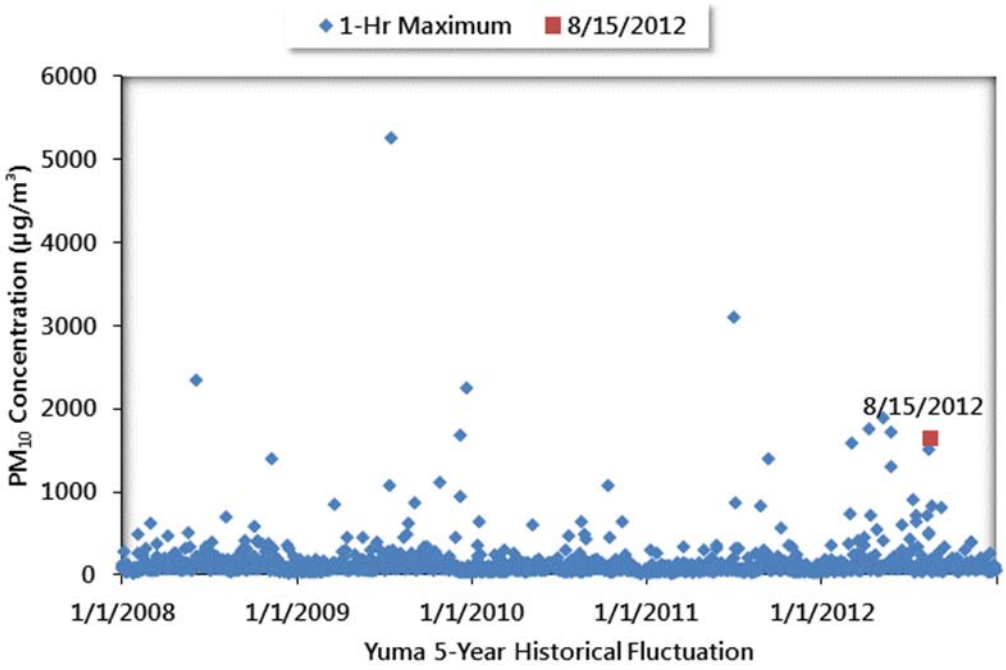


Figure 4-2. Daily maximum 1-hr PM_{10} concentrations at the Yuma Supersite monitor (2008–2012). The daily maximum 1-hr PM_{10} concentration on August 15, 2012, is highlighted by the red square.

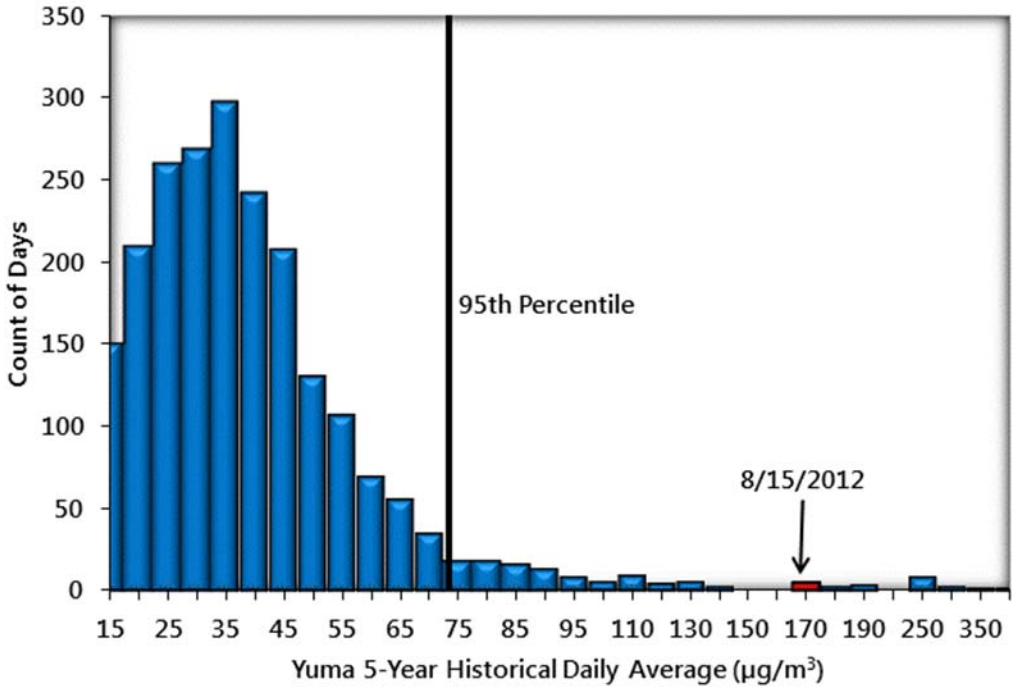


Figure 4-3. 24-hr average PM_{10} concentrations at the Yuma Supersite monitor for 2008-2012. The 24-hr average PM_{10} concentration on August 15, 2012, was in excess of the 95th percentile.

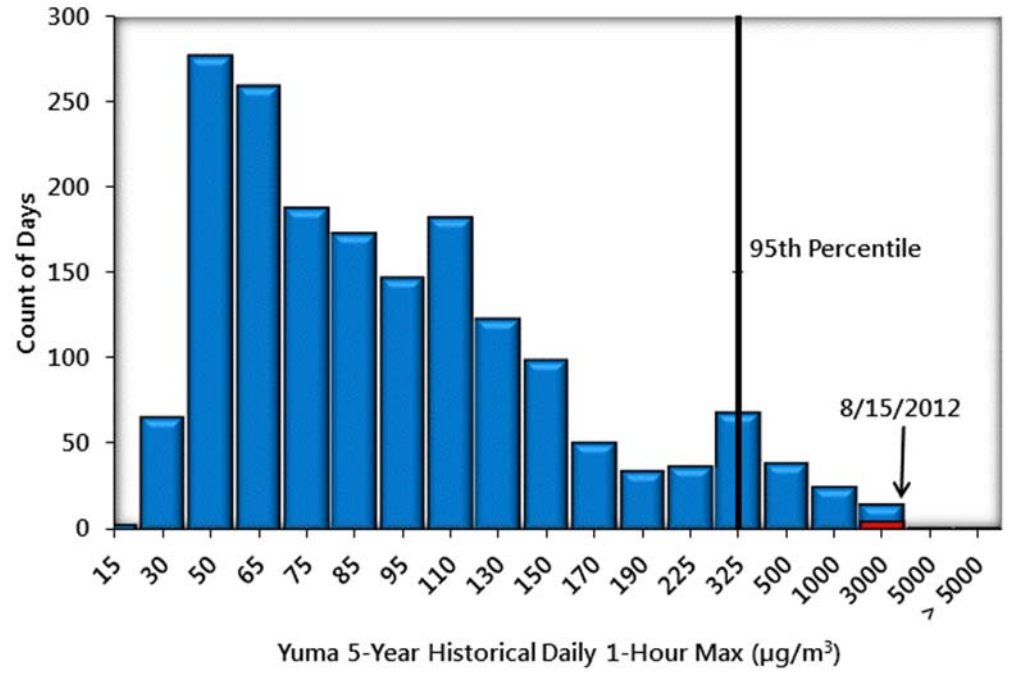


Figure 4-4. Daily maximum 1-hr PM_{10} concentrations at the Yuma Supersite monitor for 2008–2012. The daily maximum 1-hr PM_{10} concentration on August 15, 2012, was in excess of the 95th percentile.

5. Not Reasonably Controllable or Preventable

5.1 Background

Yuma was designated as a moderate PM_{10} nonattainment area by operation of the 1990 Clean Air Act. The nonattainment area is defined in 40 CFR 481.303. ADEQ completed a state implementation plan (SIP) for the area in 1991; however, the plan was found incomplete and in 1994, ADEQ updated the plan, identifying additional RACM. In 2001, due to several years of "clean data" and the existence of permanent and enforceable measures, ADEQ began to develop of a maintenance plan and request for redesignation of the area to attainment. The maintenance plan was submitted to EPA in August 2006.

5.1.1 Control Measures

Details of the control measures implemented from 1994–2001 are in Appendix G of the 2006 Yuma PM_{10} Maintenance Plan. A list of the measures is contained in **Table 5-1**.

Table 5-1. Control measures implemented in the Yuma PM_{10} Nonattainment Area, 1994–2001.

Implementing Agency	Reasonably Available Control Measure
City of Yuma	Paving unpaved roads
	Closing unpaved roads
	Chemically stabilizing unpaved roads
	Paving or stabilizing parking lots
	Re-routing traffic or rapid cleanup of temporary sources of dust and spills
	Covering haul trucks
	Dust control plans for land clearing, construction projects
	Stabilizing soil; controlling dust on open lands
	Amending building codes
Town of Somerton	Re-routing traffic or rapid cleanup of temporary sources of dust and spills
	Covering haul trucks
	Dust control plans for land clearing, construction projects
	Stabilizing soil
Yuma County	Paving unpaved roads
	Stabilizing unpaved roads
	Re-routing traffic or rapid cleanup of temporary sources of dust and spills
	Covering haul trucks
	Open Burn Permit Program (Rural Metro)
Irrigation Districts	Reducing traffic on unpaved roads
AZ Dept. of Transportation	Requiring contractors to adhere to local dust control plans

RACM for 2000 through 2004 can be found in Table 6.3 of the 2006 Yuma PM_{10} Maintenance Plan and are reproduced in part in **Table 5-2**. Chapter 7 of the Maintenance Plan also contains a list of contingency measures that could be implemented promptly should any violation of the NAAQS for PM_{10} occur.

Table 5-2. Control measures implemented in the Yuma area, 2000–2004.

Implementing Agency	Reasonably Available Control Measure
City of Yuma	Pave unpaved roads
	Pave unpaved alleys
	Paving unpaved vacant land
	Chemically stabilize unpaved roads
	Watering shoulders
	Street sweeping paved roads
	Install curbs and sidewalks
	Landscaping median
	Magnesium chloride on alleys
	Magnesium chloride on city property
Town of Somerton	Water unpaved roads
	Water unpaved shoulders
	Pave unpaved roads
	Weekly cleanup of paved roads, mud, trackout, spills
	Pave unpaved lots
	Landscape shoulders
	Install curbs
	Pave/stabilize unpaved roads
	Chip/seal
	Magnesium chloride on unpaved roads
	Street sweeping
Yuma County	Pave unpaved roads
	Developers add new paved roads
	Chip/seal unpaved roads
	Magnesium chloride unpaved roads
	Street sweeping

Table 5-2. Control measures implemented in the Yuma area, 2000-2004.

Implementing Agency	Reasonably Available Control Measure
Immigration & Naturalization	Water drag roads
	Pipelined
	Maintain 350 “No Trespassing” signs and 50 barricades
	Patrol and water unpaved canal roads
	3 mi posted/barricaded
	Paved 2.5 mi
	2.5 mi fenced off
	Abandoned 3/8 mi
	Lined 8 mi of canal
N. Gila Irrigation District	20 miles posted
Unit B Irrigation District	3 mi posted/barricaded
Bureau of Reclamation	Water 960 miles of canal banks
Marine Corps Air Station	Remove 26 gas vehicles
	Remove 25 gas scooters
	Pave 240,329 ft roadway
	Pave 102,112 ft parking
	Sweeping 717,221 yd runway
	Sweeping 388,952 yd taxiway
	Sweeping 401,090 yd aprons and 121,380 yd other
	Stabilize desert

In 2010, the Yuma Metropolitan Planning Organization (YMPO) updated the Transportation Improvement Plan (TIP) as required to comply with the requirements for transportation conformity under Section 176(c)(2) of the Clean Air Act. The update required a review of control measures included in the 2006 Yuma PM_{10} Maintenance Plan to assure that emissions were within the limits found in both plans for the current review years through the 2016 projected maintenance period. Yuma’s plans related to transportation improvements can be found under “Plans and Reports” at http://www.ympo.org/.

5.1.2 Additional Measures

On August 18, 2002, Yuma recorded a 24-hr average PM_{10} concentration of 170 $\mu g/m^3$, which is in exceedance of the NAAQS. A Natural Events Action Plan (NEAP) was created to address any measures that could be implemented to prevent future violations of the NAAQS. The option to develop a NEAP is no longer available; however, Yuma reviewed existing measures and developed additional measures that were later incorporated into the 2006 PM_{10} Maintenance Plan. These included (1) a public notification and education program still in place today and augmented recently by a pilot flag program for public schools and facilities based on the Yuma Dust Control Action Forecast (Appendices D, E, and F of the 2006 PM_{10} Maintenance

Plan); (2) an analysis of best available control measures (BACM) normally reserved for serious nonattainment areas; and (3) a review of existing control measures for construction sources, street sweepers, paved roads, covered trucks, off-highway vehicles, stationary source opacity limits, other stationary source control measures, and agricultural best management practices (Appendix H of the 2006 PM_{10} Maintenance Plan). In 2002, ADEQ met with Yuma stakeholders and began work on the development of a Yuma Agricultural Best Management Practices (AgBMP) rule. The rule became effective July 18, 2005, as R18-2-613 of the Arizona Administrative Code, and was submitted to EPA on August 16, 2006.

5.1.3 Review of Source-Permitted Inspections and Public Complaints

ADEQ's Arizona Unified Repository for Information Tracking of the Environment (AZURITE) database was queried to compile a list of inspections for the permitted sources in the Yuma area around the time of the August 15, 2012, PM_{10} exceedance. An evaluation of all inspection reports, air quality complaints, compliance reports, and other documentation indicated no evidence of unusual anthropogenic-based PM_{10} emissions during the time period of August 9 through August 18, 2012.

5.2 Forecasts and Warnings

Dust forecasts were released prior to the event by both ADEQ and the NWS office in Phoenix (Appendix B). The ADEQ Yuma and Vicinity Dust Control Action Forecast issued on Tuesday, August 14, stated that dust events due to thunderstorm outflow were likely for the next several days.

The NWS in Phoenix issued a Short-Term Forecast stating that "gusty winds from distant thunderstorms will continue to generate areas of blowing dust with reduced visibilities less than 3 miles as well as increasing winds… gusts near 40 mph… through the overnight hours until 4 a.m." The time this Short-Term Forecast was issued coincides with the peak PM_{10} concentration of 1,626 $\mu g/m^3$ recorded at the Yuma Supersite monitor.

5.3 Wind Observations

Monitors in Yuma County recorded sustained winds of up to 26 mph and wind gusts of up to 38 mph in association with the August 15 outflow event. Monitors in Imperial County recorded sustained winds of up to 24 mph and wind gusts of over 30 mph during this event. These gusty winds transported dust and PM_{10} from open desert areas south and southeast of Yuma into the Yuma PM_{10} Nonattainment Area. Wind speeds of over 25 mph are normally sufficient to overcome most PM_{10} control measures.

5.4 Summary

The weather and air quality forecasts and warnings outlined in this section demonstrate that outflow winds from thunderstorms caused uncontrollable PM_{10} emissions. The RACM outlined in the Yuma PM_{10} Maintenance Plan were in place at the time of the event. These control measures are required for areas designated as Moderate non-attainment for PM_{10}, such

as Yuma County. Thus, the RACM in place at the time of the event were reasonable. In addition, surface wind measurements in the Yuma area during the event were high enough (wind gusts above 30 mph) that most reasonable PM_{10} control measures would have been overwhelmed.

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} exceedance at the Yuma Supersite monitor on August 15, 2012,

- the exceedance was 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 Yuma PM_{10} Nonattainment Area and the measured PM_{10} exceedance in Yuma.

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 exceedance 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 the Yuma Supersite monitor. Multiple independent measurements of wind speed, wind direction, and visibility all point to the presence of thunderstorm outflow as the mechanism for transport of PM_{10} into the Yuma PM_{10} Nonattainment Area. High PM_{10} concentrations and gusty winds were also reported throughout southern and western Arizona and southeastern California, illustrating the widespread, regional nature of this event. In addition, PM_{10} concentrations were well below the NAAQS immediately before and after the windblown dust event. The source regions for the thunderstorm outflow and PM_{10} are clearly identified as desert areas south and southeast of the Yuma PM_{10} Nonattainment Area. The weight of evidence presented in this submittal provides no alternative that could tie the exceedance of August 15, 2012, to any causal source except PM_{10} transported by thunderstorm outflow, confirming that there would have been no exceedance but for the presence of these uncontrollable natural events.

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 within three days before and after the time of the event. Local regulatory agencies, industry, and the general public were alerted to the possibility of dust storms due to 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 exceedance of August 15, 2012, to any causal source except PM_{10} transported by thunderstorm outflow, confirming that there would have been no exceedance but for the presence of these uncontrollable natural events.

7. Conclusions

The PM_{10} exceedance that occurred on August 15, 2012, satisfies 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:

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

7.1 Affects Air Quality

As stated in the preamble to the Exceptional Events Rule, 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 Yuma County, high winds overwhelmed all reasonably available controls. The PM_{10} exceedance discussed in this report was caused by naturally occurring thunderstorm outflow that transported dust into Yuma County from areas largely outside the Yuma PM_{10} Nonattainment Area. These facts provide strong evidence that the PM_{10} exceedance on August 15, 2012, was not reasonably controllable or preventable.

7.3 Natural Event

As discussed above, the PM_{10} exceedance in Yuma on August 15, 2012, was shown to be caused by transport of PM_{10} into Yuma from 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 the Yuma Supersite was consistent with gusty winds and low visibilities at Yuma-area meteorological stations (Section 3).
- High PM_{10} concentrations and gusty winds were reported across much of southern and western Arizona, including Yuma County, and in Imperial County, California, illustrating the widespread, regional, and uncontrollable nature of this event (Section 3).
- PM_{10} concentrations were well below the NAAQS immediately before and after the windblown dust event.
- Dry conditions preceding the event resulted in soils that were particularly susceptible to particulate suspension by high winds (Section 3).

7.5 Historical Norm

The 24-hr average and daily 1-hr maximum PM_{10} values measured at the Yuma Supersite monitor were historically unusual compared to a multi-year data set (Section 4).

7.6 But For

On the basis of the weight of evidence described above and in Section 6, the exceedance of the federal 24-hr PM_{10} standard on August 15, 2012, at the Yuma Supersite monitor would not have occurred but for the thunderstorm-driven high winds and transport of dust from areas largely outside the Yuma PM_{10} Nonattainment Area.

Appendix A:
Air Quality and Meteorological Data for Yuma County

This section contains time-series graphs of air quality and meteorological data for Yuma and other regional monitors on August 14 and 15, 2012. The data show a regionwide increase in wind speeds and wind gusts coincident with the arrival of dust and high PM_{10} concentrations in Yuma.

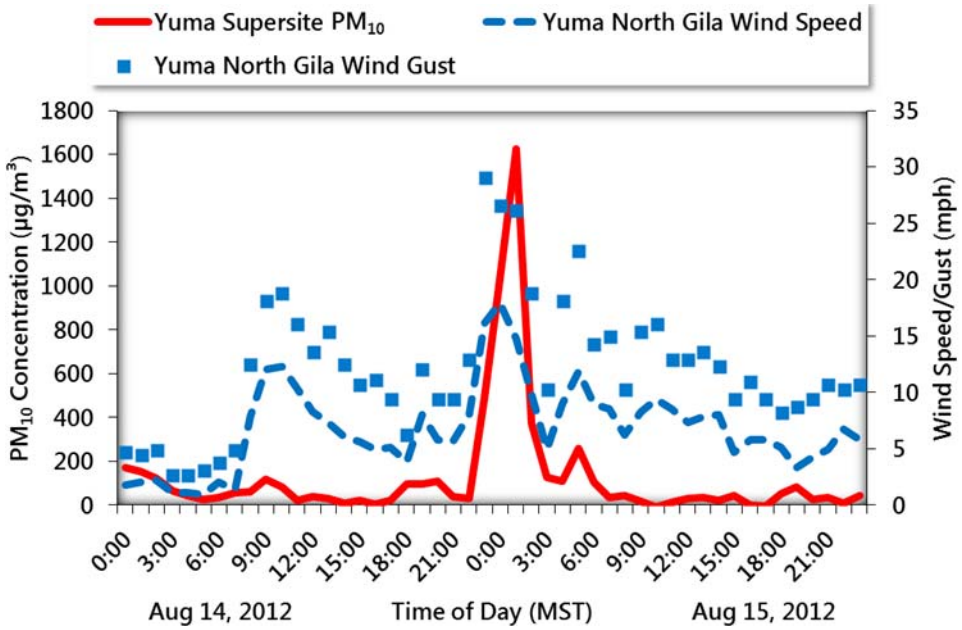


Figure A-1. Hourly PM_{10} concentrations at the Yuma Supersite monitor and wind speeds and wind gusts at the Yuma North Gila monitor on August 14 and 15, 2012. PM_{10} concentrations and wind speeds sharply increased just before midnight MST on August 15, 2012, indicating the arrival of windblown dust.

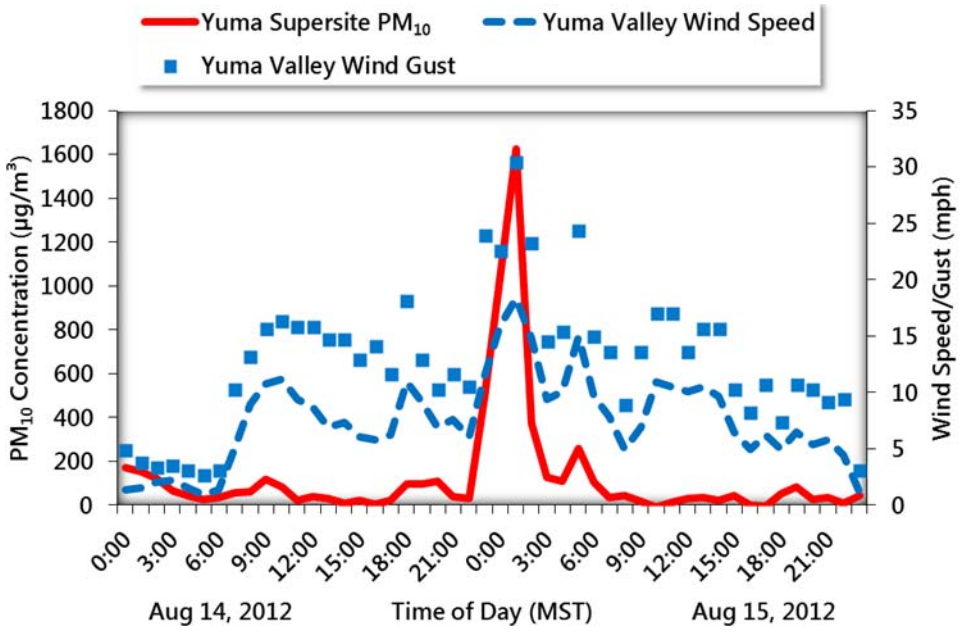


Figure A-2. Hourly PM_{10} concentrations at the Yuma Supersite monitor and wind speeds and wind gusts at the Yuma Valley monitor on August 14 and 15, 2012. PM_{10} concentrations and wind speeds sharply increased just before midnight MST on August 15, 2012, indicating the arrival of windblown dust.

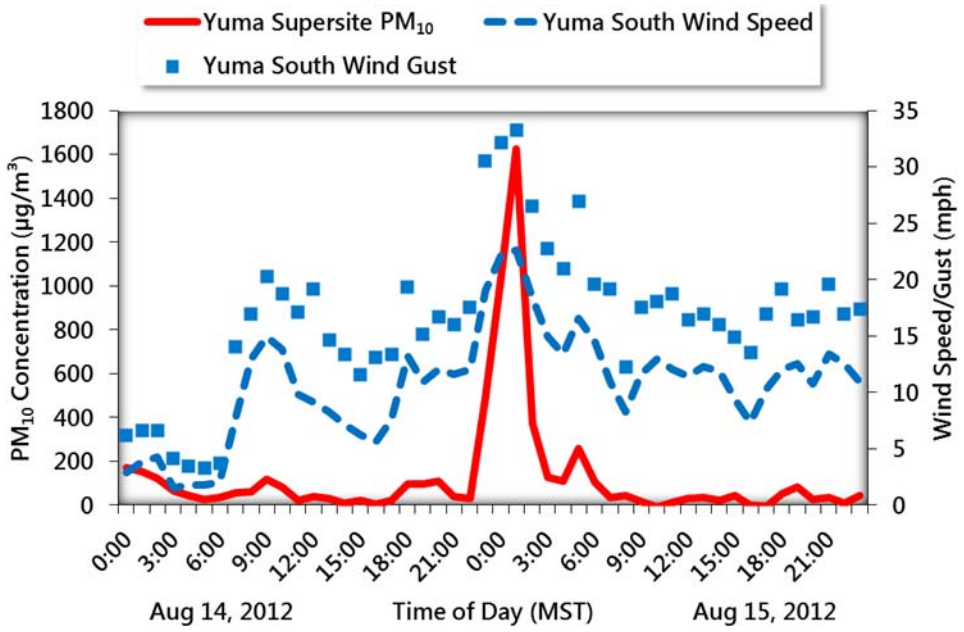


Figure A-3. Hourly PM_{10} concentrations at the Yuma Supersite monitor and wind speeds and wind gusts at the Yuma South monitor on August 14 and 15, 2012. PM_{10} concentrations and wind speeds sharply increased just before midnight MST on August 15, 2012, indicating the arrival of windblown dust.

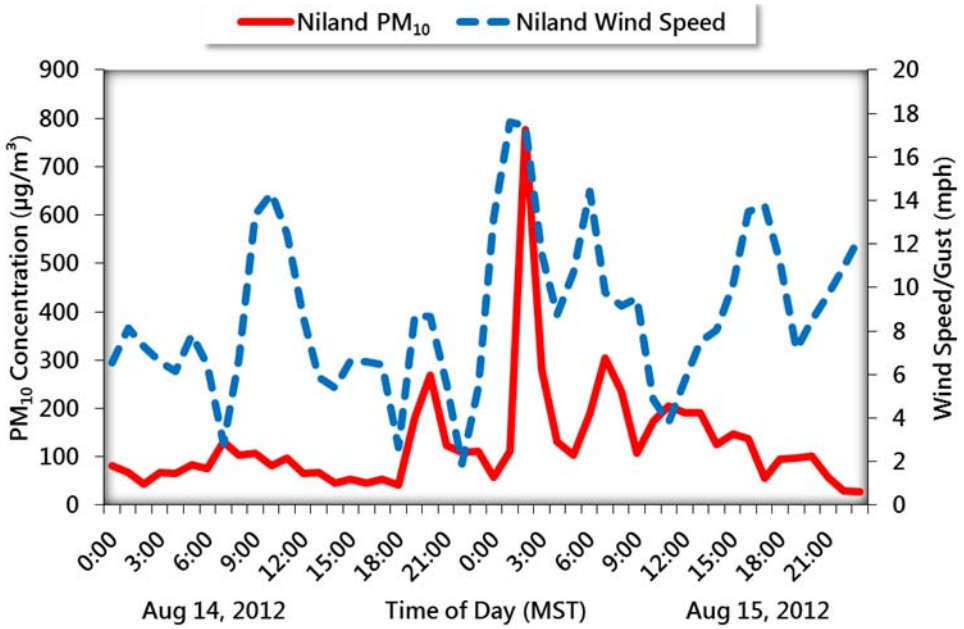


Figure A-4. Hourly PM_{10} concentrations and wind speeds at the Niland monitor in Imperial County, California, on August 14 and 15, 2012.

U.S. Department of Commerce
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QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA
HOURLY OBSERVATIONS TABLE
YUMA MCAS (03145), YUMA, AZ (08/14/2012)

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

Elevation: 213 ft. above sea level **Latitude:** 32.65 **Longitude:** -114.616 **Data Version:** VER2

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
14	0055	5	FEW060 SCT100	10.00		94	34.4	69	20.4	54	12.2	26	6	170		29.46			29.67	AA		29.69
14	0155	5	SCT100	10.00		92	33.3	70	20.9	57	13.9	31	6	170		29.46	3	003	29.68	AA		29.69
14	0255	5	SCT100	10.00		91	32.8	73	23.0	65	18.3	42	5	180		29.46			29.67	AA		29.69
14	0355	5	SCT100	10.00		90	32.2	75	23.8	68	20.0	48	0	000		29.46			29.67	AA		29.69
14	0455	5	SCT100	10.00		88	31.1	74	23.5	68	20.0	52	0	000		29.46	6	002	29.67	AA		29.69
14	0555	5	FEW060 SCT100 SCT150	10.00		89	31.7	73	23.0	66	18.9	47	0	000		29.47			29.68	AA		29.70
14	0655	5	FEW080 SCT120	10.00		89	31.7	73	22.7	65	18.3	45	5	170		29.49			29.71	AA		29.72
14	0755	5	SCT060 BKN120	10.00		93	33.9	75	23.9	67	19.4	43	13	160		29.52	3	021	29.74	AA		29.75
14	0855	5	FEW060 SCT100	10.00		97	36.1	75	23.9	65	18.3	35	11	170		29.53			29.75	AA		29.76
14	0955	5	FEW100	10.00		102	38.9	77	24.9	66	18.9	31	18	180		29.54			29.76	AA		29.77
14	1055	5	FEW100	10.00		103	39.4	77	25.0	66	18.9	30	15	190		29.53	0	003	29.75	AA		29.76
14	1155	5	FEW100	10.00		105	40.6	77	24.7	64	17.8	26	10	200		29.51			29.72	AA		29.74
14	1255	5	FEW080	10.00		108	42.2	77	25.1	64	17.8	24	9	200		29.48			29.69	AA		29.71
14	1355	5	FEW080	10.00		110	43.3	76	24.3	60	15.6	20	8	190		29.46	6	024	29.67	AA		29.69
14	1455	5	FEW080	10.00		111	43.9	75	23.8	57	13.9	17	9	230		29.43			29.65	AA		29.66
14	1555	5	FEW060CB	10.00		111	43.9	74	23.1	54	12.2	15	7	200		29.40			29.61	AA		29.63
14	1655	5	FEW060CB SCT120	10.00		113	45.0	74	23.1	53	11.7	14	7	140		29.37	7	030	29.59	AA		29.60
14	1755	5	FEW060CB SCT120	10.00		112	44.4	73	22.6	51	10.6	13	9	200		29.35			29.57	AA		29.58
14	1855	5	FEW060CB SCT150	10.00		107	41.7	76	24.4	62	16.7	23	16	210		29.36			29.57	AA		29.59
14	1955	5	FEW080 SCT120	10.00		102	38.9	75	23.8	62	16.7	27	11	200		29.38	3	003	29.59	AA		29.61
14	2055	5	FEW080 SCT120	10.00		99	37.2	79	26.0	71	21.7	41	13	220		29.42			29.63	AA		29.65
14	2155	5	FEW080 SCT120	10.00		95	35.0	78	25.5	71	21.7	46	10	190		29.43			29.65	AA		29.66
14	2255	5	FEW080 SCT120	10.00		94	34.4	77	25.0	70	21.1	46	8	210		29.47	1	030	29.69	AA		29.70
14	2355	5	SCT080 BKN120	7.00		92	33.3	79	26.1	74	23.3	56	23	170	34	29.49			29.71	AA		29.72

Figure A-5. Quality-controlled local climatological data hourly observations table for the Yuma MCAS (03145), Yuma, AZ (08/14/2012). Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

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

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA
HOURLY OBSERVATIONS TABLE
YUMA MCAS (03145), YUMA, AZ (08/15/2012)

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

Elevation: 213 ft. above sea level **Latitude:** 32.65 **Longitude:** -114.616 **Data Version:** VER2

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
15	0043	5	SCT080 BKN120	2.50	BLDU	93	34.0	78	25.5	72	22.0	51	26	170	36	29.50			M	SP		29.73
15	0055	5	BKN060 BKN100	2.00	BLDU	93	33.9	74	23.0	64	17.8	38	23	170	38	29.50			29.72	AA		29.73
15	0155	5	BKN060 BKN100	3.00	BLDU	91	32.8	75	23.9	68	20.0	47	17	190		29.52	1	016	29.73	AA		29.75
15	0255	5	SCT060 BKN100	10.00	BLDU	90	32.2	76	24.4	70	21.1	52	18	190		29.50			29.72	AA		29.73
15	0355	5	SCT060 SCT100	10.00		90	32.2	76	24.4	70	21.1	52	15	150		29.51			29.73	AA		29.74
15	0455	5	SCT060 SCT100	9.00		89	31.7	76	24.3	70	21.1	54	23	140	30	29.53	3	005	29.75	AA		29.76
15	0555	5	SCT060 BKN100	5.00	BLDU	87	30.6	75	24.0	70	21.1	57	17	150		29.53			29.75	AA		29.76
15	0655	5	SCT060 BKN100 BKN150	10.00		87	30.6	75	24.0	70	21.1	57	14	140		29.54			29.75	AA		29.77
15	0755	5	SCT080 BKN120 BKN150	10.00		88	31.1	75	23.8	69	20.6	53	7	170		29.55	3	004	29.76	AA		29.78
15	0855	5	SCT080 BKN120 BKN150	10.00		89	31.7	75	24.0	69	20.6	52	8	190		29.55			29.76	AA		29.78
15	0955	5	SCT080 BKN120 BKN150	10.00		93	33.9	75	23.9	67	19.4	43	9	190		29.56			29.78	AA		29.79
15	1055	5	SCT080 BKN120 BKN150	10.00		97	36.1	74	23.3	63	17.2	33	14	190		29.56	0	004	29.78	AA		29.79
15	1155	5	SCT080 BKN100 BKN150	10.00		97	36.1	74	23.3	63	17.2	33	14	180		29.55			29.77	AA		29.78
15	1255	5	SCT080 BKN110 BKN150	10.00	-RA	97	36.1	75	23.6	64	17.8	34	11	150		29.55			29.77	AA	T	29.78
15	1355	5	SCT080 BKN100 BKN150	10.00		97	36.1	76	24.2	66	18.9	36	10	160		29.53	8	008	29.75	AA	T	29.76
15	1455	5	SCT080 BKN100 BKN150	10.00		98	36.7	75	24.0	65	18.3	34	8	170		29.51			29.72	AA		29.74
15	1555	5	SCT080 BKN100 BKN150	10.00		99	37.2	76	24.2	65	18.3	33	9	200		29.49			29.70	AA		29.72
15	1655	5	SCT080 BKN100 BKN150	10.00		99	37.2	74	23.3	62	16.7	30	8	220		29.47	6	022	29.68	AA		29.70
15	1755	5	SCT080 BKN100 BKN150	10.00		100	37.8	73	22.9	60	15.6	27	9	180		29.45			29.67	AA		29.68
15	1855	5	SCT080 BKN100 BKN150	10.00		97	36.1	74	23.0	62	16.7	31	9	190		29.46			29.68	AA		29.69
15	1955	5	SCT080 BKN100 BKN150	10.00		93	33.9	75	23.9	67	19.4	43	11	210		29.48	3	005	29.70	AA		29.71
15	2055	5	SCT080 BKN100 BKN150	10.00		91	32.8	75	23.6	67	19.4	45	10	190		29.51			29.73	AA		29.74
15	2155	5	SCT100 BKN150	10.00		89	31.7	73	22.7	65	18.3	45	7	190		29.53			29.74	AA		29.76
15	2255	5	SCT100 BKN150	10.00		89	31.7	75	23.6	68	20.0	50	10	160		29.55	1	023	29.77	AA		29.78
15	2355	5	SCT100 BKN150	10.00		87	30.6	75	24.0	70	21.1	57	8	170		29.55			29.77	AA		29.78

Figure A-6. Quality-controlled local climatological data hourly observations table for the Yuma MCAS (03145), Yuma, AZ (08/15/2012). Note in the Weather Type column that BLDU (blowing dust) and reduced visibilities were reported intermittently between midnight and 6:00MST on August 15. Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

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

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA
HOURLY OBSERVATIONS TABLE
IMPERIAL COUNTY AIRPORT (03144), IMPERIAL, CA (08/14/2012)

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

Elevation: -58 ft. below sea level **Latitude:** 32.834 **Longitude:** -115.578 **Data Version:** VER2

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
14	0053	12	CLR	10.00		88	31.1	72	22.2	64	17.8	45	6	240		29.72	3	001	29.66	AA		29.66
14	0153	12	CLR	10.00		85	29.4	72	22.1	65	18.3	51	6	220		29.72			29.66	AA		29.66
14	0253	12	CLR	10.00		85	29.4	72	22.1	65	18.3	51	5	230		29.71			29.65	AA		29.65
14	0353	12	CLR	10.00		89	31.7	71	21.5	61	16.1	39	5	100		29.73	3	003	29.67	AA		29.67
14	0453	12	CLR	10.00		86	30.0	72	21.9	64	17.8	48	0	000		29.73			29.67	AA		29.67
14	0553	12	CLR	10.00		86	30.0	73	22.5	66	18.9	51	6	120		29.74			29.68	AA		29.68
14	0653	12	CLR	10.00		90	32.2	76	24.1	69	20.6	50	0	000		29.76	3	012	29.70	AA		29.70
14	0753	12	CLR	10.00		95	35.0	76	24.6	68	20.0	41	3	190		29.78			29.72	AA		29.72
14	0853	12	CLR	8.00		100	37.8	79	25.9	70	21.1	38	13	150		29.78			29.72	AA		29.72
14	0953	12	CLR	10.00		104	40.0	77	25.2	66	18.9	29	15	140		29.78	0	007	29.72	AA		29.72
14	1053	12	M	10.00		107	41.7	79	25.9	67	19.4	28	13	150	17	29.76			29.70	AA		29.70
14	1153	12	CLR	10.00		109	42.8	79	26.1	67	19.4	26	11	130	18	29.73			29.67	AA		29.67
14	1253	12	CLR	10.00		111	43.9	77	24.8	61	16.1	20	10	110		29.71	8	025	29.65	AA		29.65
14	1353	12	CLR	10.00		112	44.4	77	24.9	61	16.1	19	10	110	17	29.68			29.62	AA		29.62
14	1453	12	CLR	10.00		112	44.4	75	23.9	57	13.9	17	8	130		29.65			29.59	AA		29.59
14	1553	12	CLR	10.00		113	45.0	75	23.8	56	13.3	16	6	120		29.62	6	028	29.57	AA		29.56
14	1653	12	CLR	10.00		109	42.8	75	23.7	58	14.4	19	13	200		29.63			29.57	AA		29.57
14	1753	12	CLR	10.00		103	39.4	74	23.4	60	15.6	24	8	210		29.62	3	003	29.57	AA		29.56
14	1853	12	CLR	10.00		102	38.9	73	23.0	59	15.0	24	7	220		29.63			29.57	AA		29.57
14	1953	12	FEW050	10.00		99	37.2	72	22.0	57	13.9	25	11	240		29.66			29.60	AA		29.60
14	2053	12	CLR	10.00		95	35.0	69	20.7	54	12.2	25	10	260		29.69	1	023	29.63	AA		29.63
14	2153	12	CLR	10.00		95	35.0	69	20.4	53	11.7	24	7	250		29.70			29.64	AA		29.64
14	2253	12	CLR	10.00		93	33.9	69	20.6	55	12.8	28	7	110		29.72			29.67	AA		29.66
14	2353	12	CLR	10.00		92	33.3	83	28.3	80	26.7s	68	16	140	26	29.73			29.67	AA		29.67

Figure A-7. Quality-controlled local climatological data hourly observations table for the Imperial County Airport (03144), Imperial, CA (08/14/2012). Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

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

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA
HOURLY OBSERVATIONS TABLE
IMPERIAL COUNTY AIRPORT (03144), IMPERIAL, CA (08/15/2012)

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

Elevation: -58 ft. below sea level **Latitude:** 32.834 **Longitude:** -115.578 **Data Version:** VER2

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
15	0053	12	BKN016	3.00	HZ	92	33.3	82	27.6	78	25.6	64	24	160	33	29.75	1	017	29.69	AA		29.69
15	0153	12	OVC016	3.00	HZ	92	33.3	79	26.1	74	23.3	56	5	180		29.74			29.68	AA		29.68
15	0201	12	OVC014	3.00	HZ	91	33.0	78	25.6	73	23.0	56	3	160		29.74			M	SP		29.68
15	0244	12	OVC012	2.50	HZ	91	33.0	78	25.3	72	22.0	54	6	130		29.72			M	SP		29.66
15	0253	12	OVC012	2.00	HZ	90	32.2	77	24.8	71	21.7	54	6	130		29.72			29.66	AA		29.66
15	0327	12	OVC012	3.00	HZ	90	32.0	77	25.1	72	22.0	56	0	000		29.73	5	003	M	SP		29.67
15	0353	12	OVC014	4.00	HZ	88	31.1	76	24.5	71	21.7	57	7	060		29.74			29.68	AA		29.68
15	0409	12	OVC016	6.00	HZ	88	31.0	76	24.2	70	21.0	55	10	080		29.75			M	SP		29.69
15	0453	12	OVC026	10.00		87	30.6	75	24.0	70	21.1	57	13	120		29.78			29.72	AA		29.72
15	0512	12	OVC032	10.00		88	31.0	77	24.8	72	22.0	59	14	130		29.79			M	SP		29.73
15	0553	12	OVC030	10.00		88	31.1	76	24.5	71	21.7	57	11	140		29.80			29.74	AA		29.74
15	0605	12	OVC028	10.00		88	31.0	77	24.8	72	22.0	59	10	130		29.80			M	SP		29.74
15	0653	12	OVC020	10.00		89	31.7	77	25.0	72	22.2	57	9	130		29.80	1	021	29.74	AA		29.74
15	0753	12	OVC026	6.00	HZ	91	32.8	77	24.9	71	21.7	52	5	180		29.81			29.75	AA		29.75
15	0853	12	OVC022	8.00		93	33.9	78	25.6	72	22.2	51	3	260		29.81			29.75	AA		29.75
15	0953	12	OVC024	7.00		97	36.1	79	26.1	72	22.2	45	6	VR		29.81	0	003	29.75	AA		29.75
15	1053	12	BKN024 OVC032	9.00		99	37.2	79	26.1	71	21.7	41	5	VR		29.80			29.74	AA		29.74
15	1153	12	BKN022 OVC031	7.00		102	38.9	80	26.5	71	21.7	37	7	110		29.79			29.73	AA		29.73
15	1253	12	OVC020	10.00		101	38.3	80	26.6	72	22.2	39	7	110		29.77	8	014	29.71	AA		29.71
15	1353	12	OVC016	10.00		104	40.0	79	26.1	69	20.6	32	9	110		29.75			29.69	AA		29.69
15	1453	12	OVC016	10.00		102	38.9	80	26.4	71	21.7	37	21	120	24	29.73			29.67	AA		29.67
15	1553	12	OVC016	10.00		100	37.8	79	26.2	71	21.7	39	16	140		29.72	6	015	29.67	AA		29.66
15	1653	12	BKN016	10.00		98	36.7	78	25.3	69	20.6	39	14	140		29.71			29.65	AA		29.65
15	1753	12	BKN020	10.00		98	36.7	78	25.6	70	21.1	40	11	130		29.71			29.65	AA		29.65
15	1853	12	OVC022	10.00		96	35.6	78	25.3	70	21.1	43	10	140		29.73	3	001	29.67	AA		29.67
15	1953	12	OVC028	10.00		94	34.4	78	25.4	71	21.7	47	11	140		29.75			29.69	AA		29.69
15	2005	12	OVC030	10.00		93	34.0	78	25.6	72	22.0	51	11	140		29.75			M	SP		29.69
15	2053	12	OVC030	10.00		91	32.8	78	25.6	73	22.8	56	13	140		29.76	3	020	29.70	AA		29.70
15	2153	12	FEW032	10.00		90	32.2	78	25.5	73	22.8	57	14	140		29.79			29.73	AA		29.73
15	2253	12	CLR	10.00		90	32.2	77	25.1	72	22.2	56	15	150		29.80			29.74	AA		29.74
15	2302	12	FEW002	10.00		90	32.0	77	25.1	72	22.0	56	11	140		29.80			M	SP		29.74
15	2353	12	CLR	10.00		89	31.7	78	25.3	73	22.8	59	10	140		29.80			29.74	AA		29.74

Figure A-8. Quality-controlled local climatological data hourly observations table for the Imperial County Airport (03144), Imperial, CA (08/15/2012). Note in the Weather Type column that HZ (haze) and reduced visibilities were reported intermittently between midnight and 8:00 MST on August 15. Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

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

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (may be updated) HOURLY OBSERVATIONS TABLE NAF (23199) EL CENTRO, CA (08/14/2012)

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

Elevation: -42 ft. below sea level
Latitude: 32.816
Longitude: -115.683
Data Version: VER2

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
14	0056	5	CLR	10.00		89	31.7	71	21.5	61	16.1	39	7	270		29.70	3	001	29.71	AA		29.66
14	0156	5	CLR	10.00		88	31.1	70	21.1	60	15.6	39	6	270		29.70			29.70	AA		29.66
14	0256	5	CLR	10.00		88	31.1	71	21.3	61	16.1	40	5	230		29.70			29.70	AA		29.66
14	0356	5	CLR	10.00		83	28.3	71	21.4	64	17.8	53	10	130		29.71	3	001	29.71	AA		29.67
14	0456	5	CLR	10.00		83	28.3	71	21.7	65	18.3	55	0	000		29.71			29.72	AA		29.67
14	0556	5	CLR	10.00		84	28.9	71	21.9	65	18.3	53	3	150		29.73			29.73	AA		29.69
14	0656	5	CLR	10.00		89	31.7	75	23.7	68	20.0	50	3	160		29.75	3	014	29.75	AA		29.71
14	0756	5	CLR	10.00		94	34.4	78	25.4	71	21.7	47	7	150		29.76			29.77	AA		29.72
14	0856	5	CLR	10.00		100	37.8	77	25.0	67	19.4	34	9	140		29.76			29.77	AA		29.72
14	0956	5	FEW060	10.00		104	40.0	77	25.2	66	18.9	29	11	130		29.76	1	006	29.77	AA		29.72
14	1056	5	FEW060	10.00		107	41.7	78	25.6	66	18.9	27	10	140		29.74			29.74	AA		29.70
14	1156	5	FEW060	10.00		109	42.8	80	26.4	68	20.0	27	10	130		29.71			29.72	AA		29.67
14	1256	5	FEW060	10.00		110	43.3	77	25.1	63	17.2	22	7	140		29.69	6	026	29.69	AA		29.65
14	1356	5	FEW060	10.00		112	44.4	78	25.4	63	17.2	21	11	080		29.66			29.66	AA		29.62
14	1456	5	FEW060	10.00		111	43.9	76	24.5	60	15.6	19	9	140		29.63			29.63	AA		29.59
14	1556	5	FEW060	10.00		112	44.4	76	24.4	59	15.0	18	6	110		29.61	6	027	29.61	AA		29.57
14	1654	5	SCT060CB	10.00		106	41.0	75	23.6	59	15.0	21	17	170		29.62			M	SP		29.58
14	1656	5	SCT060CB	10.00		104	40.0	74	23.5	60	15.6	24	15	180		29.61			29.62	AA		29.57
14	1756	5	FEW060 SCT120	10.00		105	40.6	74	23.2	58	14.4	21	7	210		29.60			29.61	AA		29.56
14	1856	5	FEW180	10.00		100	37.8	72	22.4	58	14.4	25	10	190		29.62	3	001	29.62	AA		29.58
14	1956	5	FEW180	10.00		100	37.8	69	20.6	50	10.0	19	16	240		29.65			29.65	AA		29.61
14	2056	5	FEW180	10.00		94	34.4	68	20.0	52	11.1	24	10	250		29.68			29.68	AA		29.64
14	2156	5	CLR	10.00		96	35.6	68	20.1	51	10.6	22	11	250		29.68	1	021	29.68	AA		29.64
14	2256	5	CLR	10.00		93	33.9	68	19.8	52	11.1	25	7	290		29.70			29.70	AA		29.66
14	2329	5	CLR	10.00		90	32.0	69	20.6	57	14.0	33	16	130		29.72			M	SP		29.68
14	2356	5	CLR	10.00		90	32.2	82	27.7	79	26.1s	70	16	130		29.71			29.72	AA		29.67

Figure A-9. Quality-controlled local climatological data hourly observations table for the El Centro NAF (23199), El Centro, CA (08/14/2012). Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

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

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (may be updated) HOURLY OBSERVATIONS TABLE NAF (23199) EL CENTRO, CA (08/15/2012)

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

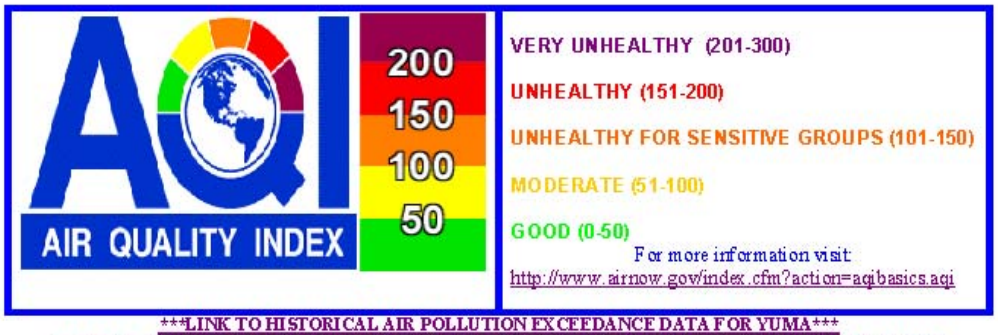
Elevation: -42 ft. below sea level
Latitude: 32.816
Longitude: -115.683
Data Version: VER2

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
						(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
15	0054	5	BKN012	10.00		91	33.0	79	26.3	75	24.0	60	24	140	32	29.73			M	SP		29.69
15	0056	5	BKN012	10.00		91	32.8	80	26.7	76	24.4	62	23	140	32	29.73	3	016	29.73	AA		29.69
15	0125	5	OVC016	10.00		90	32.0	79	26.2	75	24.0	61	9	160		29.74			M	SP		29.70
15	0154	5	OVC014	10.00		91	33.0	81	27.0	77	25.0	64	13	170		29.72			M	SP		29.68
15	0156	5	OVC014	10.00		90	32.2	81	26.9	77	25.0	66	11	160		29.72			29.72	AA		29.68
15	0256	5	OVC014	10.00		88	31.1	79	25.9	75	23.9	65	7	140		29.70			29.70	AA		29.66
15	0356	5	OVC012	10.00		87	30.6	78	25.4	74	23.3	65	6	010		29.72	5	003	29.72	AA		29.68
15	0427	5	OVC018	10.00		86	30.0	75	23.8	70	21.0	59	10	090		29.74			M	SP		29.70
15	0456	5	OVC024	10.00		84	28.9	74	23.5	70	21.1	63	11	090		29.77			29.77	AA		29.73
15	0506	5	SCT200	10.00		86	30.0	75	23.8	70	21.0	59	14	110		29.77			M	SP		29.73
15	0556	5	SCT200	10.00		86	30.0	76	24.2	71	21.7	61	8	140		29.78			29.78	AA		29.74
15	0656	5	FEW200	10.00		89	31.7	76	24.3	70	21.1	54	7	170		29.79	1	023	29.79	AA		29.75
15	0756	5	BKN200	10.00		92	33.3	77	25.1	71	21.7	50	7	270		29.79			29.79	AA		29.75
15	0856	5	BKN200	10.00		94	34.4	77	25.1	70	21.1	46	8	270		29.79			29.80	AA		29.75
15	0956	5	BKN200	10.00		98	36.7	78	25.6	70	21.1	40	3	VR		29.79	0	001	29.79	AA		29.75
15	1056	5	BKN200	10.00		100	37.8	78	25.6	69	20.6	37	5	VR		29.78			29.79	AA		29.74
15	1156	5	BKN200	10.00		100	37.8	79	25.9	70	21.1	38	6	070		29.77			29.77	AA		29.73
15	1256	5	BKN200	10.00		101	38.3	79	26.0	70	21.1	37	3	VR		29.75	8	012	29.76	AA		29.71
15	1356	5	BKN200	10.00		104	40.0	75	24.1	62	16.7	25	7	160		29.73			29.74	AA		29.69
15	1456	5	BKN200	10.00		103	39.4	79	25.9	69	20.6	33	13	120		29.71			29.72	AA		29.67
15	1556	5	BKN200	10.00		98	36.7	80	26.6	73	22.8	45	16	120		29.70	6	018	29.70	AA		29.66
15	1656	5	BKN200	10.00		97	36.1	78	25.8	71	21.7	43	9	130		29.69			29.70	AA		29.65
15	1756	5	SCT100 BKN200	10.00		96	35.6	78	25.6	71	21.7	44	8	120		29.69			29.70	AA		29.65
15	1856	5	SCT100 BKN200	10.00		95	35.0	77	25.2	70	21.1	44	10	140		29.71	3	002	29.71	AA		29.67
15	1956	5	SCT100 BKN200	10.00		92	33.3	78	25.4	72	22.2	52	9	130		29.73			29.73	AA		29.69
15	2056	5	SCT100 BKN200	10.00		90	32.2	77	24.8	71	21.7	54	8	130		29.74			29.75	AA		29.70
15	2156	5	FEW100 BKN200	10.00		89	31.7	76	24.6	71	21.7	55	11	130		29.77	1	020	29.77	AA		29.73
15	2256	5	CLR	10.00		89	31.7	77	25.0	72	22.2	57	14	130		29.77			29.78	AA		29.73
15	2356	5	CLR	10.00		88	31.1	76	24.2	70	21.1	55	10	130		29.78			29.78	AA		29.74

Figure A-10. Quality-controlled local climatological data hourly observations table for the El Centro NAF (23199), El Centro, CA (08/15/2012). Dynamically generated via http://cdo.ncdc.noaa.gov/qclcd/QCLCD.

Appendix B:
ADEQ and NWS Forecast Products

ADEQ Arizona Department of Environmental Quality



LINK TO HISTORICAL AIR POLLUTION EXCEEDANCE DATA FOR YUMA

YUMA AIR QUALITY FORECAST FOR WEDNESDAY, AUGUST 15, 2012

This report is updated by 1:00 p.m. Sunday thru Friday and is valid for areas within and bordering the city of Yuma, Arizona

FORECAST DATE	YESTERDAY MON 08/13/2012	TODAY TUE 08/14/2012	TOMORROW WED 08/15/2012	EXTENDED THU 08/16/2012
NOTICES (*SEE BELOW FOR DETAILS)	NWS EXCESSIVE HEAT WARNING	DUST NWS EXCESSIVE HEAT WARNING	DUST NWS EXCESSIVE HEAT WARNING	DUST
AIR POLLUTANT	AQI Reading/Category (Preliminary data only)			
O3*	80 MODERATE	51 MODERATE	50 GOOD	44 GOOD
PM-10*	115 UNHEALTHY FOR SENSITIVE GROUPS	65 MODERATE	75 MODERATE	75 MODERATE

* O3 = Ozone PM-10 = Particles 10 microns & smaller

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

Health message for Tuesday August 14: Unusually sensitive people should consider reducing prolonger or heavy exertion outdoors.

Health message for Wednesday August 15: Unusually sensitive people should consider reducing prolonger or heavy exertion.

Synopsis and Discussion

OZONE (O3): A decrease in afternoon high temperatures and an increase in moisture, winds, and daytime cloud cover should bring local ozone levels down to near the good range of the Air Quality Index during the next few days.
COARSE PARTICLES (PM-10): For the second consecutive day blowing dust generated by thunderstorm outflow boundaries have contributed to unhealthy PM-10 levels at the Yuma monitoring site. One peculiarity is that the outflow winds were produced by thunderstorms located to the west of the city and reached the airport at 6:00 p.m. on both occasions. At any rate, summer monsoon moisture and thunderstorm activity is forecast to ramp up during the next few days so additional dust events are likely. In addition, there will be an increased likelihood for a gulf-surge wind event during the Thursday-Friday period.

POLLUTION MONITOR READINGS FOR MONDAY, AUGUST 13, 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
Yuma Supersite	69	80	

PM-10 (PARTICLES)

SITE NAME	MAX 24-HR VALUE (µg/m3)	MAX AQI	AQI COLOR CODE
Yuma Supersite	184	115	

Click Here to find out how the AQI forecast is used in the Yuma Air Quality Flag Program

YUMA SUPERSITE POLLUTION MONITORS LOCATION MAP

SHORT TERM FORECAST
NATIONAL WEATHER SERVICE PHOENIX AZ
1256 AM MST WED AUG 15 2012

AZZ020-025-CAZ031>033-151100-
LOWER COLORADO RIVER VALLEY AZ-YUMA/MARTINEZ LAKE AND VICINITY-
LOWER COLORADO RIVER VALLEY CA-RIVERSIDE COUNTY/EASTERN DESERTS-
IMPERIAL COUNTY-
INCLUDING THE CITIES OF...EHRENBERG...PARKER...FORTUNA FOOTHILLS...
SAN LUIS...SOMERTON...YUMA...BLYTHE...CHIRIACO SUMMIT...
DESERT CENTER...EAGLE MOUNTAIN...BRAWLEY...CALEXICO...EL CENTRO...
GLAMIS...IMPERIAL...AND THE SALTON SEA
1256 AM MST WED AUG 15 2012 /1256 AM PDT WED AUG 15 2012/

.NOW...
GUSTY WINDS FROM DISTANT THUNDERSTORMS WILL CONTINUE TO GENERATE
AREAS OF BLOWING DUST WITH REDUCED VISIBILITIES LESS THAN 3 MILES AS
WELL AS INCREASING WINDS...GUSTS NEAR 40 MPH...THROUGH THE OVERNIGHT
HOURS UNTIL 4 AM. A STRAY ISOLATED THUNDERSTORM IS NOT OUT OF THE QUESTION.