



Janice K. Brewer  
Governor

# ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

1110 West Washington Street • Phoenix, Arizona 85007  
(602) 771-2300 • www.azdeq.gov



Benjamin H. Grumbles  
Director

## Assessment of Qualification for Treatment under the Arizona Natural and Exceptional Events Policy for the High Particulate (PM<sub>10</sub>) Concentration Events in the Buckeye Area on March 2, 2008

### Background

The Arizona Department of Environmental Quality (ADEQ) issues Dust Control Action Forecasts for the Phoenix area as part of their Natural Events Action Plan. On Friday, February 29, 2008, in response to an approaching trough of low pressure, ADEQ air quality forecasters issued the Maricopa County Dust Control Action Forecast calling for a moderate risk of wind-blown dust for Sunday, March 2<sup>nd</sup>, for Maricopa County. In addition to the approaching trough, a cutoff area of low-pressure was forecast to move eastward south of the Arizona border causing the pressure gradient over the state to tighten. This potential wind-blown dust event equated to a significant risk of exceeding the PM<sub>10</sub> National Ambient Air Quality Standards (NAAQS) in Maricopa County. The forecasts/advisories discussed above satisfy the requirement in 40 CFR 51.930(a)(1).

The initialization of the wind-blown dust event is evident in the Phoenix visible camera images, particularly for the White Tank and Estrella Mountains, as well as the Arizona Meteorological Network (AzMET), Maricopa County (MC), and National Weather Service (NWS) monitors (see Fig. 1). The high winds in the Phoenix Metro area were able to suspend soils leading to an exceedance of the NAAQS at the Buckeye monitor. There were numerous potential PM<sub>10</sub> sources upwind of the Buckeye monitor on March 2<sup>nd</sup>. Barren agricultural fields and dry washes lie to the northwest of the Buckeye monitor. Additionally, large road construction projects were occurring along HWY 85 within a quarter mile west and northwest of the monitoring site at the time of the exceedance. Evidence of this construction can be seen in the

images that were taken a week after the event occurred (see attachments). This construction in conjunction with the high winds may have contributed to the PM<sub>10</sub> exceedance measured at the site. At the time the exceedance occurred, the major earth moving portion of the construction had been completed in order to prepare for storm drainage control, and the soils were being readied for hydro-mulching. Unfortunately, the high-wind event occurred just days before the hydro-mulch was put down on the disturbed soils. While the exact source of PM cannot be determined for this event, the five consecutive hours of 40+ mph winds were strong enough to suspend and transport soils from any of these possible sources. All appropriate State Implementation Plan (SIP) control measures were in place during the event, demonstrating, per 40 CFR 50.1(j) that the event “is not reasonably controllable or preventable.” A discussion of commonly employed Best Available Control Measures (BACM) for dust in Maricopa and Yuma counties can be found in “High Wind Exceptional Events and Control Measures for PM<sub>10</sub> Areas” (see “References”).

The significant region wide wind event brought localized elevated ambient concentrations of PM<sub>10</sub> to the Buckeye area that exceeded the NAAQS at the Buckeye monitor operated by Maricopa County. The fact that ambient concentrations exceeded the NAAQS satisfies the criteria in 40 CFR 50.1(j) that the event “affects air quality.”

The following are the key PM<sub>10</sub> monitor readings for the monitors examined in this report:

Monitor (Operator/Type)	AQS ID	24-hr Avg PM <sub>10</sub>	1-hr Max PM <sub>10</sub>	Max Time	Flag**
<b>BUCKEYE AREA</b>					
<b>Buckeye (MC/TEOM)</b>	<b>04-013-4011*</b>	<b>160</b>	<b>880</b>	<b>1400</b>	<b>RJ &amp; L</b>
<b>PHOENIX METRO AREA</b>					
<b>West 43<sup>rd</sup> Ave (MC/TEOM)</b>	<b>04-013-4009*</b>	<b>45</b>	<b>178</b>	<b>1600</b>	None
<b>Durango Complex (MC/TEOM)</b>	<b>04-013-9812*</b>	<b>39</b>	<b>117</b>	<b>1800</b>	None
<b>South Phoenix (MC/TEOM)</b>	<b>04-013-4003*</b>	<b>56</b>	<b>181</b>	<b>1800</b>	None

\* EPA Air Quality System Identification Number

\*\* 24-hr PM<sub>10</sub> concentration influenced by natural or exceptional event to be flagged.

Type Abbreviations: TEOM – Tapered Element Oscillating Microbalance Monitor (Continuous monitor).

The preliminary findings from this analysis were presented at stakeholders meetings on November 19, 2008, and March 19, 2009, in Phoenix, Arizona. Following the stakeholders meetings, ADEQ supplemented and finalized the analysis and

a public comment period was held from October 15, 2009 through November 13, 2009. This finalized document and any comments received are being submitted to EPA to satisfy the requirements in 40 CFR 50.14(c)(3)(i).



Assessment under the Technical Criteria Document (TCD)

1. Properly qualify and validate the air quality measurement to be flagged. As this was not a filter sampling date (1-in-6 run day), only data from the continuous analyzers were examined. The air quality monitoring data were reviewed by the agency responsible for operation of the monitor. All hourly PM<sub>10</sub> readings from the Buckeye monitor were valid for March 2<sup>nd</sup>. Audits of the analyzers revealed operations were within acceptable tolerance. An exceedance of the NAAQS was recorded at the Buckeye monitor operated by Maricopa County.

2. Review suspected contributing sources. The NWS, AzMET, and MC surface data for Arizona, along with the visible camera images in Phoenix, provide a good explanation of the meteorological conditions that were in place on March 2<sup>nd</sup>. Throughout much of the state, strong north-northwesterly winds associated with a frontal system passage were reported throughout the afternoon hours. HYSPLIT back trajectories show that likely dust sources included the dry Hassayampa River bed as well as many barren dirt fields (see attachments). The direction of these winds would have also allowed for any loose or disturbed soils associated with the construction project occurring along HWY 85 to be suspended and transported the short distance to the Buckeye monitor site. The plot of hourly PM<sub>10</sub> concentration data in the upper right corner of Figure 1 confirms the identical timing of elevated PM<sub>10</sub> concentrations at the Buckeye site with gusty winds recorded at the Buckeye MC site beginning at approximately 11:00 a.m. and continuing through the afternoon.

3. Examine all air quality monitoring information. Data from all monitors in the network were reviewed. Monitors from the affected areas are summarized in the table in the Background section of this assessment. Pursuant to 40 CFR 50.14(c)(3)(iii)(C), the “Historical Distribution” Table in Figure 1 has been included to demonstrate that the event is associated with measured concentrations in excess of normal historical fluctuations, including background (i.e., concentrations greater than the 95<sup>th</sup> percentile). Additionally, the winds associated with the elevated PM<sub>10</sub> concentrations may be characterized as unusual as described in “Impact of Exceptional Events’ ‘Unusual Winds’ on PM<sub>10</sub> Concentrations” (see “References”).

4. Examine the meteorological conditions before and during the event. Meteorological data are summarized in Figure 1. The wind data are highlighted yellow if the max wind speed in the hour exceeds 15 mph and orange if it exceeds 25 mph.

As can be seen in Figure 1, wind speeds did not pick up in central Arizona until approximately 11:00 a.m., when several stations reported gusty winds that approached 40 mph at times. Winds were generally out of the north-northwest with sustained wind speeds above 15 mph beginning around 11:00 am and continuing through the late afternoon and evening hours. Gusty winds over 25 mph were recorded beginning around noon and continuing through the 6:00 pm hour. This timing corresponded to the onset of elevated PM<sub>10</sub> concentrations recorded at Buckeye. Additionally, an exceedance due to abnormally high winds was also measured at the Yuma Courthouse monitor, which shows that this was not merely a localized wind event.

5. Perform a qualitative attribution to emission source(s). All evidence indicates the elevated PM<sub>10</sub> concentrations in the Buckeye area can be attributed to a high wind event which occurred over a broad area causing some localized windblown dust. No source-specific emission allocation is possible based on the data available for analysis; however, it is possible that construction occurring north and west of the Buckeye monitor provided additional loose soil for wind transport and added to the dust event recorded as an exceedance at the Buckeye monitor. The timing of the high winds, as well as the visual evidence of reduced visibility most clearly seen in the 3:00 p.m. images for the White Tank and Estrella Mountains in the lower right portion of Figure 1, is evidence that elevated PM<sub>10</sub> concentrations in Buckeye can be attributed to soil emissions.

6. Estimation of Contribution from Source or Event. The primary source appears to be wind-blown dust over central and southwestern Arizona for which there is not an effective or efficient method to estimate the relative contributions from specific sources. The demonstration analysis contained in this report establishes the linkage between the measurements to be flagged and the event, thus satisfying a 40 CFR 50.14(c)(3)(iii)(B) requirement. Pursuant to 40 CFR 50.14(c)(3)(iii)(D), the “Event Contrib. Analysis” Table in Figure 1 has been included to demonstrate that there would have been no exceedances or violations but for the wind event (i.e., the contribution during the event overwhelmed the 24-hour averages).

7. Determination that a Natural or Exceptional Event Contributed To an Exceedance. Based on this analysis, the event satisfies the requirement in 40 CFR 50.1(j) that the elevated concentrations at the Buckeye monitoring sites can be attributed to a natural event.

Conclusion

Transport of dust from soils by high winds. A region wide wind event lead to elevated PM<sub>10</sub> concentrations in Buckeye on March 2, 2008, due to the transport of dust from winds that suspended natural soils and soils from areas where Best Available Control Measures are in place or from areas where the monitor was not cited for the purpose of sampling a potential PM<sub>10</sub> source. For these reasons, the monitor readings for the Buckeye site should be flagged for air quality planning

purposes. The “high wind” (RJ) flag and “highway construction” (L) flag should be applied to the monitor readings indicated in the table at the beginning of this report, as the monitor would have been below the NAAQS but for the event contribution.

**ATTACHMENTS AND REFERENCES**  
**FOR EXCEPTIONAL EVENTS ANALYSIS**

**The following are supplemental materials helpful in understanding the exceptional event summarized in the main report. In addition, the reader is referred to the following references.**

**REFERENCES**

Arizona Department of Environmental Quality (ADEQ), *Air Quality Exceptional and Natural Events Policy*, Policy Number 2009.002 (April 28, 1999; revised January 10, 2006 and June 22, 2007).

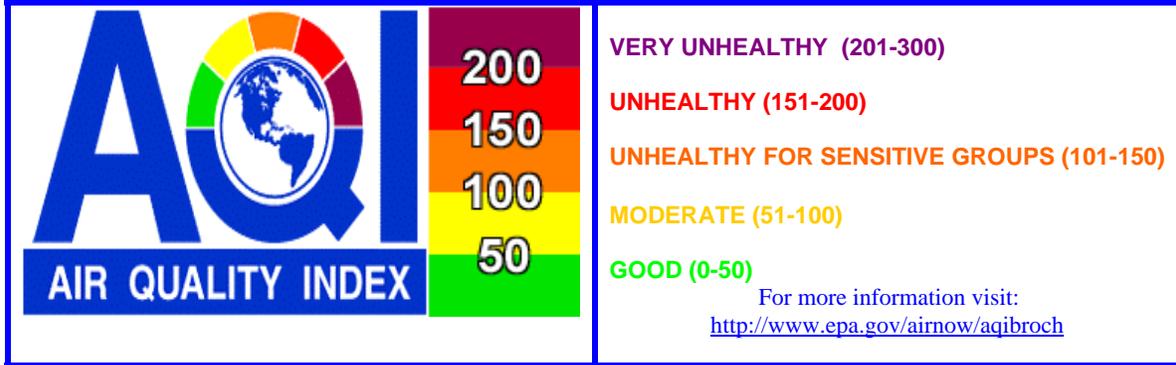
Arizona Department of Environmental Quality (ADEQ), *Technical Criteria Document for Determination of Natural Exceptional Events for Particulate Matter Equal to or Less Than Ten Microns in Aerodynamic Diameter (PM<sub>10</sub>)* (May 31, 2000).

Arizona Department of Environmental Quality (ADEQ), *Technical Criteria Document for Determination of Natural and Exceptional Events* (December 12, 2005).

Arizona Department of Environmental Quality (ADEQ), *Impact of Exceptional Events 'Unusual Winds' on PM<sub>10</sub> Concentrations* (October 14, 2009).

Arizona Department of Environmental Quality (ADEQ), *High Wind Exceptional Events and Control Measures for PM<sub>10</sub> Areas* (October 14, 2009).

Environmental Protection Agency (EPA), *The Treatment of Data Influenced by Exceptional Events (Exceptional Event Rule)*, 73 FR 70597; 40 CFR Parts 50 and 51 (November 21, 2008).



**\*LINK TO EXCEEDANCE & HEALTH STATEMENT INFO FOR THE 2006-07 & 2007-08 FORECAST SEASONS\***

## AIR QUALITY FORECAST FOR SATURDAY, MARCH 1, 2008

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	YESTERDAY <u>THU 02/28/2008</u>	TODAY <u>FRI 02/29/2008</u>	TOMORROW <u>SAT 03/01/2008</u>	EXTENDED <u>SUN 03/02/2008</u>
<b>NOTICES</b> (*SEE BELOW FOR DETAILS)	NONE	NONE	NONE	NONE
AIR POLLUTANT	Highest AQI Reading/Site (Preliminary data only)			
<b>O3*</b>	<b>38</b> FOUNTAIN HILLS & PINNACLE PEAK	<b>37</b> GOOD	<b>35</b> GOOD	<b>37</b> GOOD
<b>CO*</b>	<b>19</b> WEST INDIAN SCHOOL	<b>23</b> GOOD	<b>16</b> GOOD	<b>16</b> GOOD
<b>PM-10*</b>	<b>59</b> WEST 43 <sup>RD</sup>	<b>64</b> MODERATE	<b>63</b> MODERATE	<b>40</b> GOOD
<b>PM-2.5*</b>	<b>56</b> DURANGO	<b>58</b> MODERATE	<b>46</b> GOOD	<b>41</b> 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 message for Friday, Feb 29: Unusually sensitive people should consider limiting prolonged exertion outdoors.**

**Health message for Saturday, Mar 1: Unusually sensitive people should consider limiting prolonged exertion outdoors.**

**Synopsis and Discussion**

Particulates have climbed into the low part of the “Moderate” category under this ridge of high pressure. Changes in the weather the next couple of days may increase those levels initially before dropping them back into the “Good” range. The ridge of high pressure will give way to a trough of low pressure that will push through the western U.S. on Friday and Saturday. At the same time, a cutoff area of low pressure will also move east across northern Mexico. As the two systems combine late Saturday into Sunday over Arizona, we expect to see pretty windy condition develop out of the west. These winds may kick up additional dust and particles at times. By Monday, the trough moves east away from the region, allowing high pressure to return and winds to decrease. No rain is expected, but cooler air will replace Saturday’s mid 80s with mid 70s on Sunday and Monday. Particulates should begin to clear out of the Valley on Sunday and Monday for a good start to the week air quality-wise. Check back on Sunday for more to your coming workweek’s weather and air quality. Have a great weekend! –J.Paul

MONITORING SITE MAPS: STATIC MAP – <http://www.azdeq.gov/enviro/air/monitoring/images/winter.jpg>  
 INTERACTIVE MAPS – <http://aqwww.maricopa.gov/AirMonitoring/SitePollutionMap.aspx>  
<http://www.airnow.gov/>



**POLLUTION MONITOR READINGS FOR THURSDAY, FEBRUARY 28, 2008**



**O3 (OZONE)**

SITE NAME	MAX 8-HR VALUE (PPB)	MAX AQI	AQI COLOR CODE
Apache Junction	46	36	
Blue Point	37	29	
Central Phoenix	36	28	
Fountain Hills	48	38	
North Phoenix	36	28	
Phoenix Supersite	42	33	
Pinnacle Peak	49	38	
South Phoenix	47	37	
South Scottsdale	40	31	
West Phoenix	42	33	

**CO (CARBON MONOXIDE)**

SITE NAME	MAX 8-HR VALUE (PPM)	MAX AQI	AQI COLOR CODE
Buckeye	0.9	10	
Central Phoenix	1.3	15	
Dysart	0.4	5	
Glendale	0.7	8	
Greenwood	1.2	14	
Mesa	0.3	3	
North Phoenix	0.8	9	
Phoenix Supersite	1.4	16	
South Phoenix	0.6	7	
South Scottsdale	0.9	10	
Tempe	0.8	9	
West Chandler	0.5	6	
West Indian School	1.7	19	
West Phoenix	1.5	17	

## PM-10 (PARTICLES)

SITE NAME	MAX 24-HR VALUE (ug/m3)	MAX AQI	AQI COLOR CODE
Buckeye	63.9	55	
Central Phoenix	38.7	35	
Coyote Lakes	30.9	28	
Durango	60.0	53	
Greenwood	58.9	53	
Higley	33.9	31	
Maricopa (Pinal County)	51.5	47	
Phoenix Supersite	30.1	27	
Queen Creek (Pinal County)	NOT AVBL	NOT AVBL	NOT AVBL
South Phoenix	40.7	37	
West Forty Third	70.8	59	
West Phoenix	49.7	45	

## 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 (ug/m3)	MAX AQI	AQI COLOR CODE
Durango	17.6	56	
Dysart	3.2	10	
Estrella Mountain Park	5.3	17	
Phoenix Supersite	12.1	39	
Vehicle Emissions Lab	5.8	19	
West Phoenix	11.6	38	

## LOCAL AIR POLLUTANTS IN DETAIL



### O3 (OZONE):

**Description** – This is a secondary pollutant that is formed by the reaction of other primary pollutants (precursors) such as VOCs (volatile organic compounds) and NO<sub>x</sub> (Nitrogen Oxides) in the presence of heat and sunlight.

**Sources** – VOCs are emitted from motor vehicles, chemical plants, refineries, factories, and other industrial sources. NO<sub>x</sub> is emitted from motor vehicles, power plants, and other sources of combustion.

**Potential health impacts** – Exposure to ozone can make people more susceptible to respiratory infection, result in lung inflammation, and aggravate pre-existing respiratory diseases such as asthma. Other effects include decrease in lung function, chest pain, and cough.

**Unit of measurement** – Parts per billion (ppb).

**Averaging interval** – Highest eight-hour period within a 24-hour period (midnight to midnight).

**Reduction tips** – Curtail daytime driving, refuel cars and use gasoline-powered equipment as late in the day as possible.

### **CO (CARBON MONOXIDE):**

**Description** – A colorless, odorless, poisonous gas formed when carbon in fuels is not burned completely.

**Sources** – In cities, as much as 95 percent of all CO emissions emanate from automobile exhaust. Other sources include industrial processes, non-transportation fuel combustion, and natural sources such as wildfires. Peak concentrations occur in colder winter months.

**Potential health impacts** – Reduces oxygen delivery to the body's organs and tissues. The health threat is most serious for those who suffer from cardiovascular disease.

**Unit of measurement** – Parts per million (ppm).

**Averaging interval** – Highest eight-hour period within a 24-hour period (midnight to midnight)

**Reduction tips** – Keep motor vehicle tuned properly and minimize nighttime driving.

### **PM-10 & PM-2.5 (PARTICLES):**

**Description** – The term “particulate matter” (PM) includes both solid particles and liquid droplets found in air. Many manmade and natural sources emit PM directly or emit other pollutants that react in the atmosphere to form PM. Particles less than 10 micrometers in diameter tend to pose the greatest health concern because they can be inhaled into and accumulate in the respiratory system. Particles less than 2.5 micrometers in diameter are referred to as “fine” particles and are responsible for many visibility degradations such as the “Valley Brown Cloud” (see <http://www.phoenixvis.net/>). Particles with diameters between 2.5 and 10 micrometers are referred to as “coarse”.

**Sources** – Fine = All types of combustion (motor vehicles, power plants, wood burning, etc.) and some industrial processes. Coarse = crushing or grinding operations and dust from paved or unpaved roads.

**Potential health impacts** – PM can increase susceptibility to respiratory infections and can aggravate existing respiratory diseases, such as asthma and chronic bronchitis.

**Units of measurement** – Micrograms per cubic meter (ug/m<sup>3</sup>)

**Averaging interval** – 24 hours (midnight to midnight).

**Reduction tips** – Stabilize loose soils, slow down on dirt roads, carpool, and use public transit.

{ Updated 09/24/2007 }



**MARICOPA COUNTY  
DUST CONTROL ACTION FORECAST  
ISSUED FRIDAY, FEBRUARY 29, 2008**

Three-day weather outlook:

Afternoon desert temperatures will reach the low to mid 80s on Saturday with increasing winds ahead of an approaching trough of low pressure. This system is lacking moisture and will be primarily a wind-maker. As a result, gusty winds are expected across much of Arizona on Sunday as the system pushes through. Winds will decrease a bit on Monday with afternoon desert temperatures holding in the mid to upper 70s under mostly sunny skies. Thus, the risk of exceeding the 24-hr PM10 health standard in Phoenix will be "Moderate" on Saturday, dropping back to "Low" by Monday..

**R I S K   F A C T O R S**

	<u>WINDS</u>	+	<u>STAGNATION</u>	=	<u>RISK LEVEL</u>
<b>Day #1: Sat 03/01/2008</b>	Southwest 15 to 20 mph are expected much of the day.		Little to no stagnation is expected.		LOW
<b>Day #2: Sun 03/02/2008</b>	Northwest winds 5 to 10 mph are expected early, becoming west 15 to 20 mph during the afternoon with stronger gusts possible.		Little to no stagnation is expected.		MODERATE
<b>Day #3: Mon 03/03/2008</b>	Northwest winds 10 to 15 mph are likely early, decreasing by the afternoon.		Little to no stagnation is expected.		LOW

To review the complete air quality forecast for the Phoenix metropolitan area visit [www.azdeq.gov](http://www.azdeq.gov) or call 602-771-2367 for recorded forecast information.



Janet Napolitano, Governor  
 Stephen A. Owens, ADEQ Director

**YUMA AND VICINITY  
 DUST CONTROL ACTION FORECAST  
 ISSUED FRIDAY, FEBRUARY 29, 2008**

Three-day weather outlook:

Afternoon desert temperatures will reach the low to mid 80s on Saturday with increasing winds ahead of an approaching trough of low pressure. This system is lacking moisture and will be primarily a wind-maker. As a result, gusty winds are expected across much of Arizona on Sunday as the system pushes through. Winds will decrease a bit on Monday with afternoon desert temperatures holding in the mid to upper 70s under mostly sunny skies. The risk on wind-blown dust in Yuma will be "HIGH" on Sunday, dropping to "Moderate" on Monday.

	<u>WINDS</u>	<u>WIND BLOWN DUST RISK</u>
<b>Day #1: Sat 03/01/2008</b>	Southeast winds 10 to 20 mph are expected much of the day.	<b>LOW</b>
<b>Day #2: Sun 03/02/2008</b>	North winds 15-20 mph are expected early, increasing to 20 to 25 mph by the afternoon with occasional higher gusts.	<b>HIGH</b>
<b>Day #3: Mon 03/03/2008</b>	North winds 15 to 20 mph are likely early, decreasing by the afternoon hours.	<b>MODERATE</b>

**PM-10 & PM-2.5 (PARTICLES)**

**Description** – The term “particulate matter” (PM) includes both solid particles and liquid droplets found in air. Many manmade and natural sources emit PM directly or emit other pollutants that react in the atmosphere to form PM. Particles less than 10 micrometers in diameter tend to pose the greatest health concern because they can be inhaled into and accumulate in the respiratory system. Particles less than 2.5 micrometers in diameter are referred to as “fine” particles and are responsible for many visibility degradations (brown cloud). Particles with diameters between 2.5 and 10 micrometers are referred to as “coarse”.

**Sources** – Fine = All types of combustion (motor vehicles, power plants, wood burning, etc.) and some industrial processes. Coarse = crushing or grinding operations and dust from paved or unpaved roads.

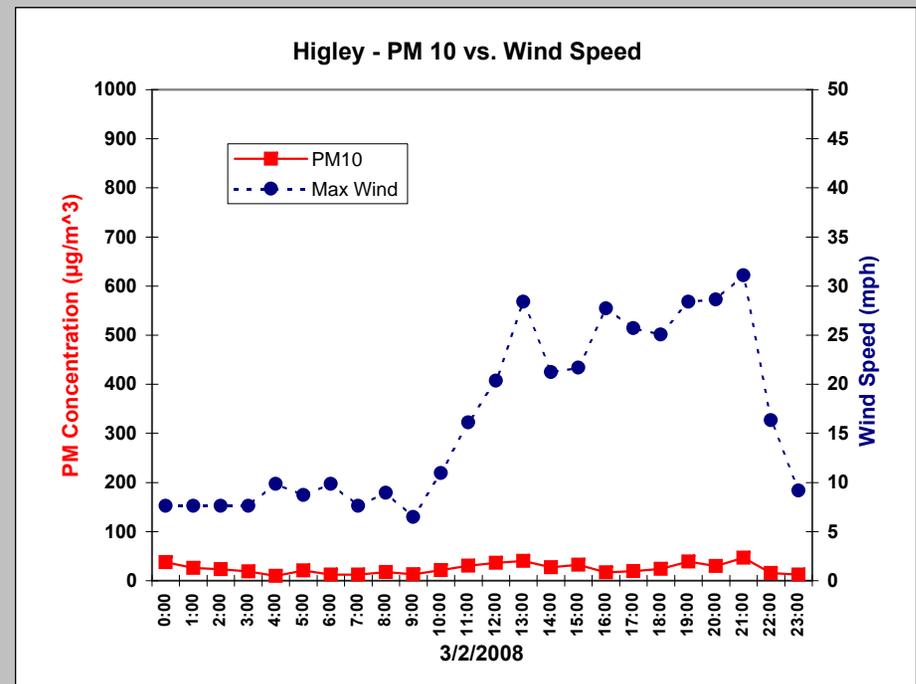
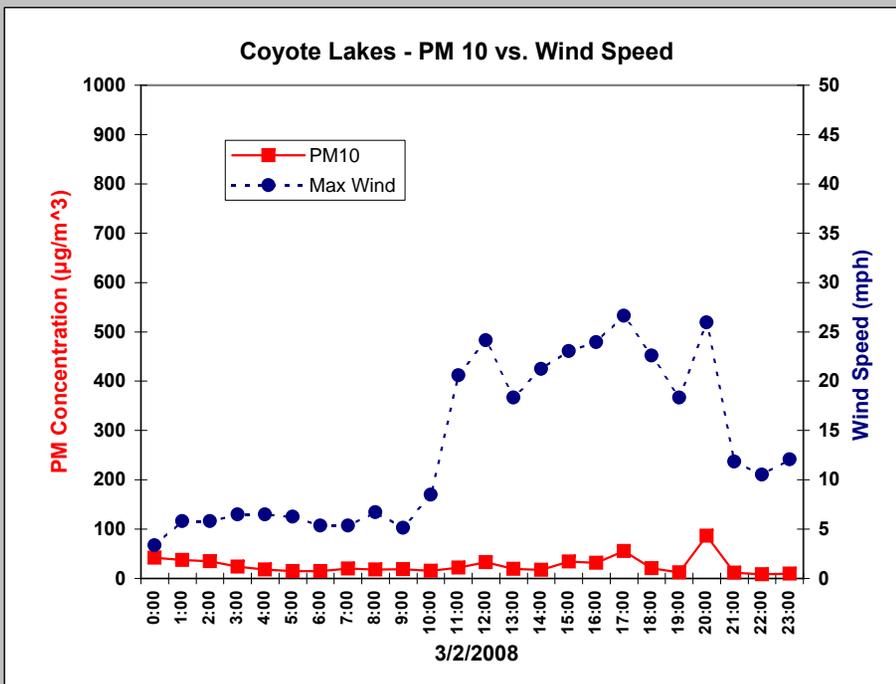
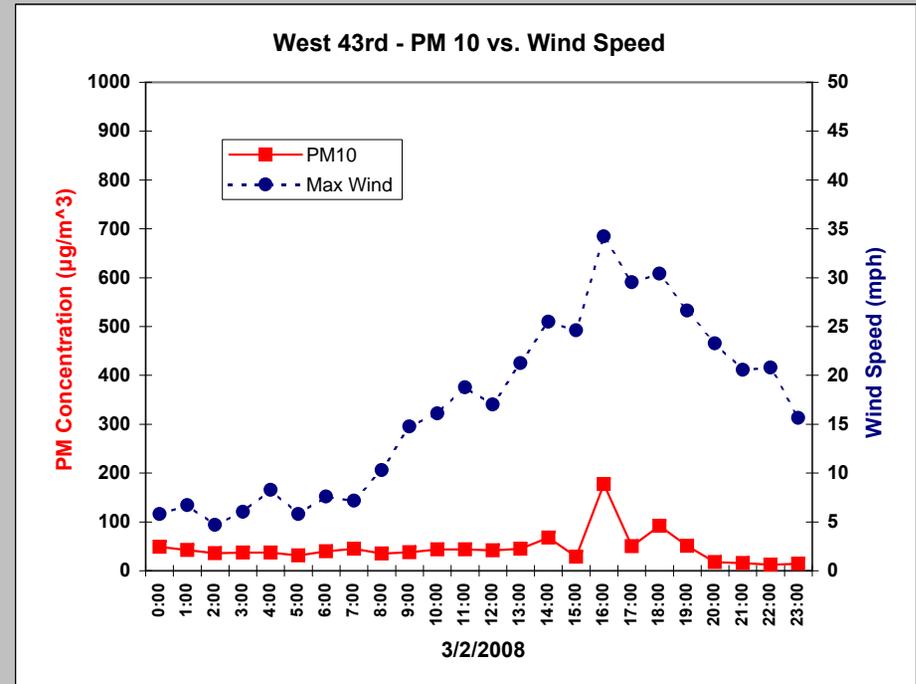
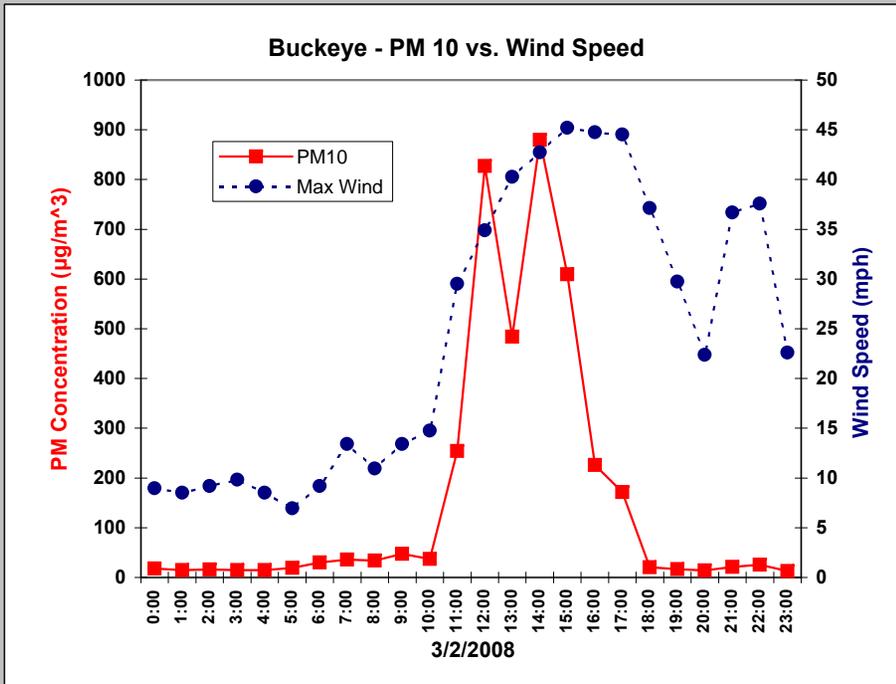
**Potential health impacts** – PM can increase susceptibility to respiratory infections and can aggravate existing respiratory diseases, such as asthma and chronic bronchitis.

**Units of measurement** – Micrograms per cubic meter (ug/m3)

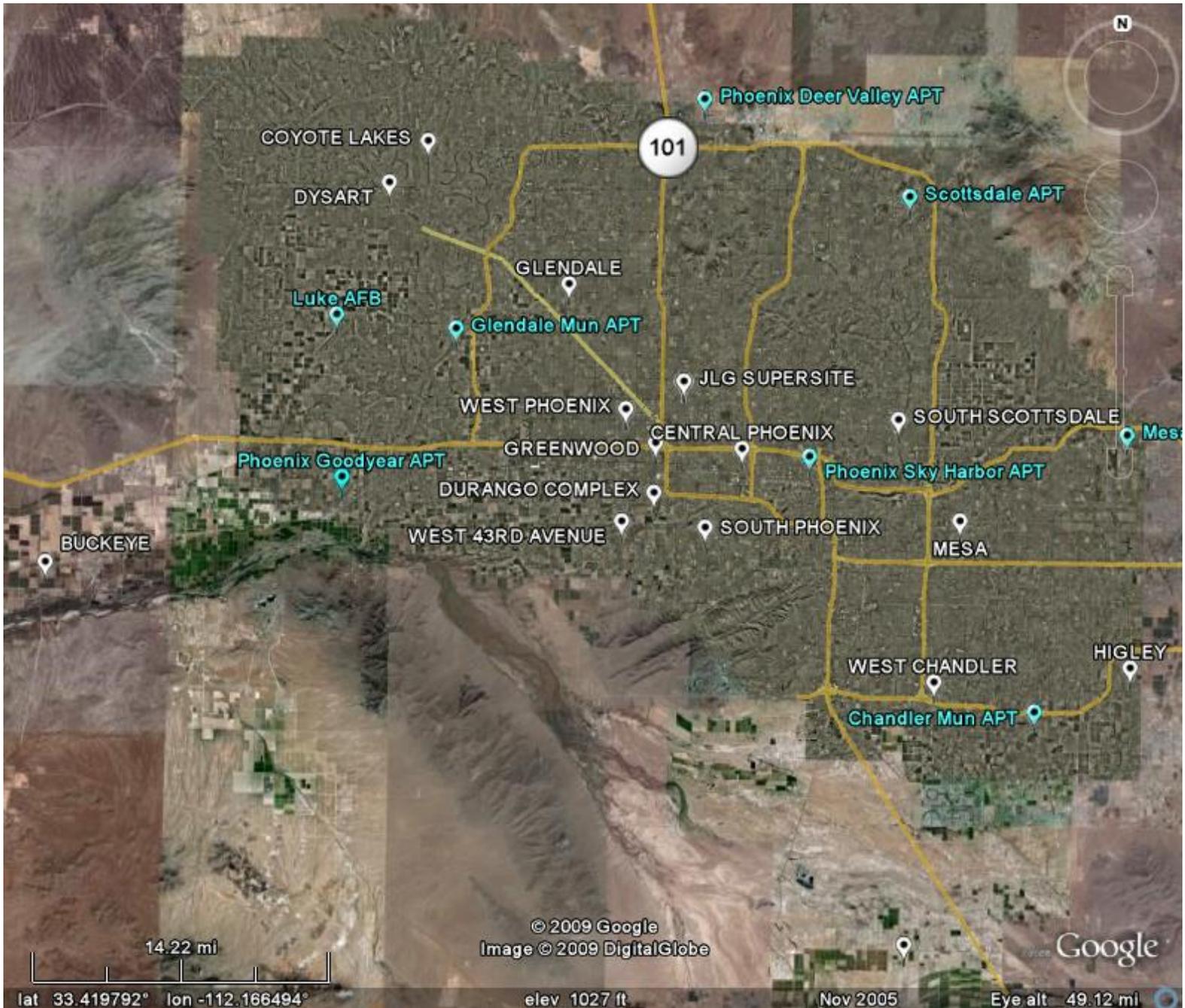
**Averaging interval** – 24 hours (midnight to midnight).

**Reduction tips** – Stabilize loose soils, minimize travel on dirt roads, utilize tarps on haul trucks, limit use of leaf-blowers, and on high-wind days reduce outdoor activities.

# 03/02/2008 - ADDITIONAL GRAPHS

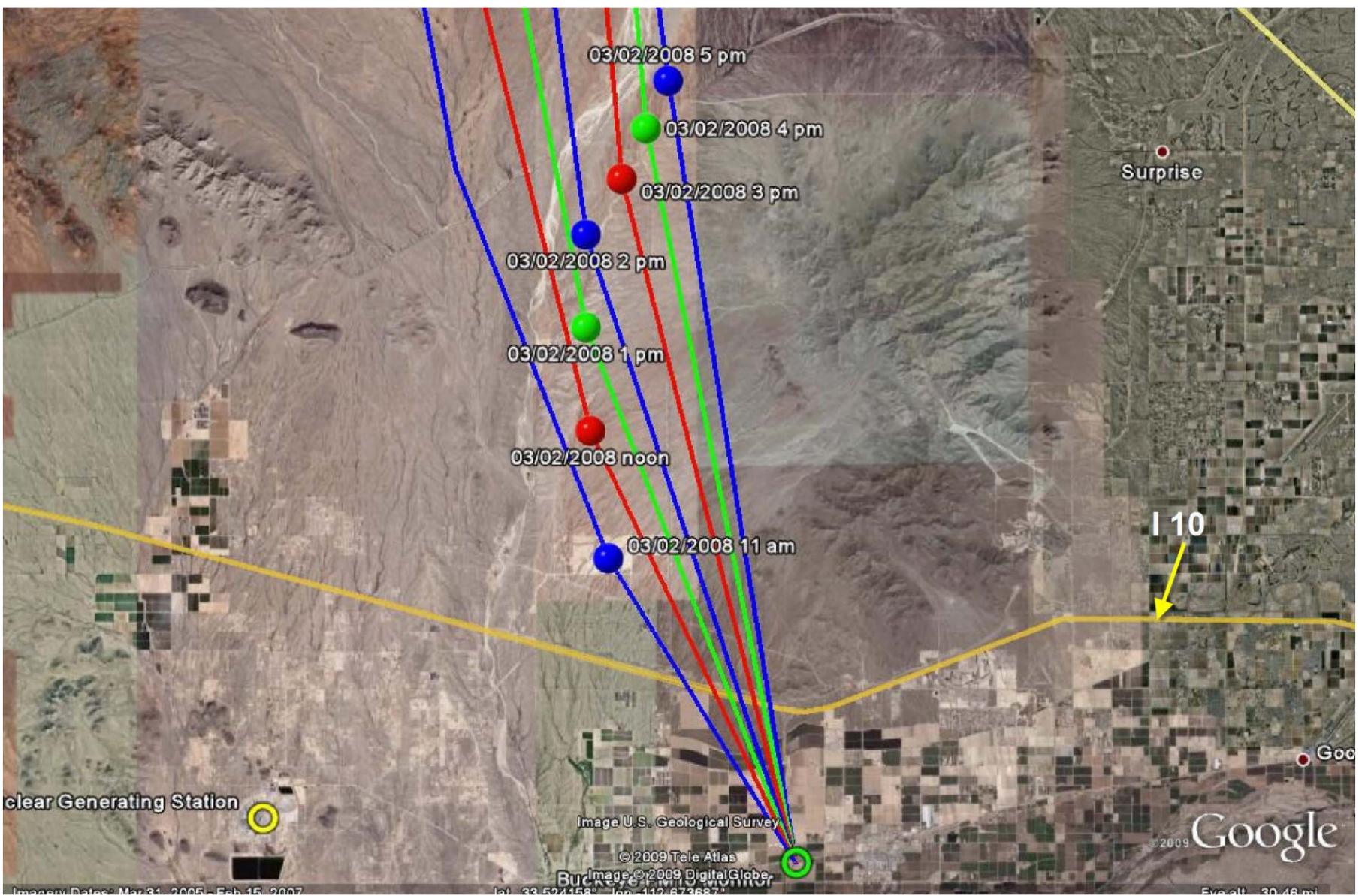


## Phoenix Area PM<sub>10</sub> and Meteorological Monitors



Source: US EPA, ADEQ, & Google Earth

# Hysplit Trajectories – March 2, 2008 – Buckeye, Arizona



## Construction Activities Near Buckeye Monitor Location

