



MONTHLY AIR QUALITY REPORT FOR
DECEMBER 2010

AOI COLOR SCALE

GOOD	MODERATE	UNHEALTHY FOR SENSITIVE GROUPS	UNHEALTHY
0-50	51-100	101-150	151-200

Calendar of maximum AQI values & their corresponding color for December 2010*

*Preliminary data

SAMPLE POLLUTANT REPORTING BOX

1 (day of month)	O3	CO
	PM10	PM2.5

	SUN	MON	TUES	WED	THU	FRI	SAT						
				1	34 25 64 77	2	32 32 62 65	3	33 38 76 73	4	31 35 61 73		
5	35 26 55 80	6	33 26 65 69	7	37 18 57 61	8	38 23 65 72	9	35 23 62 71	10	31 22 67 73	11	31 28 55 75
12	33 19 58 86	13	29 25 80 65	14	32 20 61 60	15	26 24 64 66	16	20 16 46 46	17	34 11 19 66	18	30 14 19 61
19	28 15 22 57	20	26 19 42 50	21	29 15 52 52	22	33 11 21 38	23	36 13 14 43	24	27 20 51 137	25	34 34 52 165
26	32 11 17 45	27	31 13 29 58	28	31 15 36 71	29	33 15 29 53	30	35 08 13 30	31	36 13 23 63		

Calendar of High Pollution Advisories and Health Watches issued during December 2010

SUN			MON			TUE			WED			THU			FRI			SAT		
									1			2			3			4		B
5	B	6			7			8			9			10		E	11			E
12	E	13			14			15			16			17			18			
19		20			21			22			23			24		E	25		B	
26		27			28			29			30			31	B					

LEGEND

HIGH POLLUTION ADVISORIES

- A** = PM-10 High Pollution Advisory
- B** = PM-2.5 High Pollution Advisory
- C** = Ozone High Pollution Advisory

HEALTH WATCHES

- D** = PM-10 Health Watch
- E** = PM-2.5 Health Watch
- F** = Ozone Health Watch

Calendar of Meteorological Conditions observed in Metro Phoenix during December 2010

SUN			MON			TUE			WED			THU			FRI			SAT		
									1			2		E	3		E	4		
5	E	6			7		E	8		E	9			10		E	11		E	
12	E	13		E	14		E	15		B	16		B C	17		E C	18		B C	
19		20			21		B	22	A B C	B C	23	A B C	E C	24		E F	25		E F	
26	E	27		E	28		E C	29		B C	30	A B C	E	31						

LEGEND

ELECTROMETEORS

- A** = Thunderstorm

HYDROMETEORS

- B** = Rain/Drizzle/Hail/Snow
- C** = Fog

LITHOMETEORS

- D** = Blowing Dust
- E** = Haze (vsby <10SM)
- F** = Smoke

Exceedance days during DEC 2010-

Total=	<u>Date</u>	<u>Max AQI</u>	<u>Pollutant</u>	<u>Site/s</u>
2	12/24	137	PM-2.5	South Phoenix
	12/25	165	PM-2.5	South Phoenix

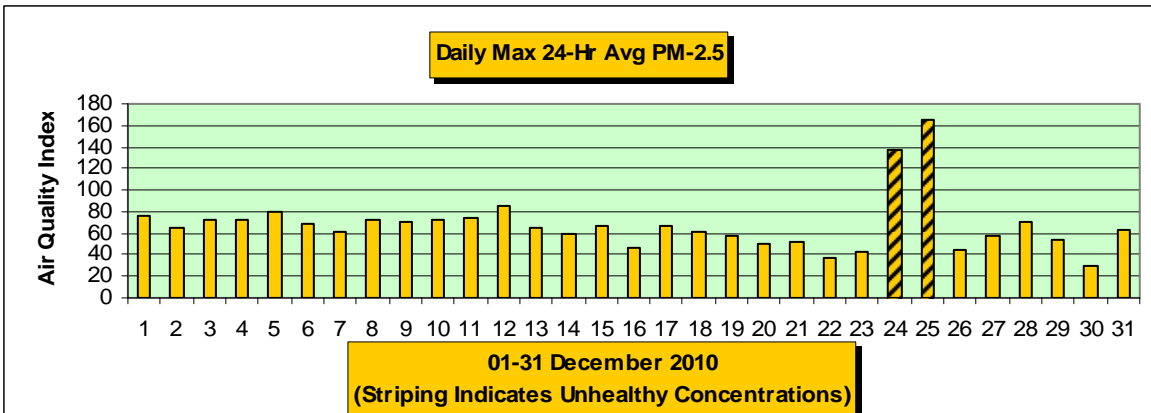
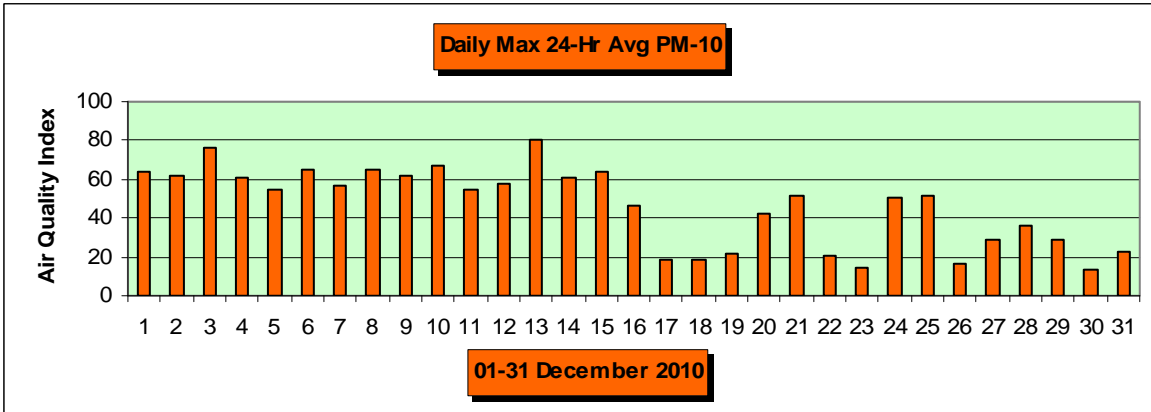
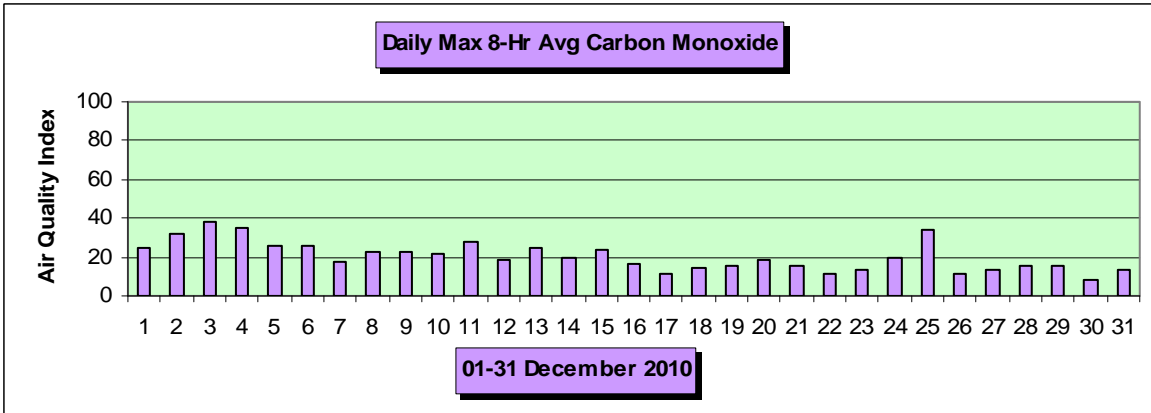
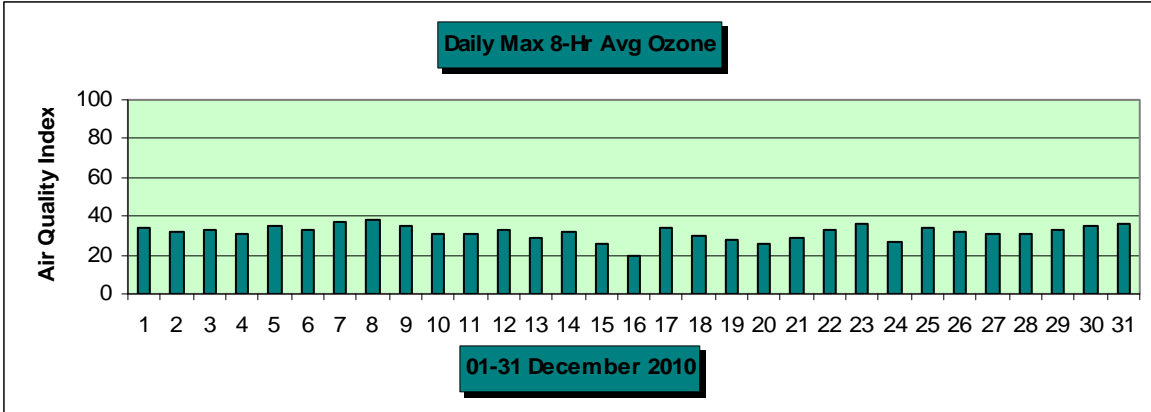
Health Watches issued during DEC 2010-

Total=	<u>Date</u>	<u>Max AQI</u>	<u>Pollutant</u>	<u>Site/s</u>
5	12/03	73	PM-2.5	Durango
	12/10	73	PM-2.5	Durango
	12/11	75	PM-2.5	Phoenix Supersite
	12/12	86	PM-2.5	West Phoenix
	12/24	137	PM-2.5	South Phoenix

High Pollution Advisories issued during DEC 2010-

Total=	<u>Date</u>	<u>Max AQI</u>	<u>Pollutant</u>	<u>Site/s</u>
4	12/04	73	PM-2.5	South Phoenix
	12/05	80	PM-2.5	Durango
	12/25	165	PM-2.5	South Phoenix
	12/31	63	PM-2.5	South Phoenix

<u>Concentration Recap:</u>	Days in the Good category:	6
	Days in the Moderate category:	23
	Days in the Unhealthy for Sensitive Groups category:	1
	Days in the Unhealthy category:	<u>1</u>
	Total Forecast Days:	31



Narrative:

Although not in the unhealthy range, air quality in the Phoenix metro area deteriorated during the first two weeks of December with elevated concentrations of both coarse (PM-10) and fine (PM-2.5) particle pollution thru the period. This was due to a variety of factors that included a stable synoptic weather pattern featuring a very strong ridge aloft either overhead or nearby, a lengthy period of air mass stagnation due to warming aloft associated with the ridge (see [Figure 1](#)), unfavorable boundary-layer characteristics due to the stagnation (see [Figures 2 and 3](#)), mostly light or calm winds, and no rainfall.

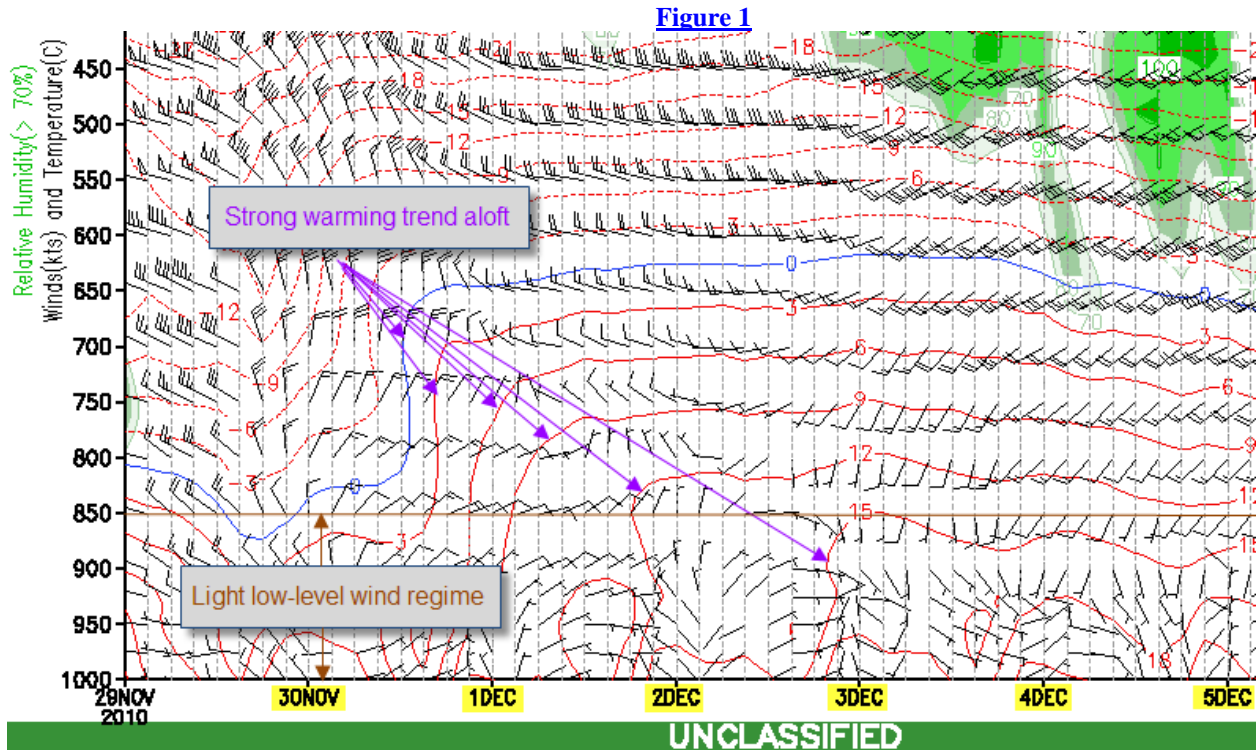


Figure 2

ACARS-BASED BOUNDARY LAYER PROFILE FOR PHOENIX METRO AREA

DATE	Wednesday	Dec 01 2010
Inversion Strength	9.6/17.3	Degrees C/F
Inversion Height	3232	Feet AGL
Inversion Break Temp	75	Degrees F
Forecast High Temp	71	Degrees F
Best Mixing Depth	2902	Feet AGL
Mean Wind Speed	Near-calm p.m.	Knots
Ventilation Index	POOR	-----

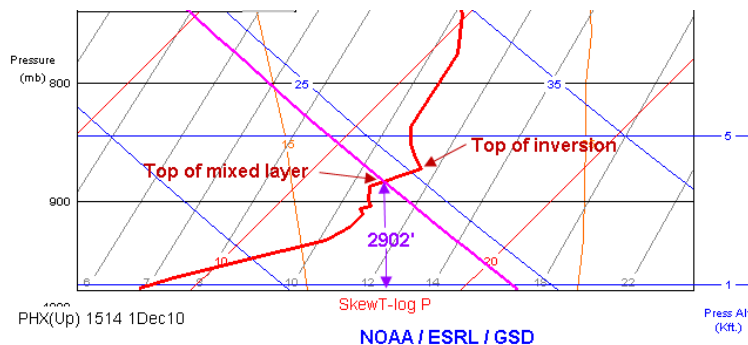
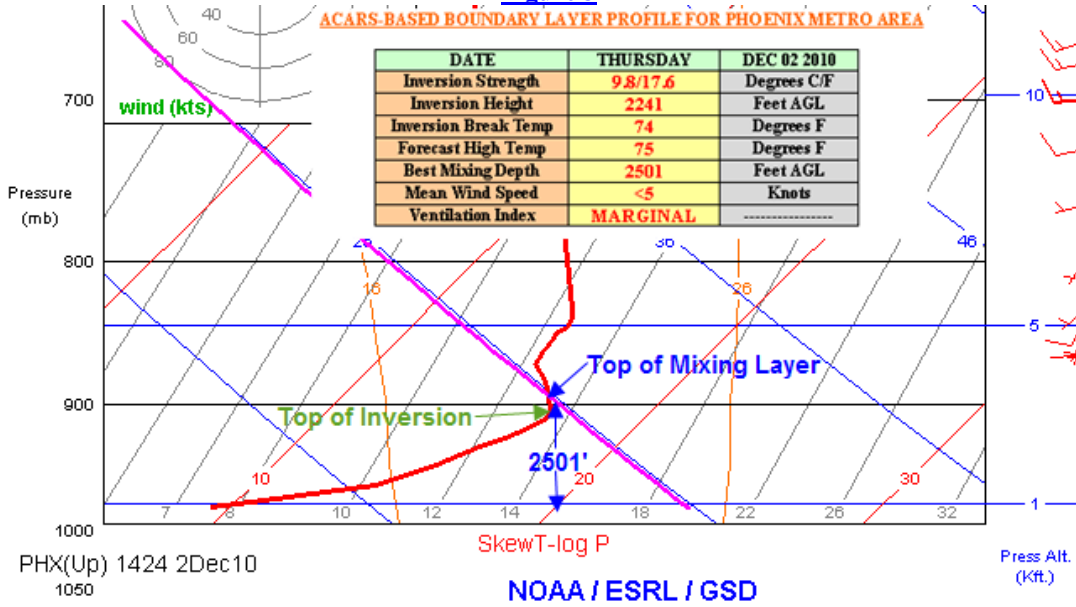


Figure 3



The graphs shown in [Figure 4](#) show the magnitude of the air mass stagnation situation. Mixing depths were low each afternoon in the wake of strong and tall surface-based radiation inversions that formed overnight. This – plus the combination of light or calm winds – yielded poor to marginal dispersion on all but one day during the period. Not surprisingly, suspended particles within the trapped layers led to degradations in visibility nearly every day with haze restrictions at times of <10 miles ([Figures 5-9](#)).

Figure 4

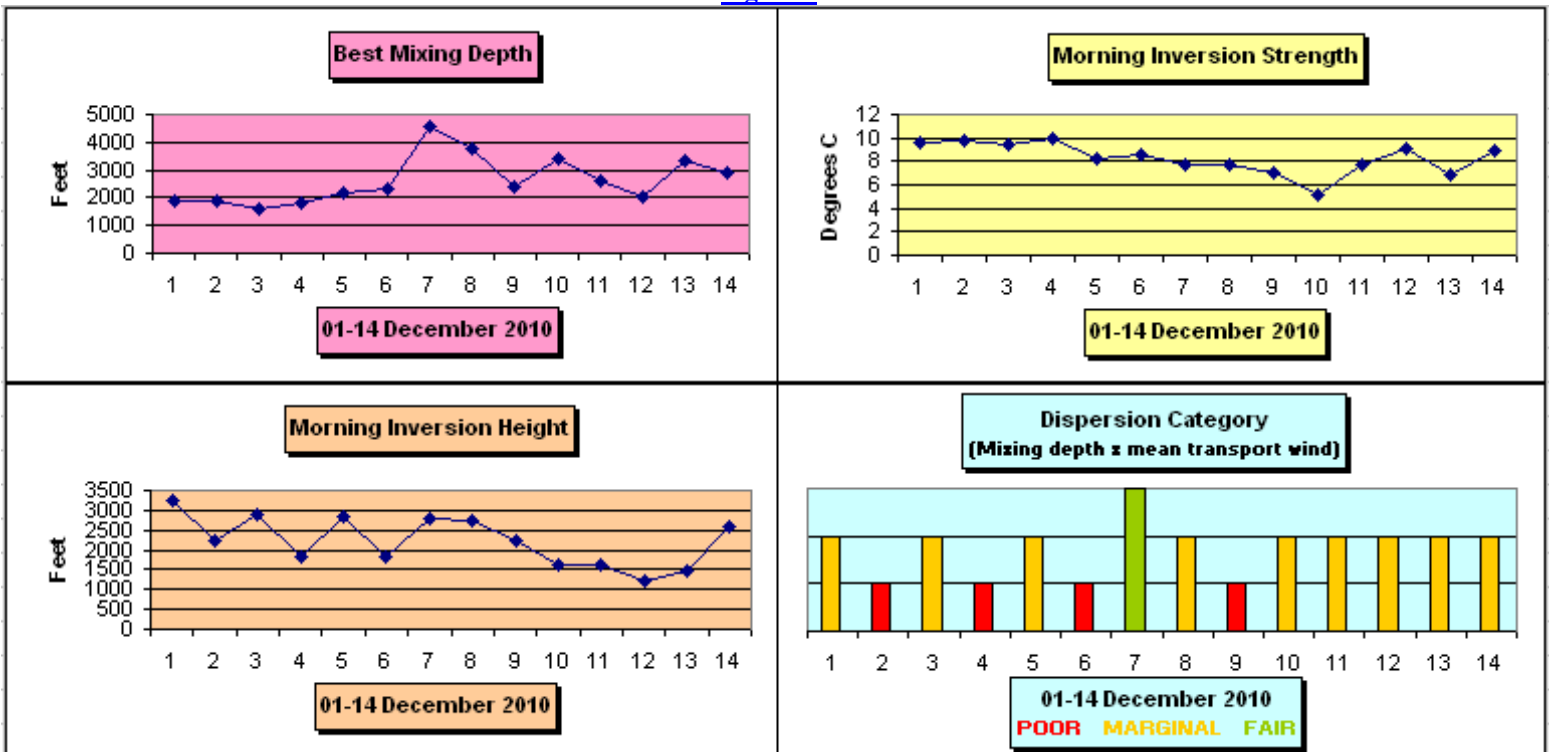


Figure 5



Figure 6



Figure 7



Figure 8

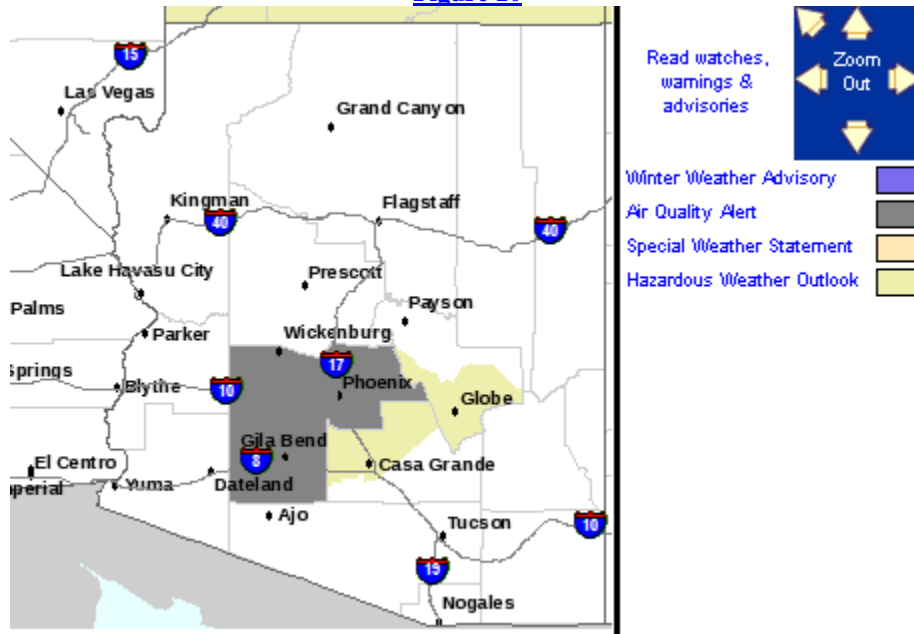


Figure 9



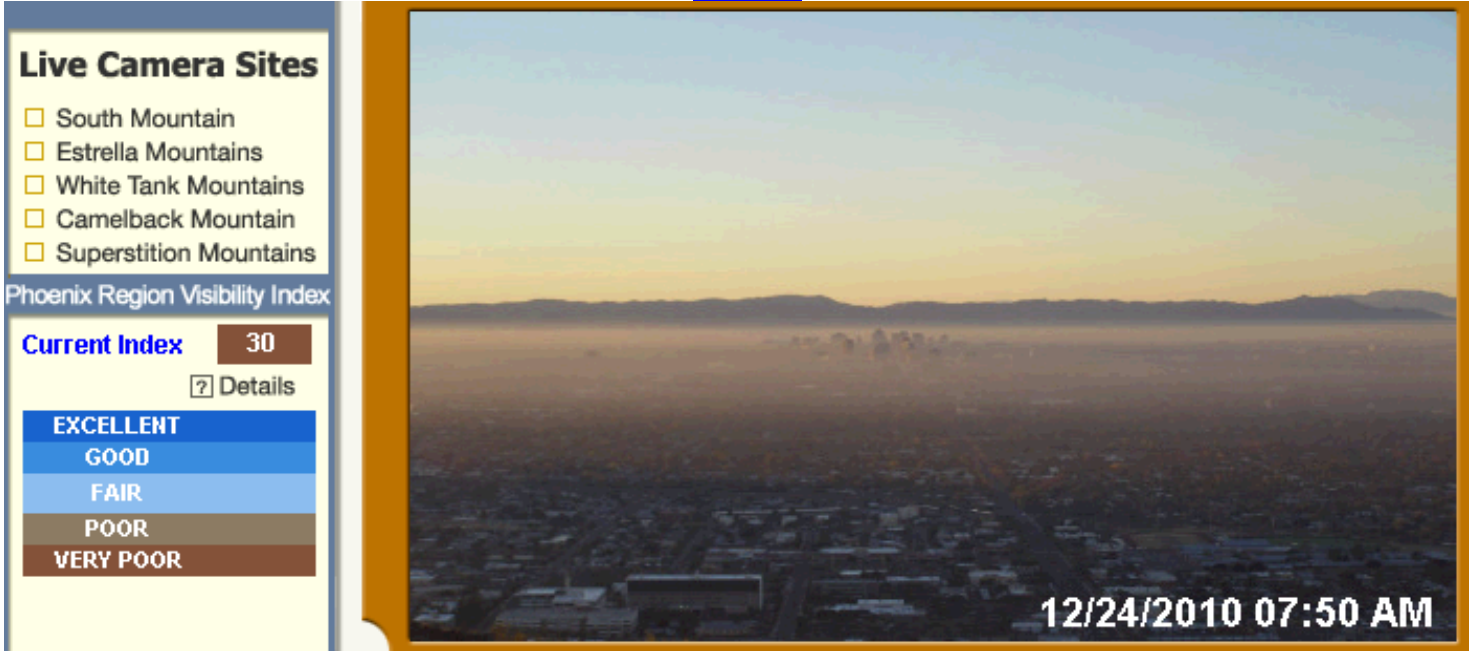
Adding to the problem this time of year is the propensity for local residents to use wood-burning fireplaces and appliances to augment the already festive holiday atmosphere – in some cases despite very warm daytime high temperatures. (Record high maximum temperatures in the 78-82 degree F range were reported at Sky Harbor Airport between the 12th and 14th of the month). Smoke from this activity adds to the already high fine particle (PM-2.5) levels produced by rush-hour traffic and other sources while being aggravated by the aforementioned air mass stagnation. PM-2.5 levels reached or exceeded the mid-moderate range of the Air Quality Index on most days during the first two weeks of the month and this prompted the issuance of a series of Health Watches and High Pollution Advisories. These ADEQ notifications were followed by No Burn Day declarations by the Maricopa County Air Quality Department with the added hope that unhealthy levels of PM-2.5 would not occur. These actions had positive results during this prolonged period of stagnation. Fortunately, the weather pattern changed on the 15th and several trough and frontal passages occurred from the 16th thru the 23rd. Rain occurred in the metro area on the 15th, 16th, 18th, and from the 21st thru the 23rd. This much-needed precipitation stabilized local soils and as a result PM-10 levels were mostly in the good range of the Air Quality Index for the remainder of the month. Improved dispersion, higher winds at times, and weaker inversions also helped the PM-2.5 situation with AQI levels in the good to low-moderate range of the AQI thru the 23rd. Unfortunately, the trend in the Valley since 2005 is for wood-burning activity to increase exponentially on Christmas Eve and continue on Christmas Day. Armed with this knowledge – and noting that a ridge aloft was forecast to begin building overhead on the 24th – forecasters were compelled to issue a PM-2.5 Health Watch for the 24th and a PM-2.5 High Pollution Advisory for the 25th (see Figure 10) with county No Burn Day declarations for both days.

Figure 10



As can be seen from [Figures 11 and 12](#) below, smoke from overnight burning was already trapped in the Valley along with some fog by the morning of the 24th. Even though dispersion was fair on the 24th and good on the 25th, the massive amounts of smoke emissions that were subsequently released beginning around 6:00 p.m. on Christmas Eve (see the PM-2.5 time-series graphs for three monitoring sites in [Figures 13-15](#)) resulted in two exceedances on the 24th and three on the 25th.

[Figure 11](#)



[Figure 12](#)

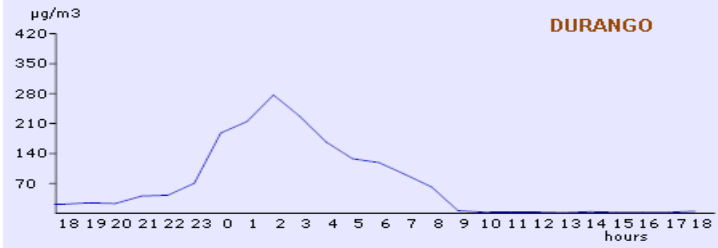


Figure 13

Particulate Matter 2.5 micrometers (PM 2.5)

Date & Time: 12-25-2010 6 PM

Last 24-Hours Readings:



Current Readings

AQI*: 154
Units: µg/m3

Time	Interval	Readings
6:00 PM	24 Hour Average	N/A
6:00 PM	Hourly Average	N/A
6:00 PM	24 Hour Average	71.3250
6:00 PM	Hourly Average	5.4000

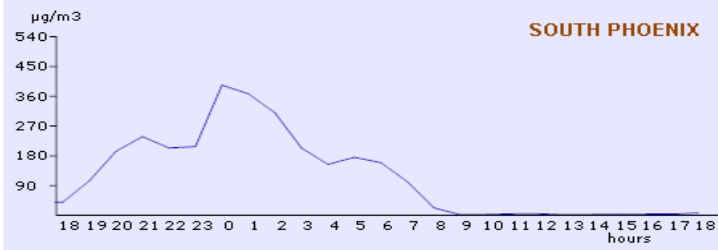
*Note: the AQI is based off of the 24-hour average.

Figure 14

Particulate Matter 2.5 micrometers (PM 2.5)

Date & Time: 12-25-2010 6 PM

Last 24-Hours Readings:



Current Readings

AQI*: 182
Units: µg/m3

Time	Interval	Readings
6:00 PM	24 Hour Average	N/A
6:00 PM	Hourly Average	N/A
6:00 PM	24 Hour Average	119.9208
6:00 PM	Hourly Average	7.9000

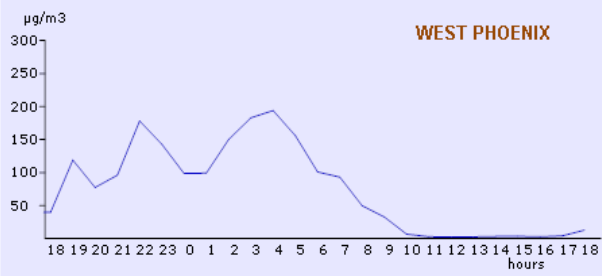
*Note: the AQI is based off of the 24-hour average.

Figure 15

Particulate Matter 2.5 micrometers (PM 2.5)

Date & Time: 12-25-2010 6 PM

Last 24-Hours Readings:



Current Readings

AQI*: 157
Units: µg/m3

Time	Interval	Readings
6:00 PM	24 Hour Average	N/A
6:00 PM	Hourly Average	N/A
6:00 PM	24 Hour Average	75.5083
6:00 PM	Hourly Average	12.9000

*Note: the AQI is based off of the 24-hour average.

The other grim statistic that resulted was that except for 2008, every year between 2005 and 2010 unhealthy levels of PM-2.5 have been measured on both December 24 and 25 (see [Figure 16](#) below). Although an increase in winds and very good visibility occurred on Christmas Day, due to the extremely high levels of PM-2.5 during the early morning hours (393.9ug/m3 at midnight), 24-hour averages for the day were still in the RED Unhealthy range of the AQI.

Figure 16

RECENT VALLEY PM-2.5 MAX AQI CLIMATOLOGY						
(**preliminary data**)						
Date	2005	2006	2007	2008	2009	2010
23-Dec	83	109	101	54	30	43
24-Dec	111	140	129	65	111	137
25-Dec	120	157	154	57	168	165
26-Dec	59	82	58	16	84	45
27-Dec	48	71	35	66	69	58
28-Dec	57	48	43	84	63	71
29-Dec	64	64	75	82	56	53
30-Dec	74	97	106	67	62	30
31-Dec	84	125	118	115	54	63
HIGHEST HOURLY PM-2.5 CONCENTRATIONS						
(<u>UG/M3</u>)/time & 24-hour Average AQI color (**preliminary data**)						
Date	2005	2006	2007	2008	2009	2010
24-Dec	<u>176.3/2300</u>	<u>180.1/2300</u>	<u>195.5/2100</u>	<u>76.0/2300</u>	<u>199.3/2300</u>	<u>238.4/2100</u>
25-Dec	<u>179.7/2400</u>	<u>180.1/2400</u>	<u>273.8/0300</u>	<u>64.9/0200</u>	<u>232.8/0400</u>	<u>393.9/2400</u>

Although the unsettled weather conditions associated with another trough passage that occurred on the 26th and 27th helped bring much cleaner air over the city, PM-2.5 levels remained elevated – peaking on the 28th when another ridge approached. Dispersion was poor that day and Figures 17-19 show the impacts on local visibility of smoke combined with high relative humidity. Using the above climatology to assess the potential for another high PM-2.5 event on New Year’s Eve day, a PM-2.5 High Pollution Advisory/No Burn Day issuance occurred for Dec 31. The Valley was spared unhealthy air quality on that day – but not on January 1 – as can be seen in [Figure 20](#) which shows daily peak PM-10 and PM-2.5 AQI levels for December 1 2010 – January 1 2011. -Reith

[Figure 17](#)



[Figure 18](#)



Figure 19



Figure 20

Daily Max Phoenix Metro PM-10 & PM-2.5 Levels

