



# **Ozone Season Summary**

# **2012**

Sunil Kumar

ACPAC

September 10, 2012



# Ozone Season Summary

[As of September 6, 2012]

## Peak 8-Hour Ozone Concentrations (ppb)

Since April 1, 2012, there have been:

- 3 Code Red Days
- 16 Code Orange Days
- 59 Code Yellow Days
- 81 Code Green Days

**April**

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
1	2	3	4	5	6	7
46	68	55	59	43	52	55
8	9	10	11	12	13	14
62	54	59	33	41	52	63
15	16	17	18	19	20	21
67	61	50	31	56	65	65
22	23	24	25	26	27	28
64	40	57	61	54	65	52
29	30					
58	58					

**May**

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
		1	2	3	4	5
		57	45	53	49	57
6	7	8	9	10	11	12
48	50	49	61	61	58	70
13	14	15	16	17	18	19
64	47	47	70	55	64	75
20	21	22	23	24	25	26
65	34	47	52	68	58	55
27	28	29	30	31		
47	49	46	69	80		

**June**

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
					1	2
					53	52
3	4	5	6	7	8	9
58	42	44	50	53	57	74
10	11	12	13	14	15	16
88	65	35	56	59	62	63
17	18	19	20	21	22	23
53	33	84	86	96	77	65
24	25	26	27	28	29	30
72	65	45	52	79	110	72

**July**

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
1	2	3	4	5	6	7
73	67	81	80	91	98	81
8	9	10	11	12	13	14
86	55	61	67	66	69	55
15	16	17	18	19	20	21
46	69	90	76	87	46	31
22	23	24	25	26	27	28
40	59	57	66	73	74	68
29	30	31				
61	64	59				

**August**

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
			1	2	3	4
			77	73	67	63
5	6	7	8	9	10	11
42	68	69	66	73	47	56
12	13	14	15	16	17	18
51	65	63	67	70	70	53
19	20	21	22	23	24	25
39	53	69	70	75	78	57
26	27	28	29	30	31	
34	52	59	62	69	74	

**September**

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
			1	2	3	4
			55	49	42	38
5	6	7	8	9	10	11
47	47					
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		



## 2012 Ozone Exceedances (As of September 6)

Date	# of Monitors Exceeding	Highest Monitor	Highest Concentration (ppb)
5/31/2012	1	Calvert	80
6/10/2012	8	McMillan	88
6/19/2012	5	Arlington	86
6/20/2012	8	Alexandria	86
6/21/2012	9	Alexandria / Franconia	96
6/22/2012	2	Southern Maryland	77
6/28/2012	2	McMillan Reservoir	79
6/29/2012	13	Calvert	110

\* Analysis is based on draft data until September 6, 2012. Data is subject to change.



## 2012 Ozone Exceedances (As of September 6)

Date	# of Monitors Exceeding	Highest Monitor	Highest Concentration (ppb)
7/03/2012	3	Prince Georges	81
7/04/2012	2	Prince Georges	80
7/05/2012	6	Calvert	91
7/06/2012	7	Franconia	106
7/07/2012	5	Prince Georges	81
7/08/2012	7	Prince Georges	86
7/17/2012	7	Prince Georges	90
7/18/2012	1	Prince Georges	76
7/19/2012	8	Prince Georges	87
8/01/2012	1	Franconia	77
8/24/2012	2	Long park	78

\* Analysis is based on draft data until September 6, 2012. Data is subject to change.



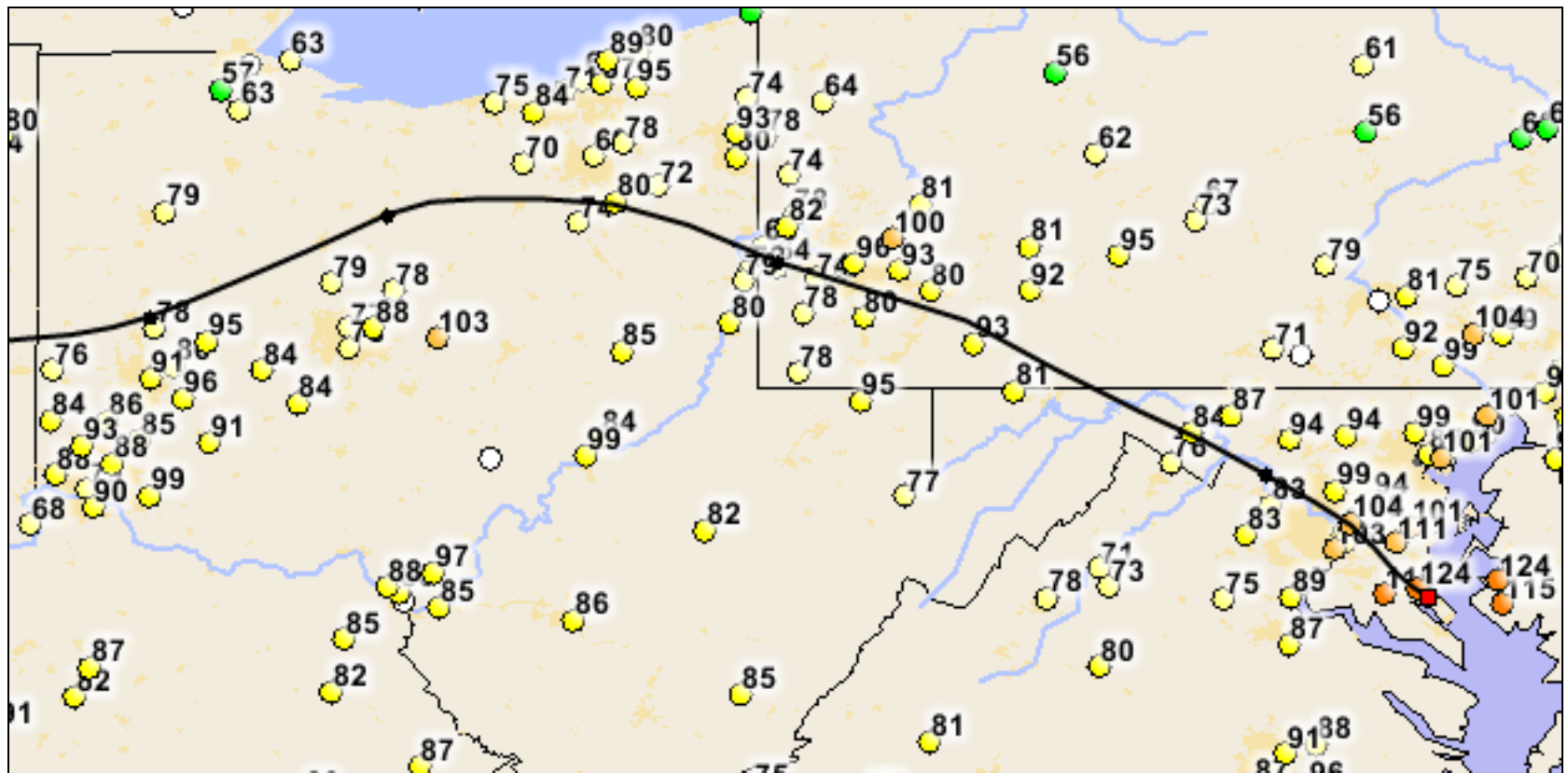
## What Caused Ozone Episodes ?

- ❖ High pressure system continuing for several days caused the following in our region -
  - Warm air
  - Limited winds
  - Limited or no clouds
  - Favorable meteorological conditions for ozone production
  
- ❖ Most of the days winds came from Ohio River Valley and beyond bringing ozone and its precursors (VOC & NO<sub>x</sub>) into our region.
  
- ❖ Local production of ozone combined with its transport from outside the region caused significant ozone build-up resulting in exceedances of ozone standard (75 ppb) on those days.



# Ozone & Precursor Transport - June 29<sup>th</sup> Code Red

- ❖ Winds came into Washington region from several polluted areas including the Ohio River Valley

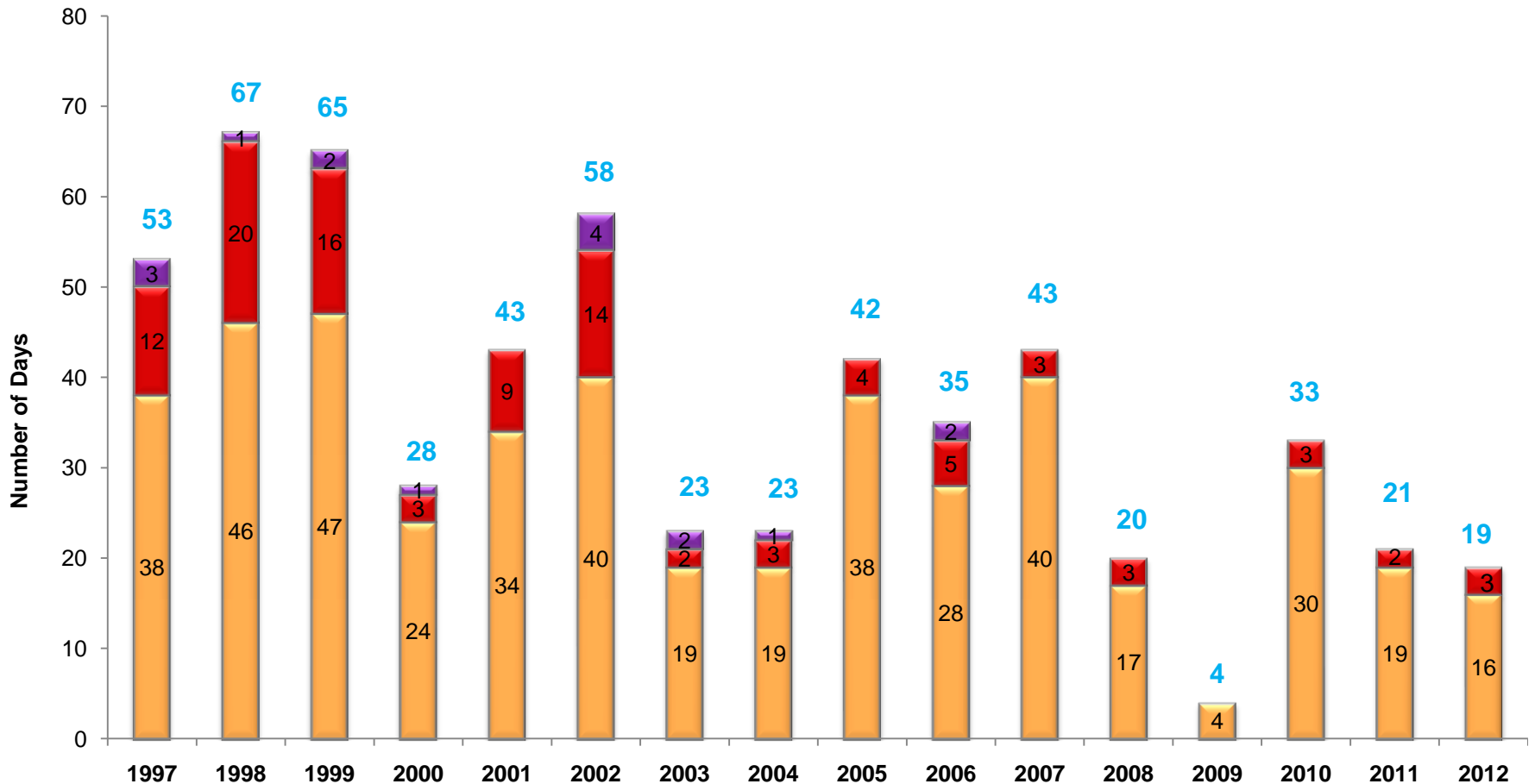


1-Hour Avg Ozone concentrations at 1:00PM  
(Avg of 12 PM – 1 PM)



# Ozone Exceedance Trend

**Number of Exceedance Days - 2008 Ozone Standard (75 ppb)  
Breakdown of Code Orange, Red, and Purple Days  
1997 - 2012**

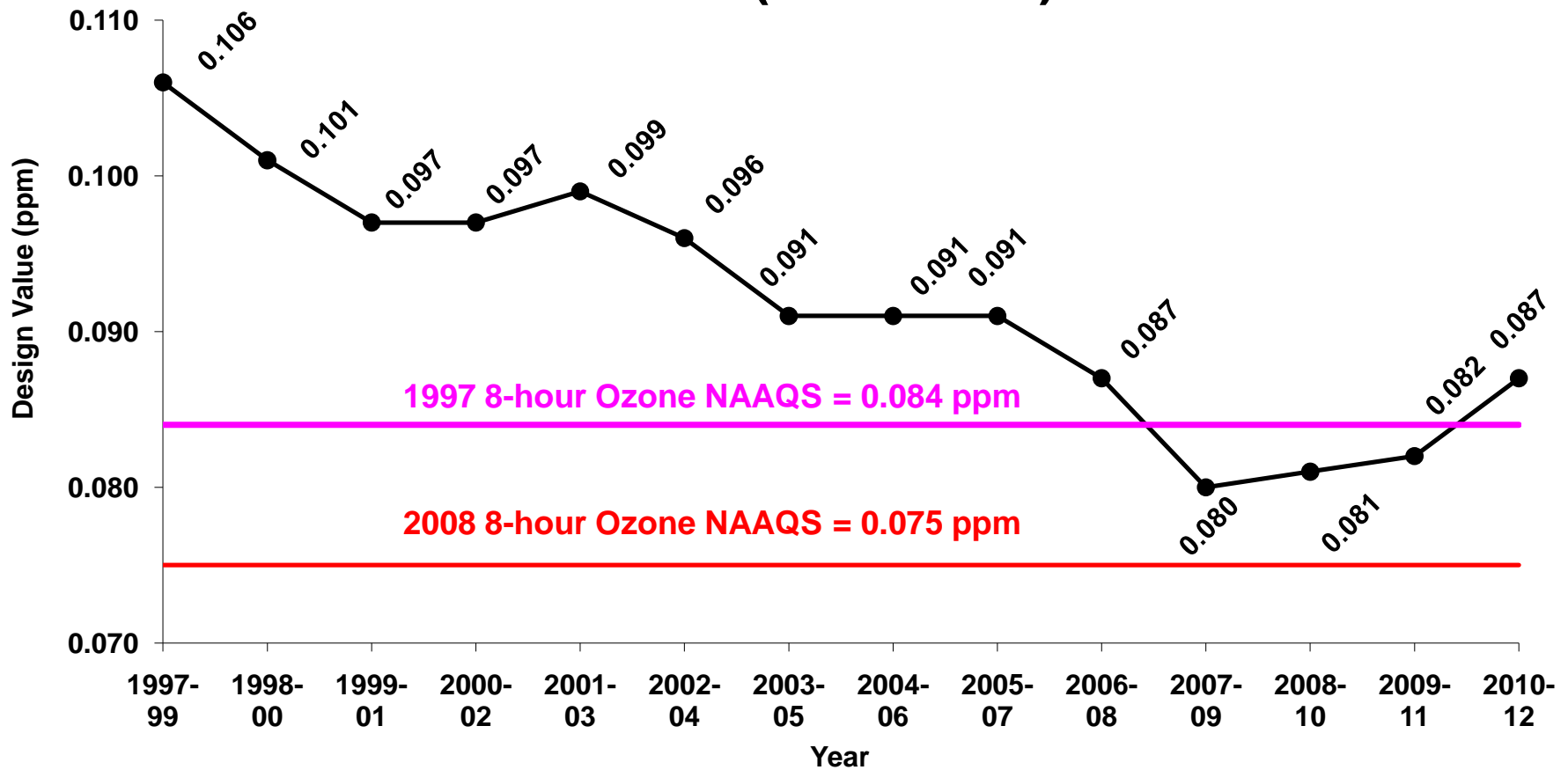


\* 2012 analysis is based on draft data as of September 6, 2012 and is subject to change.



# Ozone Design Value Trend

## 8-hour Ozone Design Value Washington, DC-MD-VA Nonattainment Area (1999-2012)



\* Design value = 3-year average of 4th highest daily maximum 8-hour average ozone concentrations. 2012 data is draft and may change.





# Fine Particle Summary

[As of September 6, 2012]

## 24-Hour PM2.5 Concentrations (ug/m3)

April

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
1	2	3	4	5	6	7
12.0	7.2	6.0	9.3	6.0	5.4	5.7
8	9	10	11	12	13	14
6.7	6.3	7.0	6.8	5.7	6.9	10.9
15	16	17	18	19	20	21
18.9	21.3	7.5	8.2	15.0	11.9	10.4
22	23	24	25	26	27	28
3.8	4.5	6.5	7.9	13.0	6.5	7.5
29	30					
10.3	9.5					

May

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
		1	2	3	4	5
		11.3	17.4	14.5	15.3	15.5
6	7	8	9	10	11	12
9.8	7.0	10.2	13.7	7.7	7.2	9.9
13	14	15	16	17	18	19
15.6	11.1	8.7	15.8	10.7	8.4	7.5
20	21	22	23	24	25	26
7.7	6.5	10.5	14.0	14.4	14.5	11.3
27	28	29	30	31		
8.9	10.6	8.8	10.0	10.3		

June

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
					1	2
					12.4	8.2
3	4	5	6	7	8	9
10.7	6.8	5.0	6.8	10.2	11.1	12.9
10	11	12	13	14	15	16
20.2	20.4	10.8	9.3	10.0	8.9	8.1
17	18	19	20	21	22	23
11.9	10.2	19.2	28.5	30.2	25.1	12.7
24	25	26	27	28	29	30
14.3	13.0	6.1	13.0	18.7	26.9	16.0

July

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
1	2	3	4	5	6	7
22.0	15.4	22.2	28.4	21.7	21.5	31.0
8	9	10	11	12	13	14
34.7	18.2	19.1	16.5	14.2	17.0	14.9
15	16	17	18	19	20	21
14.8	19.3	26.3	26.5	18.7	14.7	11.1
22	23	24	25	26	27	28
10.8	19.4	21.7	11.0	24.6	15.8	18.5
29	30	31				
16.7	18.0	14.5				

August

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
			1	2	3	4
			17.2	21.7	25.3	19.7
5	6	7	8	9	10	11
17.1	18.4	22.6	24.0	21.5	14.6	14.0
12	13	14	15	16	17	18
13.1	15.8	21.1	19.6	19.6	21.4	13.0
19	20	21	22	23	24	25
14.5	16.8	19.8	24.0	26.4	26.2	18.4
26	27	28	29	30	31	
11.5	7.4	11.6	10.1	13.5	16.0	

September

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
			1	2	3	4
			15.2	17.6	11.2	12.3
5	6	7	8	9	10	11
11.3	11.6					
12	13	14	15	16	17	18
19.0	20.0	21.0	22.0	23.0	24.0	25.0
26	27	28	29	30		

Since April 1, 2012, there have been:

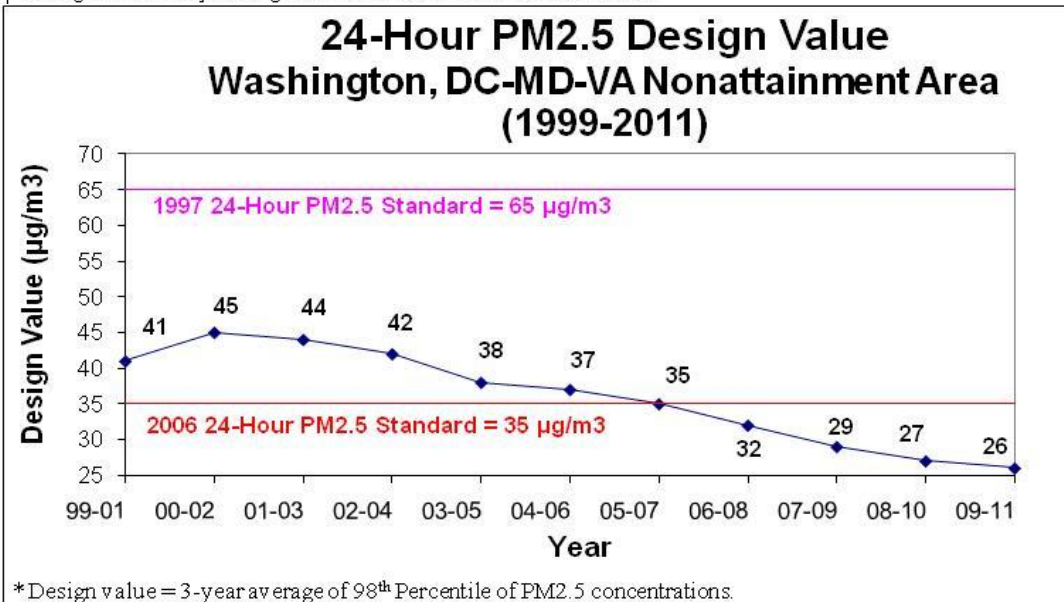
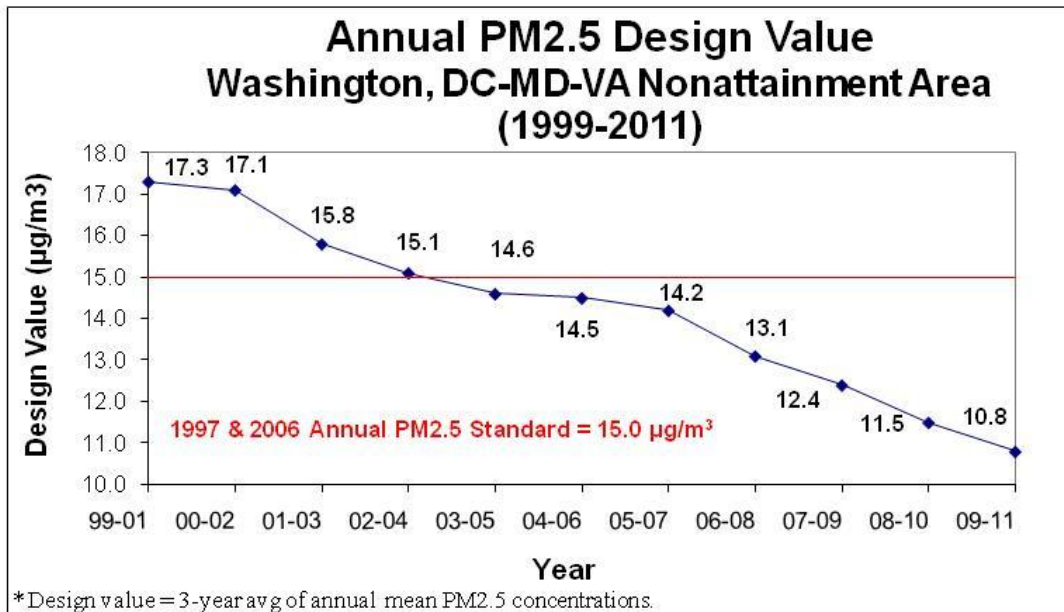
59 Code Yellow Days

100 Code Green Days

\* Analysis is based on draft data until September 6, 2012. Data is subject to change.



# PM2.5 Design Value Trend





**2012 Summer**

**&**

**Historical Temperatures**

**(Metro Washington Region)**



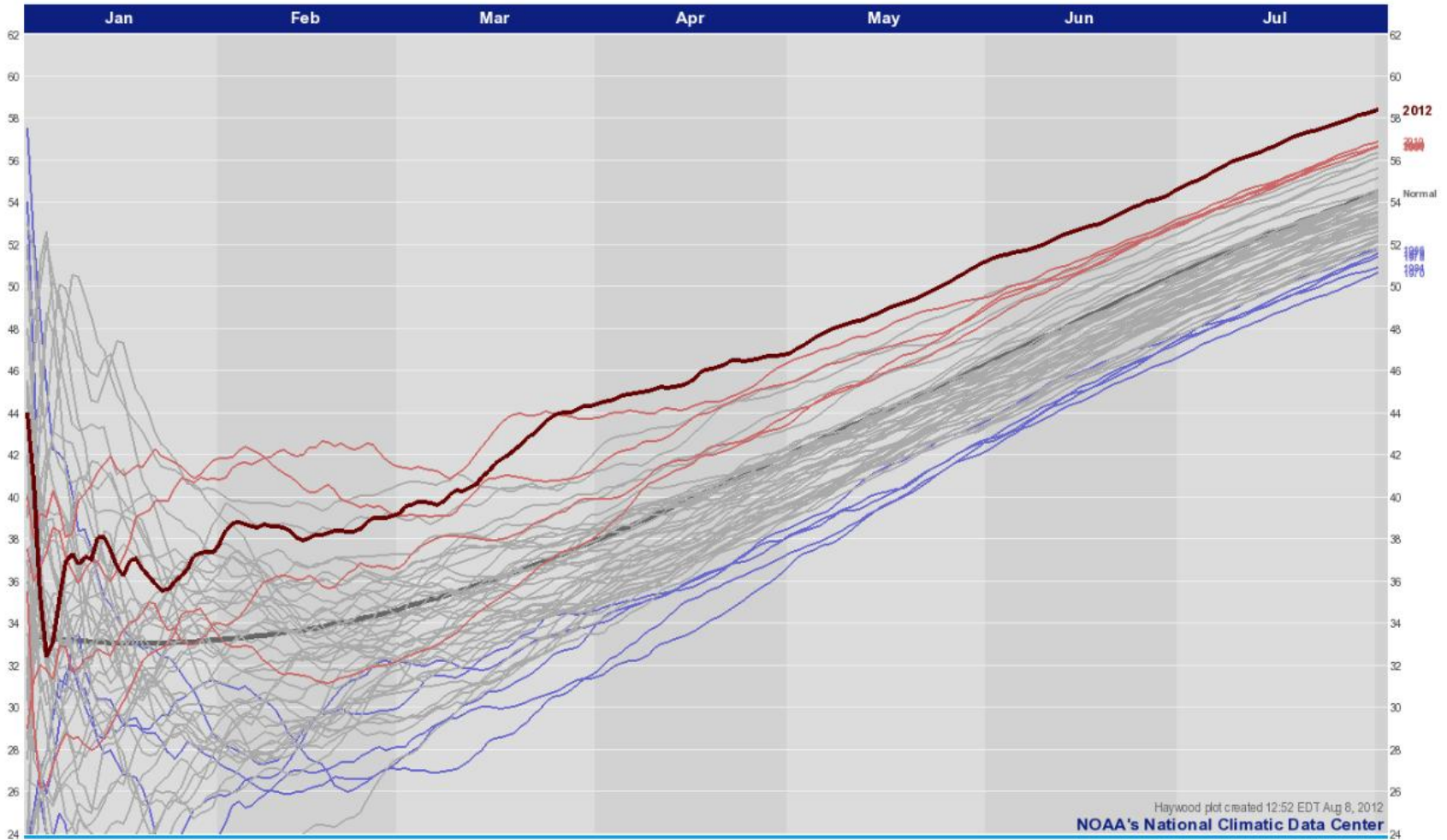
## Sources & Period of Weather Data

- ❖ National Climatic Data Center (NCDC) – A Division of NOAA
  - ❖ Dulles & National airports – 1963-2012 & 1946-2012
  - ❖ Maryland & Virginia - July & Jan-July avg (1895-2012)
  
- ❖ US Historical Climatology Network (US HCN) – A NCDC Project to detect regional climate change
  - ❖ Dulles & National airports – 1963-2012 & 1946-2012
  - ❖ Maryland & Virginia - July & Jan-July avg (1895-2012)



# Long-Term Temperature Trend - Dulles

❖ July 2012 – Warmest July on record (1963-2012)



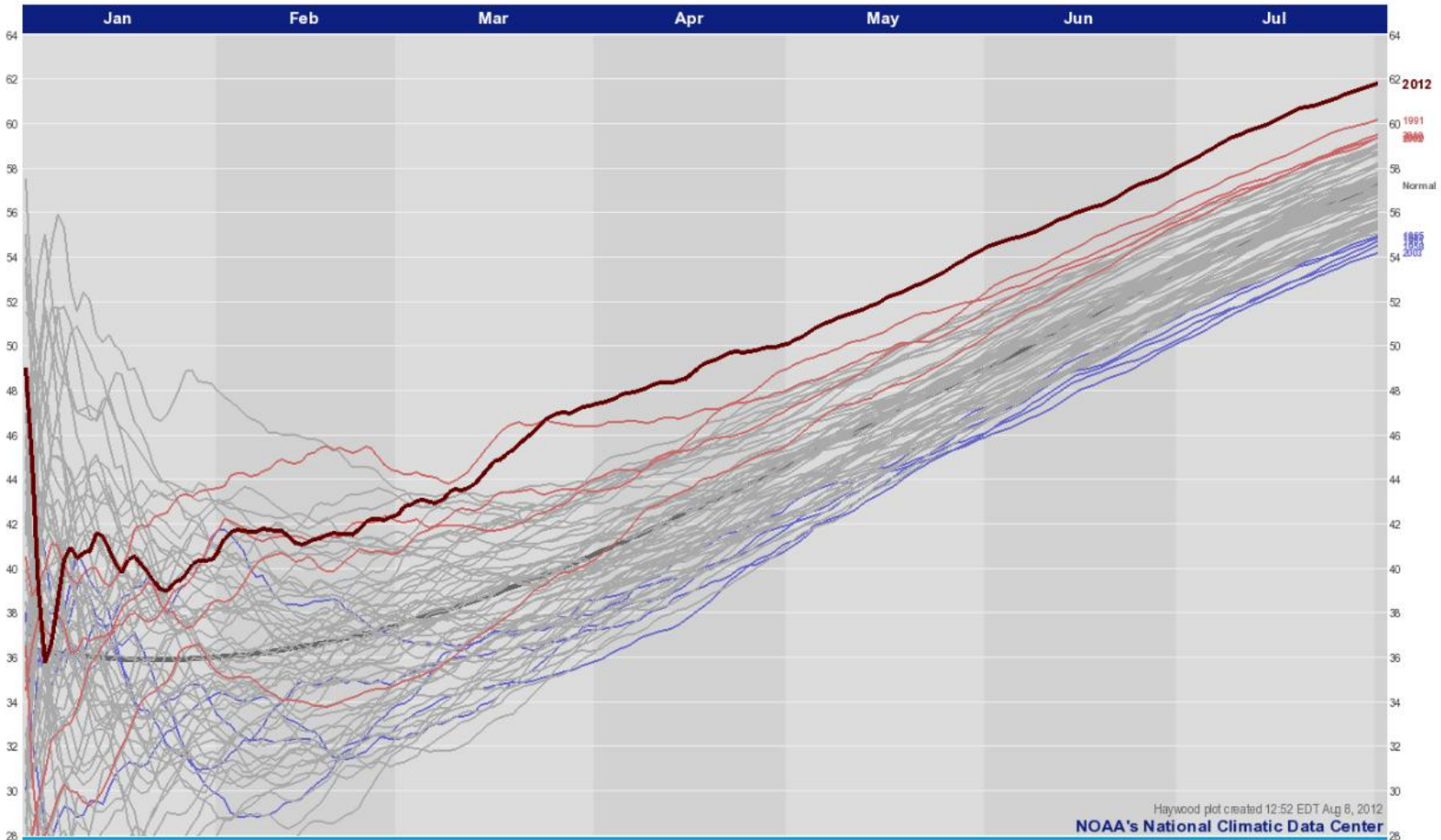
 Average Temperature (F) to Date for Washington (Dulles), DC  
Jan 1 through Jul 31. Period of record is 1963 through 2012

Haywood plot created 12:52 EDT Aug 8, 2012  
NOAA's National Climatic Data Center  
5 warmest periods in scarlet: 2012 2010 1990 2006 1991  
5 coolest periods in blue: 1966 1979 1978 1984 1970  
1981-2010 average underlaid in dark gray  
2012 period in crimson



# Long-Term Temperature Trend - National

❖ July 2012 – Warmest July on record (1946-2012)



 Average Temperature (F) to Date for Washington (Reagan National), DC  
Jan 1 through Jul 31. Period of record is 1946 through 2012

Haywood plot created 12:52 EDT Aug 8, 2012  
NOAA's National Climatic Data Center  
5 warmest periods in scarlet: 2012 1991 2010 1990 2002  
5 coolest periods in blue: 1965 1947 1961 1958 2003  
1981-2010 average underlaid in dark gray  
2012 period in crimson



## Long-Term Temperature Trend - Virginia

- ❖ July 2012 – Warmest July on record (1895-2012)
- ❖ Jan-July 2012 - Warmest Jan-July period on record (1895-2012)
- ❖ 4 out of top 10 warmest July occurred after 1990

VIRGINIA		
July 2012: warmest July on record		
Top 10 July temperature anomalies		
1st	July 2012	+4.0°F
2nd	July 1934	+3.6°F
3rd	July 1993	+3.4°F
	July 1901	+3.4°F
5th	July 1955	+3.2°F
6th	July 2010	+3.1°F
7th	July 1930	+2.9°F
8th	July 2011	+2.8°F
9th	July 1986	+2.7°F
	July 1931	+2.7°F

VIRGINIA		
118-year record (1895-2012)		
Ten warmest Jan-Jul periods		
1st	Jan-Jul 2012	+3.7°F
2nd	Jan-Jul 1953	+2.9°F
3rd	Jan-Jul 1991	+2.8°F
	Jan-Jul 1990	+2.8°F
	Jan-Jul 1921	+2.8°F
6th	Jan-Jul 1949	+2.7°F
7th	Jan-Jul 1952	+2.4°F
8th	Jan-Jul 1998	+2.1°F
	Jan-Jul 1932	+2.1°F
10th	Jan-Jul 2002	+1.9°F



## Long-Term Temperature Trend - Maryland

- ❖ July 2012 – 3<sup>rd</sup> warmest July on record (1895-2012)
- ❖ Jan-July 2012 – Warmest Jan-July on record (1895-2012)
- ❖ 5 out of top 10 warmest July occurred after 1990

MARYLAND		
July 2012: 3 <sup>rd</sup> warmest July on record		
Top 10 July temperature anomalies		
1st	July 1955	+4.2°F
2nd	July 2011	+4.1°F
3rd	<b>July 2012</b>	<b>+4.0°F</b>
4th	July 2010	+3.8°F
	July 1999	+3.8°F
6th	July 1987	+3.4°F
7th	July 1993	+3.3°F
	July 1901	+3.3°F
9th	July 1949	+3.0°F
	July 1934	+3.0°F

MARYLAND		
118-year record (1895-2012)		
Ten warmest Jan-Jul periods		
1st	<b>Jan-Jul 2012</b>	<b>+4.7°F</b>
2nd	Jan-Jul 1998	+3.4°F
	Jan-Jul 1991	+3.4°F
	Jan-Jul 2002	+3.4°F
5th	Jan-Jul 1921	+3.2°F
6th	Jan-Jul 1990	+3.0°F
	Jan-Jul 1949	+3.0°F
8th	Jan-Jul 1953	+2.9°F
9th	Jan-Jul 2006	+2.6°F
	Jan-Jul 2010	+2.6°F





## Conclusion

- ❖ July 2012 & Jan-July Avg 2012 periods – One of the warmest periods on record since 1895
- ❖ 4-5 out of top 10 warmest July & Jan-July avg periods occurred after 1990 (last 22 years)
- ❖ High temperatures during summer becoming more frequent and common