SETPMTC Meeting

Continued 8-hr Ozone Attainment Test to Research in Applying the EPA Five HGB Episodes

prepared for
Houston 8-hr Coalition

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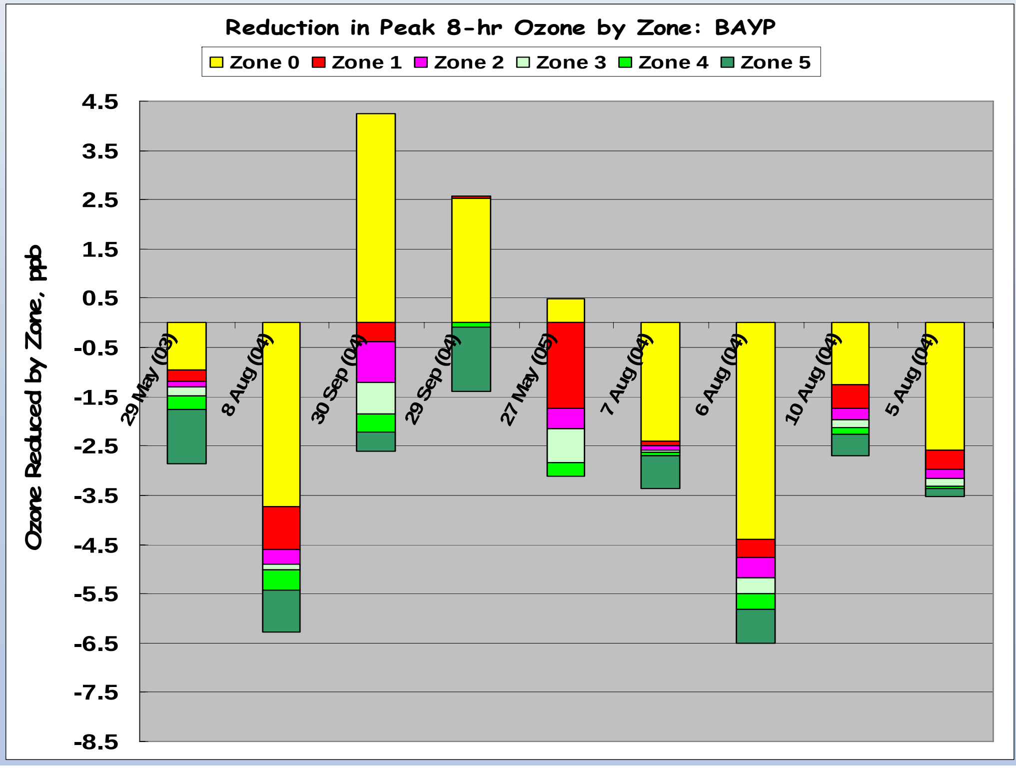
21 Jun '06



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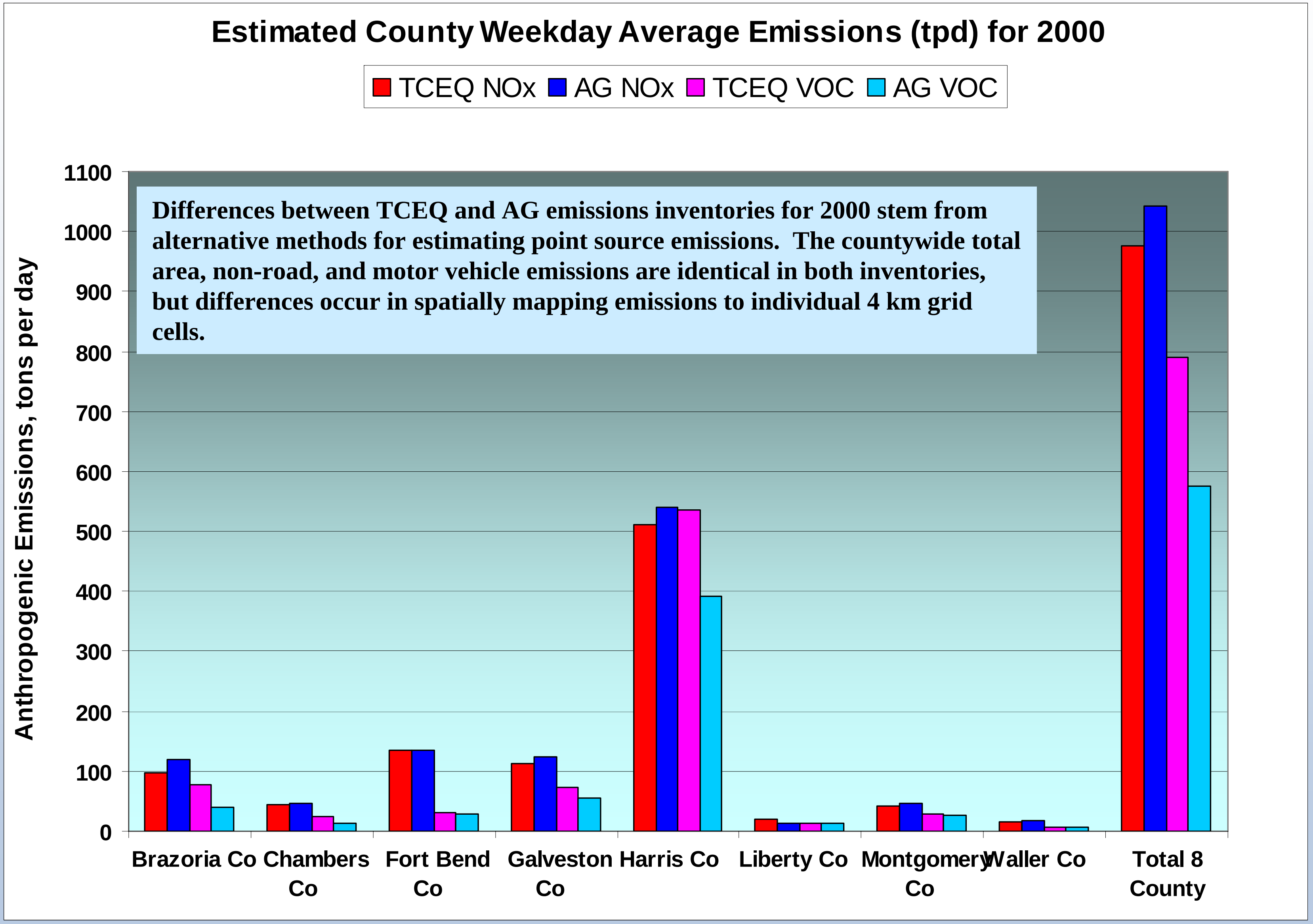
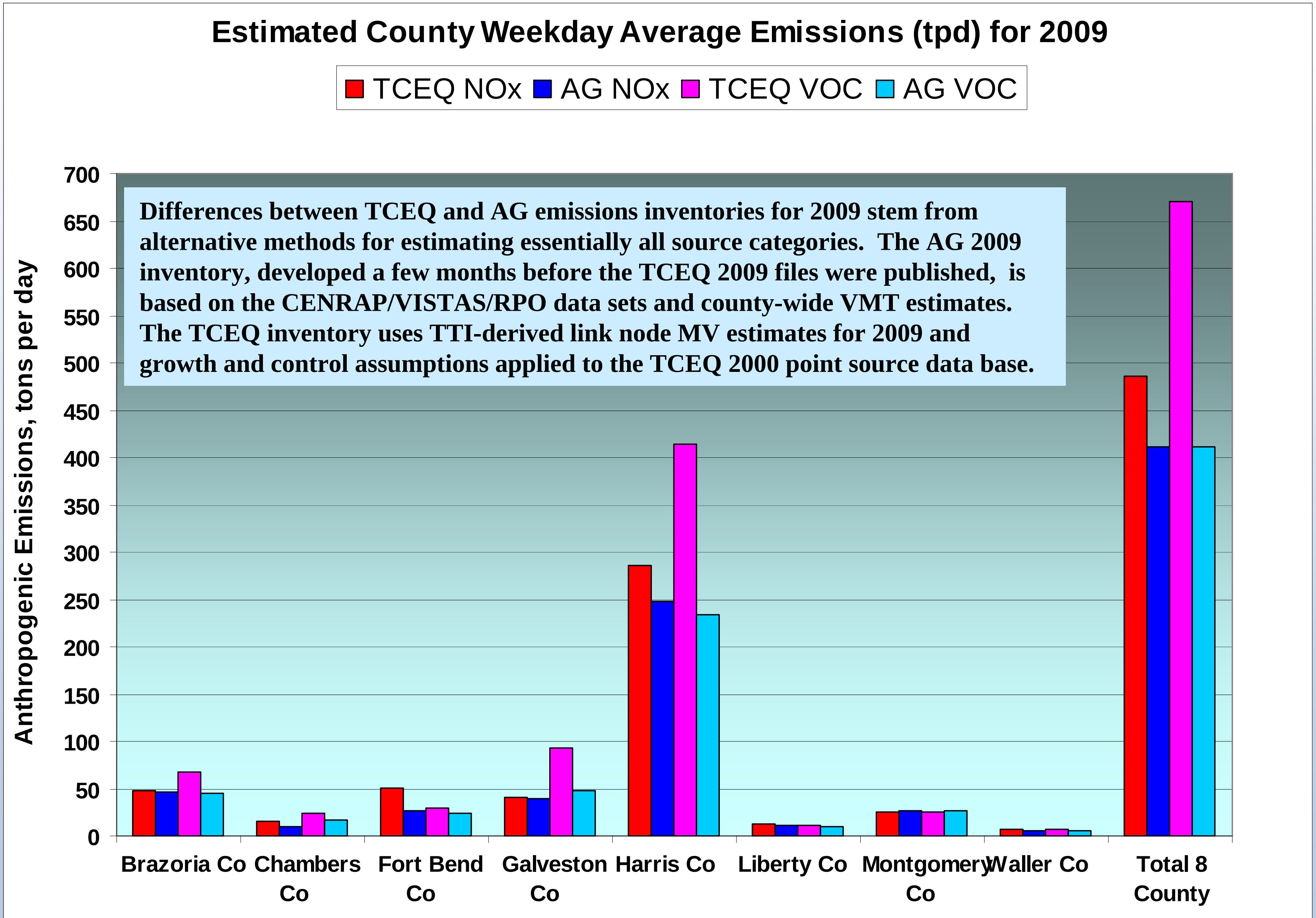
TCEQ and AG Emissions Summaries for 2000 & 2009

TCEQ vs. AG 2000 Inventory Totals



TCEQ vs. AG 2009 Inventory Totals

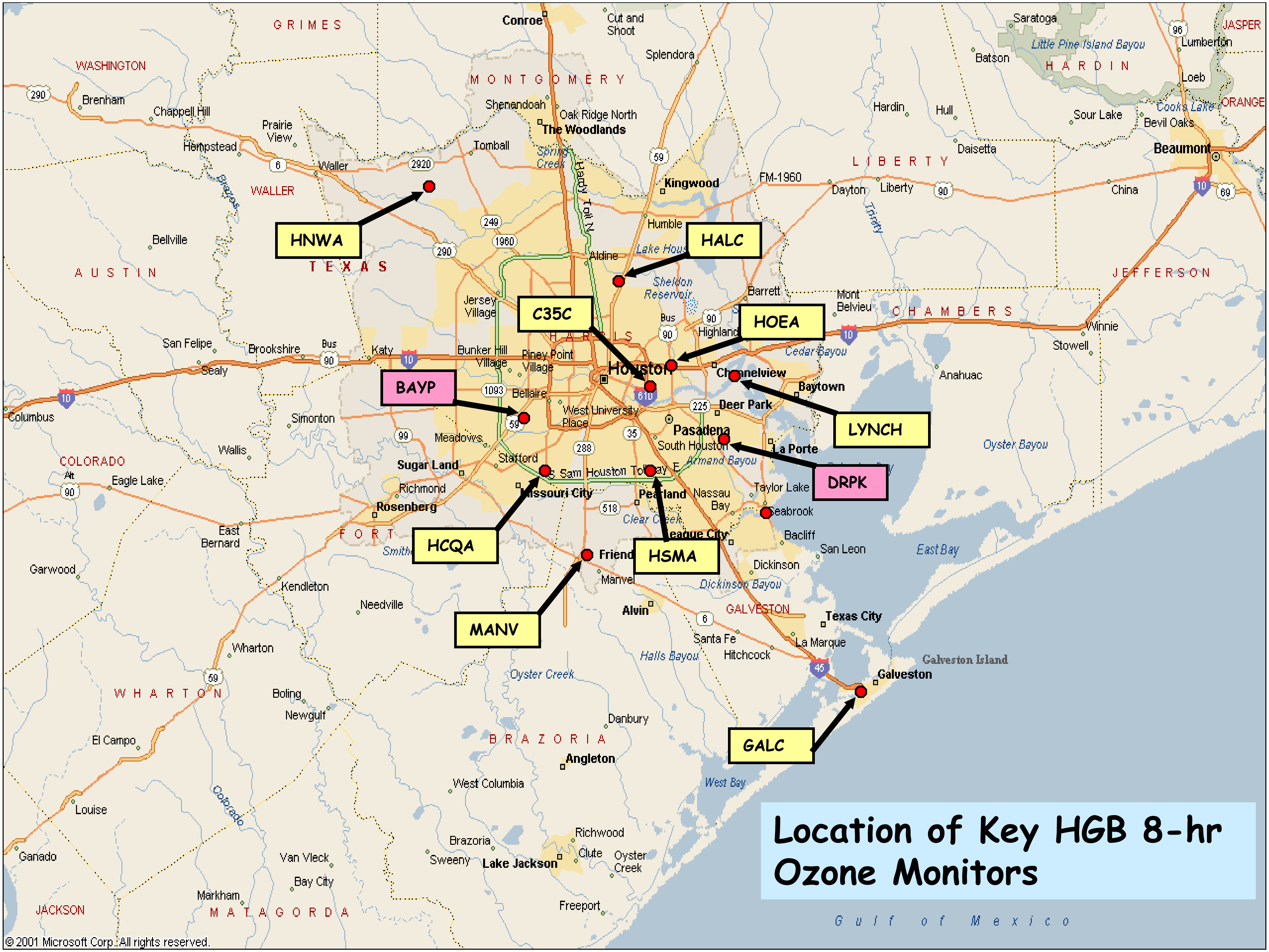


HGB Residual Non-attainment: TCEQ 2000/2009 Emissions

The Attainment Test for all 5 episodes was performed using array sizes of 3x3, 5x5, and 7x7. For each array size, we computed future Design Values at each monitor where there were at least 5 days with base year 2000 predicted peaks above 70 ppb. The test was performed for 4 different model performance accuracy thresholds. Note: this is only one type of accuracy screen and is simple-minded at best. Far more comprehensive screens, using surface wind fields, process analysis results, and multispecies evaluation information is needed.

TCEQ 2000 Episode: Choice of array size and/or accuracy cutoffs at individual monitors has an effect at most monitors. Overall, use of a more stringent accuracy cutoff leads to slightly lower 2009 Future Design Values (DV_f).

Post-2000 Episodes: On average, using more stringent accuracy cutoffs leads to design values that are ~ 1ppb or more higher. At some monitors (e.g., HALC, HCQA, HSWA), the 2009 DV_f is increased by 4 to nearly 6 ppb.



Location of Key HGB 8-hr Ozone Monitors

Table 1a. HGB Attainment Test Applied to Five Episodes using the TCEQ 2000 & 2009 Emissions Inventories--3x3

			TCEQ 2000 Episode						Post-2000 Episodes					
ID	Name	DVc	Thresh	NDAYS	00 Peak	09 Peak	RRF	FDV	Thresh	NDAYS	00 Peak	09 Peak	RRF	FDV
482011039	DRPK	107.7	72	10	88.7	80.3	0.90	97.4	81	10	95.5	86.1	0.90	97.1
482010055	BAYP	107.0	70	9	83.2	74.5	0.89	95.7	77	10	91.8	81.2	0.88	94.7
482010024	HALC	108.7	86	12	93.2	78.7	0.84	91.8	77	10	90.8	80.2	0.88	96.0
482010051	HCQA	102.0	70	8	86.5	76.5	0.88	90.2	76	10	89.3	80.3	0.90	91.8
482010029	HNWA	104.7	72	12	79.6	66.6	0.84	87.6	70	7	88.6	79.4	0.90	93.8
482011034	HOEA	102.0	82	10	92.2	79.1	0.86	87.5	82	10	93.5	83.2	0.89	90.8
482010808	H08H	96.9	73	10	90.3	81.2	0.90	87.0						
482010066	SHWH	95.0	71	10	82.6	73.7	0.89	84.7	78	10	91.3	80.4	0.88	83.7
481670014	GALC	98.3	70	5	92.7	78.9	0.85	83.8	70	7	76.9	77.5	1.01	99.1
482010070	HROC	95.0	73	10	88.4	77.1	0.87	82.9	83	10	91.8	83.8	0.91	86.7
481671002	TLMC	90.7	70	5	90.5	82.4	0.91	82.6	70	1				
482011035	C35C	93.0	77	11	87.9	77.3	0.88	81.7	83	10	93.9	84.5	0.90	83.7
		100.1	74	9	88.0	77.2	0.88	87.7	77	9	90.3	81.7	0.91	91.7

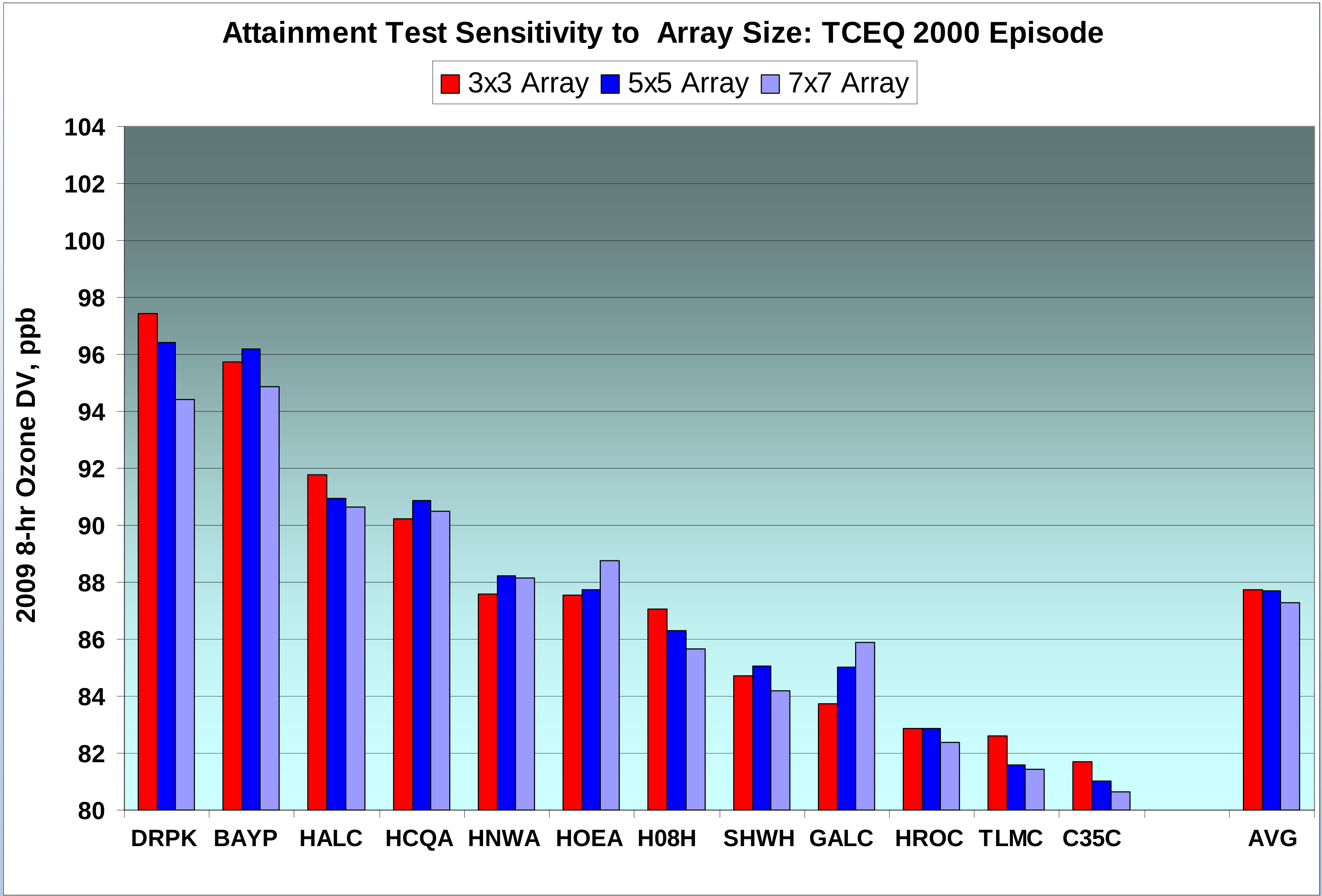
Table 1b. HGB Attainment Test Applied to Five Episodes using the TCEQ 2000 & 2009 Emissions Inventories--5x5

			TCEQ 2000 Episode						Post-2000 Episodes					
ID	Name	DVc	Thresh	NDAYS	00 Peak	09 Peak	RRF	FDV	Thresh	NDAYS	00 Peak	09 Peak	RRF	FDV
482011039	DRPK	107.7	79	10	92.9	83.2	0.90	96.4	85	10	98.6	89.9	0.91	98.2
482010055	BAYP	107.0	71	10	84.9	76.3	0.90	96.2	79	10	94.5	84.2	0.89	95.3
482010024	HALC	108.7	86	13	95.8	80.1	0.84	91.0	81	10	95.5	82.6	0.87	94.1
482010051	HCQA	102.0	72	10	86.1	76.7	0.89	90.9	83	10	95.2	85.5	0.90	91.7
482010029	HNWA	104.7	76	10	84.0	70.8	0.84	88.2	70	9	87.1	78.2	0.90	94.0
482011034	HOEA	102.0	86	10	96.0	82.5	0.86	87.7	85	10	99.5	88.0	0.88	90.2
482010808	H08H	96.9	74	10	94.9	84.5	0.89	86.3						
482010066	SHWH	95.0	74	10	85.7	76.7	0.90	85.0	79	10	95.4	83.8	0.88	83.5
481670014	GALC	98.3	70	5	95.9	82.9	0.86	85.0	70	9	77.5	77.9	1.01	98.9
482010070	HROC	95.0	83	11	91.6	79.9	0.87	82.9	86	10	96.6	89.0	0.92	87.6
481671002	TLMC	90.7	70	5	96.2	86.5	0.90	81.6						
482011035	C35C	93.0	84	10	93.4	81.3	0.87	81.0	84	11	96.4	88.0	0.91	85.0
		100.1	77	10	91.4	80.1	0.88	87.7	80	10	93.6	84.7	0.91	91.8

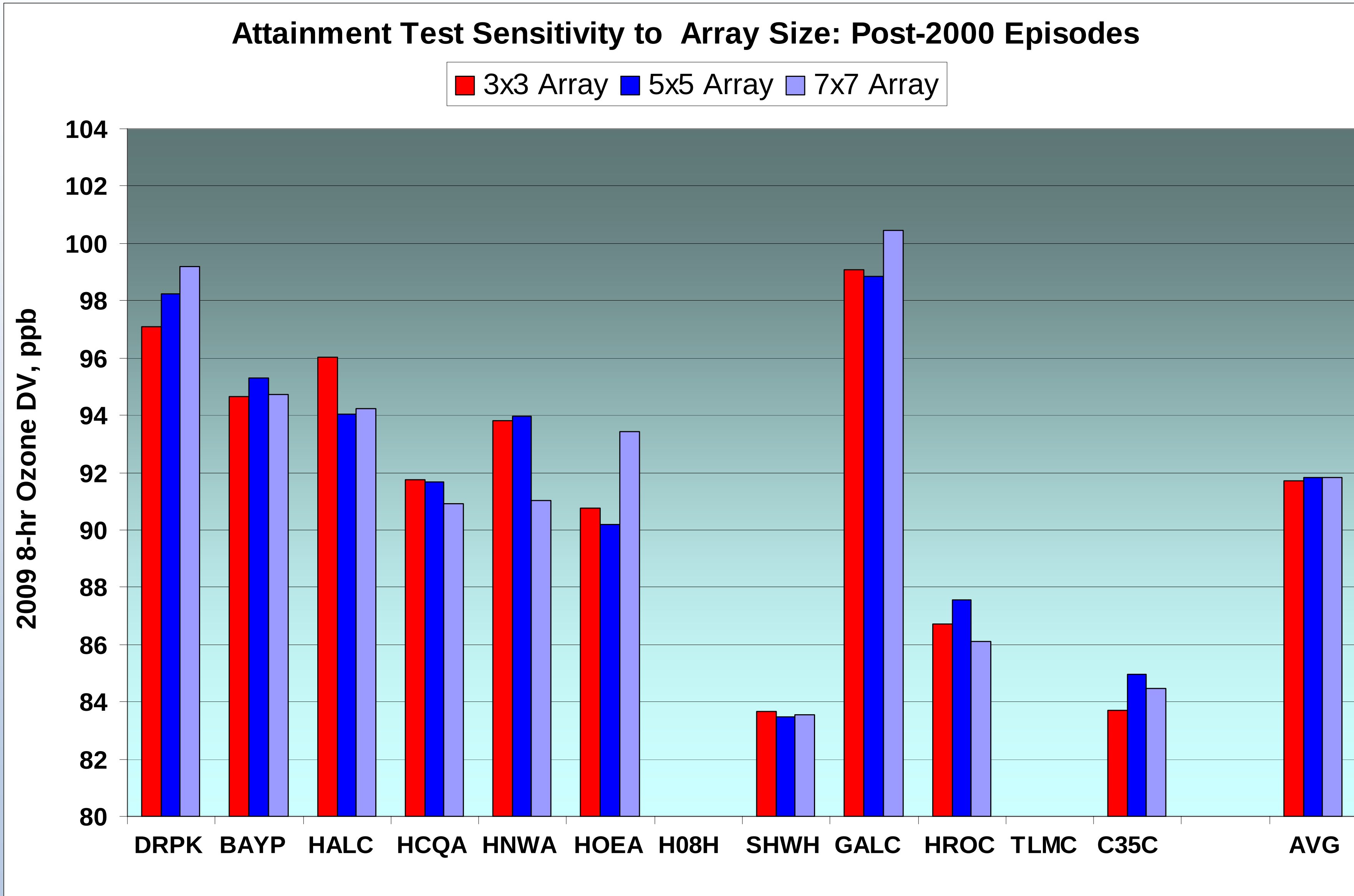
Table 1c. HGB Attainment Test Applied to Five Episodes using the TCEQ 2000 & 2009 Emissions Inventories--7x7

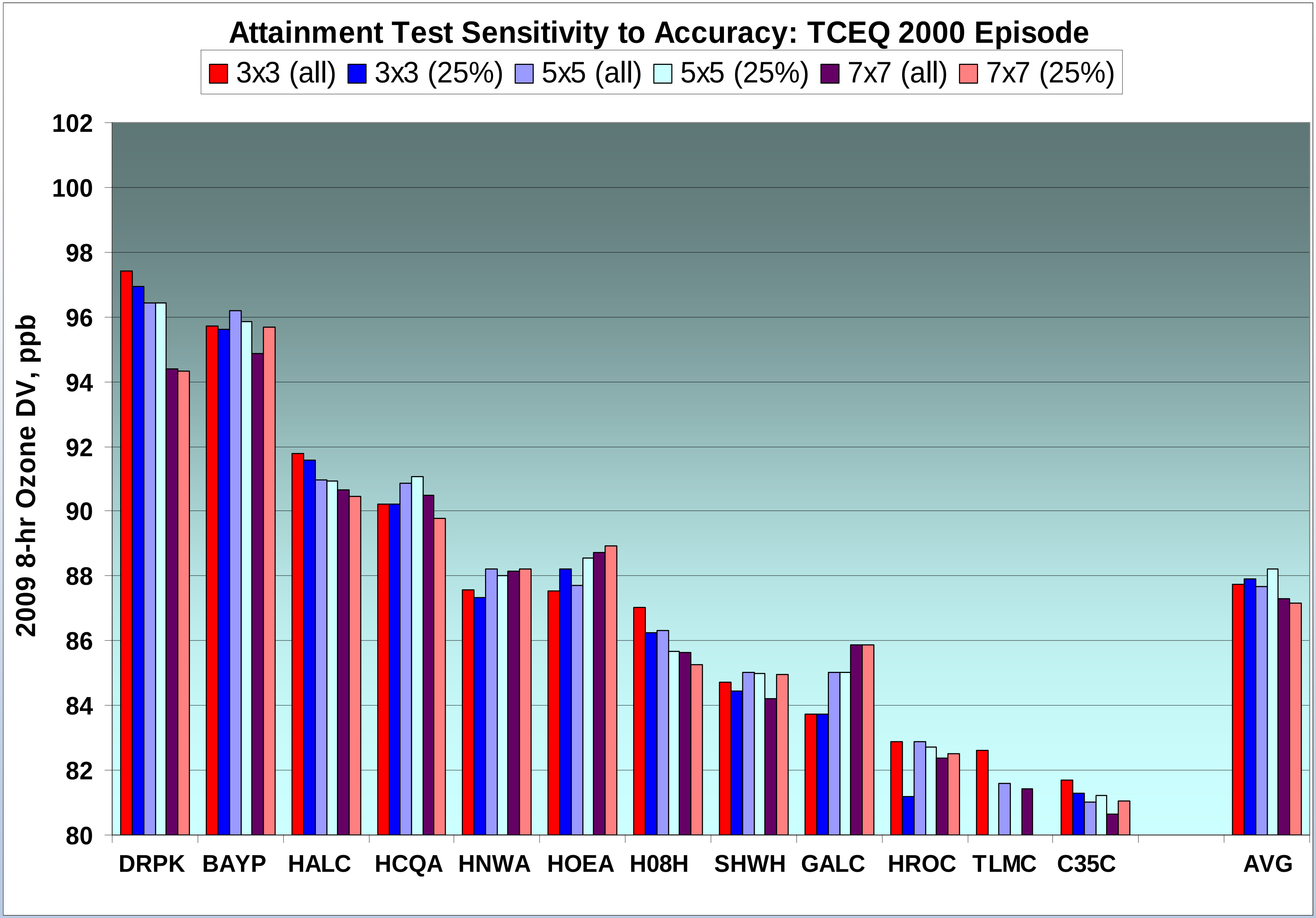
			TCEQ 2000 Episode						Post-2000 Episodes					
ID	Name	DVc	Thresh	NDAYS	00 Peak	09 Peak	RRF	FDV	Thresh	NDAYS	00 Peak	09 Peak	RRF	FDV
482011039	DRPK	107.7	83	10	97.1	85.1	0.88	94.4	86	12	98.4	90.6	0.92	99.2
482010055	BAYP	107.0	76	10	89.6	79.4	0.89	94.9	82	10	98.7	87.4	0.89	94.7
482010024	HALC	108.7	86	15	96.2	80.2	0.83	90.7	84	10	99.3	86.1	0.87	94.2
482010051	HCQA	102.0	73	11	87.7	77.8	0.89	90.5	86	10	98.6	87.9	0.89	90.9
482010029	HNWA	104.7	79	11	86.4	72.7	0.84	88.2	71	10	89.5	77.8	0.87	91.0
482011034	HOEA	102.0	86	12	96.3	83.8	0.87	88.7	86	11	100.6	92.2	0.92	93.4
482010808	H08H	96.9	79	10	97.2	85.9	0.88	85.7						
482010066	SHWH	95.0	76	10	89.7	79.5	0.89	84.2	81	10	99.0	87.1	0.88	83.5
481670014	GALC	98.3	70	5	98.2	85.8	0.87	85.9	73	10	79.0	80.7	1.02	100.5
482010070	HROC	95.0	86	11	95.0	82.3	0.87	82.4	86	12	99.1	89.8	0.91	86.1
481671002	TLMC	90.7	70	8	89.6	80.4	0.90	81.4						
482011035	C35C	93.0	86	11	96.2	83.4	0.87	80.7	86	12	100.2	91.0	0.91	84.5
		100.1	79	10	93.3	81.4	0.87	87.3	82	11	96.2	87.1	0.91	91.8

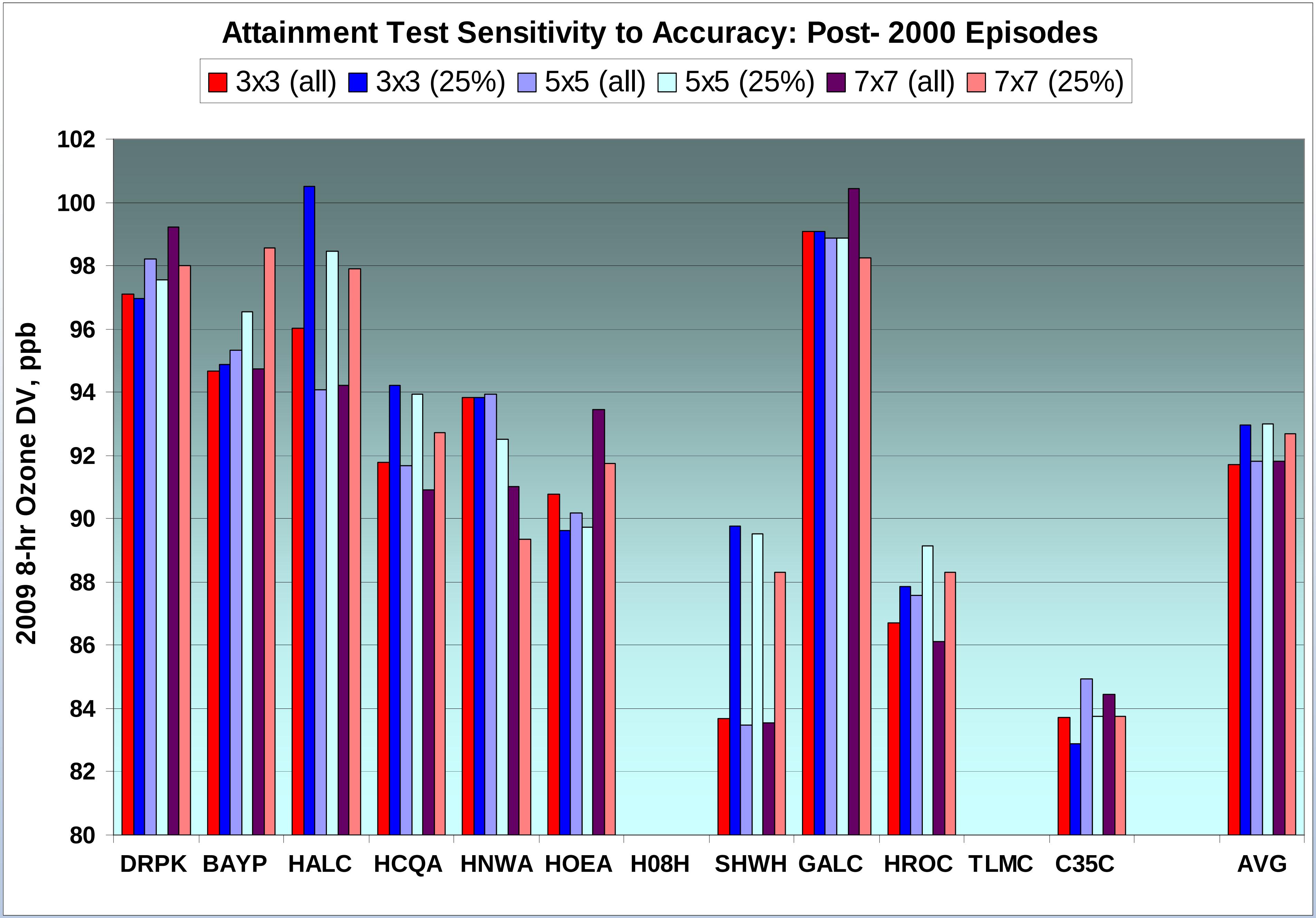
Attainment Test Sensitivity to Array Size



Attainment Test Sensitivity to Array Size



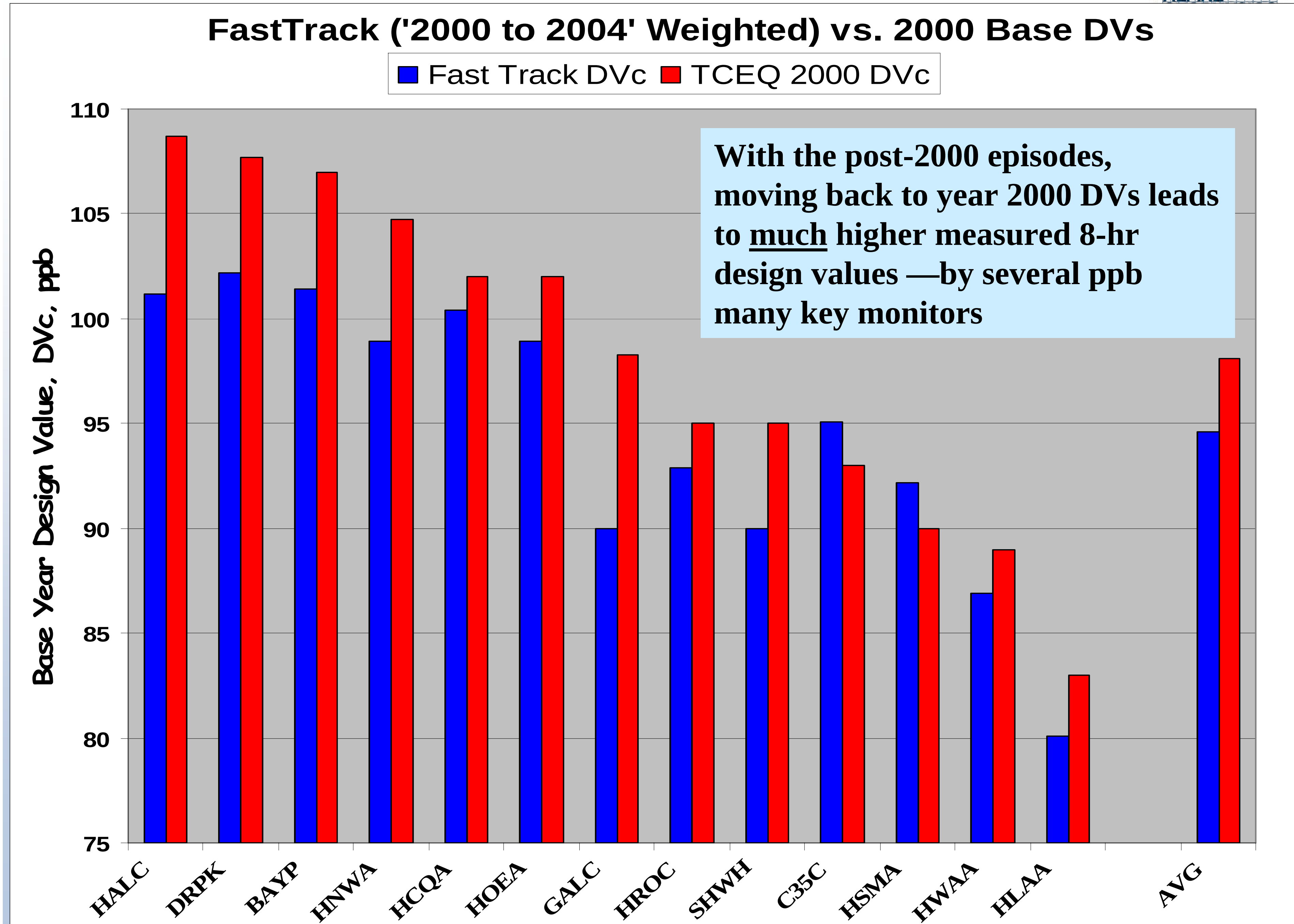

Attainment Test Sensitivity to Accuracy: TCEQ 2000 Episode
3x3 (all)
3x3 (25%)
5x5 (all)
5x5 (25%)
7x7 (all)
7x7 (25%)
2009 8-hr Ozone DV, ppb
102
100
98
96
94
92
90
88
86
84
82
80
DRPK
BAYP
HALC
HCQA
HNWA
HOEA
H08H
SHWH
GALC
HROC
TLMC
C35C
AVG



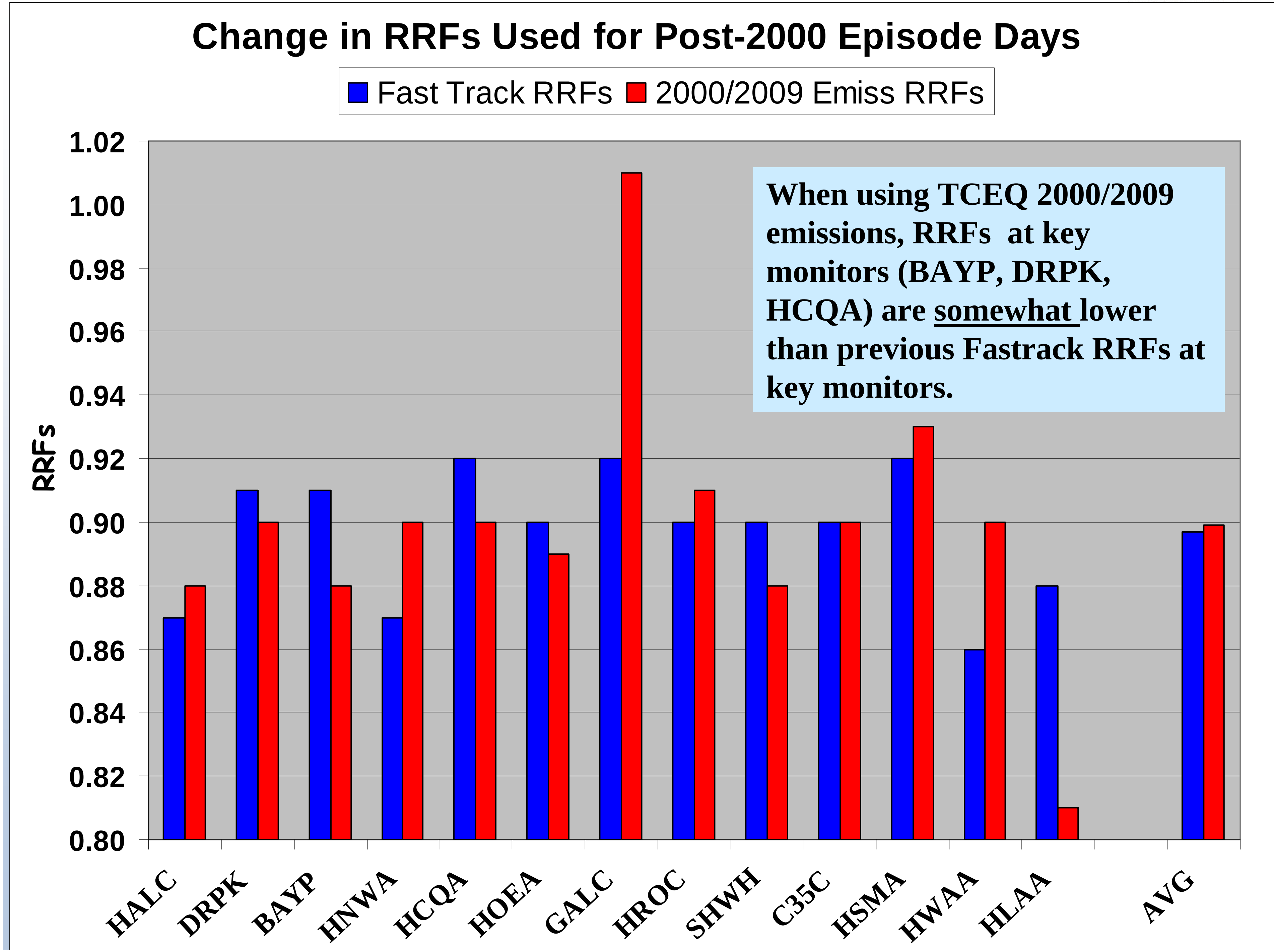
Attainment Test Sensitivity to Accuracy: Post- 2000 Episodes
3x3 (all)
3x3 (25%)
5x5 (all)
5x5 (25%)
7x7 (all)
7x7 (25%)
2009 8-hr Ozone DV, ppb
102
100
98
96
94
92
90
88
86
84
82
80
DRPK
BAYP
HALC
HCQA
HNWA
HOEA
H08H
SHWH
GALC
HROC
TLMC
C35C
AVG

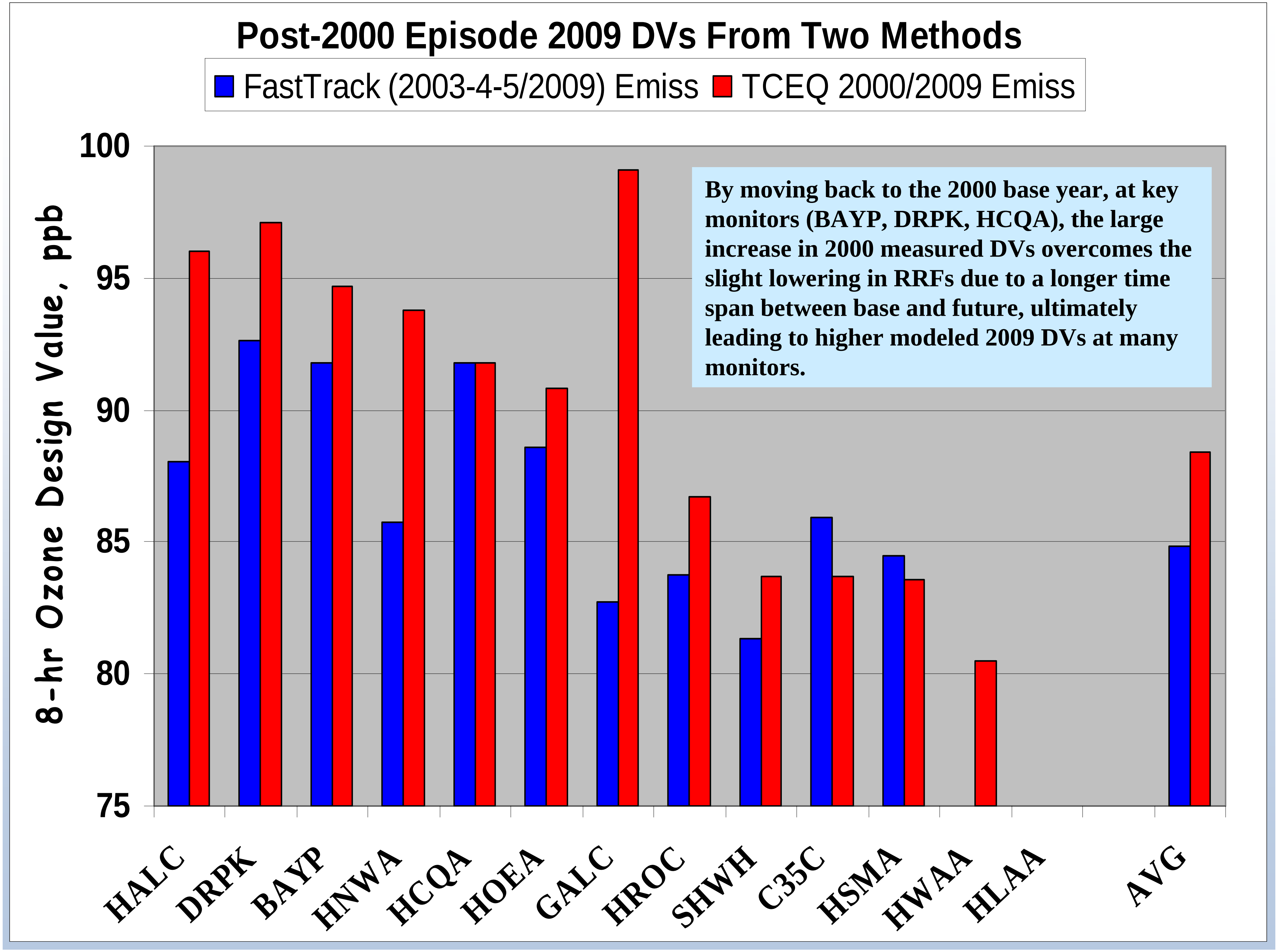
Reconciliation of Fast-track and New Attainment Test Results

AIRS ID				2001	2002	2003	2004	2005	2000-2002	2001-2003	2002-2004	2003-2005
AIRS ID	MAPS	TCEQ	Monitor Name	3-yr DV on Yr Ending					Weighted DV			
480390618	DANC	C618	DANCIGER			75.0	80.0	80.7		75.0	77.5	78.6
480390619	MSTG	C619	MUSTANG BAYOU			95.0	97.5	93.0		95.0	96.3	95.2
480391003	CLTA	C11/A111	CLUTE	91.7	86.0	87.3	89.0	83.0	90.0	88.3	87.4	86.4
480391004	MANV	C89	MANVEL	86.0	89.0	91.7	97.3	97.7		88.9	92.7	95.6
480391016	JACK	C1016	LAKE JACKSON			79.0	80.0	79.3		79.0	79.5	79.4
480710900	H10H	C610	HRM-10	82.0	90.0	81.0				84.3	85.5	81.0
480710901	H11H	C611	HRM-11	77.7	90.0	79.0				82.2	84.5	79.0
481670014	GALC	C34/A109/X152	GALVESTON	98.7	89.7	89.3	91.0	87.0	98.3	92.6	90.0	89.1
481670056	C620	C620	34TH STREET			85.0	91.5	89.7		85.0	88.3	88.7
481670571	C571	C571	CLEAR CREEK HS			68.0	81.5	83.3		68.0	74.8	77.6
481671002	TLMC	C10	TEXAS CITY	91.3	83.0	80.3	74.7	70.5	90.7	84.9	79.3	75.2
482010024	HALC	C8/A108/X150	ALDINE	109.0	107.7	100.3	95.7	92.7	108.7	105.7	101.2	96.2
482010026	H4H	C15/C115/C604	HRM4	75.0	82.0	87.3	90.7	89.3		81.4	86.7	89.1
482010029	HNWA	C26/A110/X154	HOUSTON NORTHWES	105.3	101.3	100.7	94.7	93.3	104.7	102.4	98.9	96.2
482010046	HWAA	C405	NORTH WAYSIDE	95.5	89.7	86.0	85.0	82.7	89.0	90.4	86.9	84.6
482010047	HLAA	C408	LANG	88.5	83.0	78.3	79.0	79.0	83.0	83.3	80.1	78.8
482010051	HCQA	C409	CROQUET	102.5	102.0	99.7	99.7	98.0	102.0	101.4	100.4	99.1
482010055	BAYP	C53/A146	BAYLAND PARK	110.3	100.3	102.3	101.7	103.7	107.0	104.3	101.4	102.6
482010062	HSMA	C406	SWISS & MONROE	88.5	90.7	90.7	95.3	97.0	90.0	89.9	92.2	94.3
482010066	SHWH	C410	SHELL WESTHOLLOW	100.5	95.0	87.7	87.3	89.3	95.0	94.4	90.0	88.1
482010070	HROC	C81	REGIONAL OFFICE	99.0	95.3	94.7	88.7	88.7	95.0	96.3	92.9	90.7
482010075	TXAV	C411	TEXAS AVE	90.0	84.0	88.3	89.3	88.7		87.4	87.2	88.8
482010551	SHEL	C551	SHELDON	47.0	68.0	79.7	92.7	92.0		64.9	80.1	88.1
482010552	C552	C552	WETLANDS CENTER			87.0	88.5	87.3		87.0	87.8	87.6
482010617	WALL	HRM-Wallisville	WALLISVILLE			101.0	97.5	96.3		101.0	99.3	98.3
482010803	H03H	C603/A114	HRM-3	78.7	89.5	97.0	96.0	92.0		88.4	94.2	95.0
482010804	H04H	C604	HRM-4	64.3	78.0	88.0				76.8	83.0	88.0
482010808	H08H	C608	HRM-8	77.7	97.0	93.0				89.2	95.0	93.0
482011015	BAYT	C1015/A165	BAYTOWN			108.0	100.5	96.3		108.0	104.3	101.6
482011034	HOEA	C1/G316	HOUSTON EAST	103.3	101.0	100.3	95.3	87.0	102.0	101.6	98.9	94.2
482011035	C35C	C403/C304/A113	CLINTON DR	93.5	93.0	96.0	96.3	95.0	93.0	94.2	95.1	95.8
482011039	DRPK	C35/C1001/A139	DEER PARK	108.0	103.0	102.0	101.7	100.7	107.7	104.3	102.2	101.4
482011050	SBRK	C45	SEABROOK	71.0	82.5	85.7	94.3	92.3		79.7	87.5	90.8
482450101	S40S	C640	SABINE PASS	84.7	90.0	91.3	92.7	88.7		88.7	91.3	90.9
482450102	S43S	C643	SETRPC-43	89.0	85.0	86.0	84.0	84.3		86.7	85.0	84.8
483390078	CONN	C78	CONROE-RELOCATED	58.0	70.0	78.0	85.3	86.0		68.7	77.8	83.1
483390089	CONR	C65	CONROE	91.7	95.0	90.0			91.0	92.2	92.5	90.0



FastTrack ('2000 to 2004' Weighted) vs. 2000 Base DVs
Fast Track DVc
TCEQ 2000 DVc
Base Year Design Value, DVc, ppb
110
105
100
95
90
85
80
75
With the post-2000 episodes, moving back to year 2000 DVs leads to much higher measured 8-hr design values —by several ppb many key monitors
HALC
DRPK
BAYP
HNWA
HCQA
HOEA
GALC
HROC
SHWH
C35C
HSMA
HWAA
HLAA
AVG


Change in RRFs Used for Post-2000 Episode Days
Fast Track RRFs
2000/2009 Emiss RRFs
RRFs
1.02
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
0.84
0.82
0.80
When using TCEQ 2000/2009 emissions, RRFs at key monitors (BAYP, DRPK, HCQA) are somewhat lower than previous Fastrack RRFs at key monitors.
HALC
DRPK
BAYP
HNWA
HCQA
HOEA
GALC
HROC
SHWH
C35C
HSMA
HWAA
HLAA
AVG



Post-2000 Episode 2009 DVs From Two Methods
FastTrack (2003-4-5/2009) Emiss
TCEQ 2000/2009 Emiss
8-hr Ozone Design Value, ppb
100
95
90
85
80
75
By moving back to the 2000 base year, at key monitors (BAYP, DRPK, HCQA), the large increase in 2000 measured DVs overcomes the slight lowering in RRFs due to a longer time span between base and future, ultimately leading to higher modeled 2009 DVs at many monitors.
HALC
DRPK
BAYP
HNWA
HCQA
HOEA
GALC
HROC
SHWH
C35C
HSMA
HWAA
HLAA
AVG

Synthesis

- Why do post-2000 episodes exhibit higher (e.g., ~ 4 ppb on average) 2009 DVs compared with the earlier FastTrack work?
  - Monitored 2000 Design Values are much higher than those from the measured values in the 2003-5 time period at key monitors;
  - Slight reduction in RRFs by spanning the longer 2000-2009 timeframe not enough to overcome the influence of the much higher 2000 DVc's at most monitors.

Day-Specific RRF/DVf Estimates for Five Episodes with TCEQ Emissions:

(3x3 arrays, no accuracy screen)

DRPK

2000	00 DV		Days	Pmax-b	Pmax-f	RRF	DVf
DRPK	107.7	71	10	88.7	80.3	0.90	97.4
	30-Aug	2000	243	90.4	85.5	0.95	102.3
	1-Sep	2000	245	84.3	80.4	0.95	102.3
	26-Aug	2000	239	71.3	66.5	0.93	100.2
	19-Aug	2000	232	72.7	67.1	0.92	99.1
	29-Aug	2000	242	81.1	73.6	0.91	98.0
	5-Sep	2000	249	91.3	82.0	0.90	96.9
	2-Sep	2000	246	97.4	87.0	0.89	95.9
	3-Sep	2000	247	96.1	85.6	0.89	95.9
	31-Aug	2000	244	114.0	99.0	0.87	93.7
	4-Sep	2000	248	88.7	75.9	0.86	92.6
			Avg	88.7	80.3	0.91	97.7

Value from Attainment Test – strict application of Attain. Test.

Average value from daily RRFs and DVs; approx. value for Attain. Test

Post-2k	00 DV		Days	Pmax-b	Pmax-f	RRF	DVf
DRPK	107.7	80	10	95.5	86.1	0.90	97.1
	9-Aug	2004	222	92.9	94.8	1.02	109.9
	26-May	2005	146	83.8	82.2	0.98	105.5
	1-Jun	2005	152	83.2	81.8	0.98	105.5
	27-May	2005	147	82.5	79.3	0.96	103.4
	29-May	2003	149	102.0	95.4	0.94	101.2
	28-Sep	2004	272	80.4	73.5	0.91	98.0
	5-Aug	2004	218	109.8	92.0	0.84	90.5
	29-Sep	2004	273	95.1	78.7	0.83	89.4
	10-Aug	2004	223	116.7	95.0	0.81	87.2
	11-Aug	2004	224	109.0	88.5	0.81	87.2
			Avg	95.5	86.1	0.91	97.8

DRPK

ALL	00 DV		Days	Pmax-b	Pmax-f	RRF	DVf
DRPK	107.7						
	9-Aug	2004	222	92.9	94.8	1.02	109.9
	26-May	2005	146	83.8	82.2	0.98	105.5
	1-Jun	2005	152	83.2	81.8	0.98	105.5
	27-May	2005	147	82.5	79.3	0.96	103.4
	30-Aug	2000	243	90.4	85.5	0.95	102.3
	1-Sep	2000	245	84.3	80.4	0.95	102.3
	29-May	2003	149	102.0	95.4	0.94	101.2
	26-Aug	2000	239	71.3	66.5	0.93	100.2
	19-Aug	2000	232	72.7	67.1	0.92	99.1
	29-Aug	2000	242	81.1	73.6	0.91	98.0
	28-Sep	2004	272	80.4	73.5	0.91	98.0
	5-Sep	2000	249	91.3	82.0	0.90	96.9
	2-Sep	2000	246	97.4	87.0	0.89	95.9
	3-Sep	2000	247	96.1	85.6	0.89	95.9
	31-Aug	2000	244	114.0	99.0	0.87	93.7
	4-Sep	2000	248	88.7	75.9	0.86	92.6
	5-Aug	2004	218	109.8	92.0	0.84	90.5
	29-Sep	2004	273	95.1	78.7	0.83	89.4
	10-Aug	2004	223	116.7	95.0	0.81	87.2
	11-Aug	2004	224	109.0	88.5	0.81	87.2
			Avg	**92.1**	**83.2**	**0.91**	**97.7**

BAYP

2000	00 DV		Days	Pmax-b	Pmax-f	RRF	DVf
BAYP	107.0	69	9	83.2	74.5	0.89	**95.7**
	25-Aug	2000	**238**	79.1	82.1	1.04	111.3
	30-Aug	2000	**243**	80.6	79.9	0.99	105.9
	26-Aug	2000	**239**	72.0	65.0	0.90	96.3
	1-Sep	2000	**245**	81.7	73.7	0.90	96.3
	31-Aug	2000	**244**	98.6	84.8	0.86	92.0
	3-Sep	2000	**247**	79.4	68.1	0.86	92.0
	2-Sep	2000	**246**	83.8	70.3	0.84	89.9
	4-Sep	2000	**248**	77.0	64.9	0.84	89.9
	5-Sep	2000	**249**	97.1	81.5	0.84	89.9
			Avg	**83.24**	**74.47**	**0.90**	**95.9**

Post-2k	00 DV		Days	Pmax-b	Pmax-f	RRF	DVf
BAYP	107.0	76	10	91.8	81.2	0.88	**94.7**
	29-May	2003	**149**	79.6	87.5	1.10	117.7
	8-Aug	2004	**221**	93.3	95.8	1.03	110.2
	30-Sep	2004	**274**	82.4	81.2	0.99	105.9
	29-Sep	2004	**273**	78.1	72.5	0.93	99.5
	27-May	2005	**147**	92.5	84.9	0.92	98.4
	7-Aug	2004	**220**	77.0	67.8	0.88	94.2
	6-Aug	2004	**219**	94.4	77.0	0.82	87.7
	10-Aug	2004	**223**	94.3	77.4	0.82	87.7
	5-Aug	2004	**218**	102.3	76.3	0.75	80.3
	9-Aug	2004	**222**	123.7	91.5	0.74	79.2
			Avg	**91.76**	**81.18**	**0.90**	**96.1**

BAYP

ALL	00 DV		Days	Pmax-b	Pmax-f	RRF	DVf
BAYP	107.0						
	29-May	2003	149	79.6	87.5	1.10	117.7
	25-Aug	2000	238	79.1	82.1	1.04	111.3
	8-Aug	2004	221	93.3	95.8	1.03	110.2
	30-Aug	2000	243	80.6	79.9	0.99	105.9
	30-Sep	2004	274	82.4	81.2	0.99	105.9
	29-Sep	2004	273	78.1	72.5	0.93	99.5
	27-May	2005	147	92.5	84.9	0.92	98.4
	26-Aug	2000	239	72.0	65.0	0.90	96.3
	1-Sep	2000	245	81.7	73.7	0.90	96.3
	7-Aug	2004	220	77.0	67.8	0.88	94.2
	31-Aug	2000	244	98.6	84.8	0.86	92.0
	3-Sep	2000	247	79.4	68.1	0.86	92.0
	2-Sep	2000	246	83.8	70.3	0.84	89.9
	4-Sep	2000	248	77.0	64.9	0.84	89.9
	5-Sep	2000	249	97.1	81.5	0.84	89.9
	6-Aug	2004	219	94.4	77.0	0.82	87.7
	10-Aug	2004	223	94.3	77.4	0.82	87.7
	5-Aug	2004	218	102.3	76.3	0.75	80.3
	9-Aug	2004	222	123.7	91.5	0.74	79.2
			Avg	**87.7**	**78.0**	**0.90**	**96.0**

Day-Specific RRF Findings

- These results for post-2000 episode involve no accuracy screening; removal of some days due to lower performance will change some results, but not likely overall findings.
- Typically, inclusion of the post-2000 episode days provide several days with higher RRFs and DVs compared to the TCEQ 2000 episode (in blue) and several days with lower RRFs and DVs
- Elimination of just one or a few of the highest (or lowest) RRF/DV days can have a significant impact on the bottom line future year design value.

Day-Specific RRF Findings

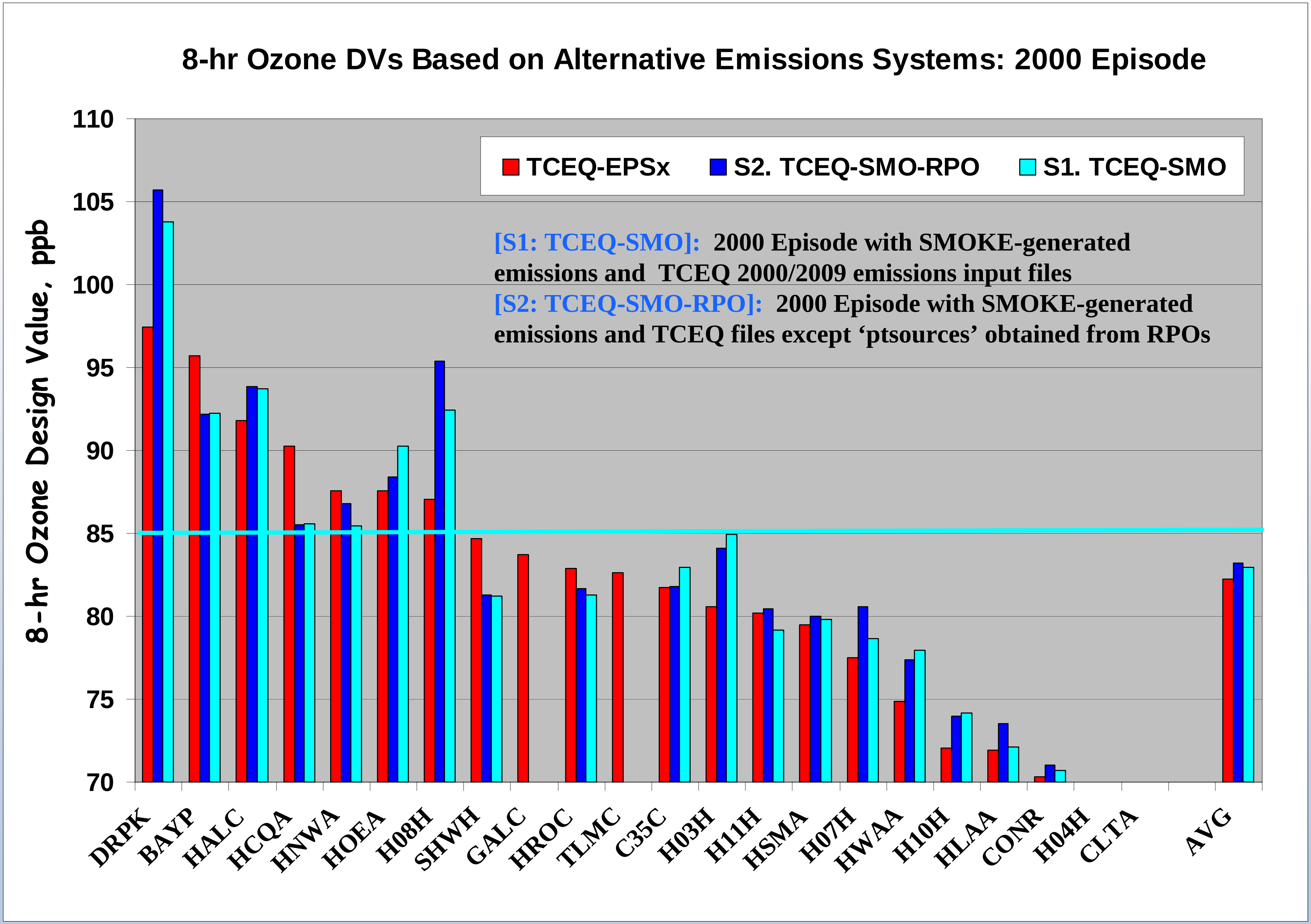
- Inclusion of the post-2000 episode days does not appear to systematically generate the need for greater or lesser ozone precursor controls in HGB
- Focused inclusion/exclusion of particular post-2000 days could lead either higher or lower control requirements compared to the 2000 episode alone.
- Similarly, focused WOE analyses with 2000 episode days can have important effects on the modeled 2009 Design Value at a given monitor.

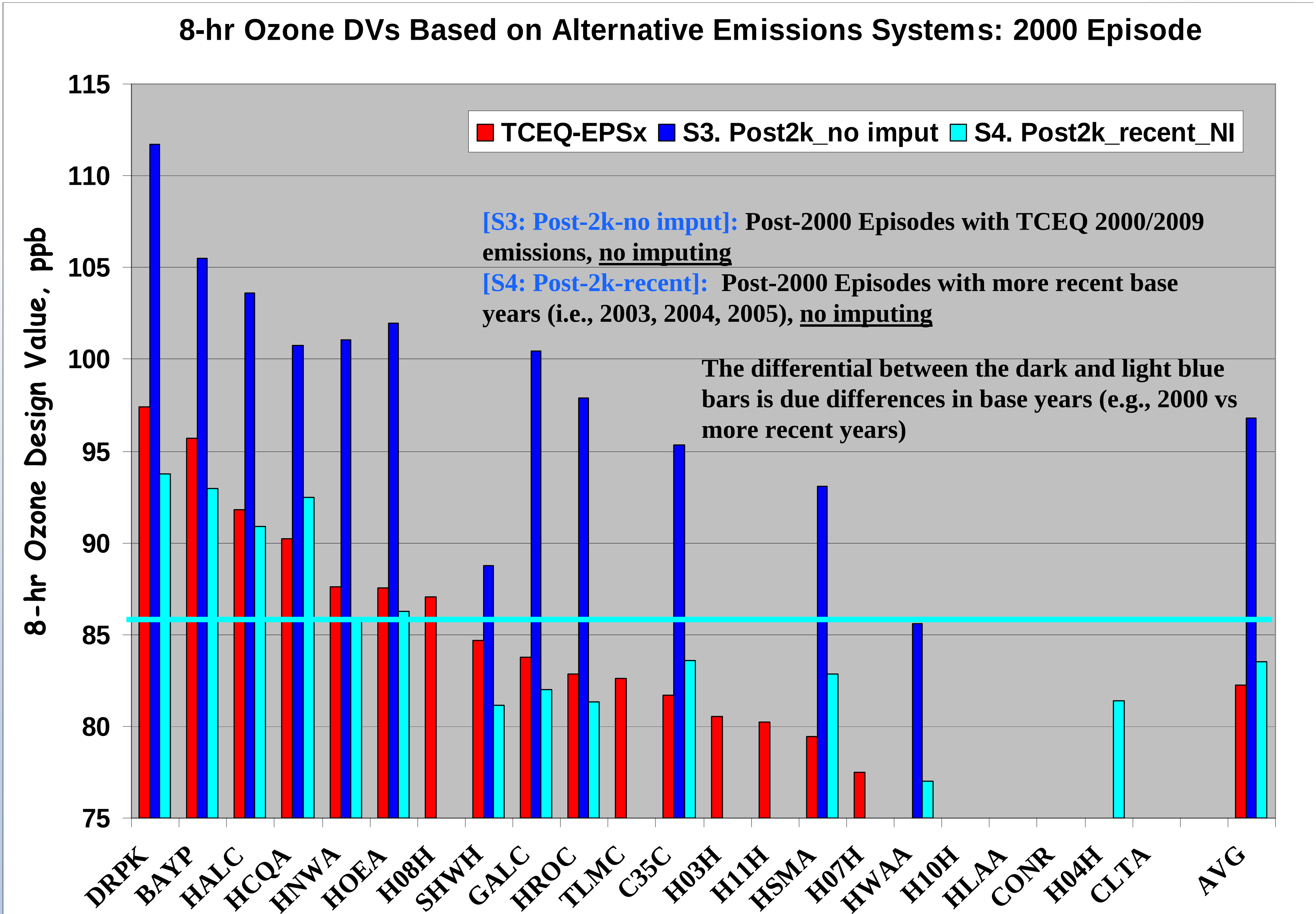
Sensitivity Tests with Alternative Emissions and Base Year

We performed several sensitivity experiments focusing on the EPS2x and SMOKE emissions models and various methods for estimating point, area and motor vehicle emissions both for 2000 as well as for more recent model years of 2003, 2004, 2005. This section presents results of four sensitivity runs examining various issues of interest.

Attain Demo ‘Sensitivity’ Studies

- **[S1: TCEQ-SMO]: 2000 Episode with SMOKE-generated emissions and TCEQ 2000/2009 emissions input files**
- **[S2: TCEQ-SMO-RPO]: 2000 Episode with SMOKE-generated emissions and TCEQ files except ‘ptsources’ obtained from RPOs**
- **[S3: Post-2k-no imput]: Post-2000 Episodes with TCEQ 2000/2009 emissions, <u>no imputing</u>**
- **[S4: Post-2k-recent]: Post-2000 Episodes with more recent base years (i.e., 2003, 2004, 2005), <u>no imputing</u>**


8-hr Ozone DVs Based on Alternative Emissions Systems: 2000 Episode
TCEQ-EPSx
S2. TCEQ-SMO-RPO
S1. TCEQ-SMO
[S1: TCEQ-SMO]: 2000 Episode with SMOKE-generated emissions and TCEQ 2000/2009 emissions input files
[S2: TCEQ-SMO-RPO]: 2000 Episode with SMOKE-generated emissions and TCEQ files except 'ptsources' obtained from RPOs
8-hr Ozone Design Value, ppb
110
105
100
95
90
85
80
75
70
DRPK
BAYP
HALC
HCQA
HNWA
HOEA
H08H
SHWH
GALC
HROC
TLMC
C35C
H03H
H11H
HSMA
H07H
HWAA
H10H
HLAA
CONR
H04H
CLTA
AVG


8-hr Ozone DVs Based on Alternative Emissions Systems: 2000 Episode
8-hr Ozone Design Value, ppb
115
110
105
100
95
90
85
80
75
TCEQ-EPSx
S3. Post2k_no imput
S4. Post2k_recent_NI
[S3: Post-2k-no imput]: Post-2000 Episodes with TCEQ 2000/2009 emissions, no imputing
[S4: Post-2k-recent]: Post-2000 Episodes with more recent base years (i.e., 2003, 2004, 2005), no imputing
The differential between the dark and light blue bars is due differences in base years (e.g., 2000 vs more recent years)
DRPK
BAYP
HALC
HCQA
HNWA
HOEA
H08H
SHWH
GALC
HROC
TLMC
C35C
H03H
H11H
HSMA
H07H
HWAA
H10H
HLAA
CONR
H04H
CLTA
AVG

Sensitivity Results

- The choice of emissions model (EPS2x vs. SMOKE) and the origin of the point source emissions (TCEQ vs RPOs/EPA) produces important differences in 2009 DVs from one monitor to the next;
- At DRPK, the SMOKE modeling approach generates higher DVs while at Bayland Park, just the opposite is true;
- SMOKE modeling shows substantially lower DVs at Croquet (by 5 ppb) while at HRM monitors (HRM8, HRM3, and HRM10), SMOKE emissions produce higher DVs;
- No one photochemical modeling methodology and Attainment Test procedure has so far been shown to be clearly superior for all HGB situations;
- Given these sensitivities, careful and thorough application and documentation of the actual 8-hr attainment test methodology ultimately used will be needed;

Findings (concluded)

- When the post-2000 episodes are run for the 2000 base case without olefin imputing, the 8-hr Design Values increase by 5-15 ppb, depending upon the monitor;
- When the same post-2000 episodes are run (without imputing) for the more recent base years (2003-5) with their lower measured DVs, the modeled ‘09 DVs are significantly reduced from run Sens3;
- Indeed, Run S4 produces 2009 DVs that are lower than the TCEQ 2000/2009 future design values at virtually all of the high monitors with the exception of Croquet; and
- This latter finding is consistent with the earlier Fasttrack work that showed that using a more recent base year for the HGB AT may lower the ’09 DVs at the peak sites.

Analysis of RRF Artifact Results at Galveston (GALC)

2000	00 DV		Days	Pmax-b	Pmax-f	RRF	DVf
GALC	98.3	69	5	92.7	78.9	0.85	83.8
	30-Aug	2000	243	71.1	66.8	0.94	92.4
	31-Aug	2000	244	87.6	75.6	0.86	84.5
	4-Sep	2000	248	106.5	90.4	0.85	83.6
	5-Sep	2000	249	125.7	99.4	0.79	77.7
			Avg	97.7	83.0	0.86	84.5

Post-2k	00 DV		Days	Pmax-b	Pmax-f	RRF	DVf
GALC	98.3	69	7	76.9	77.5	1.01	99.1
	29-Sep	2004	273	73.4	80.7	1.10	108.1
	29-May	2003	149	87.9	90.4	1.03	101.2
	28-May	2003	148	70.0	70.8	1.01	99.3
	7-Aug	2004	220	79.1	80.2	1.01	99.3
	1-Jun	2005	152	79.0	78.9	1.00	98.3
	8-Aug	2004	221	75.5	73.5	0.97	95.4
	30-Sep	2004	274	73.6	68.3	0.93	91.4
			Avg	76.9	77.5	1.01	99.0

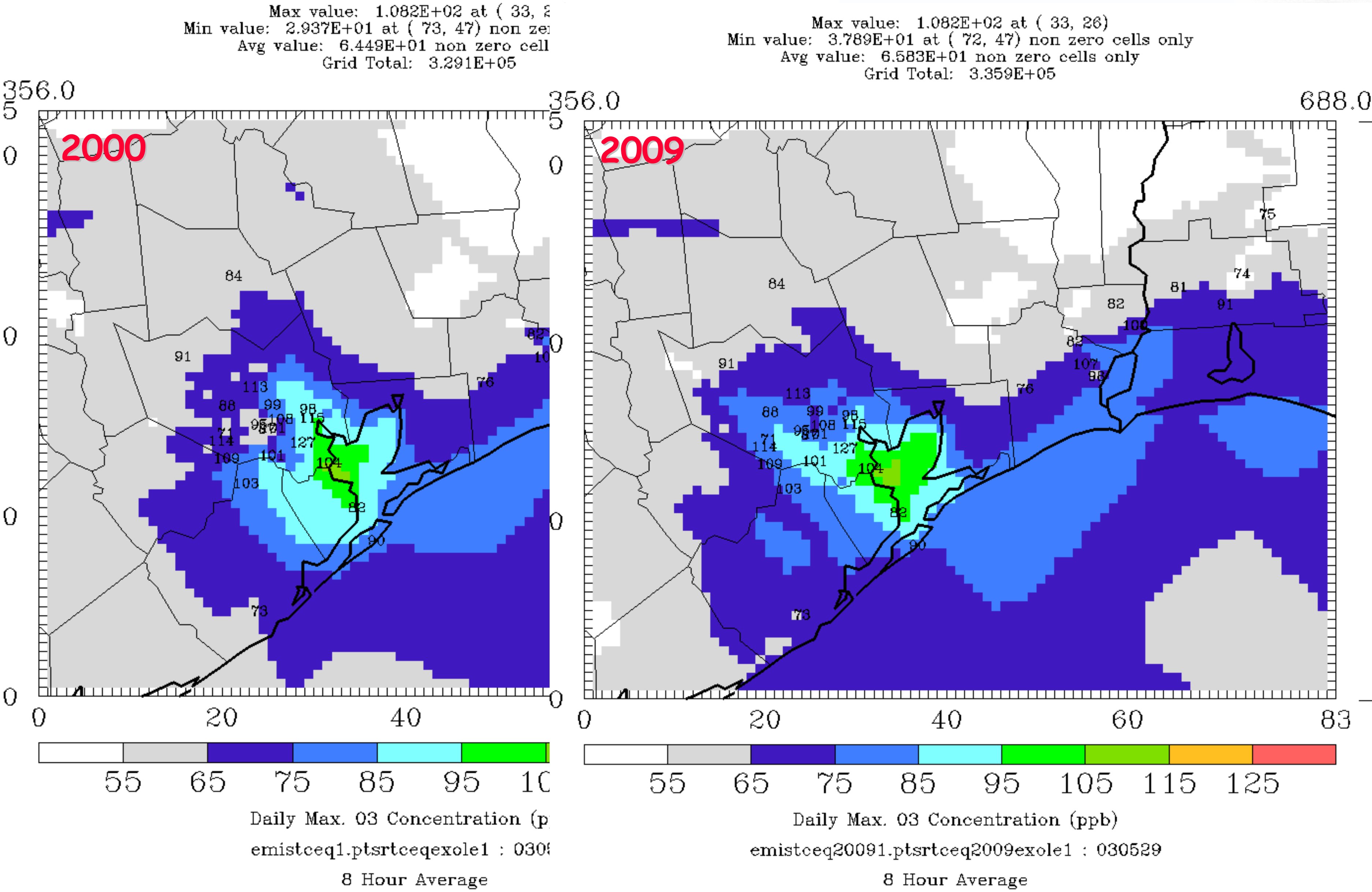
ALL	00 DV		Days	Pmax-b	Pmax-f	RRF	DVf
GALC	98.3						
	29-Sep	2004	273	73.4	80.7	1.10	108.1
	29-May	2003	149	87.9	90.4	1.03	101.2
	28-May	2003	148	70.0	70.8	1.01	99.3
	7-Aug	2004	220	79.1	80.2	1.01	99.3
	1-Jun	2005	152	79.0	78.9	1.00	98.3
	8-Aug	2004	221	75.5	73.5	0.97	95.4
	30-Aug	2000	243	71.1	66.8	0.94	92.4
	30-Sep	2004	274	73.6	68.3	0.93	91.4
	31-Aug	2000	244	87.6	75.6	0.86	84.5
	4-Sep	2000	248	106.5	90.4	0.85	83.6
	5-Sep	2000	249	125.7	99.4	0.79	77.7
			Avg	84.5	79.5	0.95	93.7

Here is the listing of all days qualified in the 2000 and post-2000 episodes to be used in the RRF analysis. In the 2000 episode, ozone at GALC drops by 6%-21% EVERY day, but in the post-2000 days, ozone INCREASES on 5 of the 7 RRF days. WHY? Due to steep gradients in local fields in base and '09 years.

Data in green rows are the true AT results, averaging across all days; below we compute RRFs and DVs on a daily basis for analysis purposes.

Max 8-hr Ozone [29 May '03]

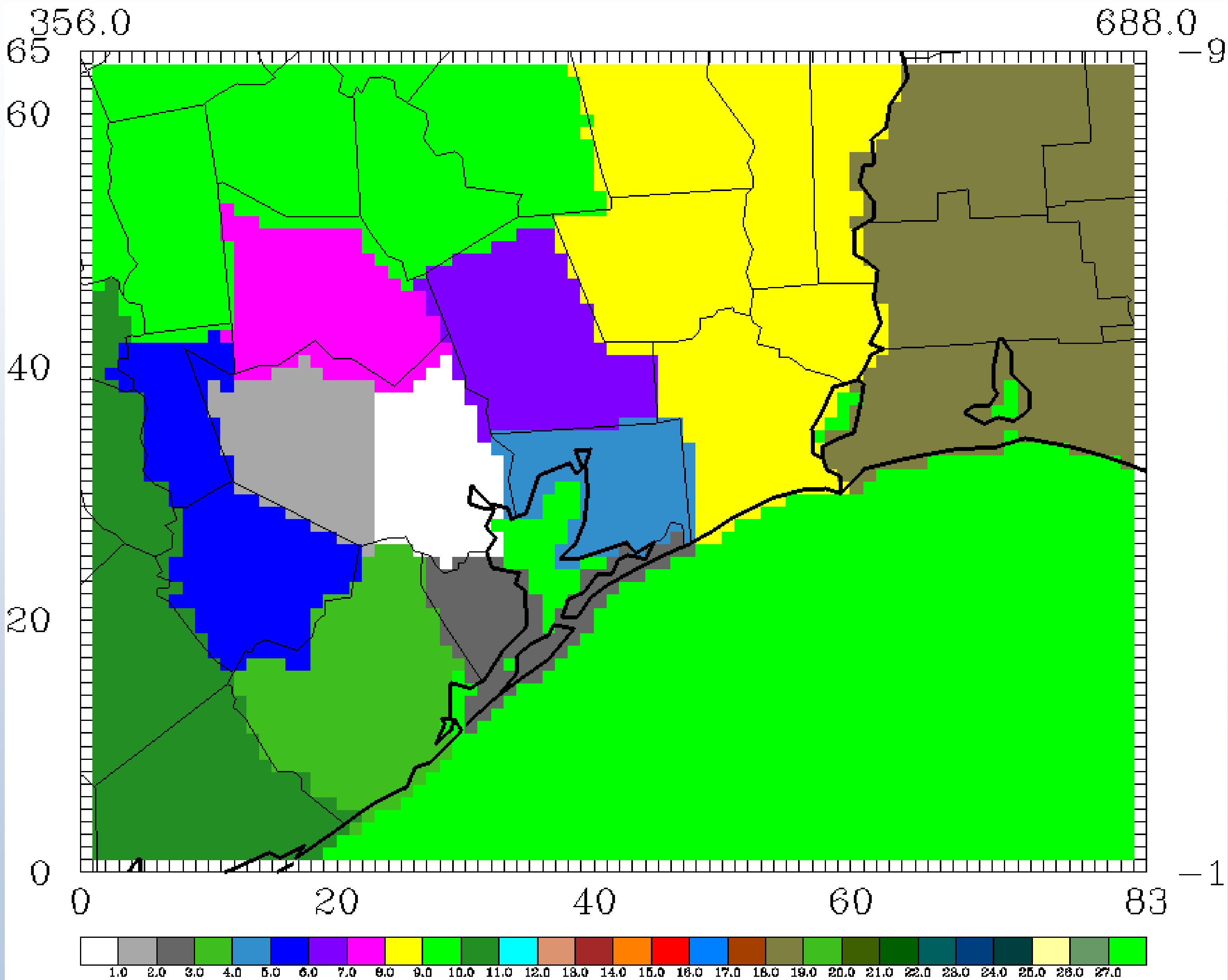
RRF=1.10



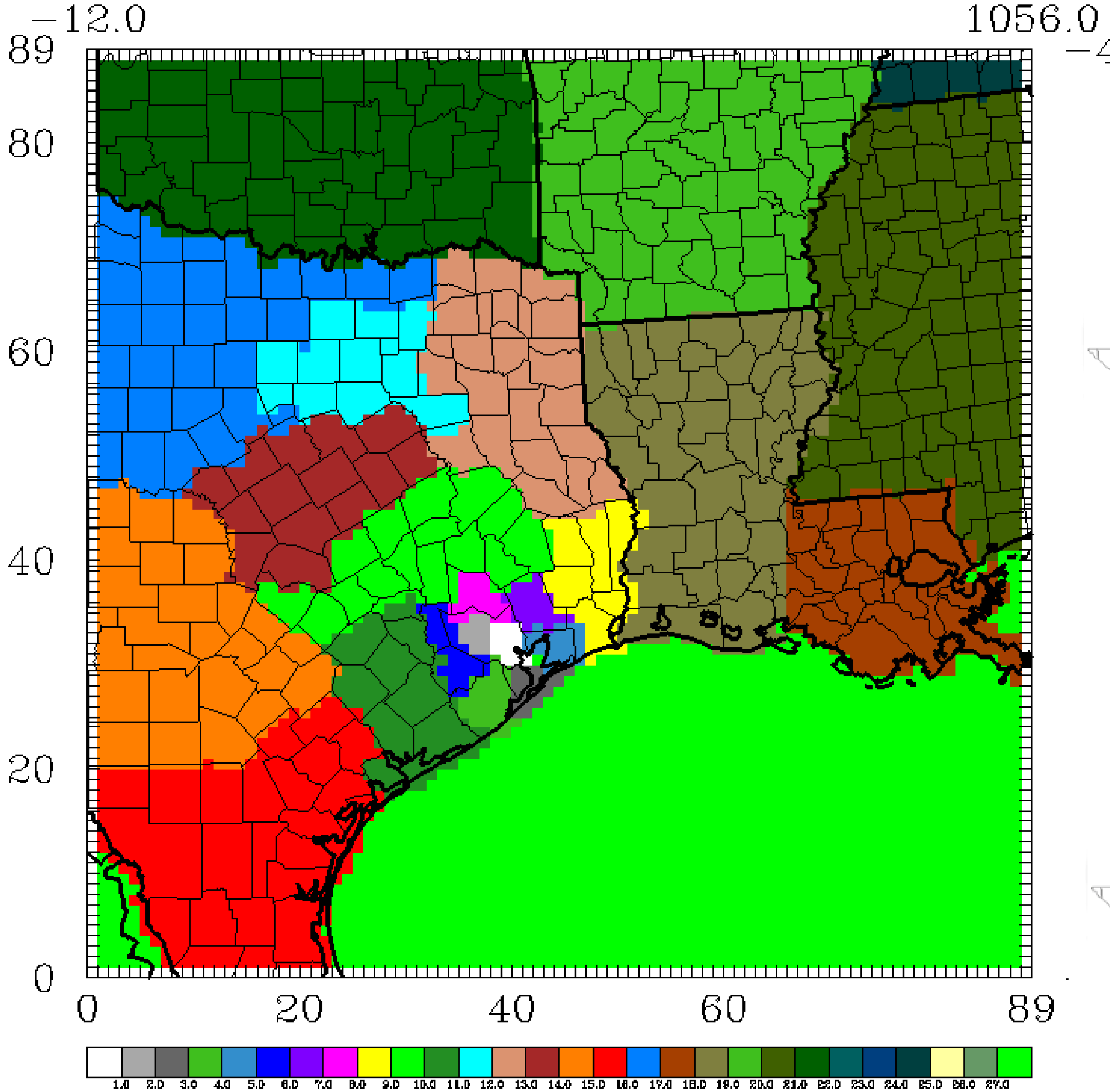
AIRS ID				2001	2002	2003	2004	2005	2000-2002	2001-2003	2002-2004	2003-2005
AIRS ID	MAPS	TCEQ	Monitor Name	3-yr DV on Yr Ending					Weighted DV			
480390618	DANC	C618	DANCIGER			75.0	80.0	80.7		75.0	77.5	78.6
480390619	MSTG	C619	MUSTANG BAYOU			95.0	97.5	93.0		95.0	96.3	95.2
480391003	CLTA	C11/A111	CLUTE	91.7	86.0	87.3	89.0	83.0	90.0	88.3	87.4	86.4
480391004	MANV	C89	MANVEL	86.0	89.0	91.7	97.3	97.7		88.9	92.7	95.6
480391016	JACK	C1016	LAKE JACKSON			79.0	80.0	79.3		79.0	79.5	79.4
480710900	H10H	C610	HRM-10	82.0	90.0	81.0				84.3	85.5	81.0
480710901	H11H	C611	HRM-11	77.7	90.0	79.0				82.2	84.5	79.0
481670014	GALC	C34/A109/X152	GALVESTON	98.7	89.7	89.3	91.0	87.0	98.3	92.6	90.0	89.1
481670056	C620	C620	34TH STREET			85.0	91.5	89.7		85.0	88.3	88.7
481670571	C571	C571	CLEAR CREEK HS			68.0	81.5	83.3		68.0	74.8	77.6
481671002	TLMC	C10	TEXAS CITY	91.3	83.0	80.3	74.7	70.5	90.7	84.9	79.3	75.2
482010024	HALC	C8/A108/X150	ALDINE	109.0	107.7	100.3	95.7	92.7	108.7	105.7	101.2	96.2
482010026	H4H	C15/C115/C604	HRM4	75.0	82.0	87.3	90.7	89.3		81.4	86.7	89.1
482010029	HNWA	C26/A110/X154	HOUSTON NORTHWES	105.3	101.3	100.7	94.7	93.3	104.7	102.4	98.9	96.2
482010046	HWAA	C405	NORTH WAYSIDE	95.5	89.7	86.0	85.0	82.7	89.0	90.4	86.9	84.6
482010047	HLAA	C408	LANG	88.5	83.0	78.3	79.0	79.0	83.0	83.3	80.1	78.8
482010051	HCQA	C409	CROQUET	102.5	102.0	99.7	99.7	98.0	102.0	101.4	100.4	99.1
482010055	BAYP	C53/A146	BAYLAND PARK	110.3	100.3	102.3	101.7	103.7	107.0	104.3	101.4	102.6
482010062	HSMA	C406	SWISS & MONROE	88.5	90.7	90.7	95.3	97.0	90.0	89.9	92.2	94.3
482010066	SHWH	C410	SHELL WESTHOLLOW	100.5	95.0	87.7	87.3	89.3	95.0	94.4	90.0	88.1
482010070	HROC	C81	REGIONAL OFFICE	99.0	95.3	94.7	88.7	88.7	95.0	96.3	92.9	90.7
482010075	TXAV	C411	TEXAS AVE	90.0	84.0	88.3	89.3	88.7		87.4	87.2	88.8
482010551	SHEL	C551	SHELDON	47.0	68.0	79.7	92.7	92.0		64.9	80.1	88.1
482010552	C552	C552	WETLANDS CENTER			87.0	88.5	87.3		87.0	87.8	87.6
482010617	WALL	HRM-Wallisville	WALLISVILLE			101.0	97.5	96.3		101.0	99.3	98.3
482010803	H03H	C603/A114	HRM-3	78.7	89.5	97.0	96.0	92.0		88.4	94.2	95.0
482010804	H04H	C604	HRM-4	64.3	78.0	88.0				76.8	83.0	88.0
482010808	H08H	C608	HRM-8	77.7	97.0	93.0				89.2	95.0	93.0
482011015	BAYT	C1015/A165	BAYTOWN			108.0	100.5	96.3		108.0	104.3	101.6
482011034	HOEA	C1/G316	HOUSTON EAST	103.3	101.0	100.3	95.3	87.0	102.0	101.6	98.9	94.2
482011035	C35C	C403/C304/A113	CLINTON DR	93.5	93.0	96.0	96.3	95.0	93.0	94.2	95.1	95.8
482011039	DRPK	C35/C1001/A139	DEER PARK	108.0	103.0	102.0	101.7	100.7	107.7	104.3	102.2	101.4
482011050	SBRK	C45	SEABROOK	71.0	82.5	85.7	94.3	92.3		79.7	87.5	90.8
482450101	S40S	C640	SABINE PASS	84.7	90.0	91.3	92.7	88.7		88.7	91.3	90.9
482450102	S43S	C643	SETRPC-43	89.0	85.0	86.0	84.0	84.3		86.7	85.0	84.8
483390078	CONN	C78	CONROE-RELOCATED	58.0	70.0	78.0	85.3	86.0		68.7	77.8	83.1
483390089	CONR	C65	CONROE	91.7	95.0	90.0			91.0	92.2	92.5	90.0

OSAT Results

4 Km Grid


356.0
688.0
65
60
40
20
0
-9
-1
0
20
40
60
83
1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0

12 Km Grid



−12.0
1056.0
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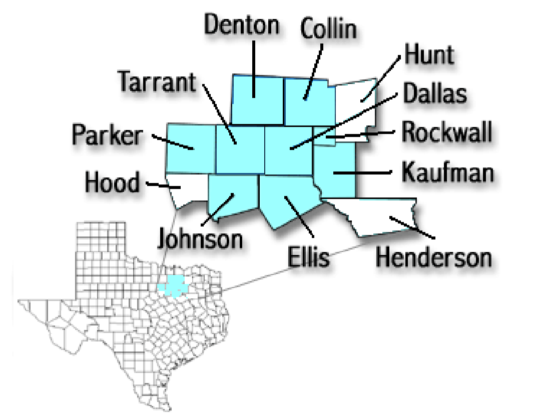
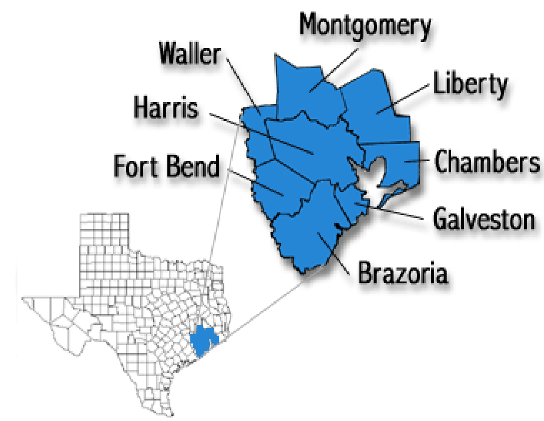
80
60
40
20
0
0
20
40
60
89

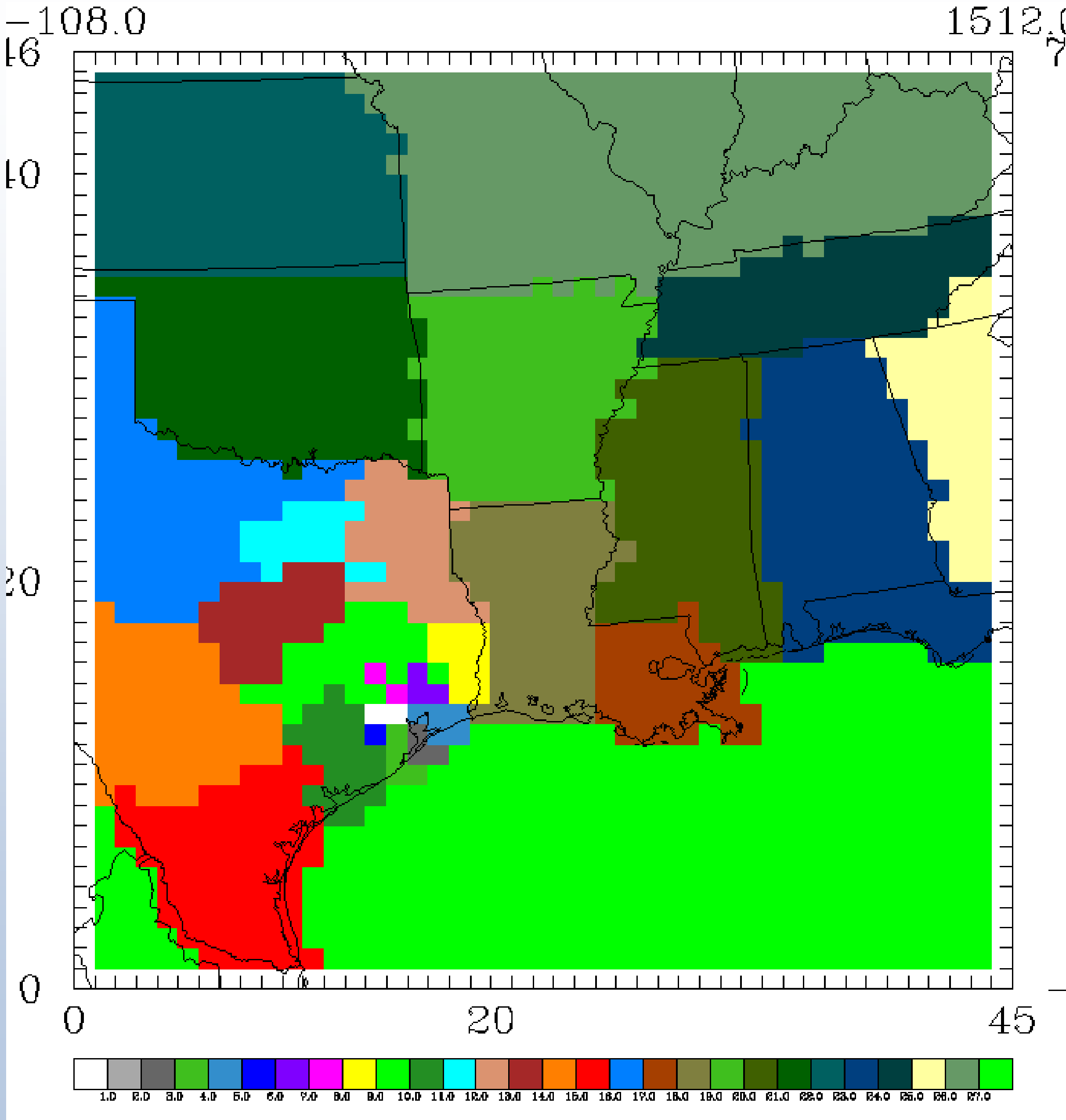


Denton
Collin
Hunt
Tarrant
Dallas
Parker
Rockwall
Hood
Kaufman
Johnson
Ellis
Henderson



Montgomery
Waller
Liberty
Harris
Fort Bend
Chambers
Galveston
Brazoria

36 Km Grid

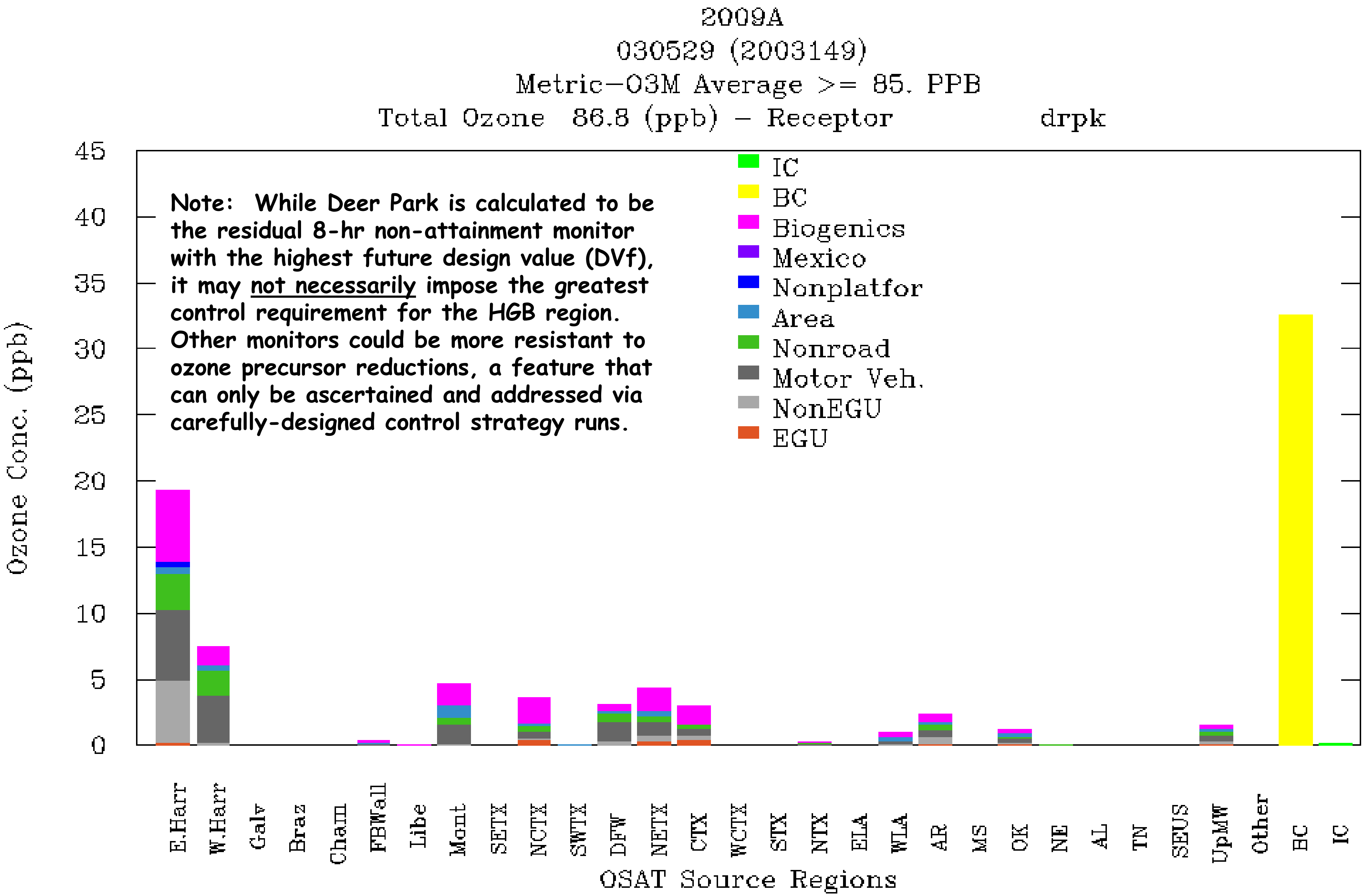


-108.0
1512.0
46
40
20
0
0
20
45
1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0

OSAT Source Categories

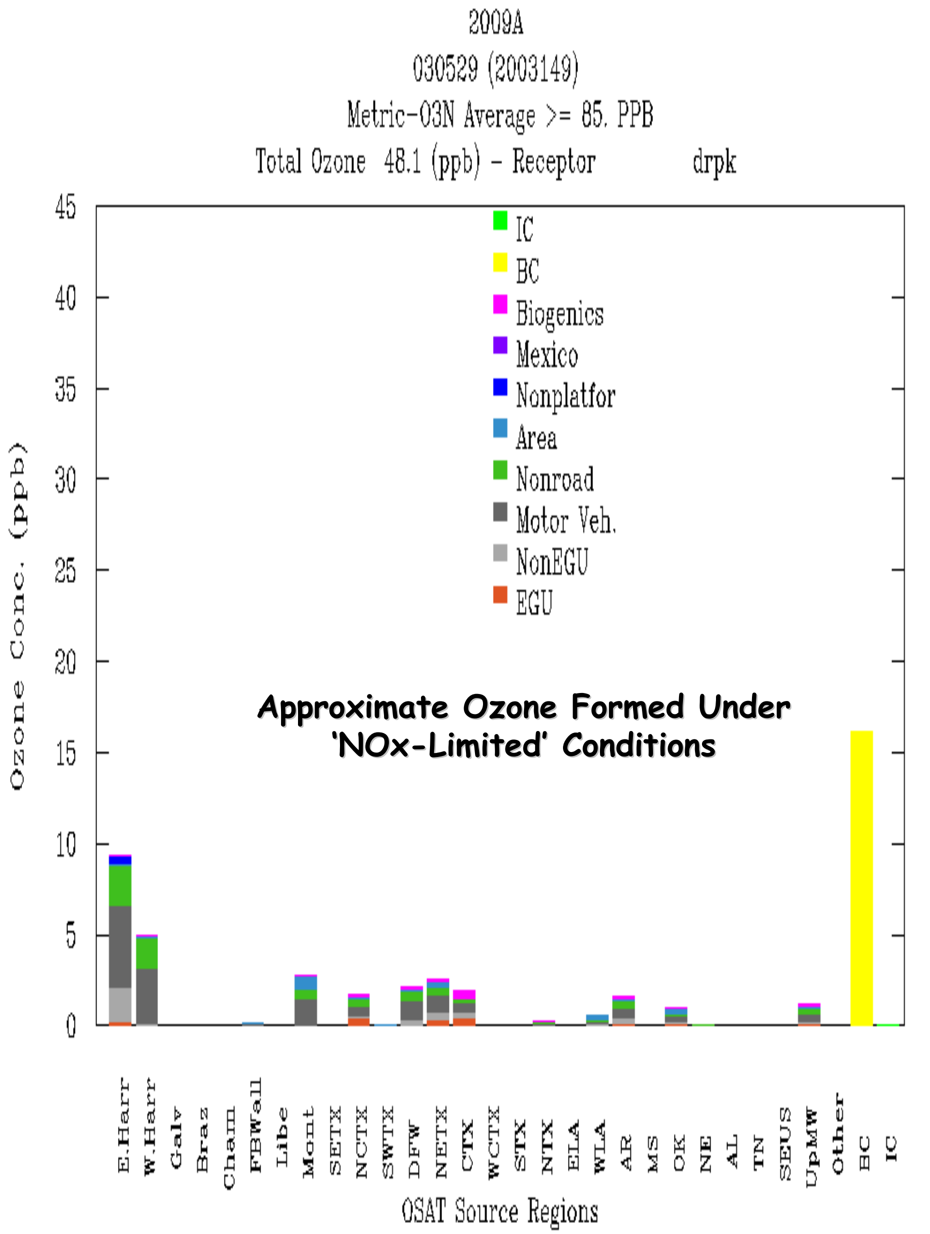
- 1. Elevated EGU
- 2. Elevated Non-EGU
- 3. On-Road Motor Vehicles
- 4. Non-Road Motor Vehicles
- 5. Area Sources
- 6. Ships & Platforms
- 7. Mexico
- 8. Biogenics

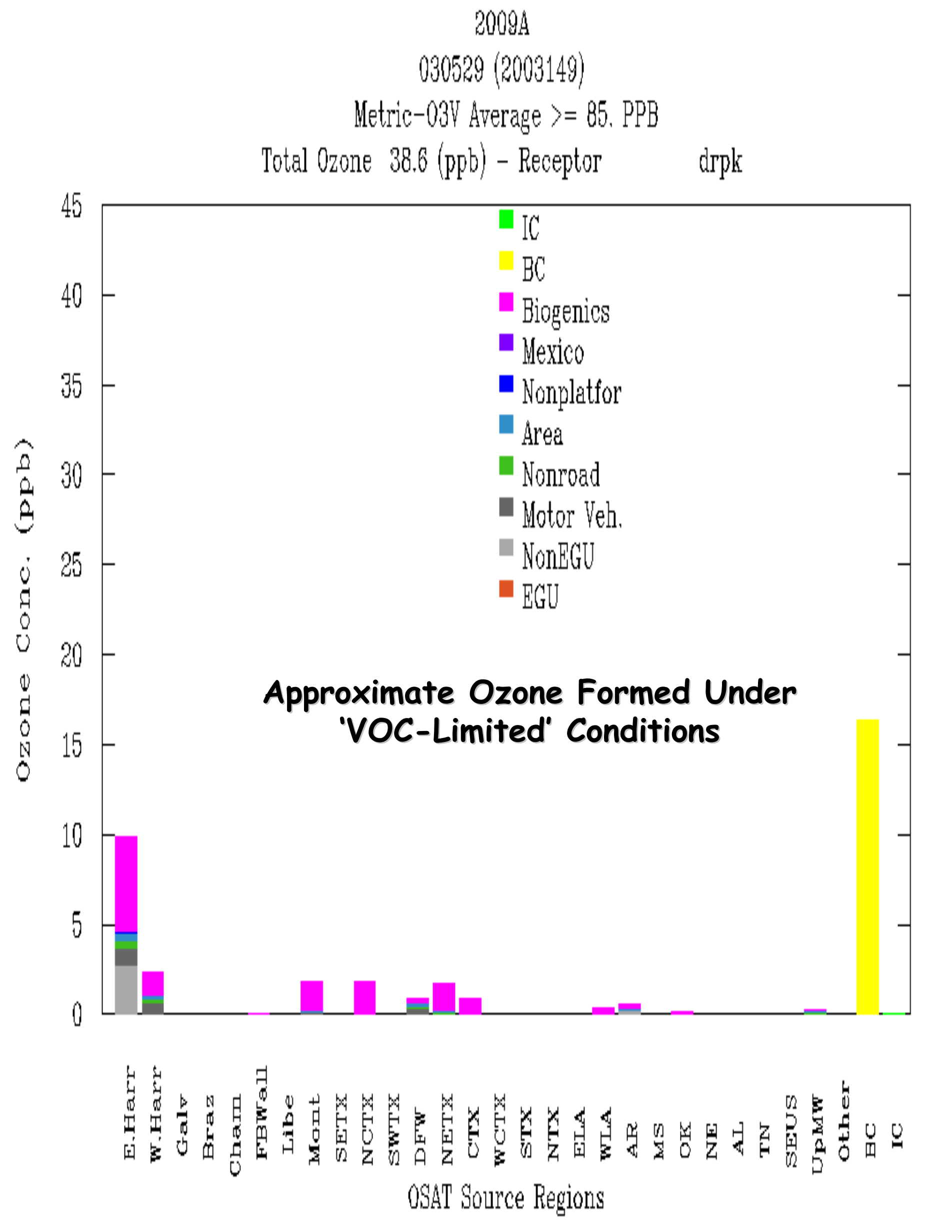
Deer Park: DV_f = 97.7 ppb



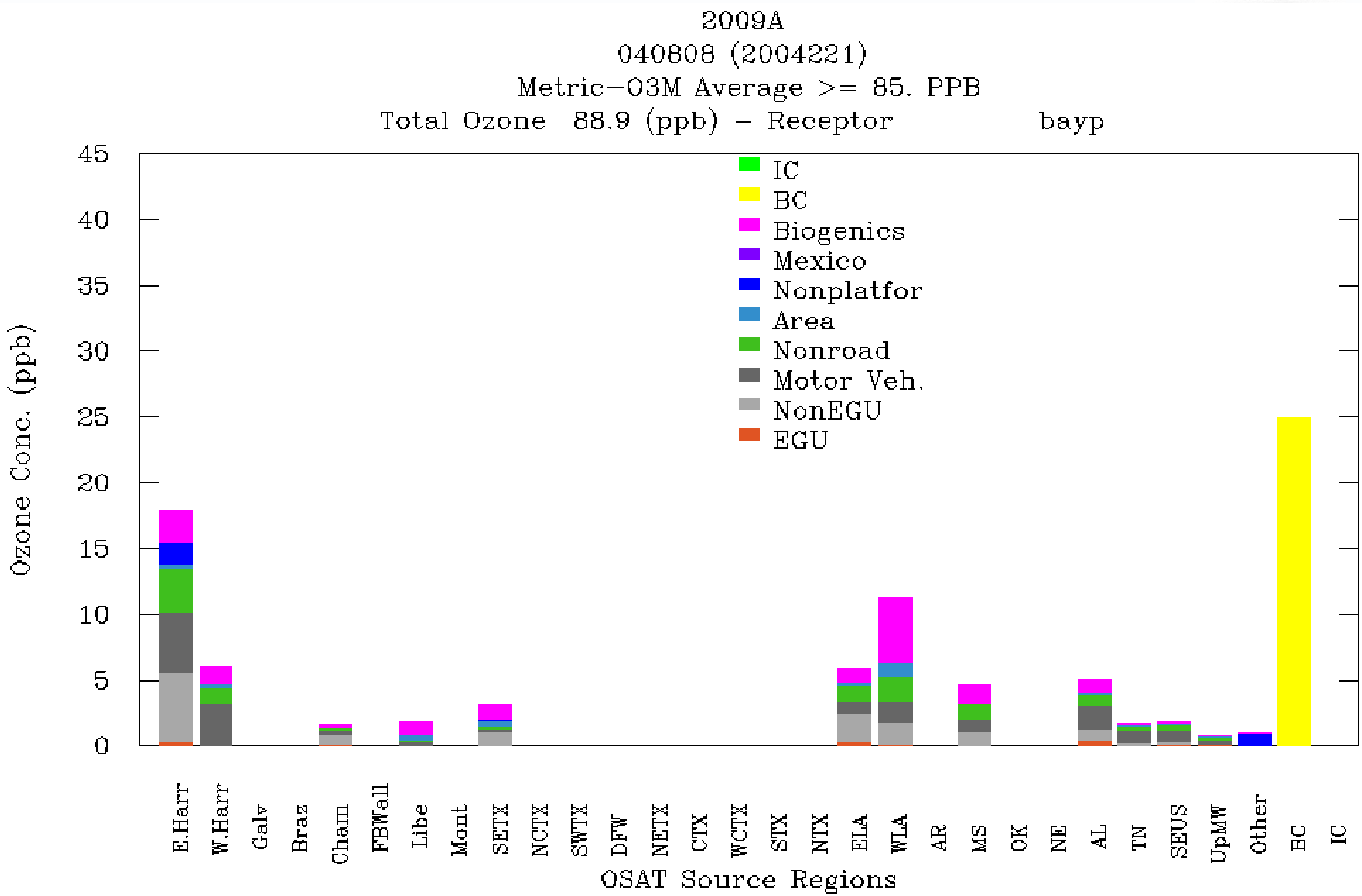
Note: While Deer Park is calculated to be the residual 8-hr non-attainment monitor with the highest future design value (DVf), it may not necessarily impose the greatest control requirement for the HGB region. Other monitors could be more resistant to ozone precursor reductions, a feature that can only be ascertained and addressed via carefully-designed control strategy runs.

Deer Park: DV_f = 97.7 ppb

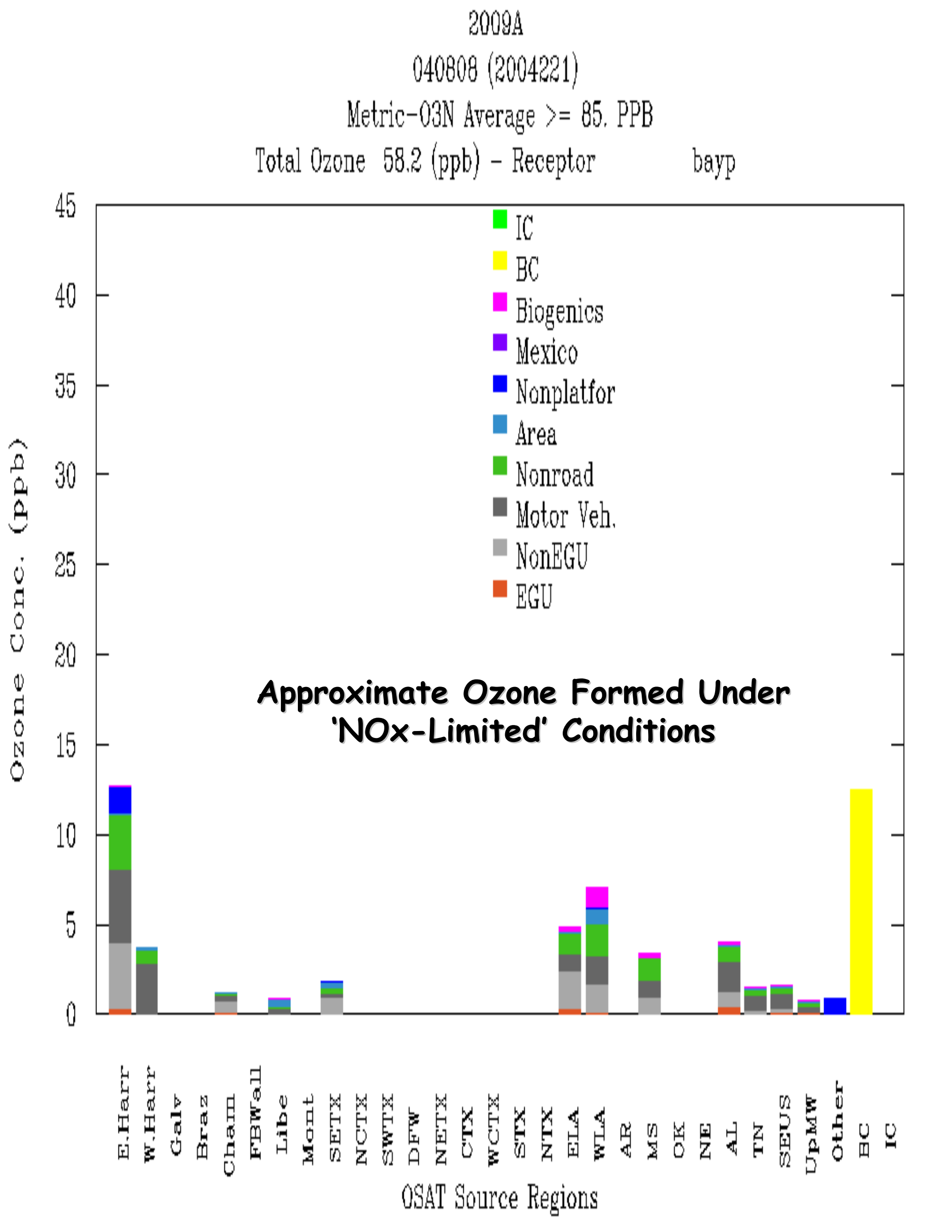


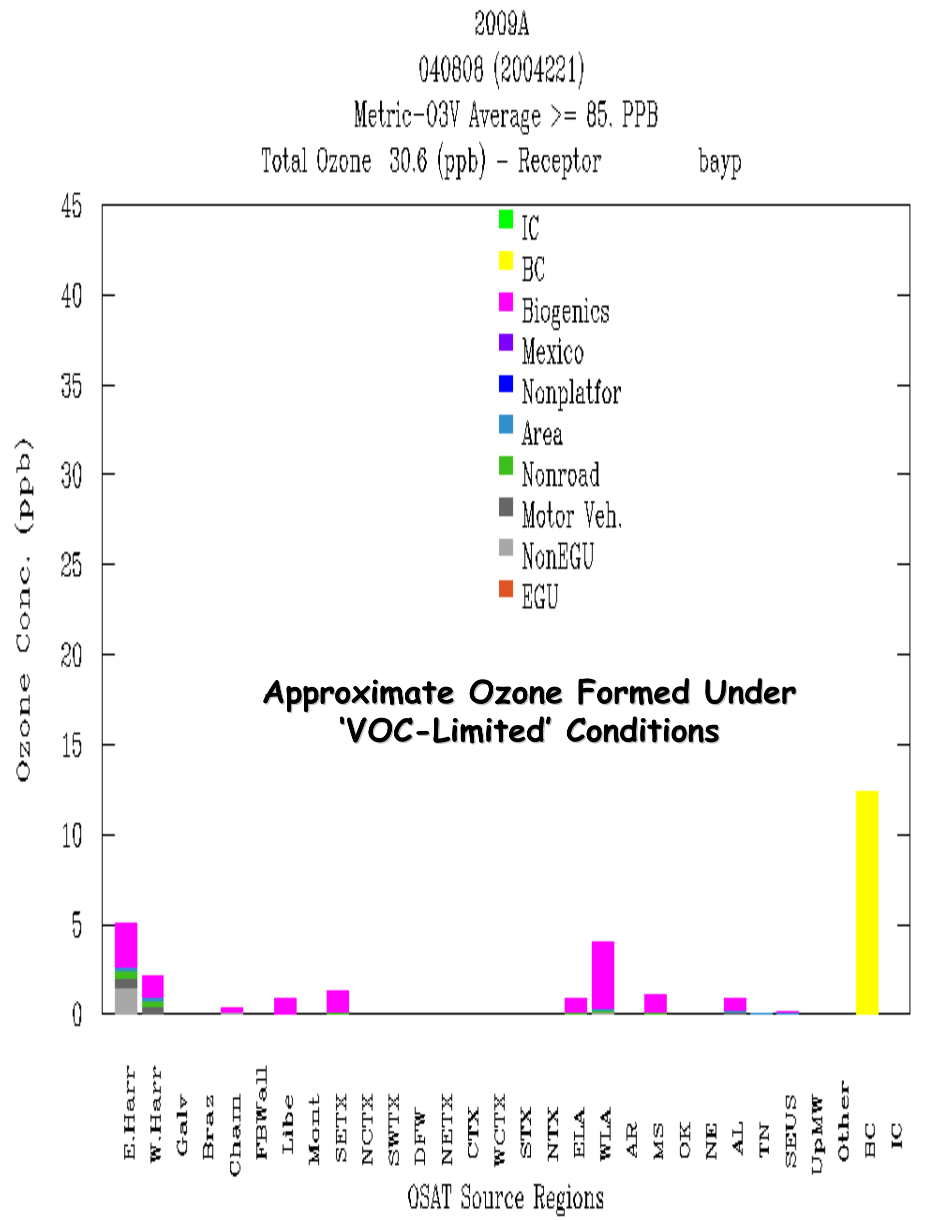


Bayland Park: DV_f = 96.0 ppb

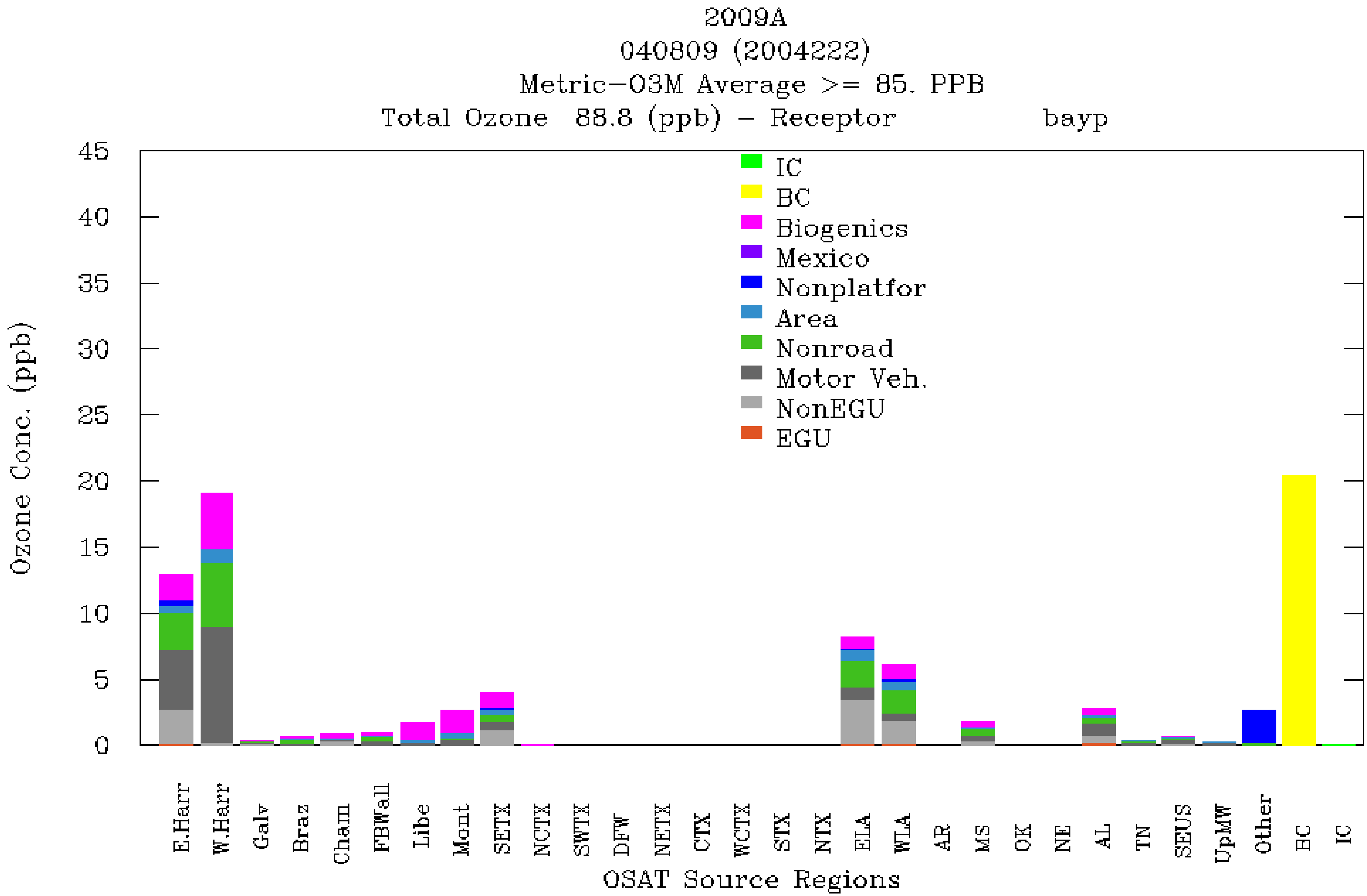


Bayland Park: DV_f = 96.0 ppb

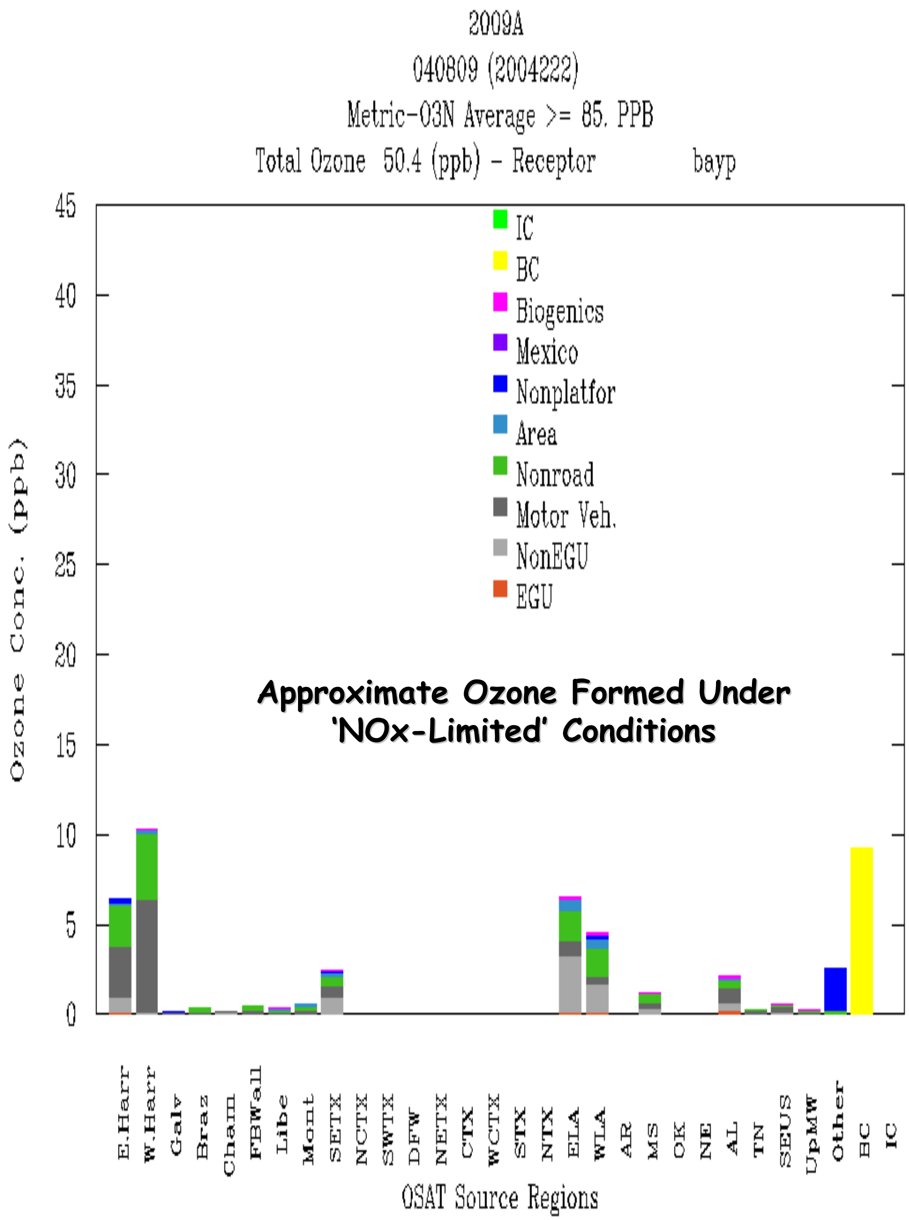


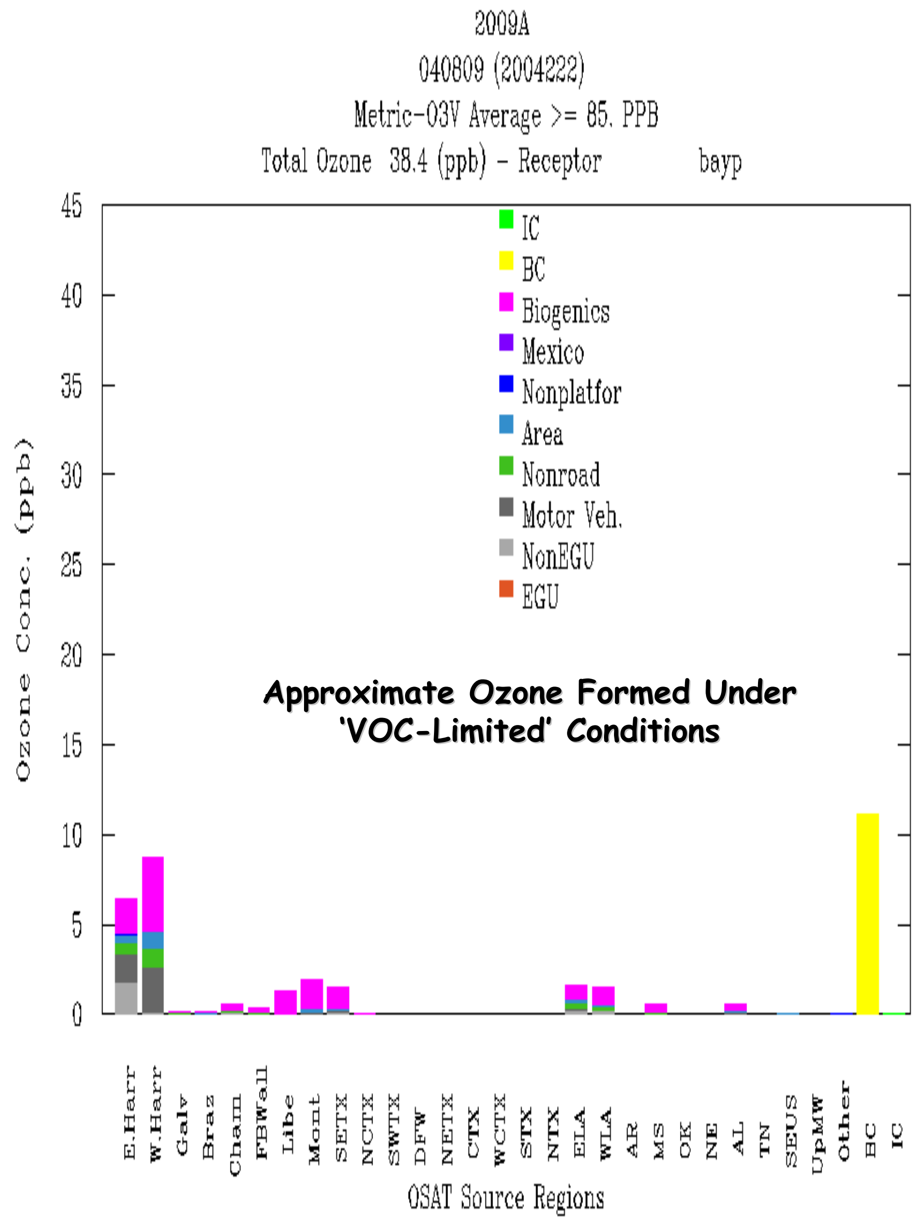


Bayland Park: DV_f = 96.0 ppb



Bayland Park: DV_f = 96.0 ppb



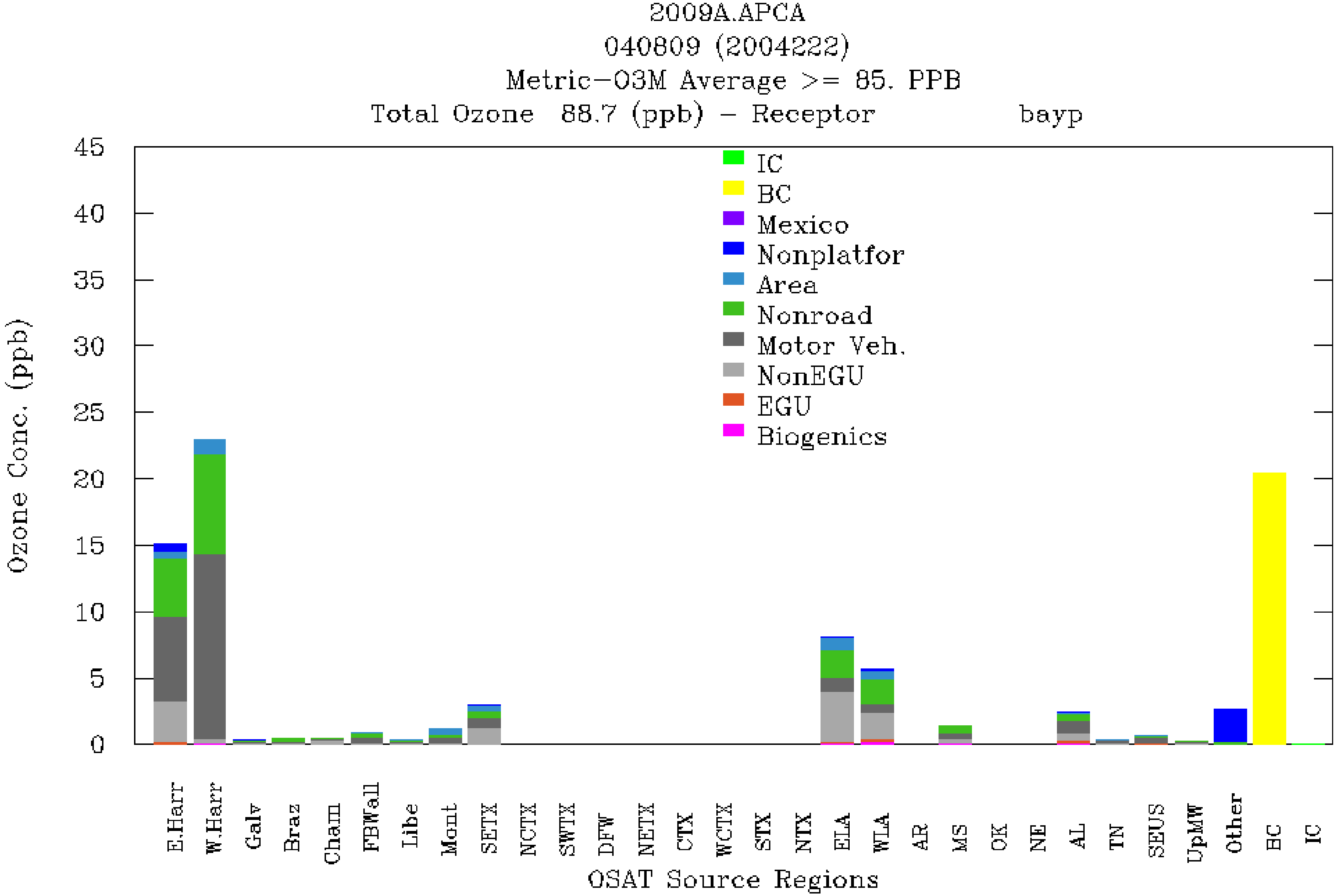


APCA Results

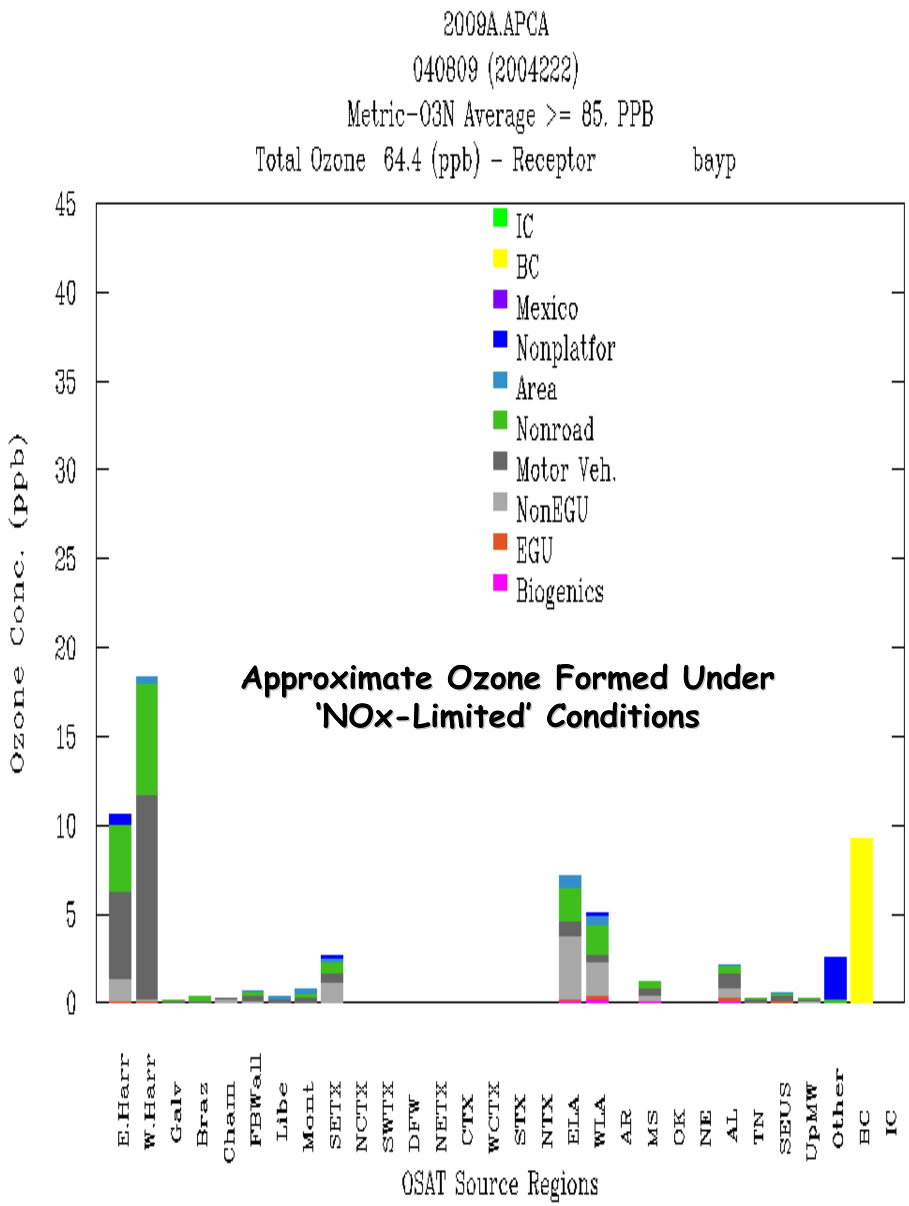
Role Fulfilled by APCA

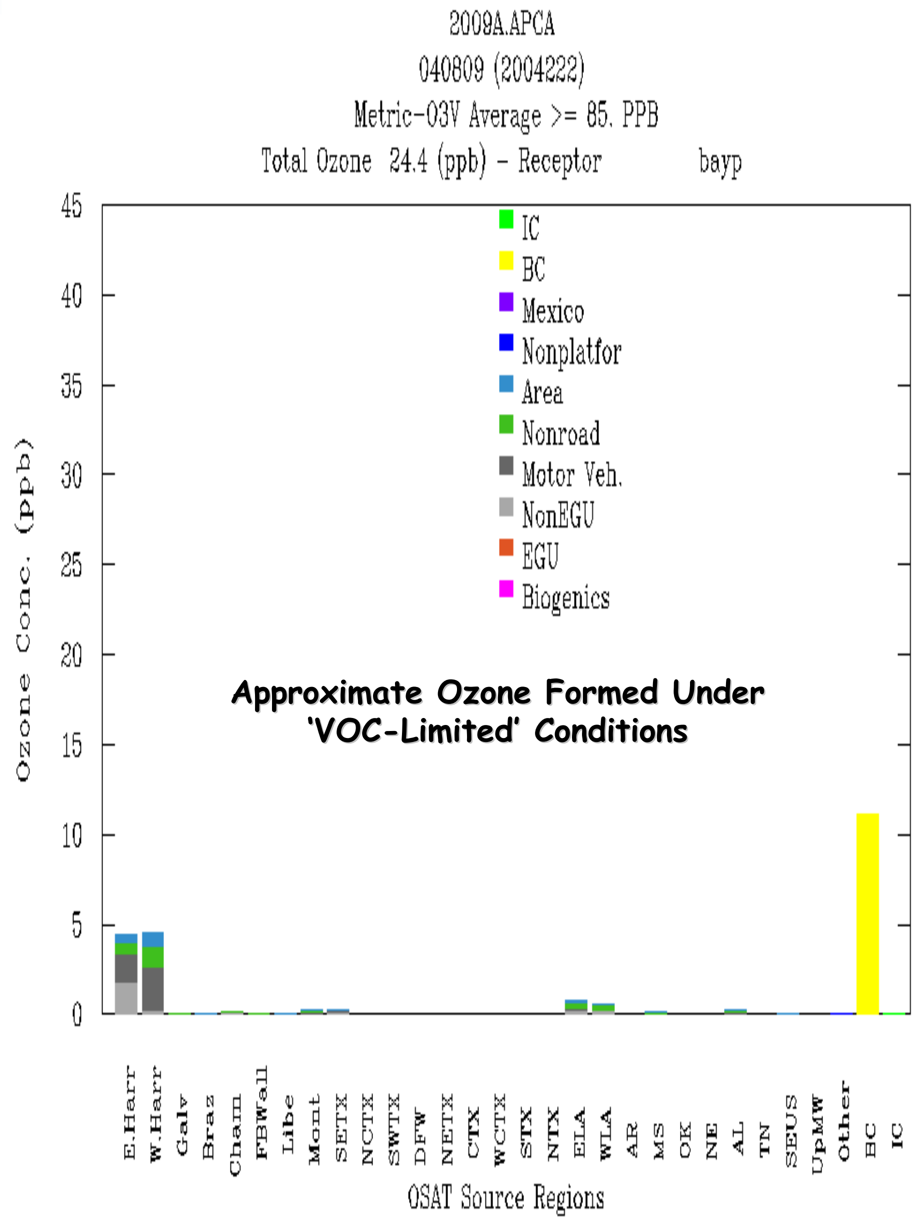
- **APCA differs from OSAT in that it recognizes that certain emissions groups are non-controllable (e.g., biogenics) and that apportioning ozone to these groups may not provide a complete picture of control strategy relevant processes;**
- **In situations where OSAT would attribute ozone production to biogenics, APCA re-allocates that ozone production the controllable precursors that participate in the ozone formation with the non-controllable precursor;**
- **For example, when ozone formation is due to biogenic VOC and anthropogenic NOx (OSAT would attribute to biogenics), APCA re-directs the ozone attribution to the anthropogenic NOx precursors;**
- **Thus, in this example, APCA attributes more ozone formation to NOx sources and less ozone to biogenic sources.**
- **APCA is not really a source apportionment method because is leads to biases as to which sources should be implicated for control; hence it is properly a "culpability assessment" tool.**

Bayland Park: DV_f = 96.0 ppb

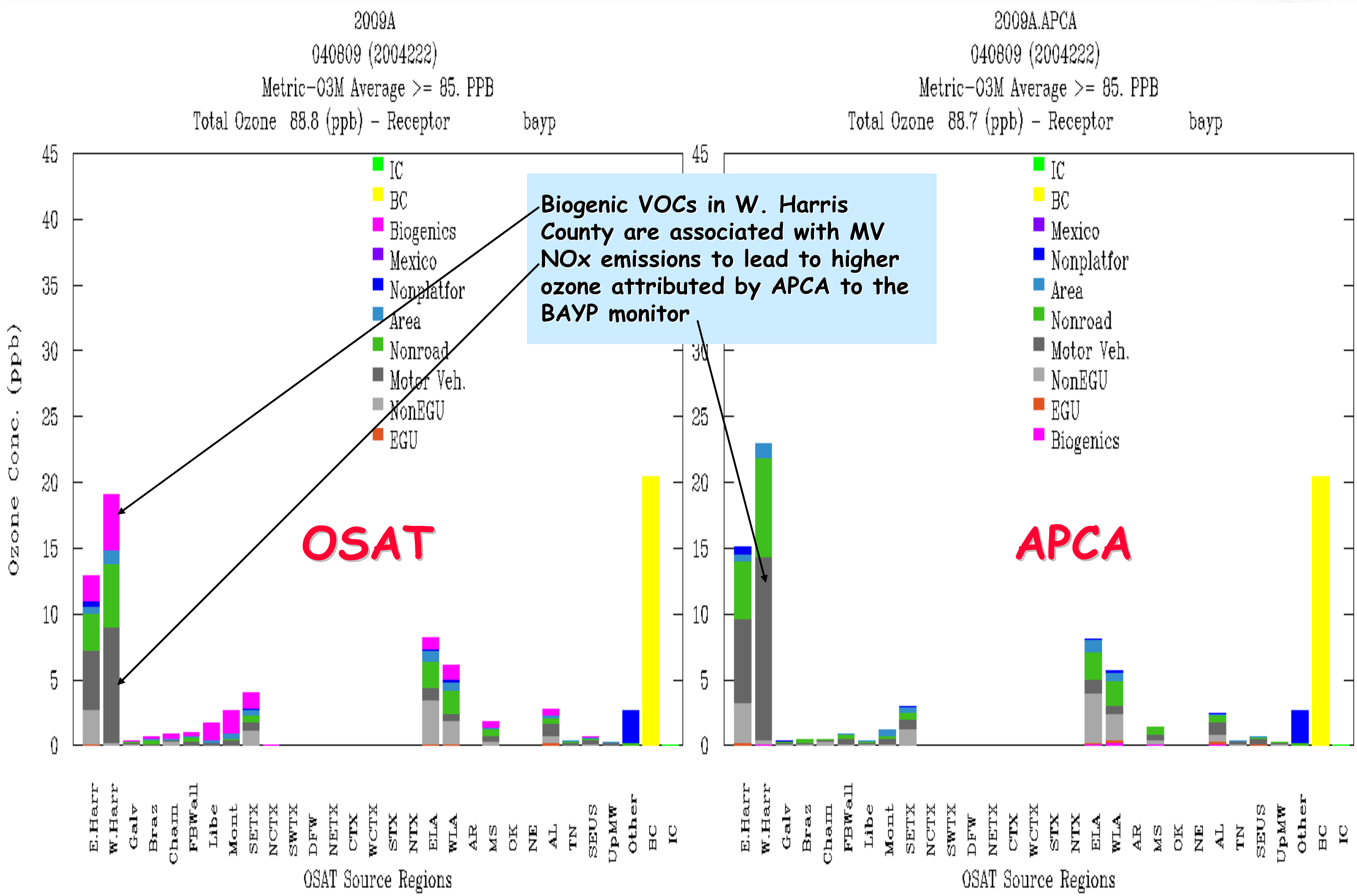


Bayland Park: DV_f = 96.0 ppb





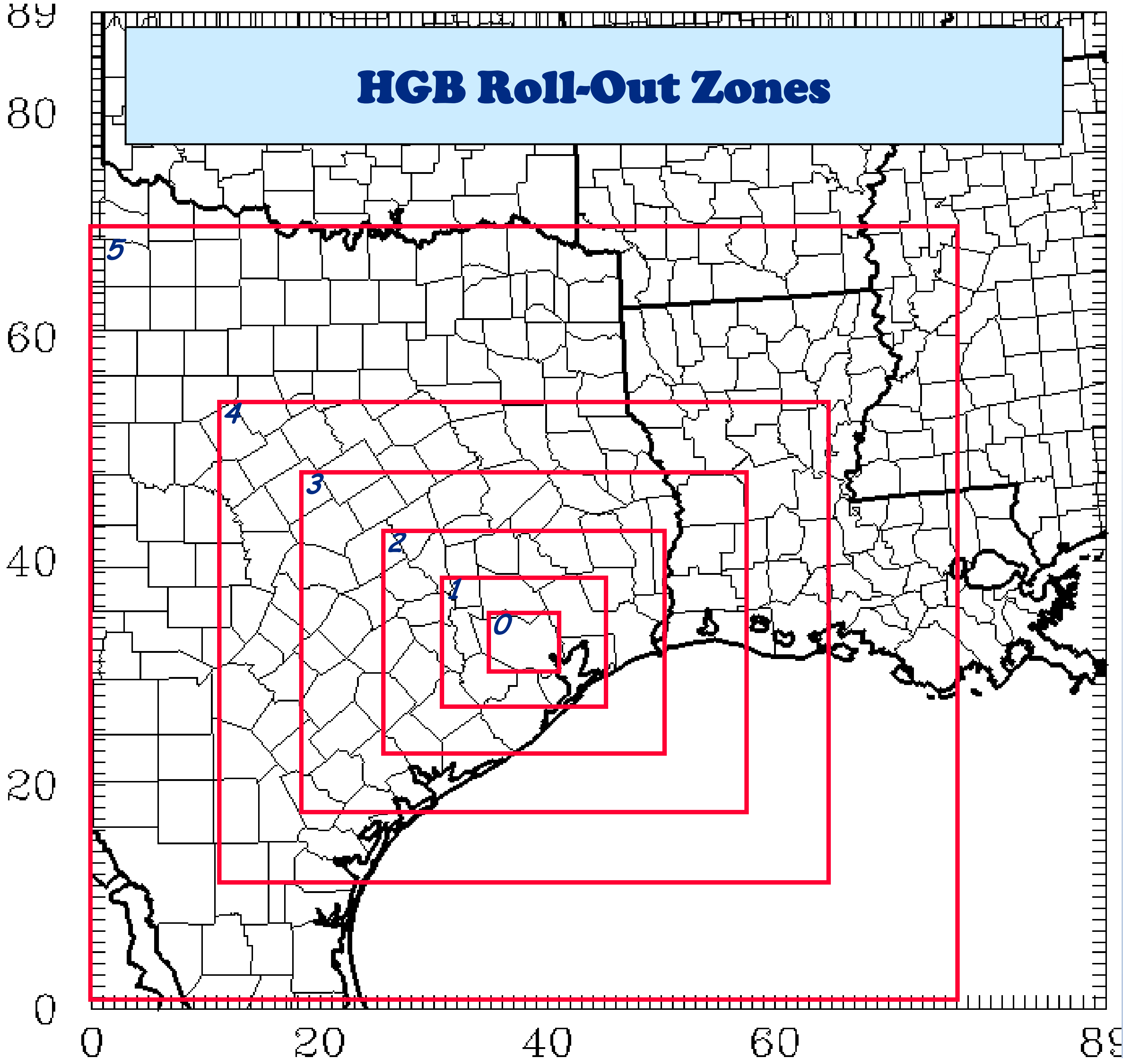
Bayland Park: DV_f = 96.0 ppb

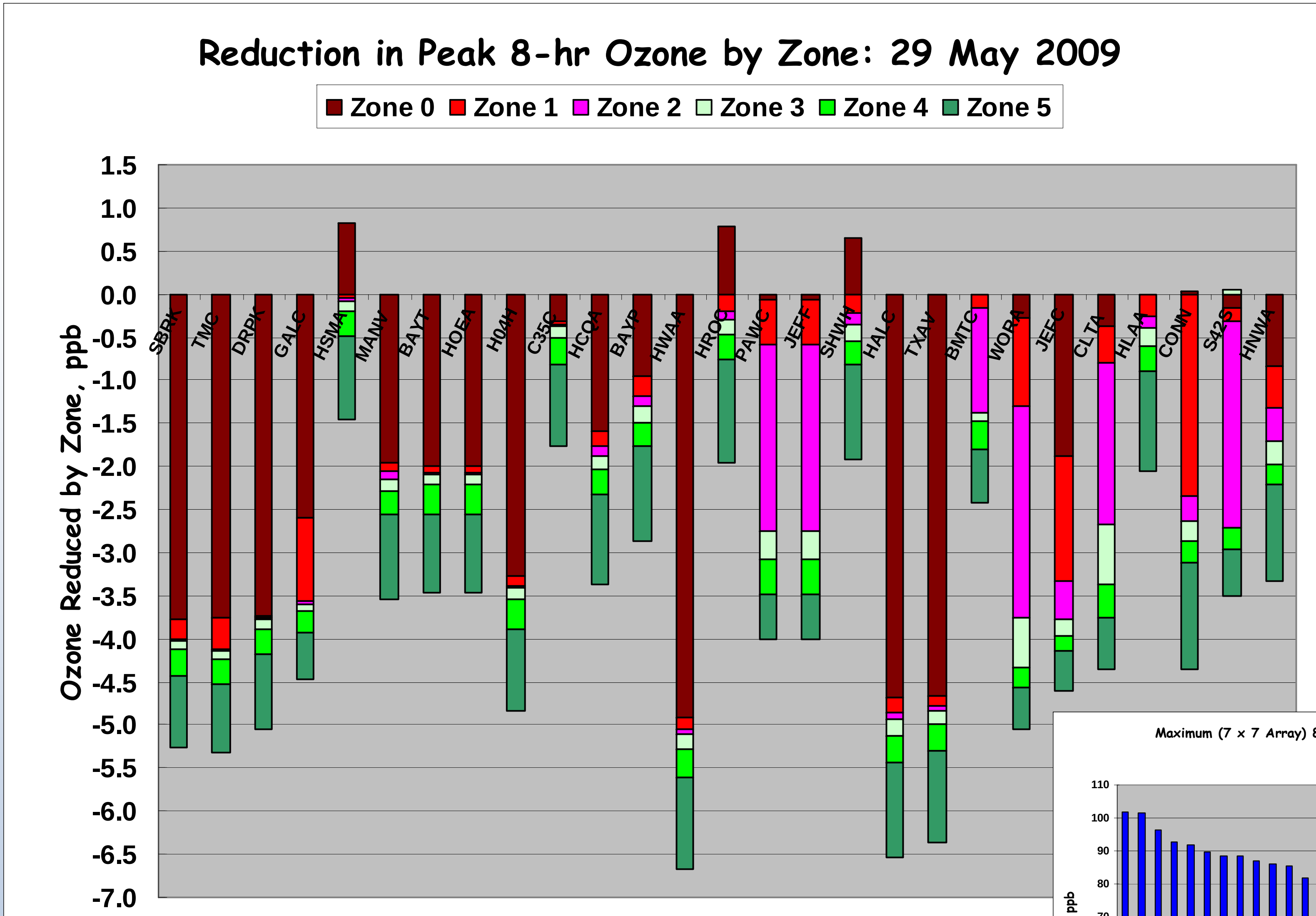


Post-2000 Episode Rollout Results:

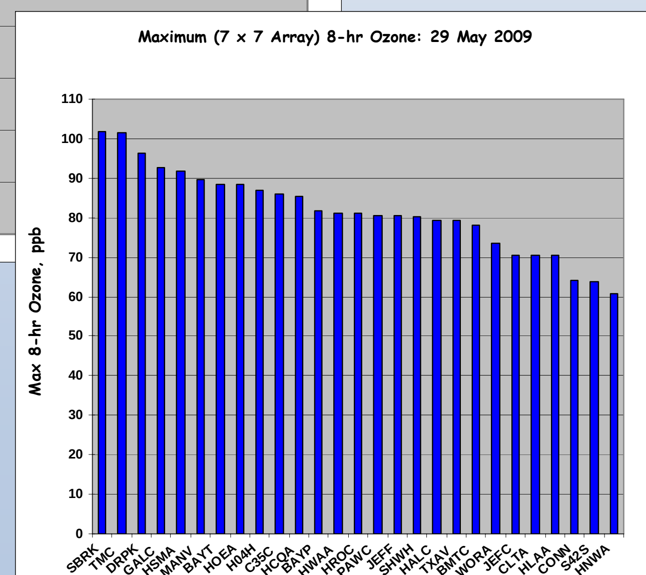
(25% VOC and NOx emissions reductions beyond 2009 levels)

HGB Roll-Out Zones

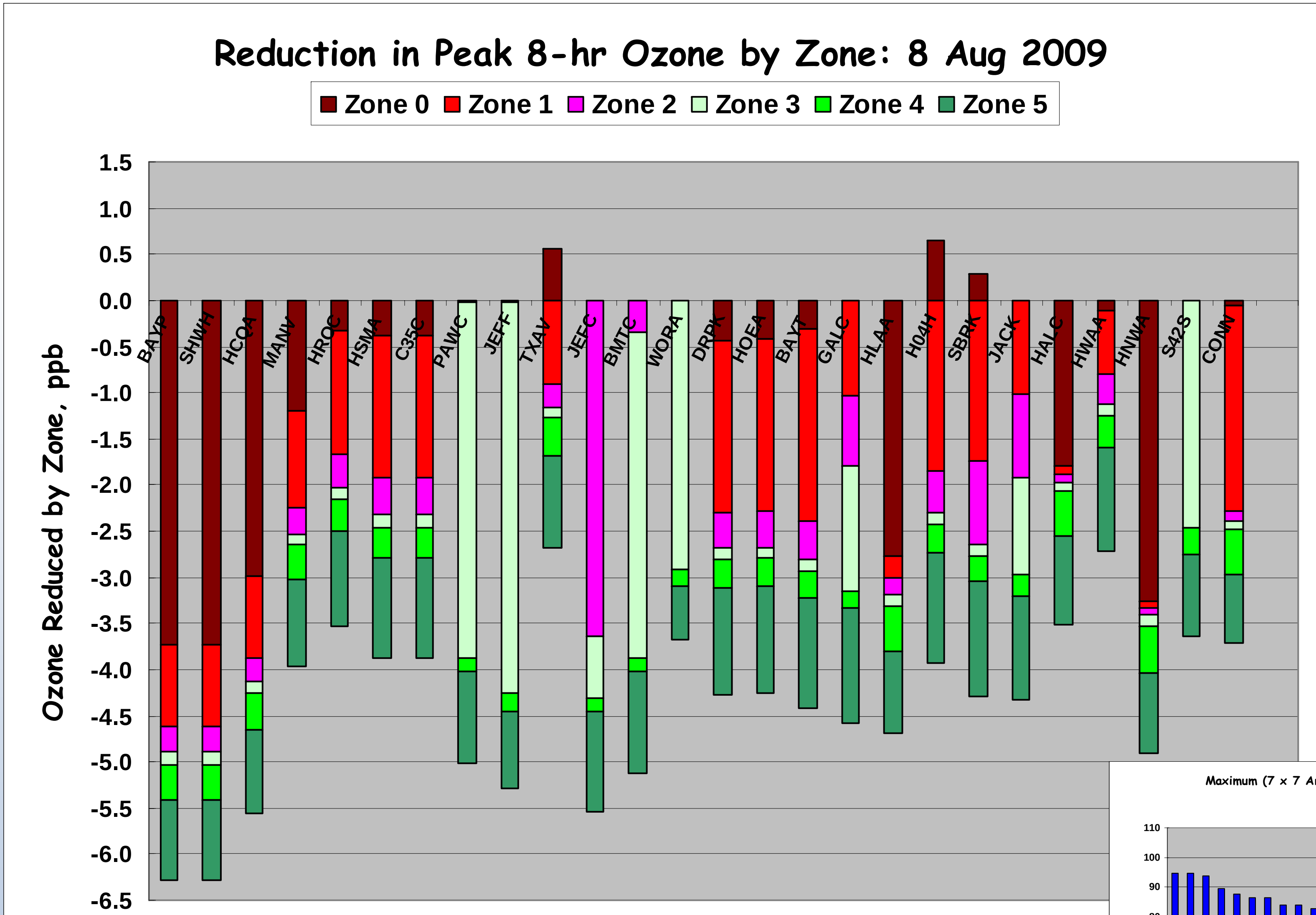


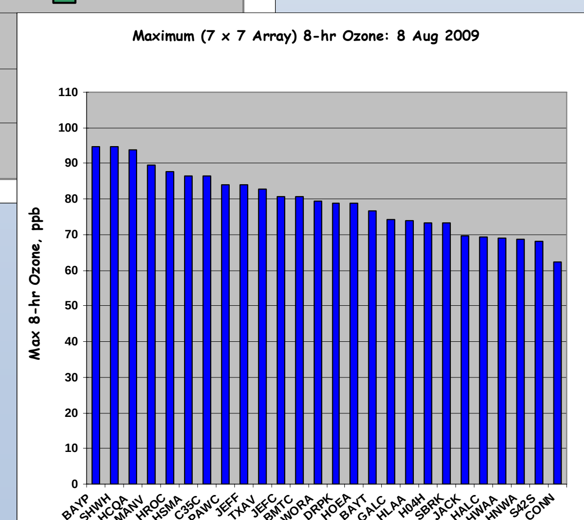


ALPINE GEOPHYSICS
Atmospheric & Hydrologic Sciences



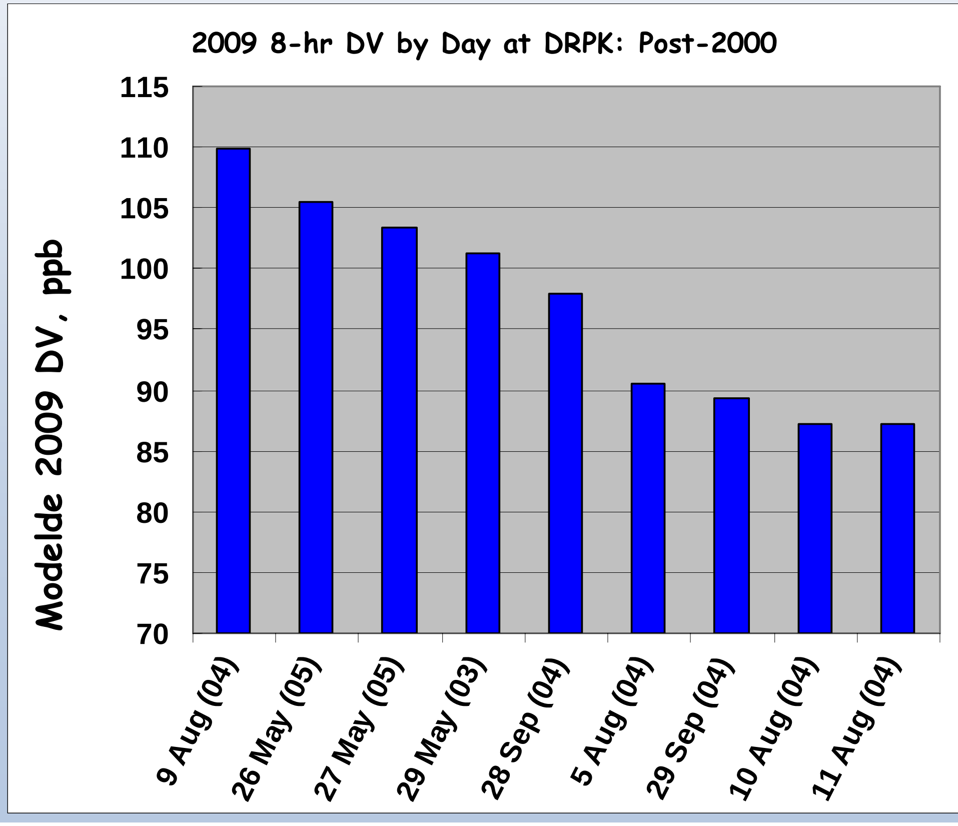
ALPINE GEOPHYSICS
Atmospheric & Hydrologic Sciences

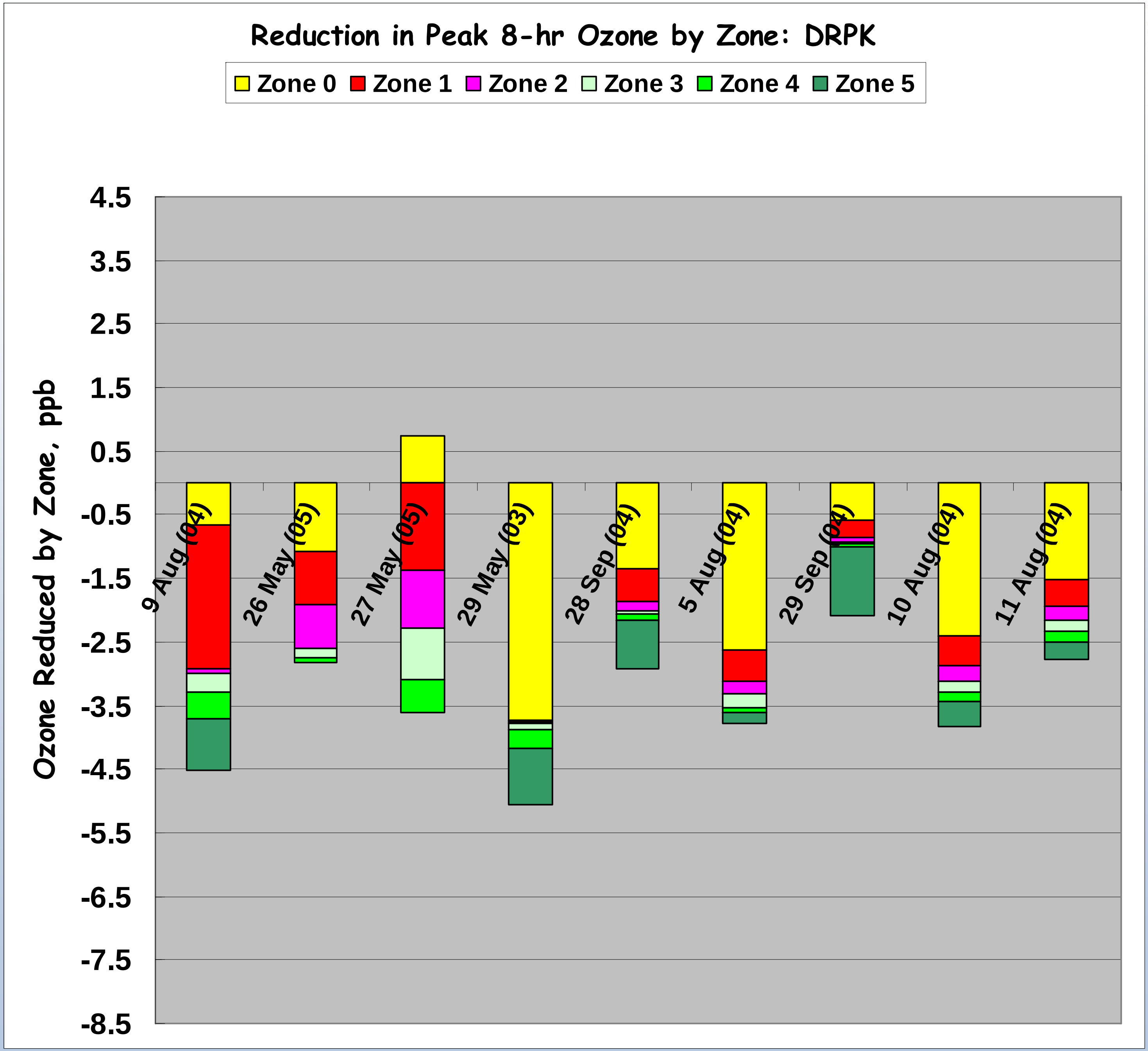




DRPK

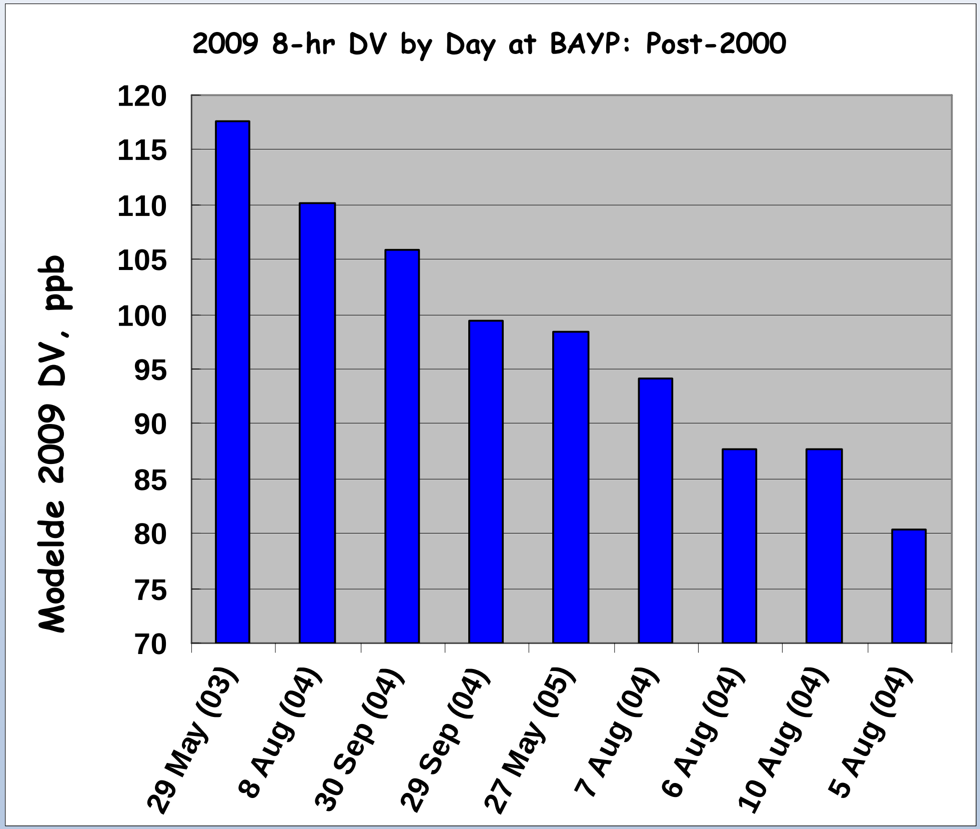
Post-2k	00 DV		Days	Pmax-b	Pmax-f	RRF	DVf
DRPK	107.7	80	10	95.5	86.1	0.90	97.1
	9-Aug	2004	222	92.9	94.8	1.02	109.9
	26-May	2005	146	83.8	82.2	0.98	105.5
	1-Jun	2005	152	83.2	81.8	0.98	105.5
	27-May	2005	147	82.5	79.3	0.96	103.4
	29-May	2003	149	102.0	95.4	0.94	101.2
	28-Sep	2004	272	80.4	73.5	0.91	98.0
	5-Aug	2004	218	109.8	92.0	0.84	90.5
	29-Sep	2004	273	95.1	78.7	0.83	89.4
	10-Aug	2004	223	116.7	95.0	0.81	87.2
	11-Aug	2004	224	109.0	88.5	0.81	87.2
			Avg	95.5	86.1	0.91	97.8

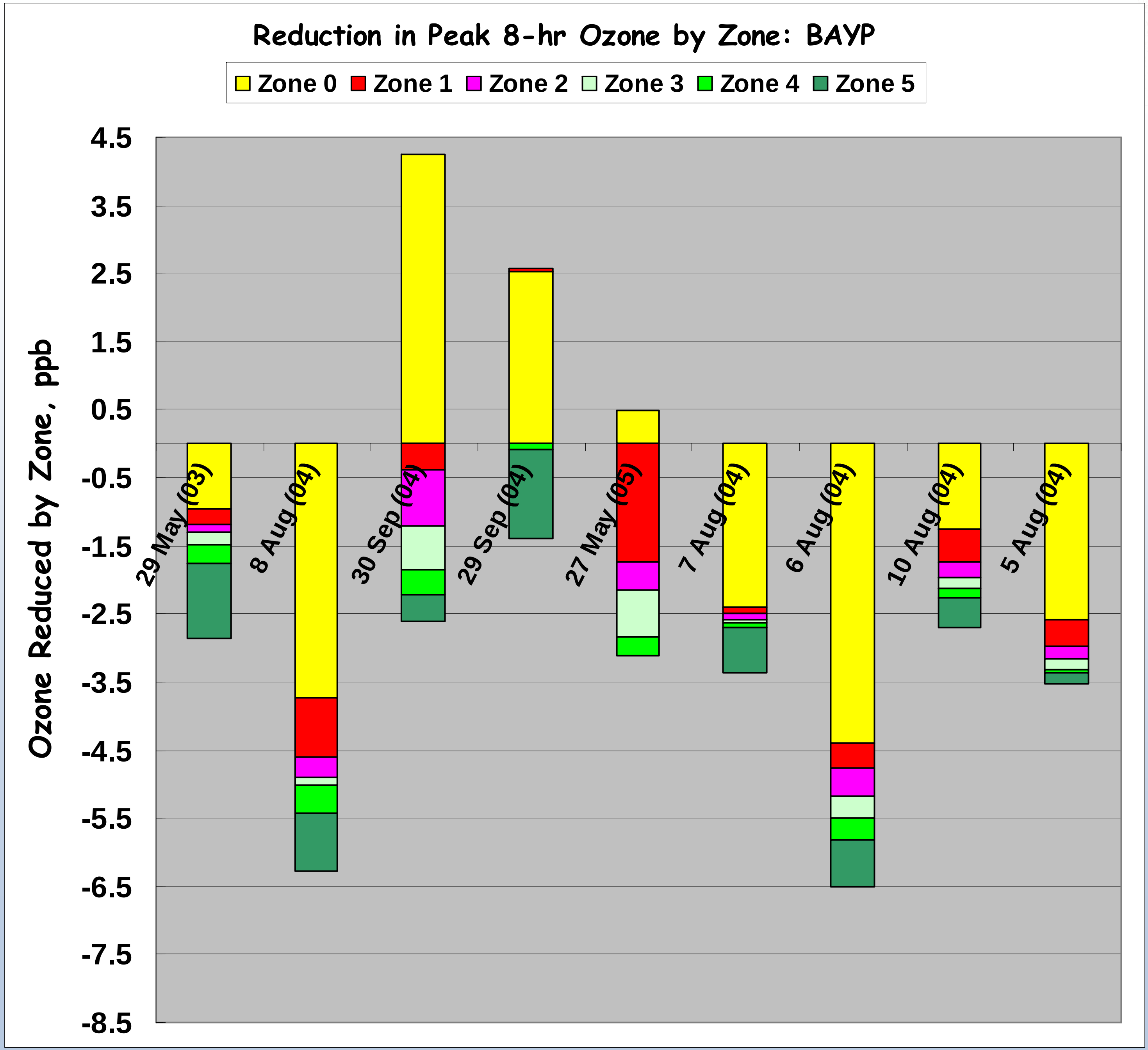



Reduction in Peak 8-hr Ozone by Zone: DRPK
Zone 0
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
Ozone Reduced by Zone, ppb
4.5
3.5
2.5
1.5
0.5
-0.5
-1.5
-2.5
-3.5
-4.5
-5.5
-6.5
-7.5
-8.5
9 Aug (04)
26 May (05)
27 May (05)
29 May (03)
28 Sep (04)
5 Aug (04)
29 Sep (04)
10 Aug (04)
11 Aug (04)

BAYP

Post-2k	00 DV		Days	Pmax-b	Pmax-f	RRF	DVf
BAYP	107.0	76	10	91.8	81.2	0.88	94.7
	29-May	2003	149	79.6	87.5	1.10	117.7
	8-Aug	2004	221	93.3	95.8	1.03	110.2
	30-Sep	2004	274	82.4	81.2	0.99	105.9
	29-Sep	2004	273	78.1	72.5	0.93	99.5
	27-May	2005	147	92.5	84.9	0.92	98.4
	7-Aug	2004	220	77.0	67.8	0.88	94.2
	6-Aug	2004	219	94.4	77.0	0.82	87.7
	10-Aug	2004	223	94.3	77.4	0.82	87.7
	5-Aug	2004	218	102.3	76.3	0.75	80.3
	9-Aug	2004	222	123.7	91.5	0.74	79.2
			Avg	91.76	81.18	0.90	96.1

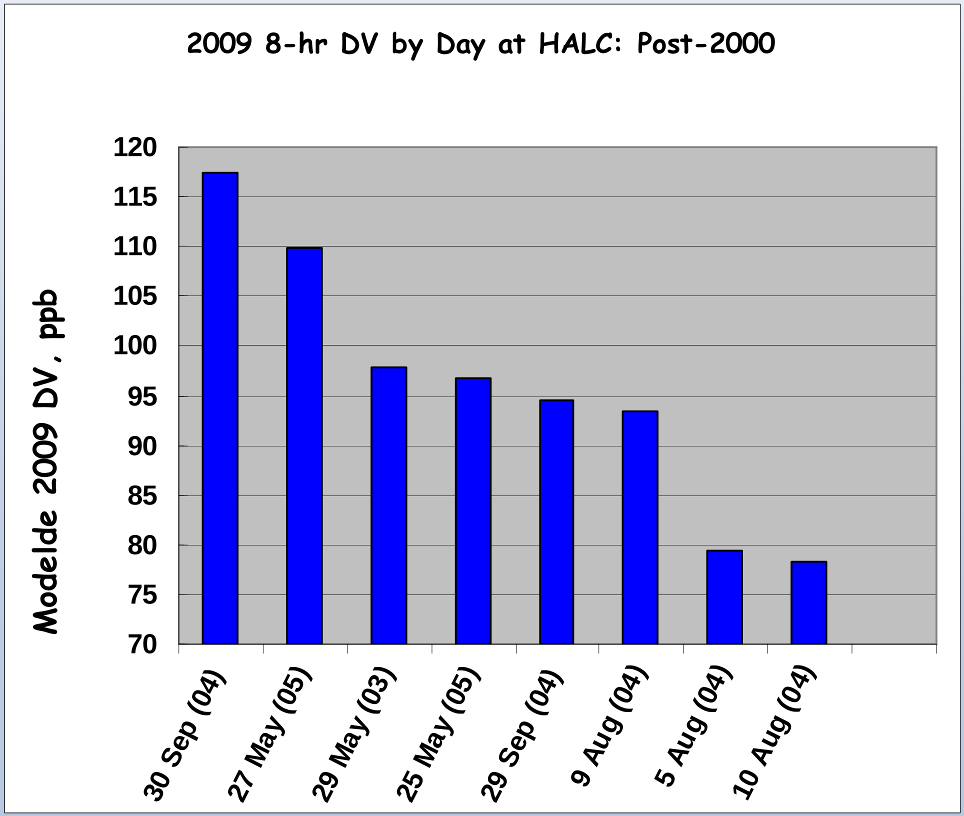


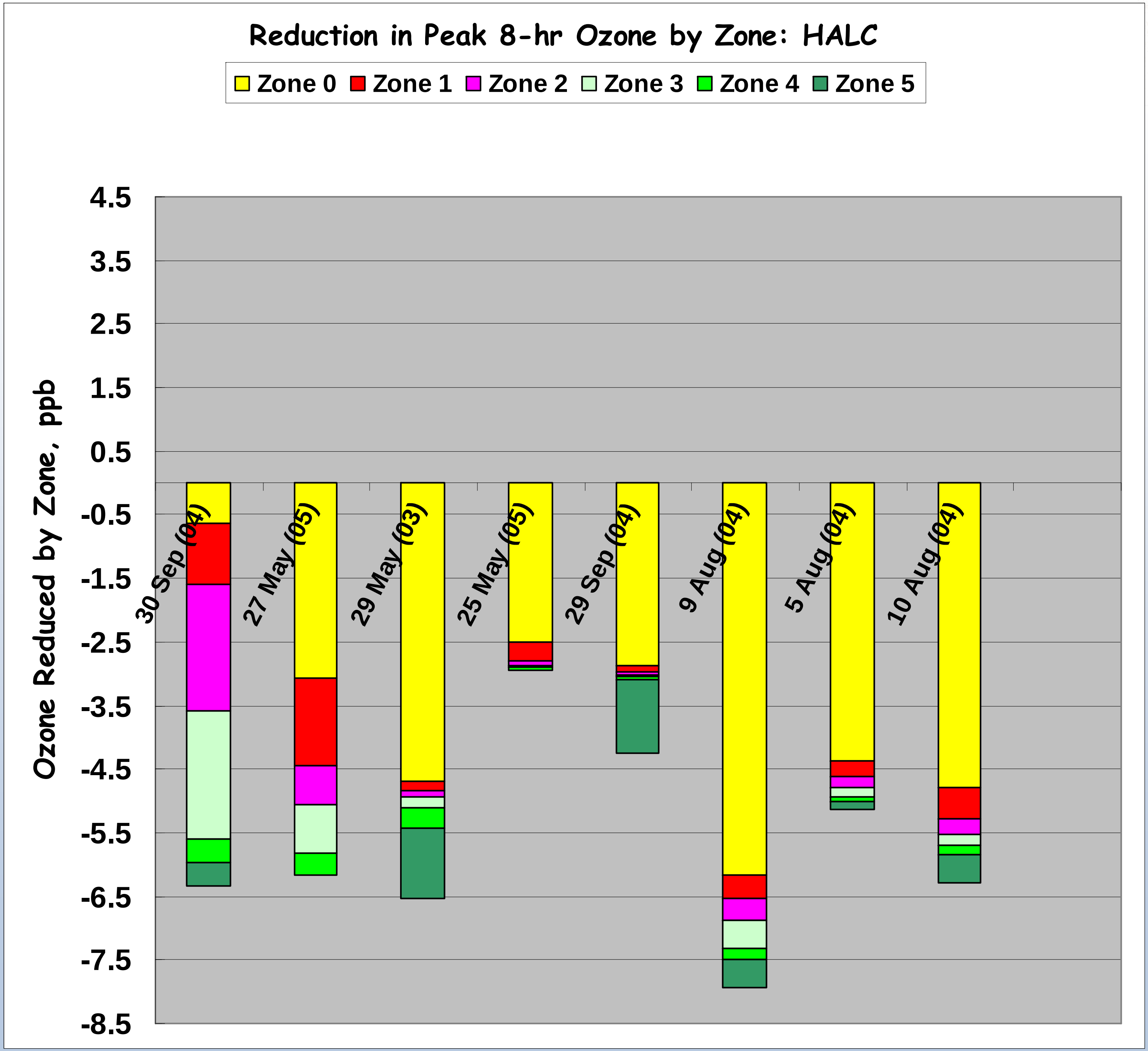


Reduction in Peak 8-hr Ozone by Zone: BAYP
Zone 0
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
Ozone Reduced by Zone, ppb
4.5
3.5
2.5
1.5
0.5
-0.5
-1.5
-2.5
-3.5
-4.5
-5.5
-6.5
-7.5
-8.5
29 May (03)
8 Aug (04)
30 Sep (04)
29 Sep (04)
27 May (05)
7 Aug (04)
6 Aug (04)
10 Aug (04)
5 Aug (04)

HALC

Post-2k	00 DV		Days	Pmax-b	Pmax-f	RRF	DVf
HALC	108.7	76	10	90.8	80.2	0.88	96.0
	30-Sep	2004	274	85.5	92.0	1.08	117.4
	27-May	2005	147	97.7	98.9	1.01	109.8
	1-Jun	2005	152	76.4	73.4	0.96	104.4
	29-May	2003	149	83.9	75.5	0.90	97.8
	25-May	2005	145	88.6	78.4	0.89	96.7
	2-Jun	2005	153	91.7	80.3	0.88	95.7
	29-Sep	2004	273	78.4	68.4	0.87	94.6
	9-Aug	2004	222	99.5	85.5	0.86	93.5
	5-Aug	2004	218	96.1	69.8	0.73	79.4
	10-Aug	2004	223	110.5	80.1	0.72	78.3
			Avg	90.8	80.2	0.89	96.7





Reduction in Peak 8-hr Ozone by Zone: HALC
Zone 0
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
Ozone Reduced by Zone, ppb
4.5
3.5
2.5
1.5
0.5
-0.5
-1.5
-2.5
-3.5
-4.5
-5.5
-6.5
-7.5
-8.5
30 Sep (04)
27 May (05)
29 May (03)
25 May (05)
29 Sep (04)
9 Aug (04)
5 Aug (04)
10 Aug (04)

Rollout Findings

- There is considerable variability from day-to-day and monitor-to-monitor in terms of the magnitude of the incremental impact from emissions reductions in individual zones;
- Emissions from zone 0 generally have the largest incremental impacts (positive and negative) on maximum year 2009 ozone levels on Harris County monitors, compared to the other zones;
- On some days, the 25% VOC/NOx emissions reductions in zones 1 and 2 lead to ozone increases of up 4.5 ppb above the 2009 baseline level; and
- Even the most distant rollout zone (5), has some potentially significant (i.e., > 1 ppb) contribution at HGB monitors on some days.
- Full Rollout/APCA/OSAT results for all monitors and episodes available upon request.

Summary and Conclusions

Summary

- The post-2000 episodes compliment the TCEQ 2000 episode but, by themselves, do not lower the 2009 8-hr ozone Design Values obtained with the TCEQ 2000/2009 data bases;
- Lower 2009 DVs can be obtained by using a more recent base year (e.g., 2003, 2005) since monitored design values (DVc) drop faster than the RRF values increase, due to shorter time span between base and future year;
- Regardless of the base year chosen, modeled 2009 DVs will in all likelihood be influenced, perhaps significantly, by the procedures used in applying the EPA Attainment Test;

Summary (concluded)

- Regardless of the episode days selected or Attainment Test method implemented, use of the TCEQ 2000/2009 emissions inventories for the base year/future year RRF/DVf computation will likely require significant precursor controls for attainment of the NAAQS in 2009;

- Source apportionment and rollout modeling indicate that 'across-the-board' control strategies will in all likelihood lead to unnecessary reduction requirements on source categories and/or individual sources not actually contributing to ozone exceedances at individual nonattainment monitors on the actual modeling days used in the Attainment Test

Conclusions

- Rigorous, documented analyses will be needed to support of the final Attainment Demonstration, addressing key technical issues (e.g., definition of array size at each monitor, level of accuracy required of the model in the base case for the monitor/day to be used). This applies to both the 2000 and post-2000 episodes.
- Applying this level of investigation and weight of evidence analysis is tremendously time-consuming and does not lend itself easily to simple objective methods (i.e., all days with accuracy better than some prescribed threshold, e.g., $A_u \leq 25\%$) or spreadsheet calculations.

Conclusions (continued)

- More attention needs to be given to the combined OSAT, APCA, and Roll-out results to see whether they corroborate or disagree with findings derived from
  - Simple “across-the-board” emissions reduction simulations,
  - Source apportionment and related diagnostic modeling performed by other groups, and
  - Previous understandings about the types of controls thought to be most effective in reducing Houston’s ozone.
- Additional source apportionment/rollout modeling may be warranted later, using refined source regions, lower ozone thresholds, etc.

Conclusions (continued)

- Rollout modeling (25% VOC and NOx emissions reductions beyond 2009 baseline) reveals that
  - Emissions reductions of VOC and NOx from the individual rollout zones have impacts at HGB nonattainment monitors that vary widely in space and by day;
  - In several instances, ozone disbenefits (significant ozone increases) occur associated with emissions cutbacks in zone 0;
  - Emissions in zones 0 and 1 appear to be give the largest ozone increments across the full set of monitors examined; and
  - Anthropogenic emissions from the most distant region (5) have significant contributions on a number of days at several monitors, leading to the view that ozone control in the HGB region cannot be viewed as purely a local issue.

Conclusions (continued)

- Because different assumptions (3x3 vs. 7x7; EPS vs. SMOKE, no accuracy vs. specific accuracy cutoff, and so on) lead to different DV_f results, there can be a significant range in the costs of control just based on the uncertainty in the specific method used to perform the attainment test.
- A credible explanation of the implications, strengths and weaknesses of the various alternative Attainment Test methods and justification of the method actually chosen is needed to in order to give policy-makers confidence in the final Design Value targets established for the key HGB monitors
- Our efforts in this preliminary analysis of the five HGB episodes indicates that a rigorous Attainment Test (AT) and supporting Weight-of-Evidence Analysis will be challenging and very time consuming, but given the influence of the AT assumptions on resultant control requirements, it is clearly needed.

Suggestion

- The forgoing experience in applying the EPA Attainment Test (AT) to the 5 HGB episodes very clearly shows that a thorough application of the AT is going to be extraordinarily time and labor intensive.
- Given the importance of the weight of evidence analyses that underpin the AT, there may be considerable value (and time saved!) in sharing recently developed Attainment Test methodologies and diagnostic analysis codes written at AG/UNC/ENVIRON that help elucidate key features of the data sets. These codes and procedures simplify many of the Attainment Test and WOE analyses that would otherwise be performed manually via spreadsheet calculations.

Questions or Suggestions?