Dallas Fort Worth

DFW Future Case Modeling APCA, CAIR, and Response Curves

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Future Case (2010) Analysis

- What sources contribute to DFW ozone?
- How much will the CAIR program help DFW?
- What kinds of controls will be more effective? NOx or VOC?
- How much reduction will be needed?

- Note: SIP Control strategy modeling must be based upon 2009 emissions estimates.

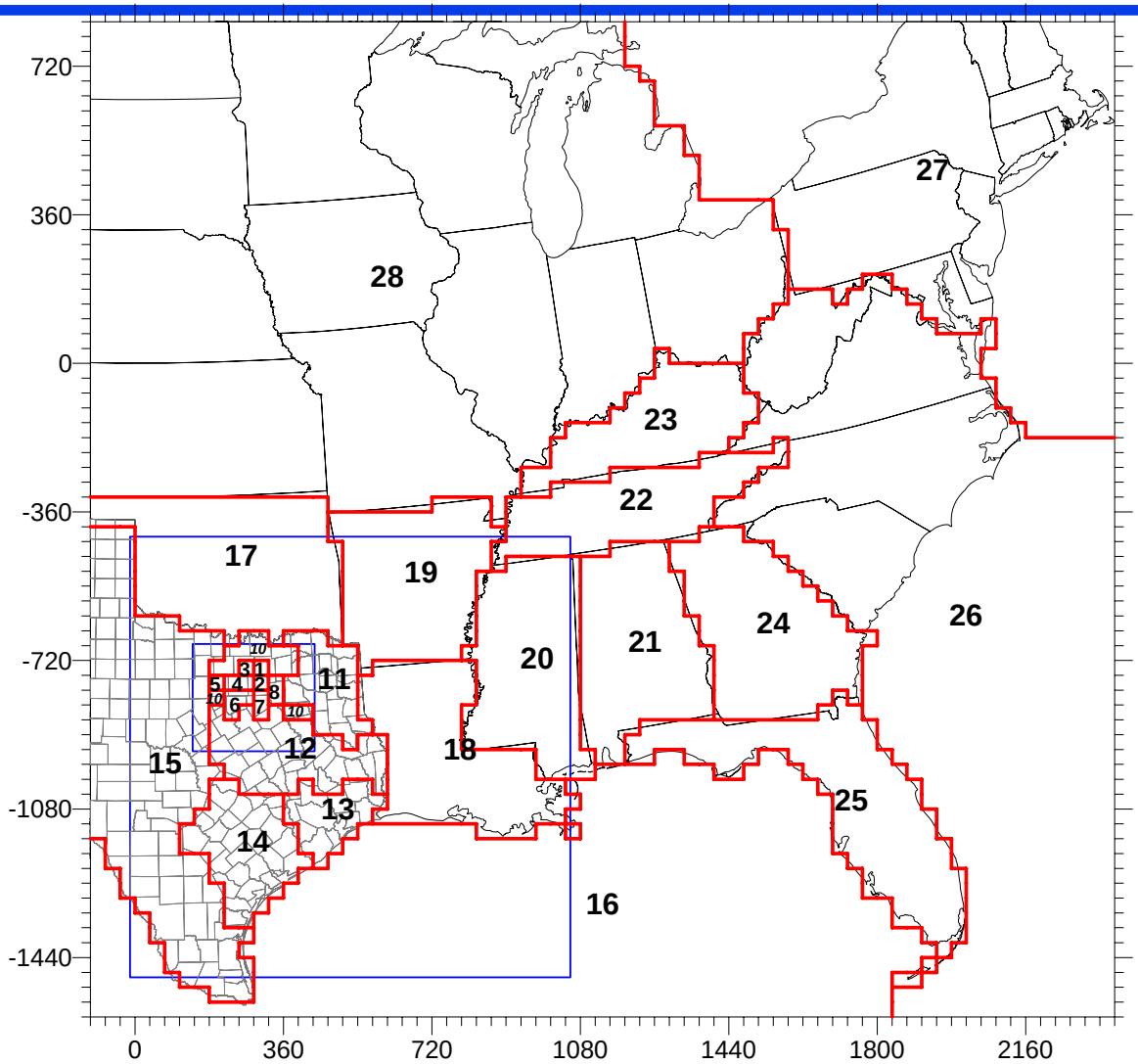
What Sources Contribute to DFW Ozone?

Anthropogenic Precursor Culpability Assessment

- APCA is simply an accounting method
  - Keeps track of where the emissions come from
  - What kinds of sources are emitting the NOx and VOC
  - Evaluates contribution from Anthropogenic sources
  - Determines how much ozone the emissions will produce in the impact area
- Run APCA for 2010 on the Extended Domain
  - Include all mandated future controls
  - Divide the USA into source regions
  - Define source categories (Mobile, Point, Area/NR)
  - Define an impact area (DFW 9-County)

APCA Source Attribution Map

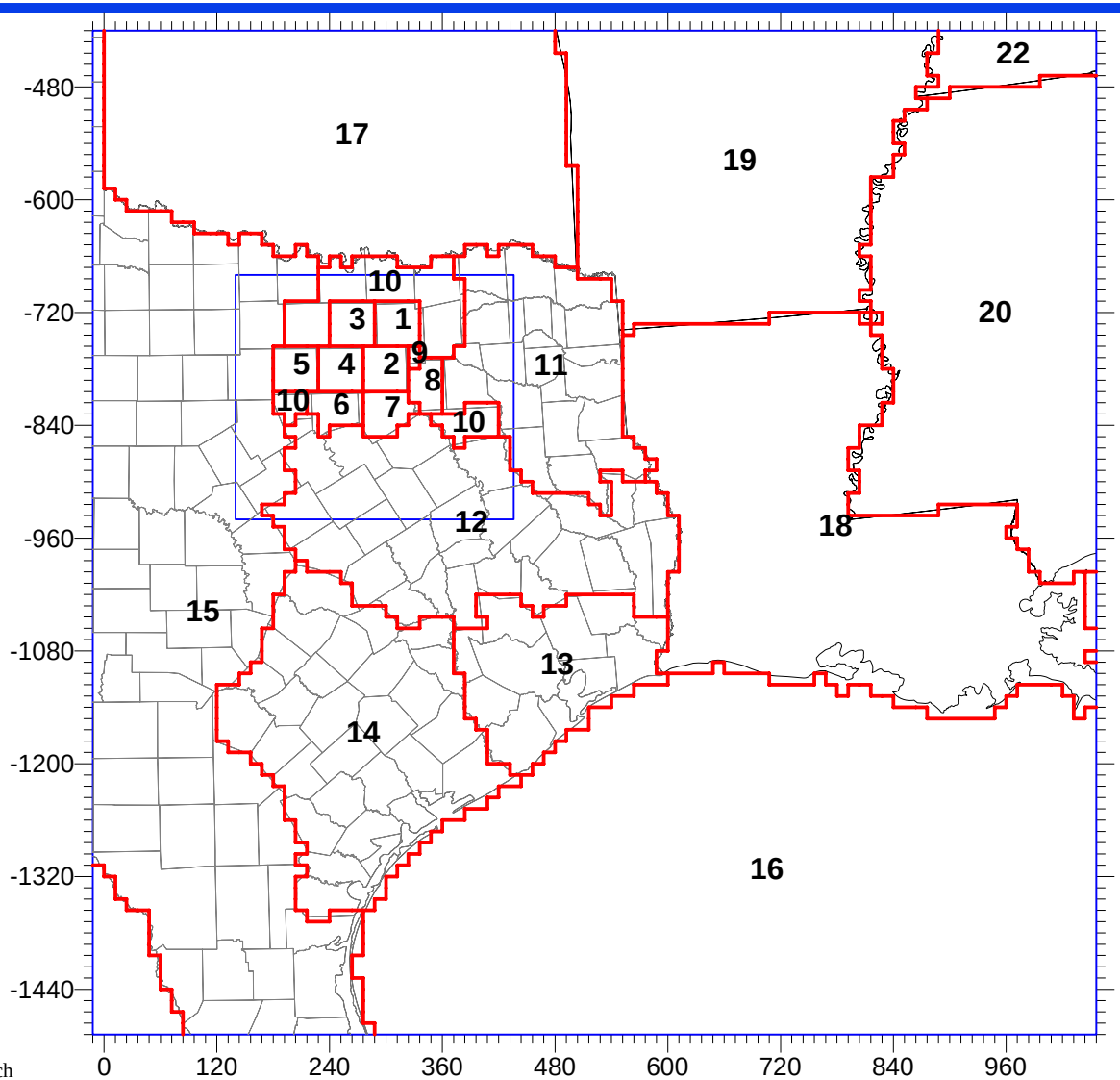
36-km Extended Domain



DFW 2010 Source Regions. 36 km Expanded Domain

APCA Source Attribution Map

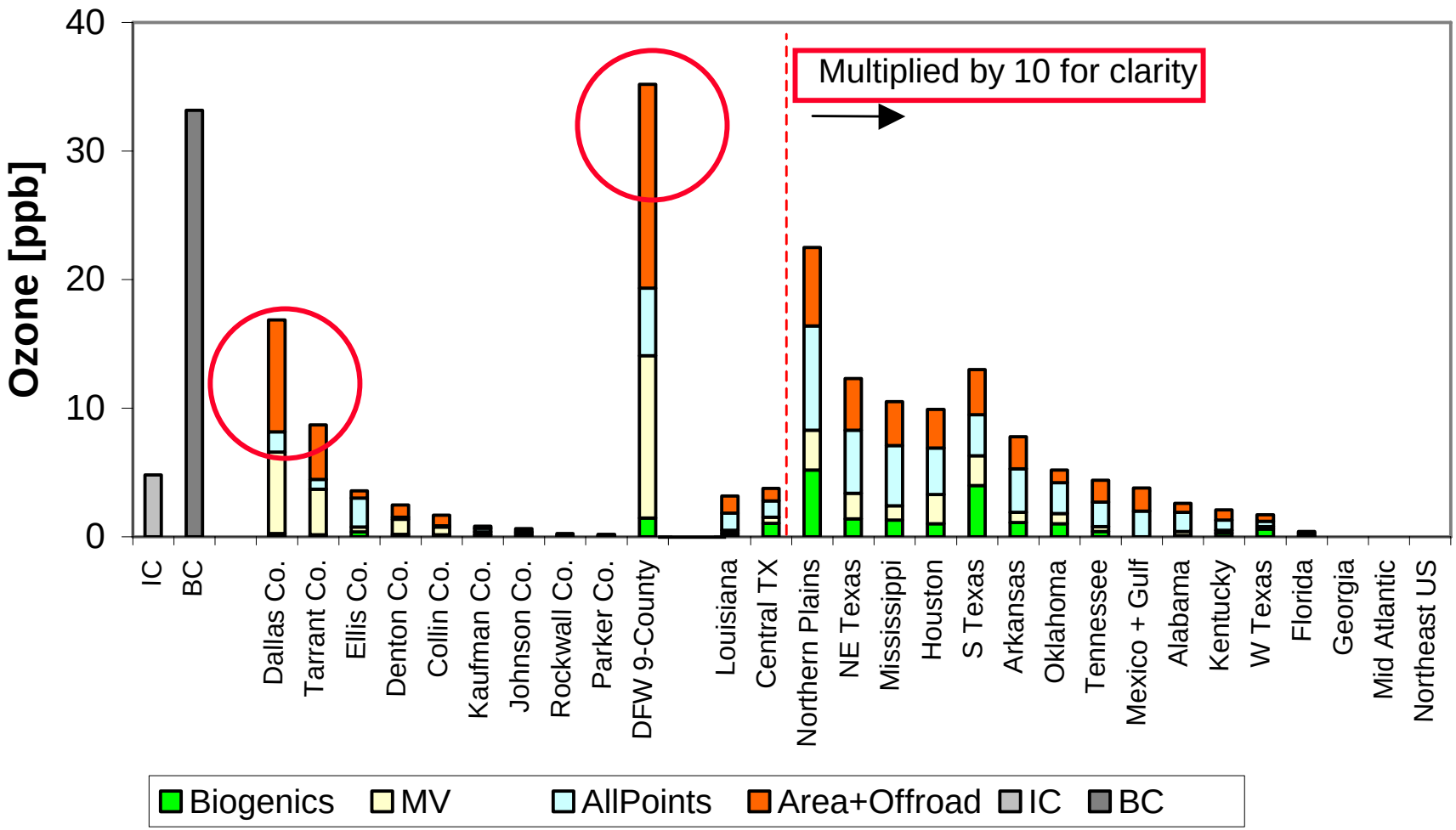
12-km Texas Sub-Domain



Episode Average Contributions to 8-Hour Ozone

Ozone >= 85 ppb in DFW-9 County NAA.

CAMx run34sa.fy2010 . Average = 90.8 ppb. # Grid-Hrs = 6019



APCA Anthropogenic Contributions

8-day Averages, Ranked by Contribution to DFW 9-County Area

DFW 2010 Average Ozone Contributions in 9-county area						
Source Reg	**Biogenic**	**Mobile**	**All Points**	**Area+NR**	**Anthro**	**% Anthro**
Dallas Co.	0.24	6.35	1.58	8.69	16.61	34.45
Tarrant Co.	0.15	3.55	0.77	4.22	8.54	17.7
Ellis Co.	0.38	0.37	2.25	0.58	3.2	6.64
Denton Co.	0.2	1.16	0.16	0.96	2.29	4.74
Collin Co.	0.15	0.61	0.1	0.83	1.54	3.19
Kaufman Co.	0.16	0.21	0.29	0.15	0.65	1.34
Johnson Co.	0.13	0.16	0.09	0.26	0.51	1.05
Rockwall Co.	0.04	0.12	0	0.08	0.2	0.41
Parker Co.	0.02	0.07	0.04	0.06	0.17	0.35
DFW 9-County	**1.47**	**12.6**	**5.28**	**15.83**	**33.71**	**69.87**
Louisiana	0.26	0.26	1.32	1.34	2.91	6.04
Central TX	1.06	0.47	1.27	0.98	2.72	5.65
Northern Plains	0.52	0.31	0.81	0.61	1.73	3.59
NE Texas	0.14	0.2	0.49	0.4	1.09	2.27
Mississippi	0.13	0.11	0.47	0.34	0.92	1.91
Houston	0.1	0.23	0.36	0.3	0.9	1.86
S Texas	0.4	0.23	0.32	0.35	0.9	1.86
Arkansas	0.11	0.08	0.34	0.25	0.66	1.38
Oklahoma	0.1	0.08	0.24	0.1	0.42	0.87
Tennessee	0.04	0.04	0.19	0.17	0.4	0.82
Mexico + Gulf	0	0	0.2	0.18	0.38	0.78
Alabama	0.01	0.03	0.15	0.07	0.24	0.5
Kentucky	0.03	0.02	0.08	0.08	0.18	0.38
W Texas	0.06	0.02	0.04	0.05	0.11	0.23
Florida	0	0.01	0.02	0.01	0.04	0.07
Georgia	0	0	0	0	0.01	0.01
Mid Atlantic	0	0	0	0	0	0
Northeast US	0	0	0	0	0	0
Total Other	**2.96**	**2.09**	**6.3**	**5.23**	**13.61**	**28.22**
Grand Total	**4.62**	**14.84**	**12.02**	**21.38**	**48.23**	**100**

DFW 2010 APCA Average Results

(Anthropogenic Precursor Culpability Assessment)

- On average, the DFW 9-county area contributes about 34 ppb to its own 8-hour ozone

- On average, the rest of the modeling domain contributes approximately 14 ppb

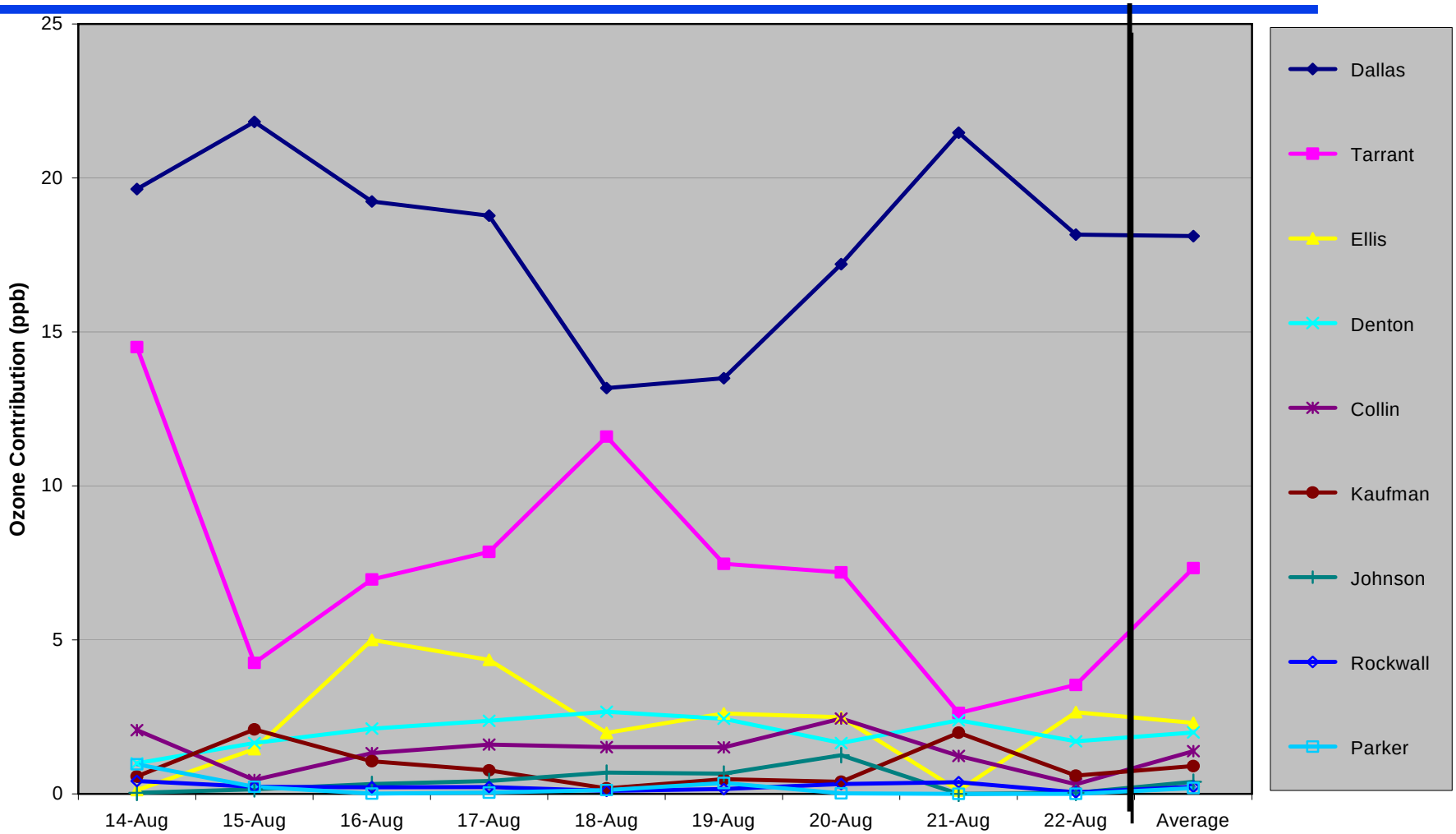
- On average during this episode, the DFW 9-county area contributed about 70% of the anthropogenic (controllable) ozone.

DFW 2010 APCA Results
Continued

- On average Dallas and Tarrant counties contribute more than other areas
  - 16.6 and 8.5 ppb respectively
- On Average Ellis county adds about 3.2 ppb
  - Ellis point sources contribute 2.3 ppb
- Contributions from sources and regions vary on a day to day basis depending upon wind direction

Daily Contributions by County

DFW 2010 APCA



Daily Range of Contributions

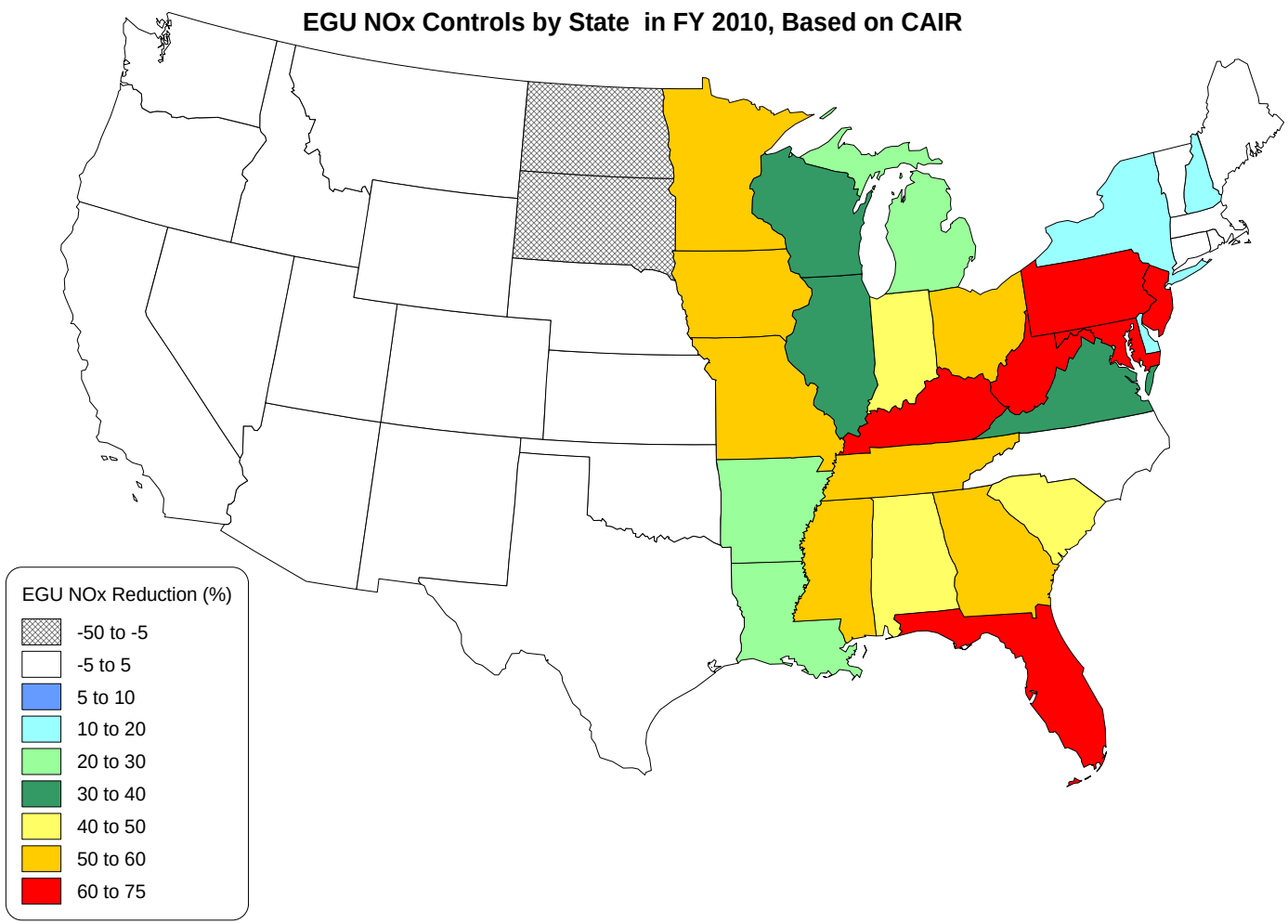
DFW 2010 APCA

Contribution (ppb)	Average	Min	Max
Dallas Co.	16.61	13.18	21.82
Tarrant Co.	8.54	2.63	14.51
Ellis Co.	3.20	0.11	5.00
Denton Co.	2.29	0.99	2.67
Collin Co.	1.54	0.91	2.45
Kaufman Co.	0.65	0.18	2.09
Johnson Co.	0.51	0	1.26
Rockwall Co.	0.20	0.05	0.42
Parker Co.	0.17	0	0.96
DFW 9-County	**33.71**	**27.04**	**39.31**
Louisiana	2.91	0	5.48
Central TX	2.72	0.01	3.86
Northern Plains	1.73	0.48	6.77
NE Texas	1.09	0.16	6.38
Mississippi	0.92	0	1.58
Houston	0.90	0	1.79
S Texas	0.90	0	2.13
Arkansas	0.66	0.10	4.73
Oklahoma	0.42	0	2.27
Tennessee	0.40	0	0.87
Mexico + Gulf	0.38	0	1.13
Alabama	0.24	0	0.68
Kentucky	0.18	0	0.34
W Texas	0.11	0	0.46
Florida	0.04	0	0.10
Georgia	0.01	0	0.01
Mid Atlantic	0.00	0	0
Northeast US	0.00	0	0.01

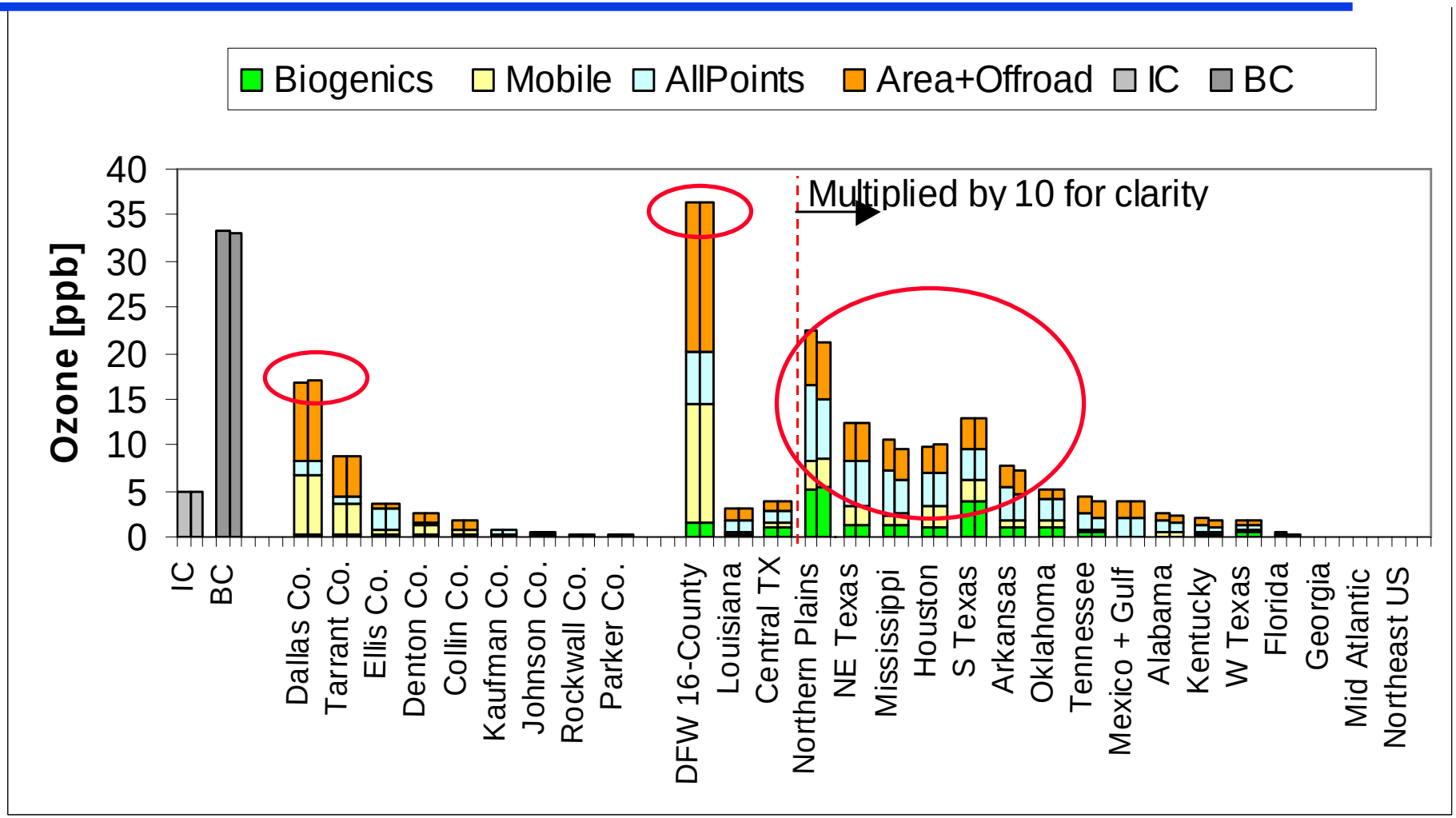
CAIR Modeling Assessment

- Clean Air Interstate Rule (CAIR)
  - CAIR Reduces NOx from Electric Generating Units, Does not address other sources
  - CAP and Trade Program
  - Implemented in Two Phases 2010 and 2015
- CAIR Modeling
  - Reductions were applied to each state individually
  - Small (1%) reductions applied in Texas

CAIR Modeling NOx Controls



2010 Average 8-Hour Ozone Contribution to DFW 9-County Area



Run-34 Base Ozone = 90.8 (left bar) Run 36-CAIR Ozone = 90.5 (right bar)

CAIR 2010 Ozone Reductions

Phase 1 Impact on DFW 9-County Ozone

Change in DFW Ozone due to 2010 CAIR/EGU Controls					
Run	**Run 34 2010 Base**	**Run 36 2010 w/CAIR**	**PPb Change In Ozone**	**% Change In Ozone**	**%Change In EGU NOx**
Dallas Co.	1.58	1.57	0.01	0.63%	-1%
Tarrant Co.	0.77	0.77	0.00	0.00%	-1%
Ellis Co.	2.25	2.26	-0.01	-0.44%	-1%
Denton Co.	0.16	0.16	0.00	0.00%	-1%
Collin Co.	0.10	0.10	0.00	0.00%	-1%
Kaufman Co.	0.29	0.29	0.00	0.00%	-1%
Johnson Co.	0.09	0.09	0.00	0.00%	-1%
Rockwall Co.	0.00	0.00		N/A	
Parker Co.	0.04	0.04	0.00	0.00%	-1%
DFW 9-County	**5.28**	**5.28**	**0.00**		**-1%**
DFW 16-County	**5.72**	**5.72**	**0.00**		**-1%**
Louisiana	1.32	1.21	0.11	8.33%	-26%
Central TX	1.27	1.27	0.00	0.00%	-1%
Northern Plains	0.81	0.63	0.18	22.22%	-37%
NE Texas	0.49	0.49	0.00	0.00%	-1%
Mississippi	0.47	0.37	0.10	21.28%	-55%
Houston	0.36	0.37	-0.01	-2.78%	-1%
S Texas	0.32	0.32	0.00	0.00%	-1%
Arkansas	0.34	0.27	0.07	20.59%	-27%
Oklahoma	0.24	0.24	0.00	0.00%	1%
Tennessee	0.19	0.13	0.06	31.58%	-51%
Mexico + Gulf	0.20	0.20	0.00	0.00%	0%
Alabama	0.15	0.12	0.03	20.00%	-45%
Kentucky	0.08	0.05	0.03	37.50%	-61%
W Texas	0.04	0.04	0.00	0.00%	-1%
Florida	0.02	0.01	0.01	50%	-61%
Georgia	0.00	0.00		N/A	-57%
Mid Atlantic	0.00	0.00		N/A	
Northeast US	0.00	0.00		N/A	
Totals	12.02	11.44	0.58	4.83%	

DFW 2010 CAIR Results

- Clean Air Interstate Rule had little effect on DFW
  - CAIR program reduces DFW ozone only about 0.6 ppb
  - Substantial NOx reductions already applied to Texas sources
- Ozone contributions from out of state were relatively small
  - The biggest changes in ozone (on a percent basis) came from the states that made the largest percent reductions
- Other CAIR Issues
  - This DFW episode may not be the best for evaluating transport
  - CAIR did show significant impact on Beaumont and Houston
  - CAIR program will also control other pollutants besides NOx, SO2, PMfine, and Visibility

Reaching Attainment

- What kinds of controls will be needed? NOx or VOC?
- How much reduction will be needed?

Estimating Future Control Requirements

- Methodology
  - Starting with the revised meteorology and 2010 projected emissions, future case ozone was estimated. Seven sites had 8-hour ozone above the 85 ppb standard.
  - Next, a series of across the board reductions were applied to anthropogenic emissions of VOC, NOx, and combinations of both in the 9-county DFW area.
  - Model-predicted future 8-hour design values were plotted against the percent reduction to estimate the reductions required to demonstrate attainment.

Estimating Future Control Requirements

- Results
  - Both the original and corroborative episodes show a limited response to reductions of VOC.
  - Both episodes respond better to NOx reductions.
  - The model predicts that NOx reductions of approximately 45% are needed for DFW to demonstrate attainment in 2010.
  - A combined 40% NOx and 50% VOC reduction also shows attainment in 2010.

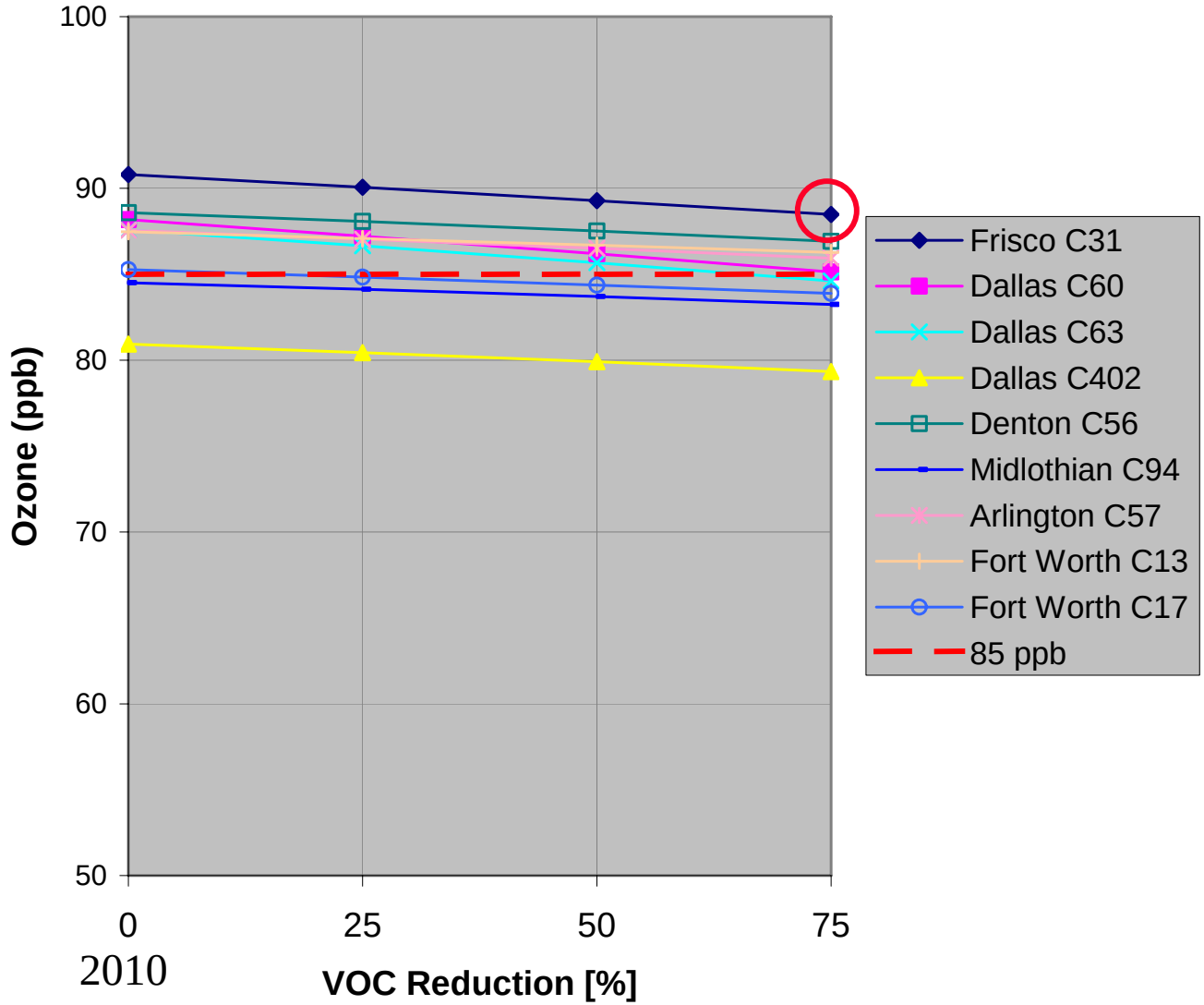
EPA "Current" Design Value

Five-Year Center Weighted Average

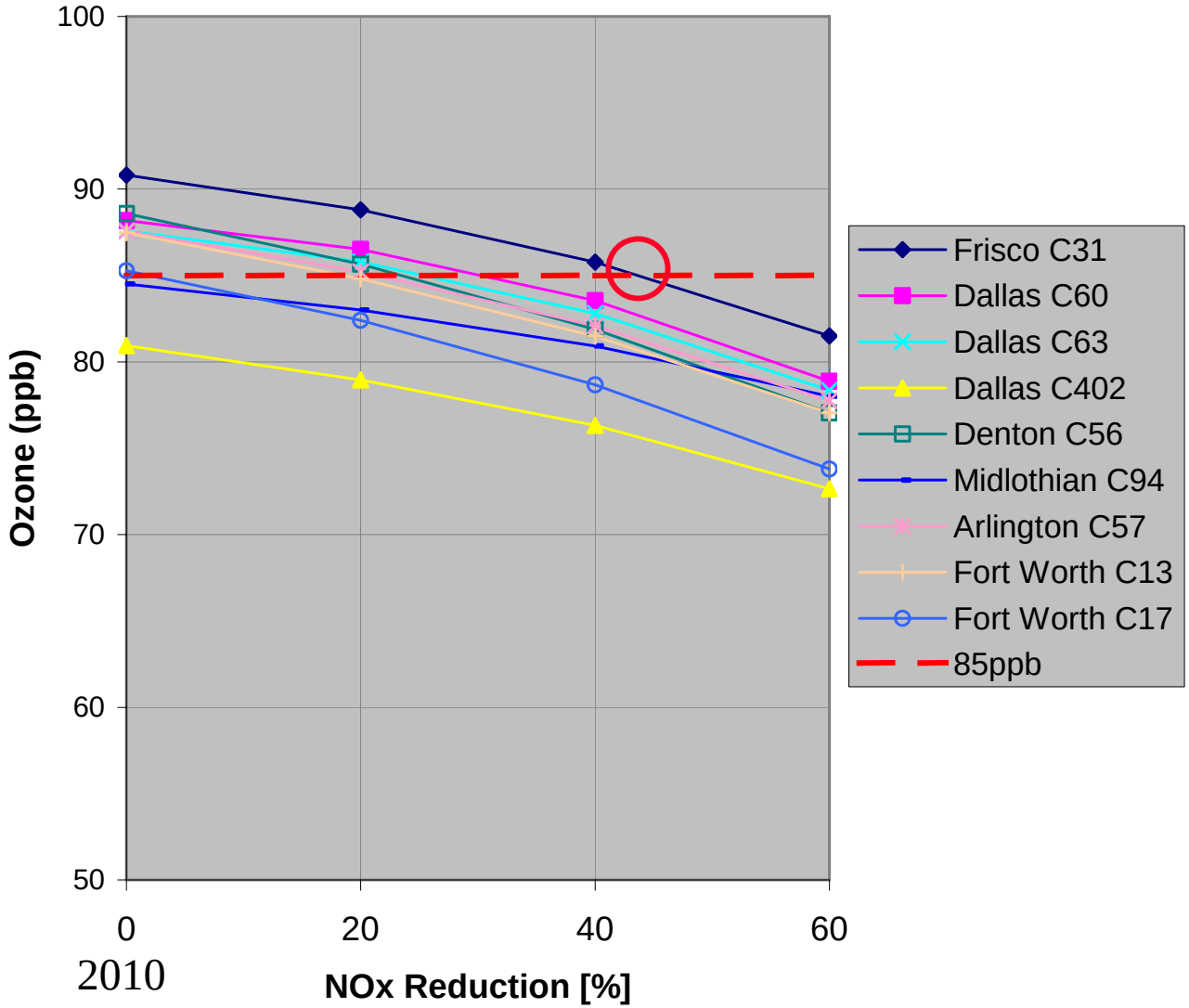
Site Name	CAMS	1999 97-99	2000 98-00	2001 99-01	**3 Yr Average**
Frisco	C31	99	101	99	**99.7**
Anna	C68	---	---	86*	---
Dallas Hinton	C60	91	93	92	**92.0**
Dallas North	C63	---	96*	93	**93.0**
Dallas Executive	C402	92	88	82	**87.3**
Sunnyvale	C74	---	---	---	---
Denton	C56	103*	102	101	**101.5**
Midlothian	C94	97*	97	88	**92.5**
Granbury	C73	---	---	---	---
Cleburne	C77	---	---	88*	---
Kaufman	C71	---	---	---	---
Weatherford	C76	---	---	---	---
Rockwall	C69	---	---	---	---
Arlington Reg Ofc	C57	100*	95	95*	**95.0**
Eagle Mt Lake	C75	---	---	---	---
FtW NW	C13	99	99	97	**98.3**
FtW Keller	C17	95	97	97	**96.3**
Grapevine	C70	---	---	---	---

Design Value identified by trailing year
Data from Lambeth: OzHist.xls
* indicates a 2 year average, so not included in calculation

Design Value-Scaled 2010 DFW 8-Hour Ozone
VOC Reductions. Aug 13-22, 1999 Core Period.

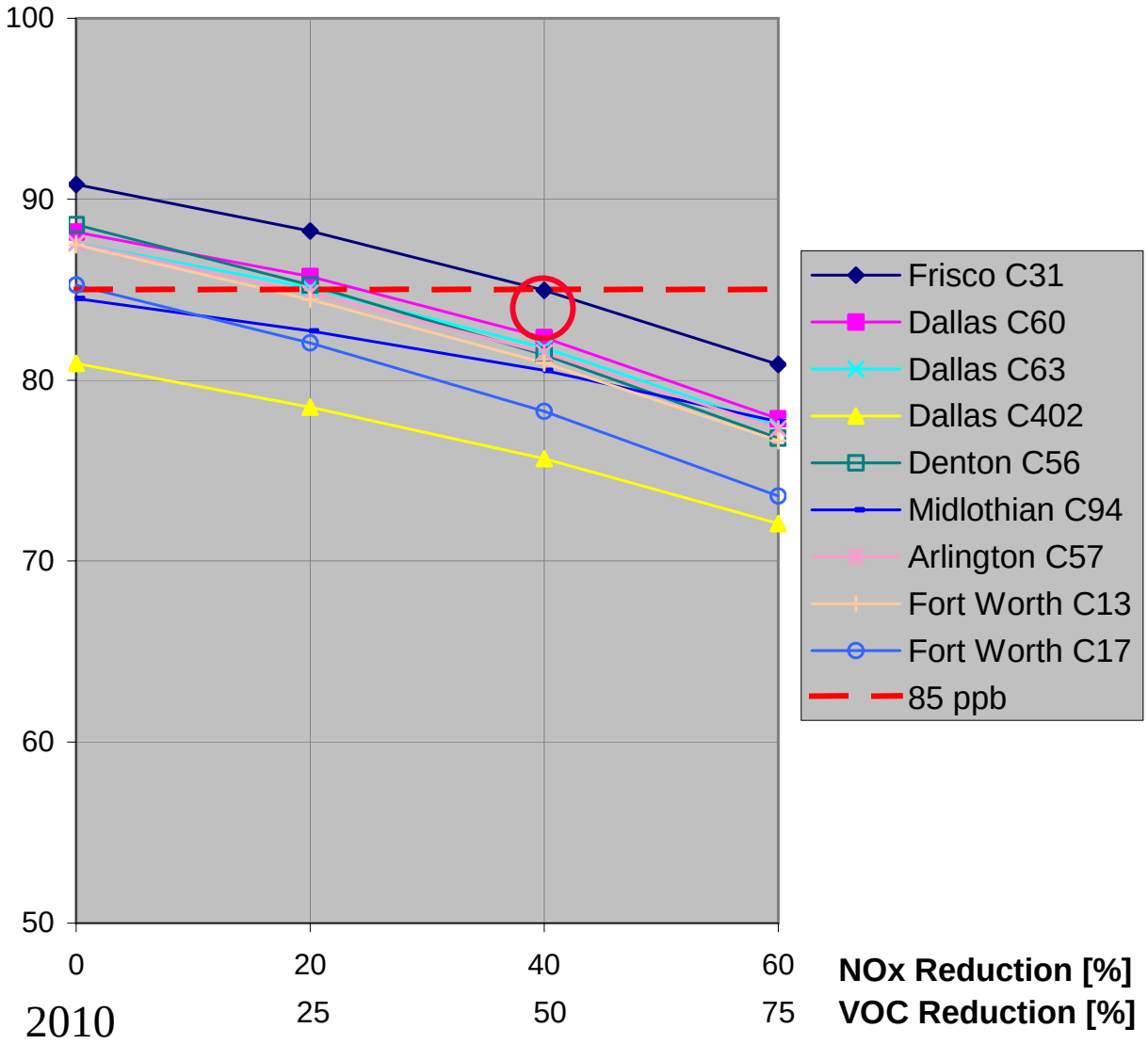


Design Value Scaled 2010 DFW 8-Hour Ozone
NOx Reductions. Aug 13-22, 1999 Core Period.



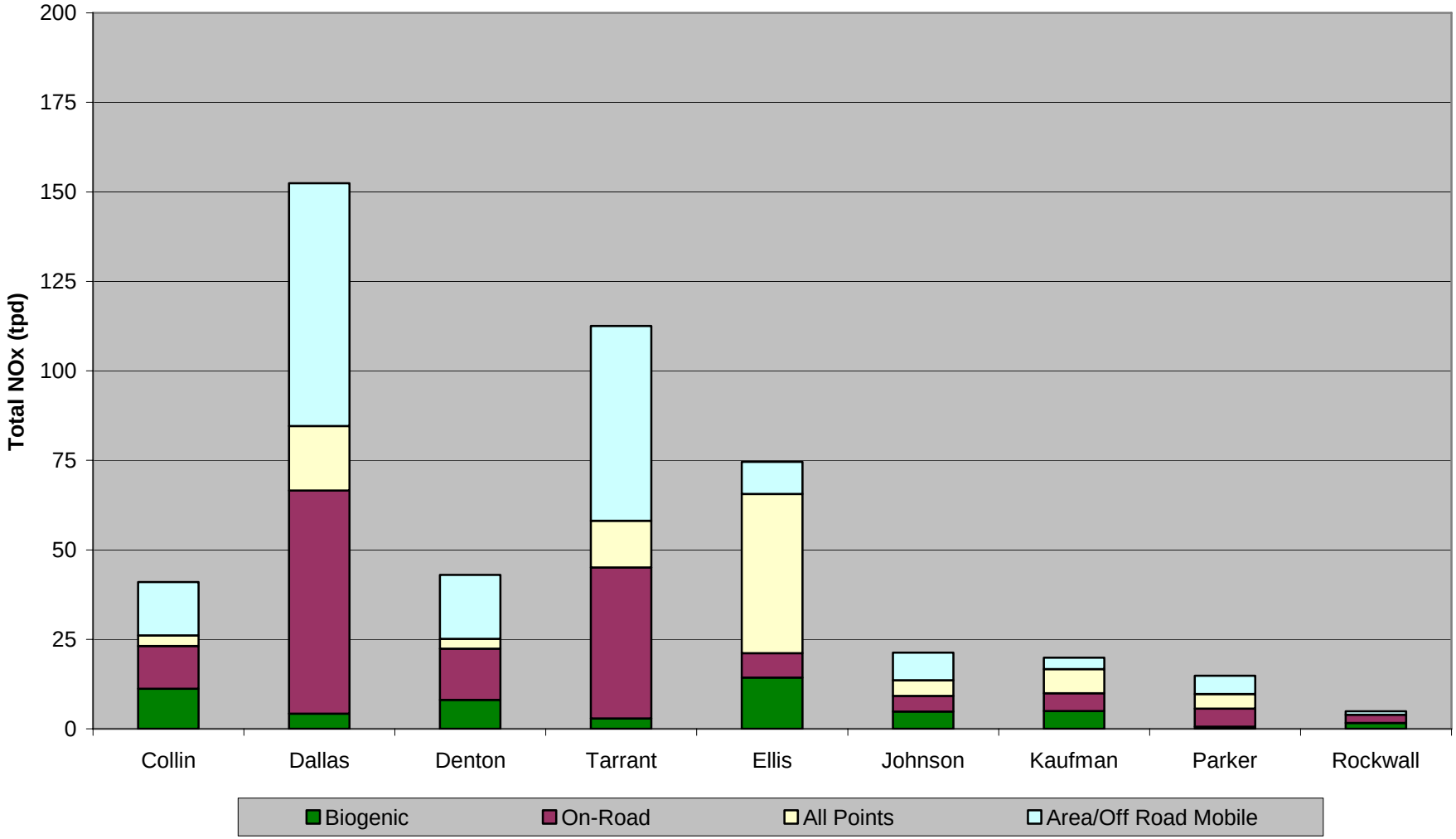
Design Value-Scaled 2010 DFW 8-Hour Ozone

NOx and VOC Reductions. Aug 13-22, 1999 Core Period.



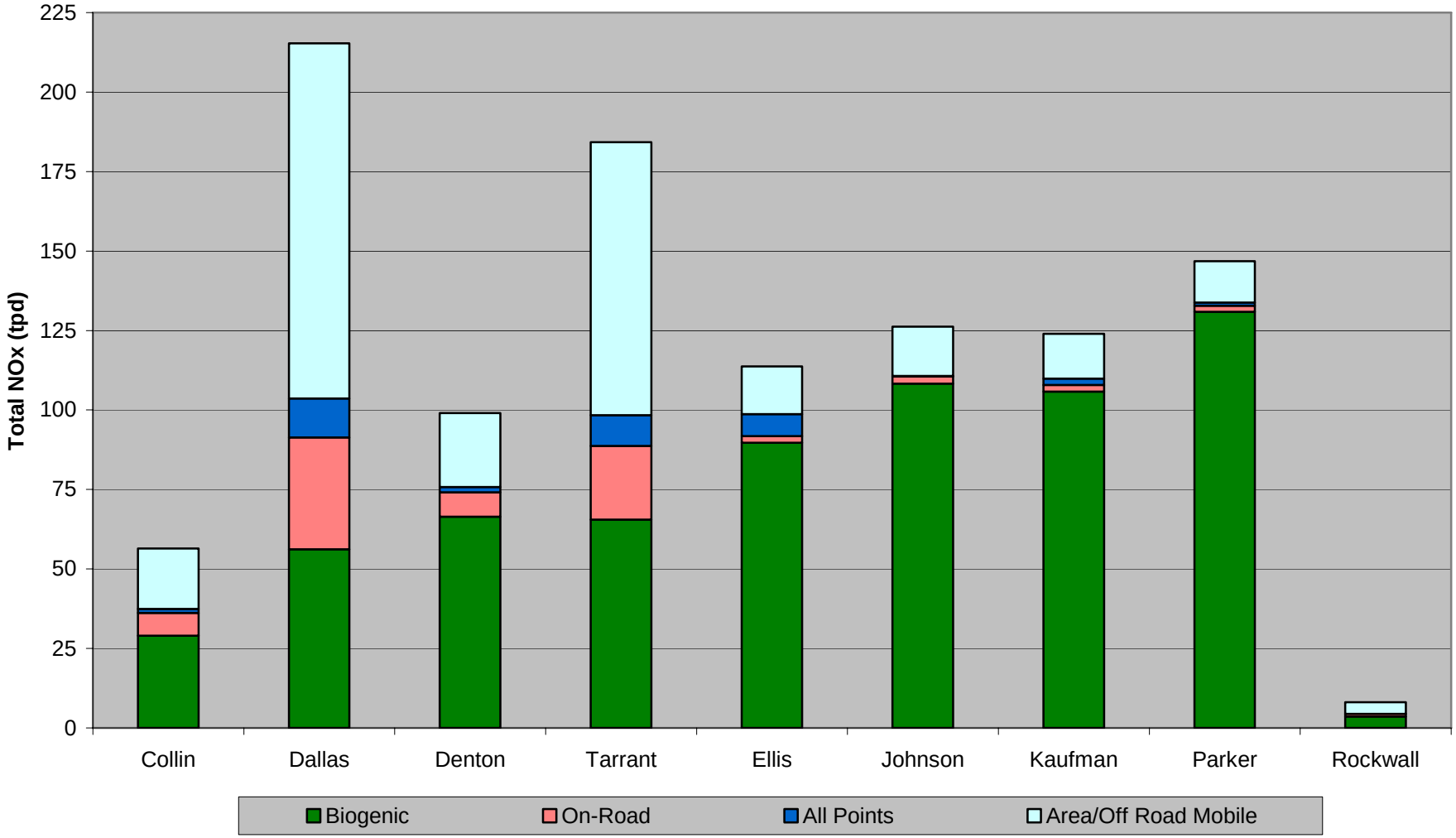
DFW 2010 Non-Attainment Area NOx by County

Typical Weekday (Tuesday)



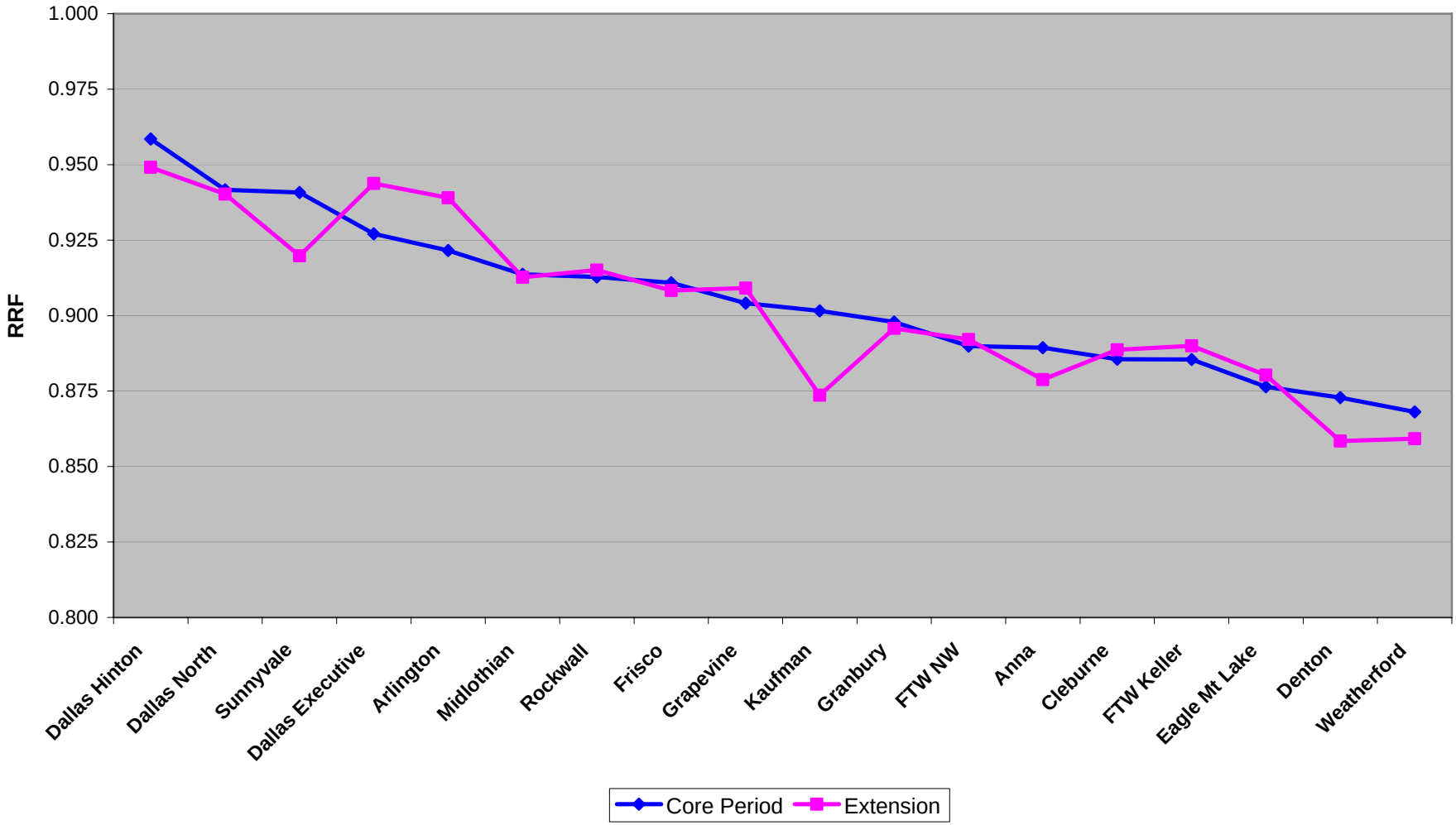
DFW 2010 Non-Attainment Area VOC by County

Typical Weekday (Tuesday)



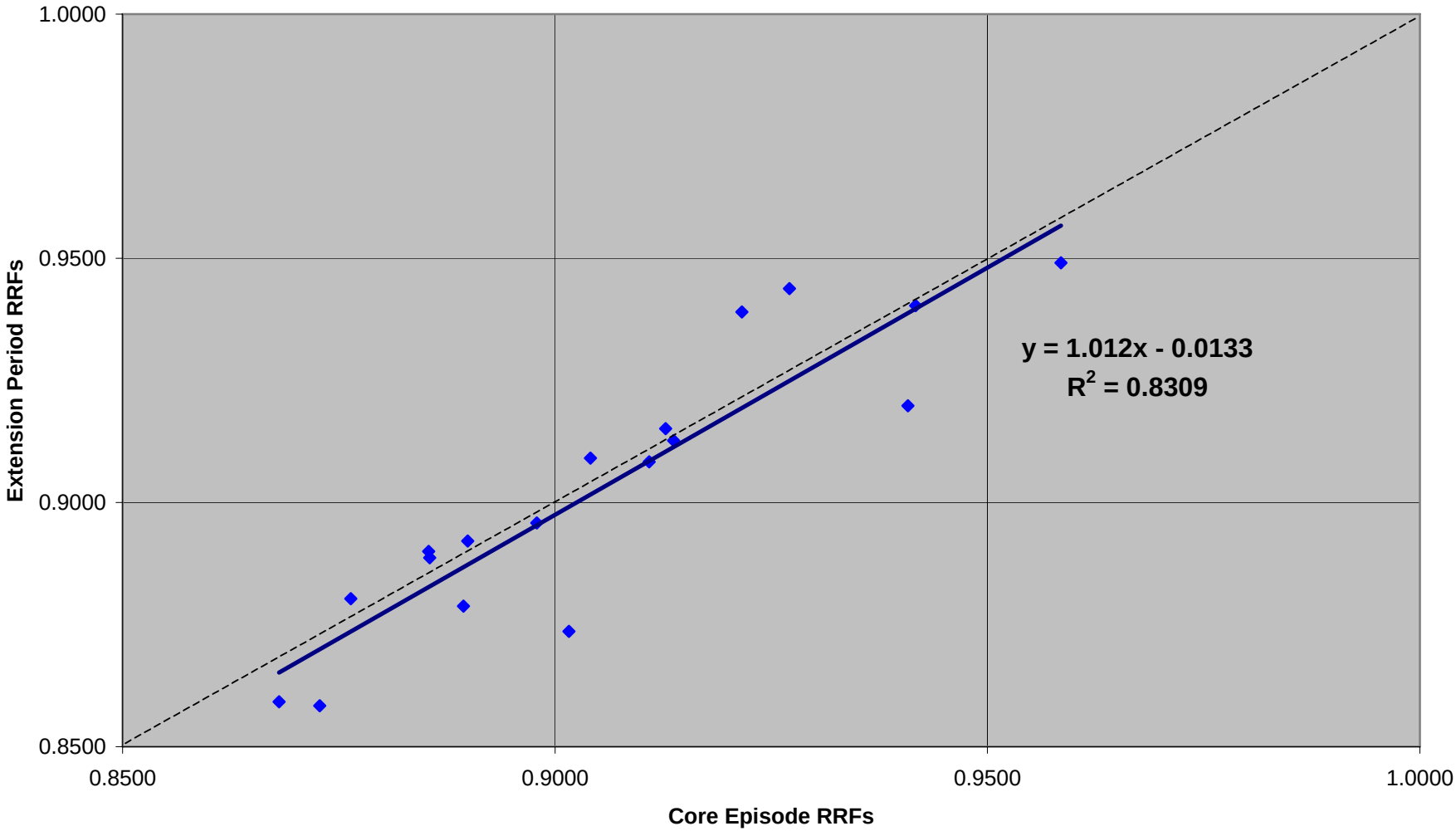
DFW Monitor Specific 2010 Relative Reduction Factors

Core vs Episode Extension, Sorted by Core RRF

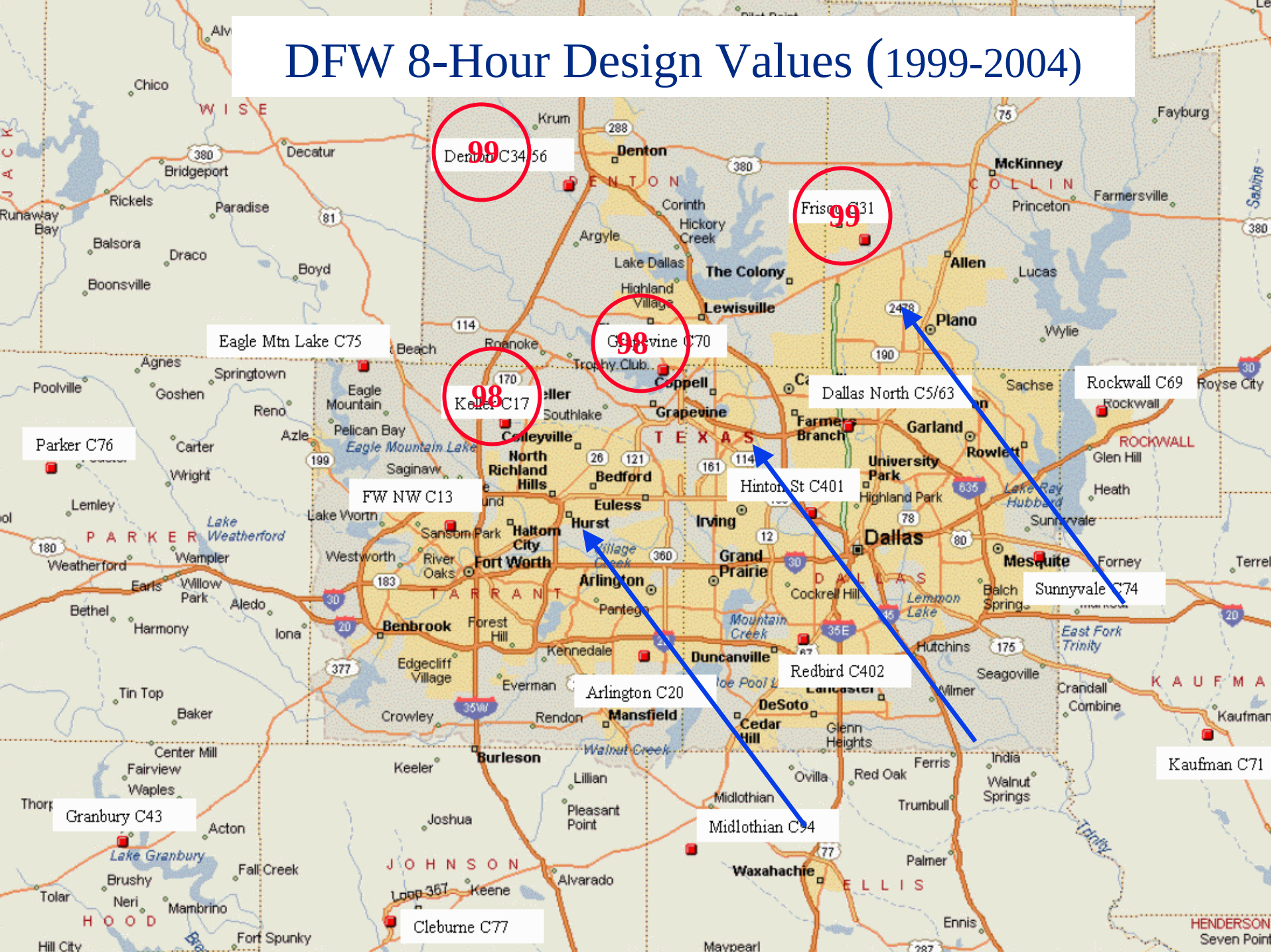


Relative Reduction Factor Comparison

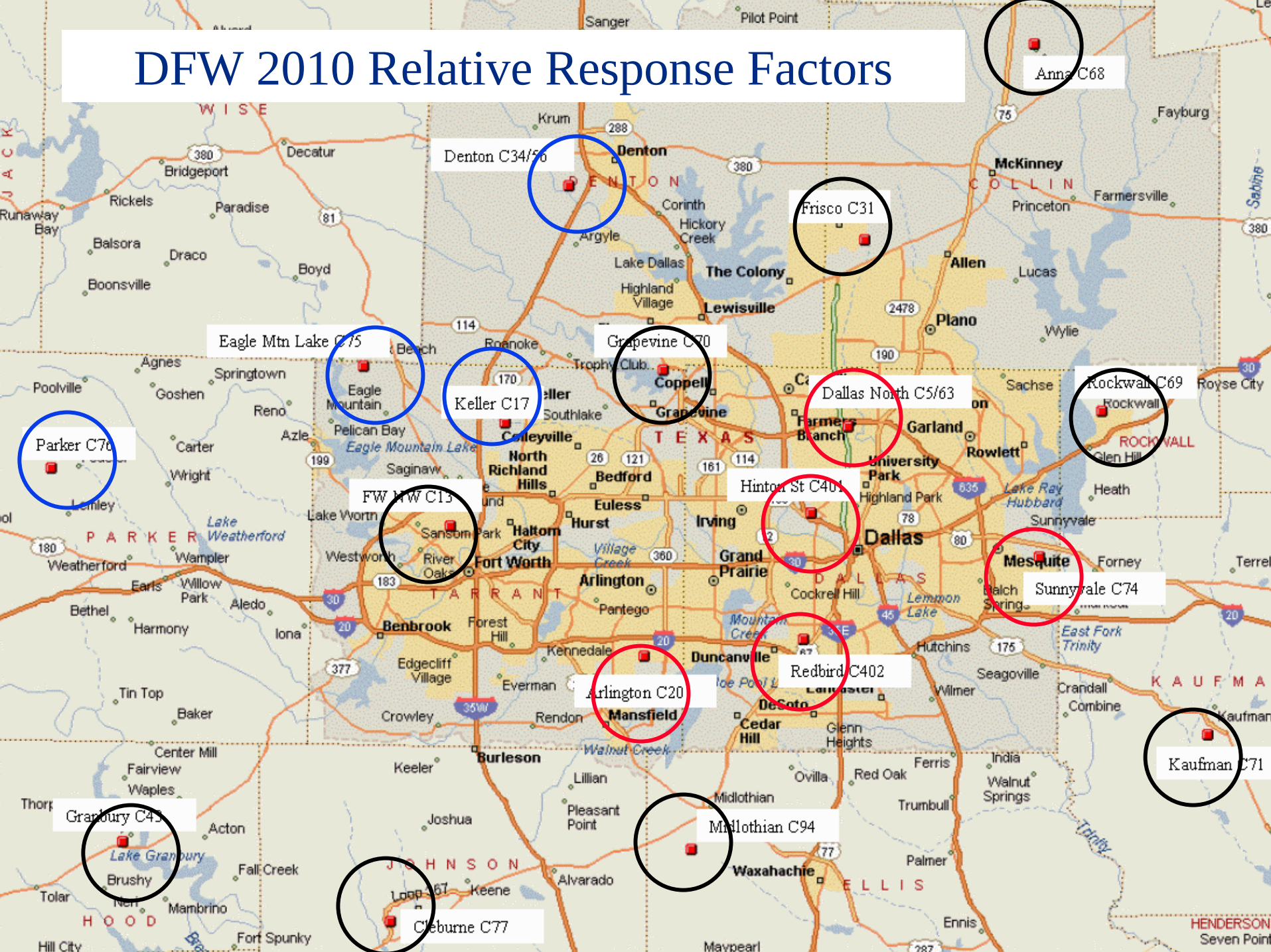
Core Episode vs Extension Period



DFW 8-Hour Design Values (1999-2004)

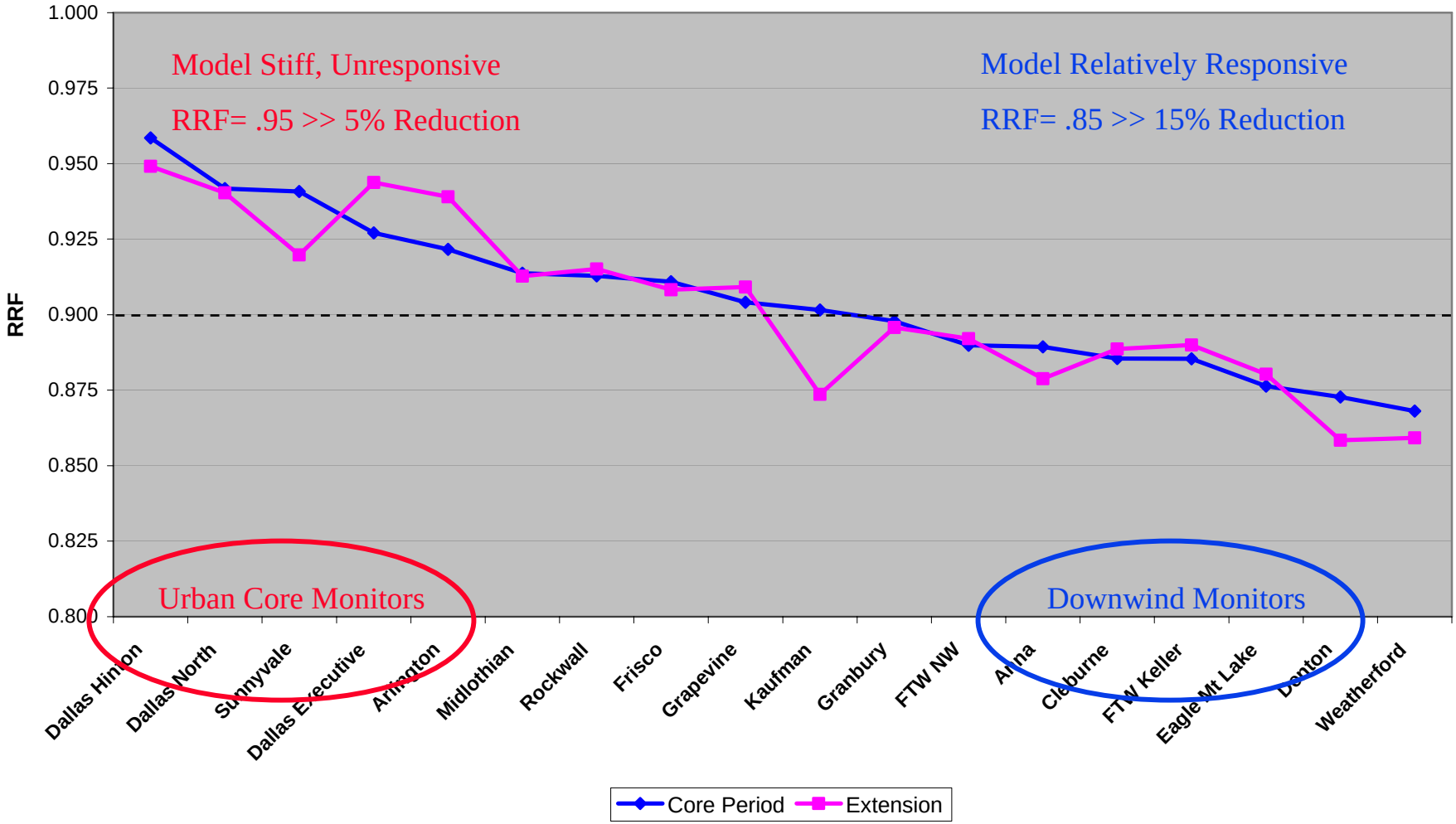


DFW 2010 Relative Response Factors



DFW Monitor Specific 2010 Relative Reduction Factors

Core vs Episode Extension, Sorted by Core RRF



DFW 2010 Modeling Summary:

1. DFW 9-county emissions contribute 34 ppb to the average 8-hour ozone in the local area
2. Reductions in local emissions will be more effective than equivalent ton reductions in distant sources
3. NOx reductions (or a combination of NOx & VOC) will be much more effective than VOC reductions alone
4. It will take a 45% reduction in NOx emissions to bring DFW into compliance with the 8-hour ozone standard