DFW Modeling Status

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EPA Coordination Meeting

Dallas, Texas

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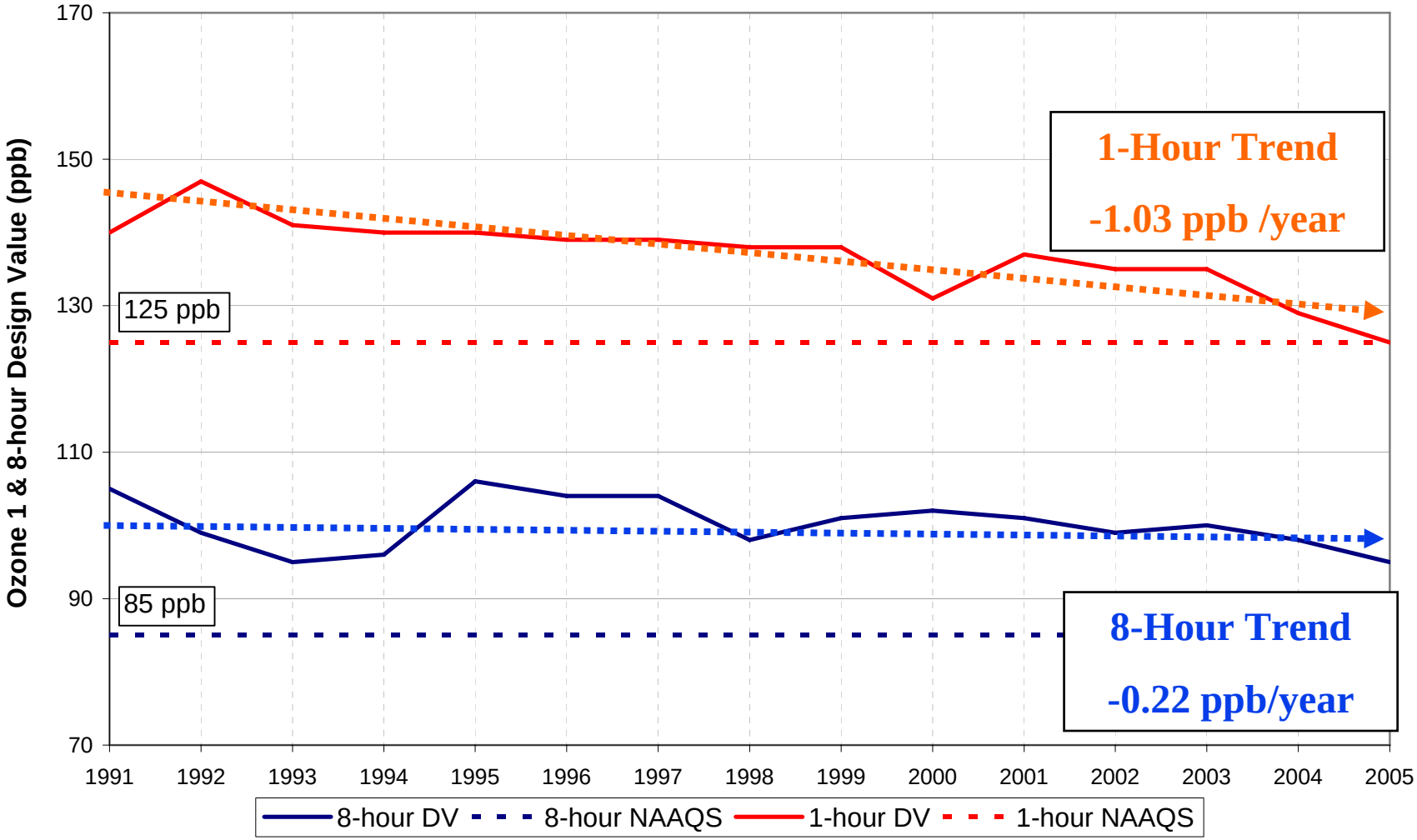
DFW Modeling Overview

- Conceptual Model and Episode Selection
- Base Case Model Performance
- Future Case (2010) Response Curves
- Future Case (2010) Sensitivity Tests
- 2009 Future Case Modeling Plans

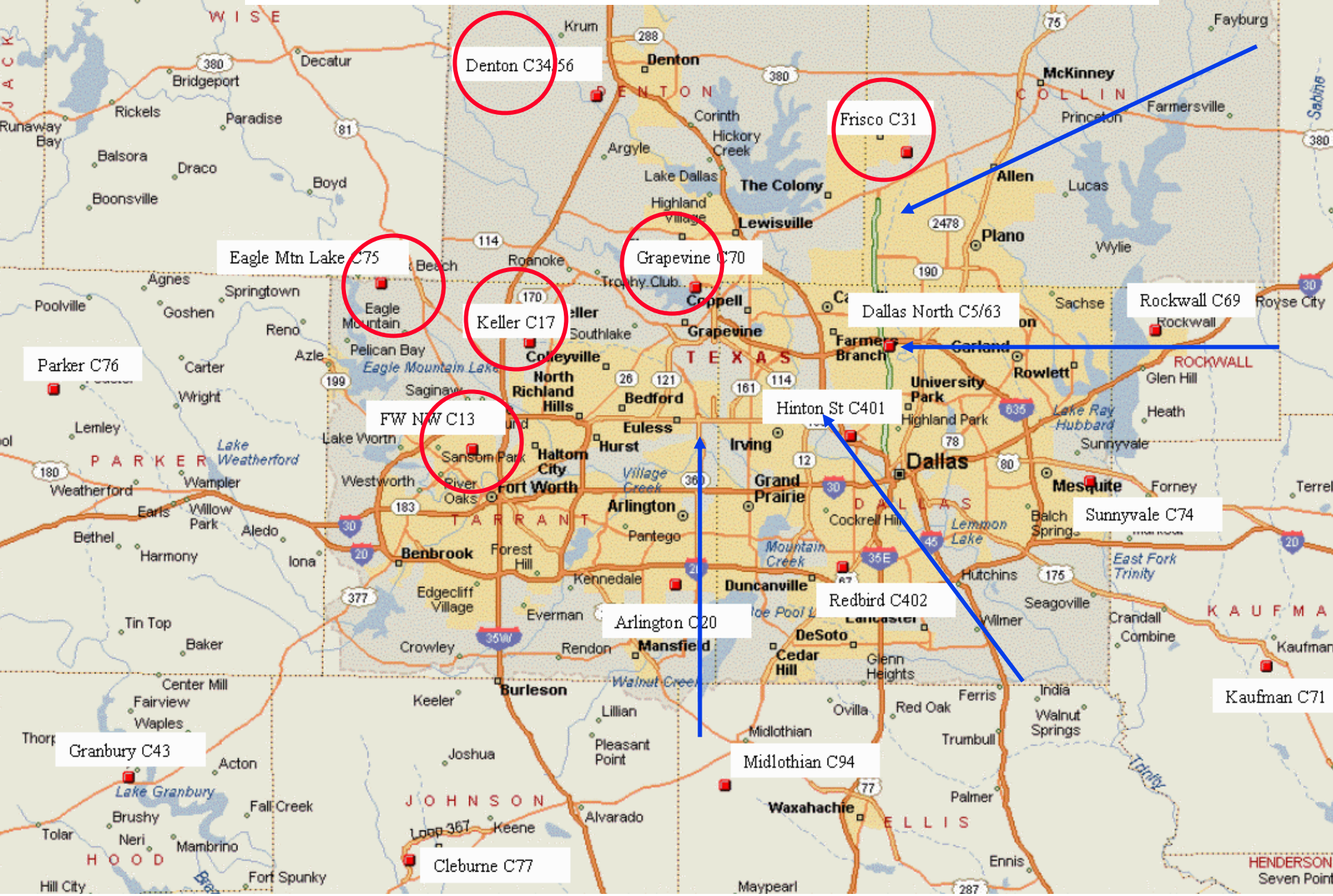
DFW 1-hr & 8-hr Ozone DV Trends

January 1991-October 2005



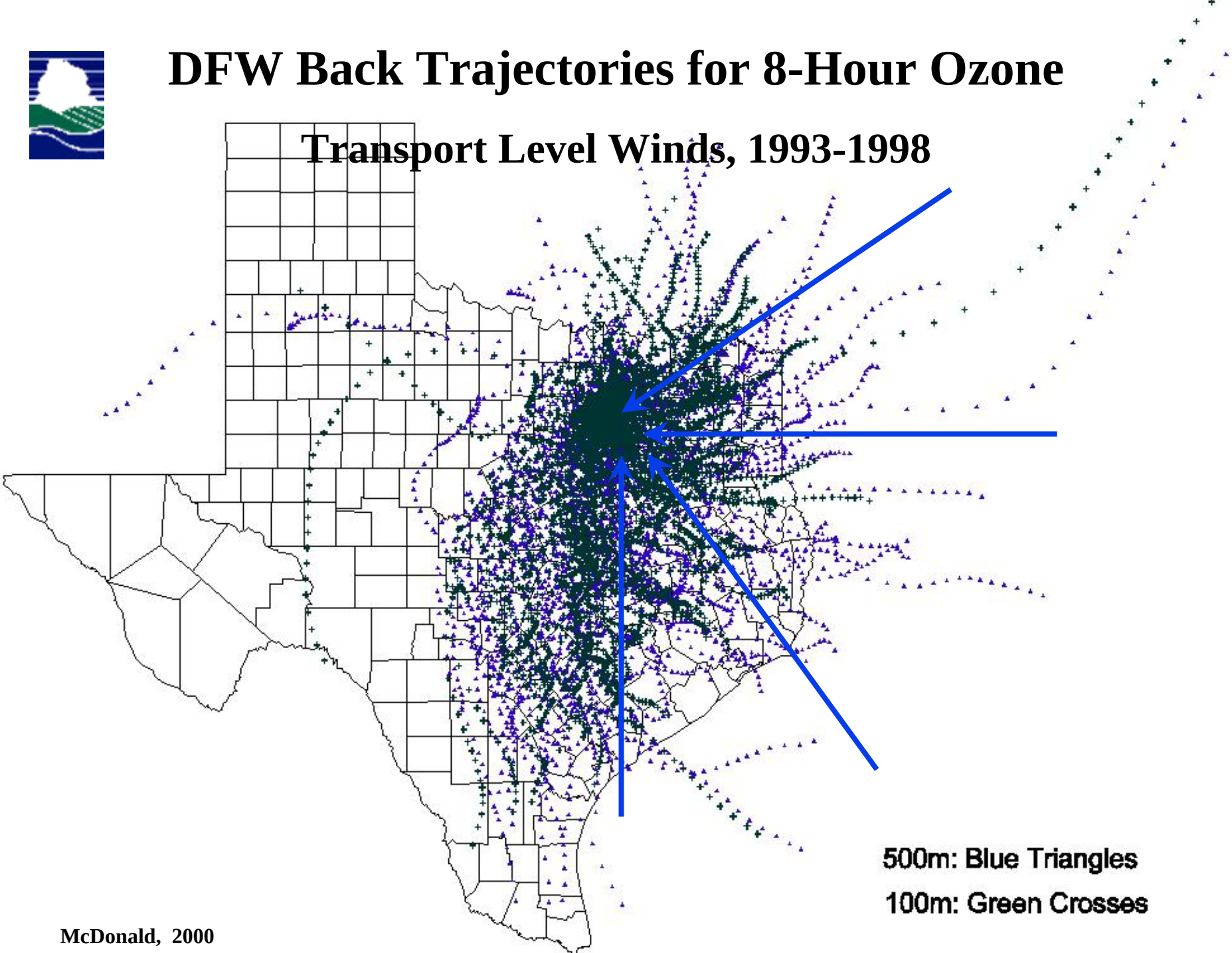
Fang & Mercado, 2005

DFW 8-Hour Design Values (1999-2005)



DFW Back Trajectories for 8-Hour Ozone

Transport Level Winds, 1993-1998



McDonald, 2000

DFW 8-Hour Ozone Episode

August 13 - August 22, 1999 Ozo

Day	Date	Max O3	Site Name	# Sites	Remarks
F	Aug 13	67	Frisco	0	SW Winds, Ramp Day
Sa	Aug 14	103	Arlington	4	NE Winds
Sun	Aug 15	97	Keller	6	East Winds
M	Aug 16	107	Keller	6	East Winds
T	Aug 17	**126**	Frisco, Denton	7	Light SE Winds
W	Aug 18	116	Frisco	4	Light South Winds
Th	Aug 19	108	Midlothian	2	Weak Front, N Winds
Fri	Aug 20	98	Midlothian	1	NE Winds
Sa	Aug 21	98	Arlington	5	East Winds
Sun	Aug 22	89	Denton	2	SE Winds
Mon	Aug 23	59	Denton	0	S Winds, Low Ozone

Episode Selection Summary

- August 13-22, 1999 DFW Ozone Episode
  - Nine Days of High 8-hour Ozone
  - 5 Weekdays, 2 Saturdays, 2 Sundays
  - Occurs during August, the core of the Ozone Season
  - Follows a complete Ozone Cycle
  - Natural progression of wind directions
  - Mix of light and moderate wind speeds
  - Exceedances within +/- 10 ppb of DV
  - High Background concentrations

- Episode Approved by Region 6 and OAQPS
  - Meeting on Feb 1, 2005; Letter dated June 9, 2005

Base Case

- DFW Modeling
  - Modeled on national grid (includes Canada, Atlantic)
  - Fine Grid (4 k) in DFW area
  - Follows Synoptic Cycle, peaks on right days
  - Good Bias and Gross Error Statistics
  - Good hourly time series for Ozone, NOx and VOC
  - Good transported background concentrations
  - Shows urban contributions, w/peaks downwind of city

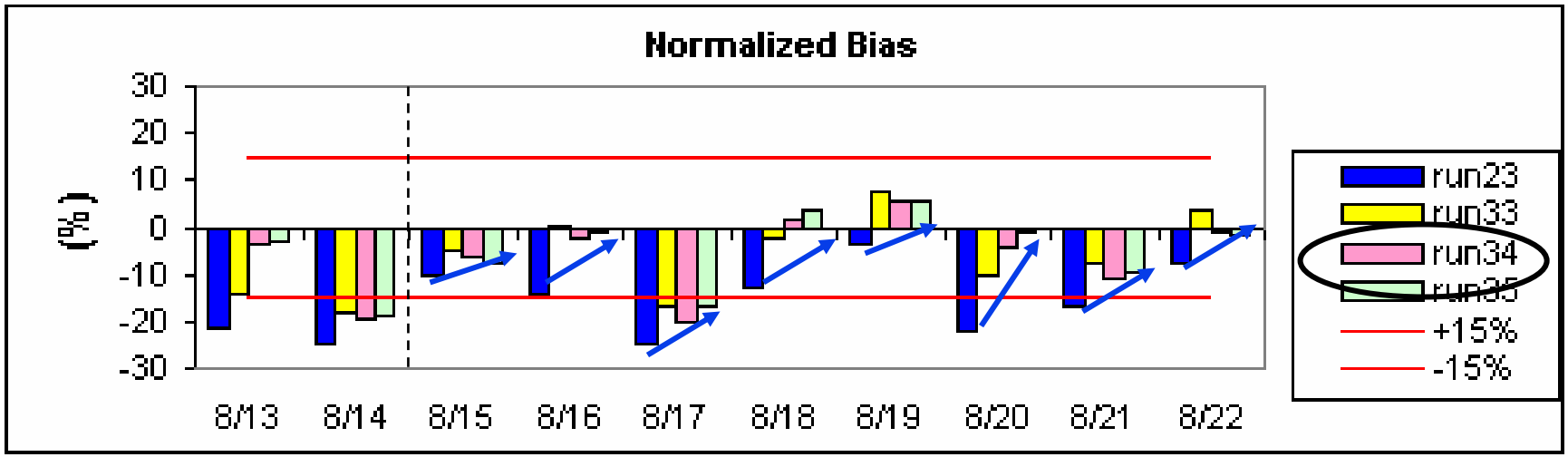
- New EPA Guidance has relaxed the statistical performance requirements

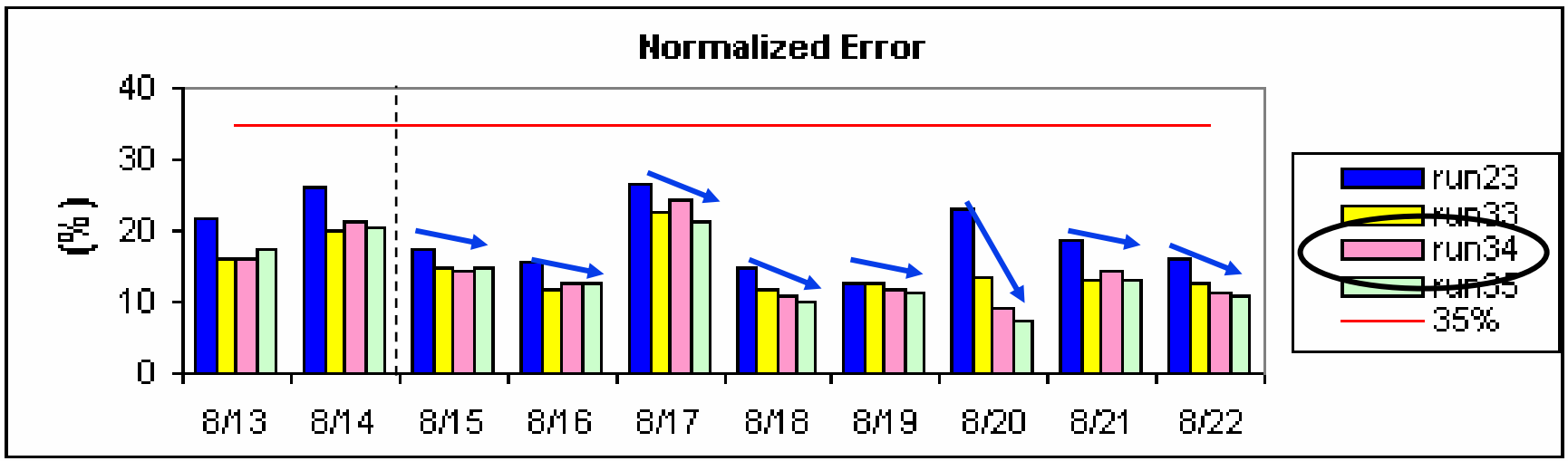
DFW Sensitivity Tests

1. Extend Model Top to 14 km
2. Extend Eastern Boundary into Atlantic
3. CMAQ Vertical Mixing
4. ETA Vertical Mixing
5. Grell Convection mechanism
6. Decrease Mobile NOx by 30%
7. Increase NEGU VOC emissions by 100%
8. Increase Biogenic emissions by 30%
9. Evaluate CB2002 Chemistry
10. Evaluate CB4 chemistry with NOx Recycling

Composite Run Performance

Bias & Gross Error



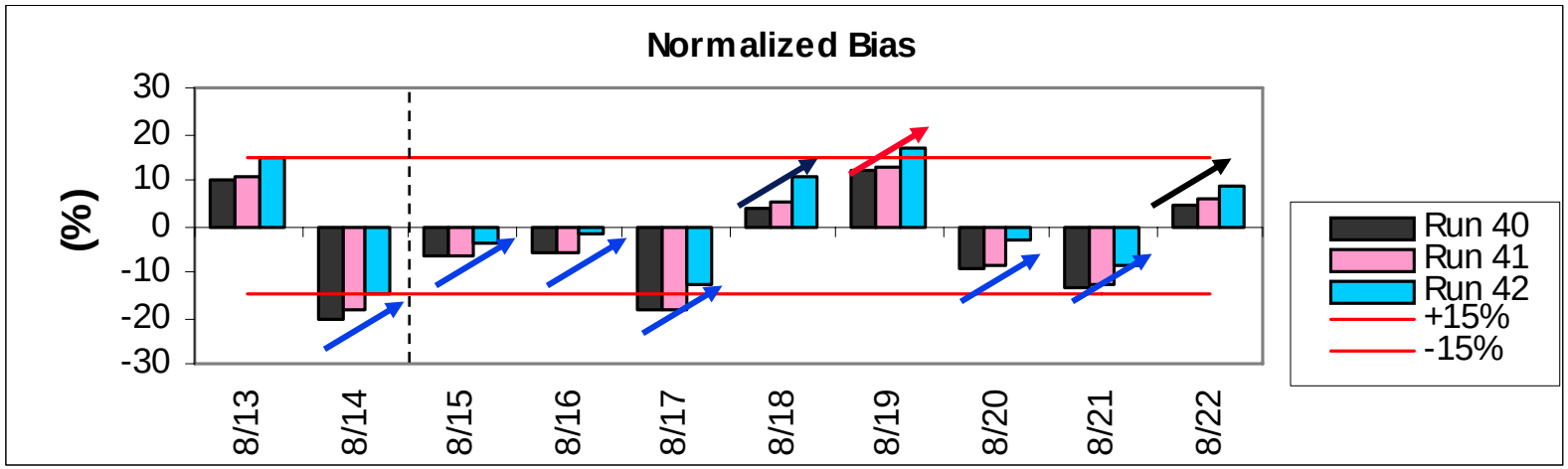


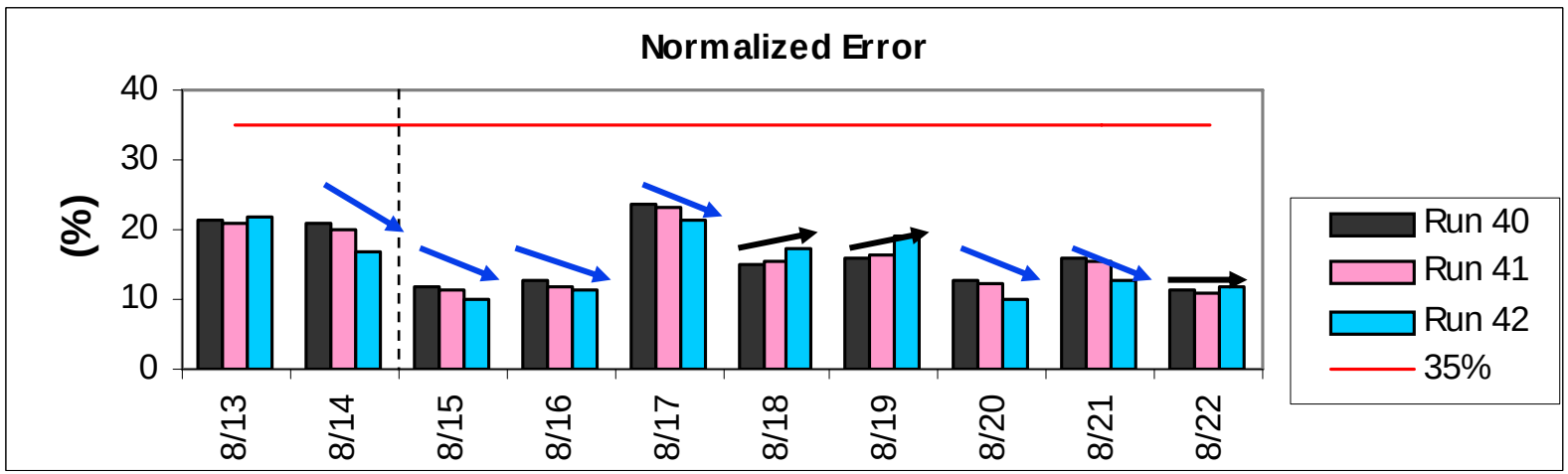
Recent Performance Upgrades

- Revise Mobile Emissions
  - Differentiate days (Mon, Tue-Thurs, Fri, Sat, Sun)
  - Adjust for decreased weekend truck traffic
- Revise NonRoad Emissions
  - Include new NONROAD model
  - Recent Texas equipment surveys
- Adjust for thermal/turbulent low level mixing
  - Upgrade the Kv100 algorithm

DFW Base Case Model Performance

New Slide – Latest Runs





Dallas Ozone

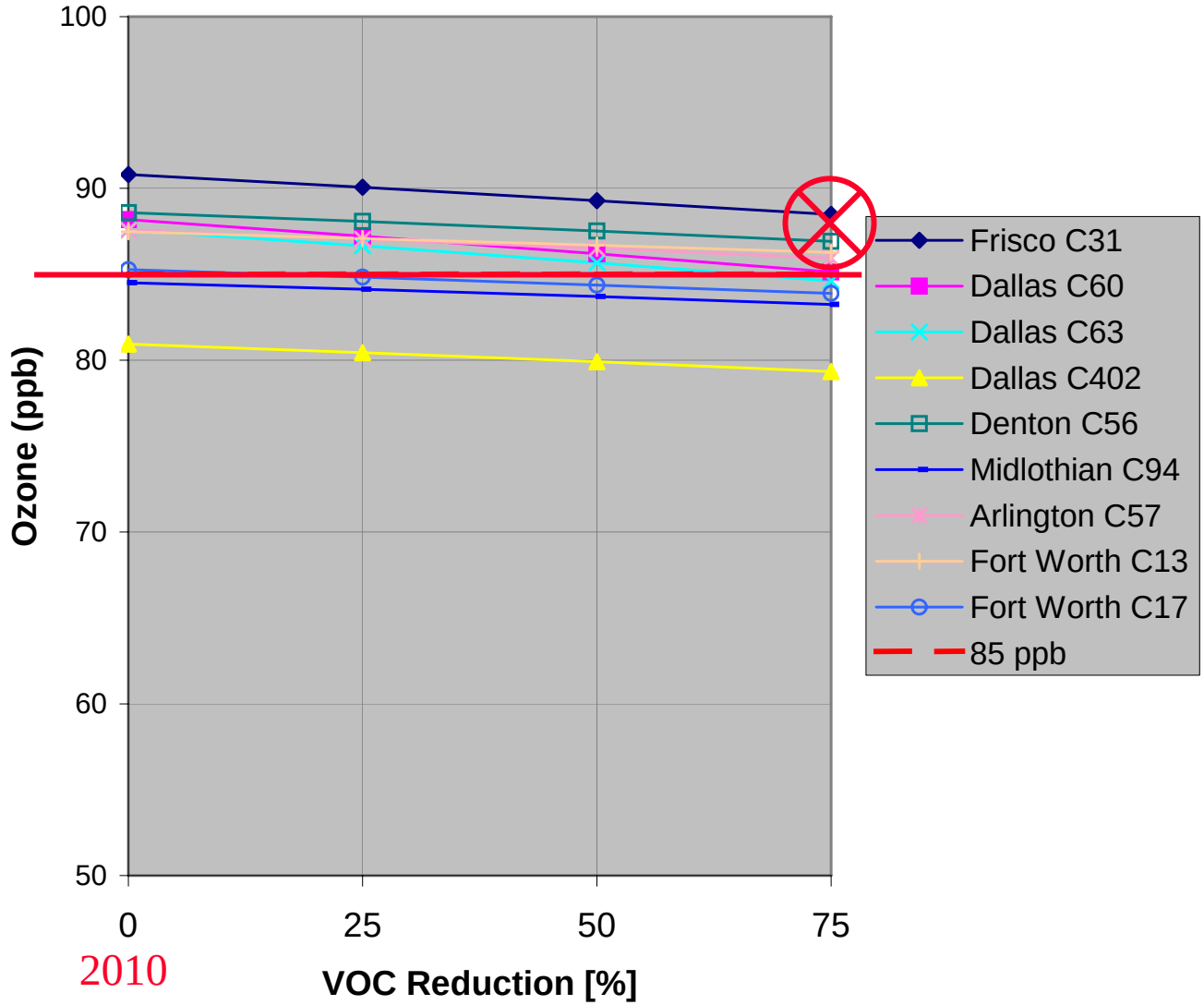
Future Case (2010) Modeling
and
DFW Response Curves

DFW 2010 Attainment

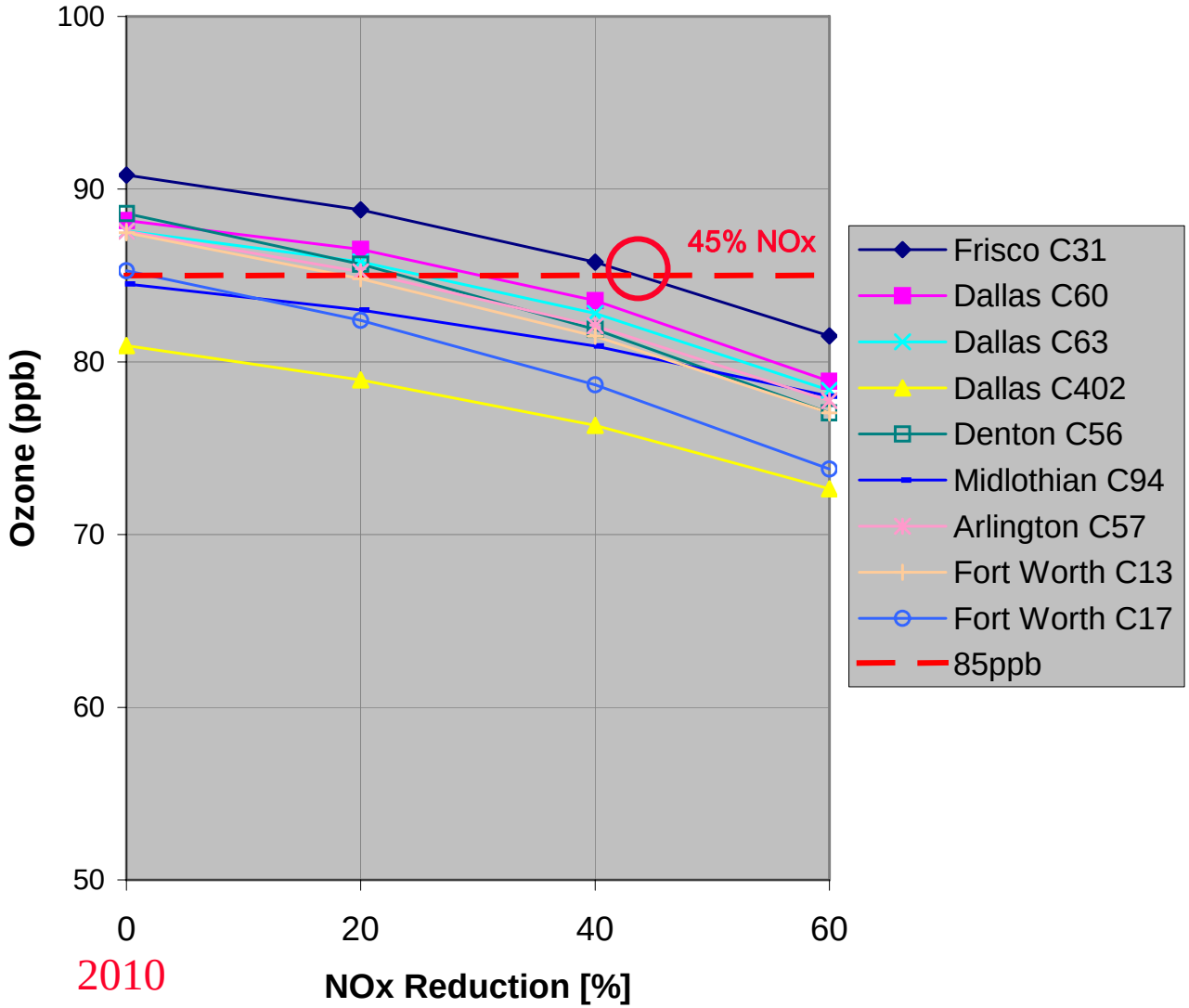
- Sensitivity Test: Determine how much reduction will be needed to reach attainment in the DFW 9-County area.

- Model reductions in 9 county area
  - NOx Reductions (20, 40, 60%)
  - VOC Reductions (25, 50, 75%)
  - Combinations of NOx and VOC

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

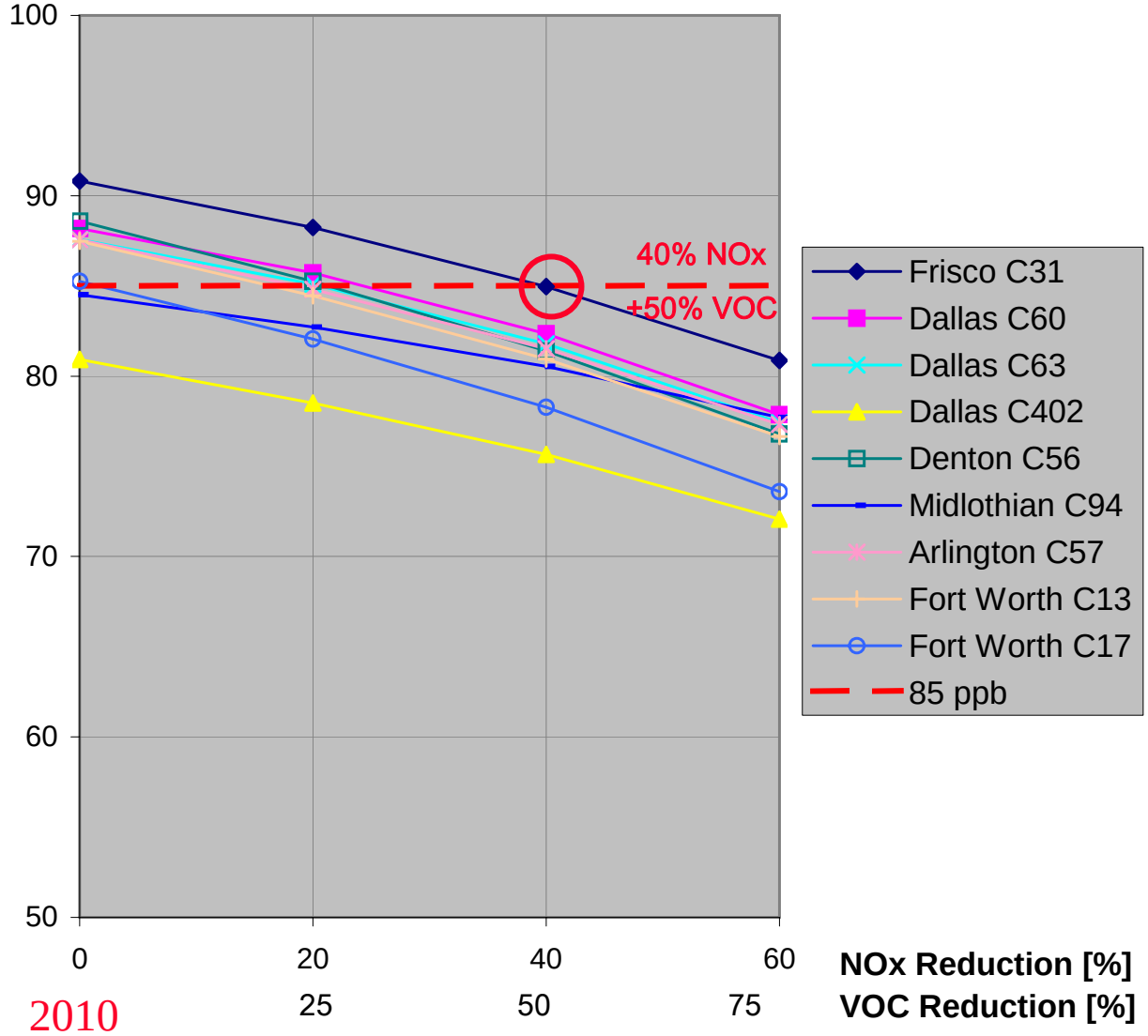


Design Value Scaled 2010 DFW 8-Hour Ozone NOx Reductions. Aug 13-22, 1999 Core Period.



Design Value-Scaled 2010 DFW 8-Hour Ozone

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



Future Case (2010) Model Response

- The Future (2010) Design Value is 90.8 ppb at the Frisco Monitor
  - On average, the DFW 9-county area contributes about 26 ppb to its own 8-hour ozone
- NOx Reductions are more effective than VOC Reductions
- It will take approximately 45% NOx reduction in the DFW 9-County Area to get down to 85 ppb
  - Combination of 40% NOx and 50% VOC reduction also leads to 2010 attainment.

East Texas EGU Controls

- Question: How much difference would it make in the DFW 9-county area if the Houston EGU controls were applied to the other EGUs in East Texas?
  - Houston and Dallas EGU sources have already reduced local emissions by approximately 80-88%
- Run 2010 sensitivity test to determine future case benefit from additional reductions.
  - Reduce emissions from other EGU sources in East Texas to match control levels established for Houston
  - Evaluate the difference plots and numerical data

Texas Power Plants in E Texas

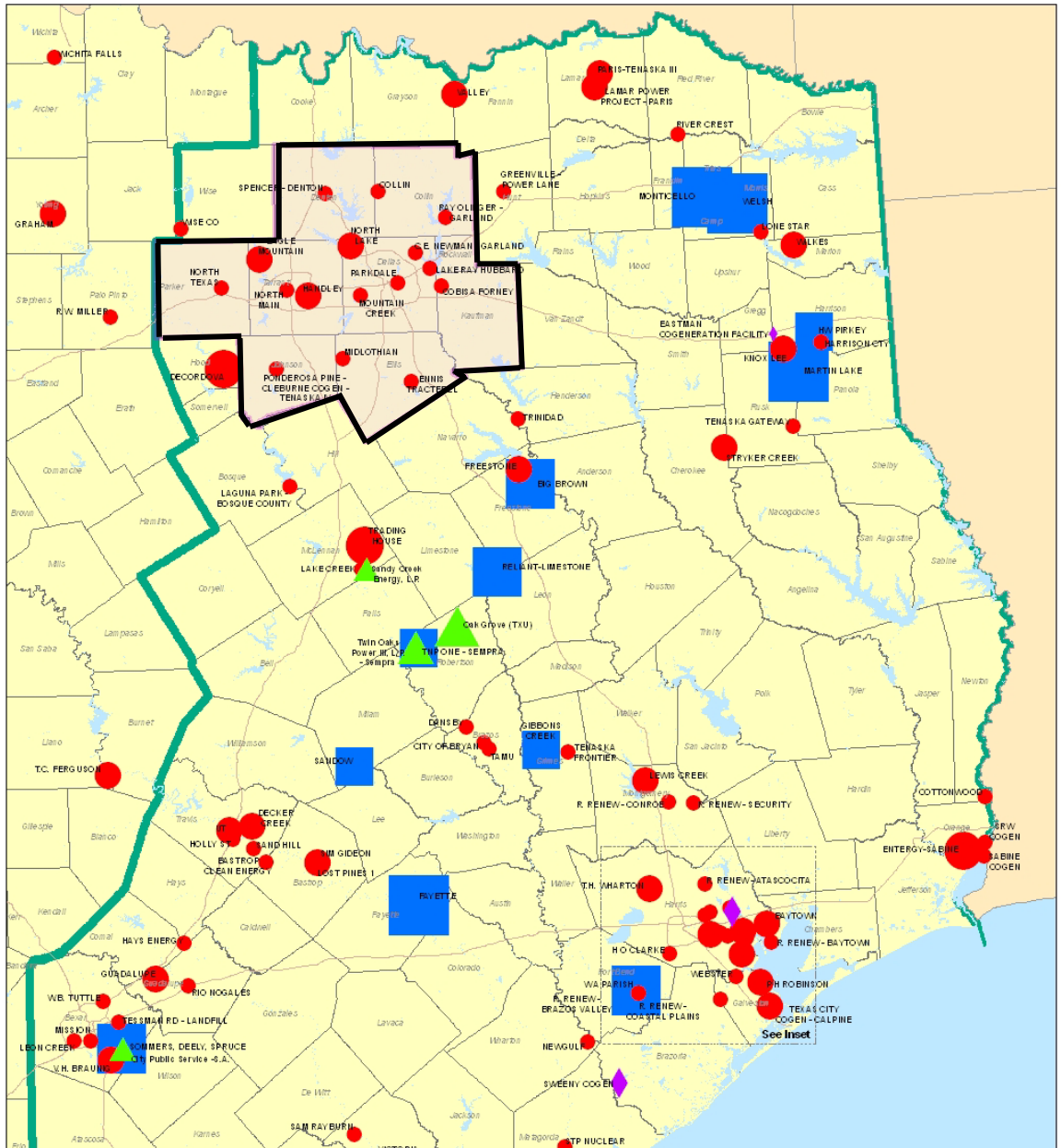
Numerous Electric Generating Units all Over eastern Texas add to rural NOx

Blue – Coal Fired

Red – Gas fired

Purple – CoGen

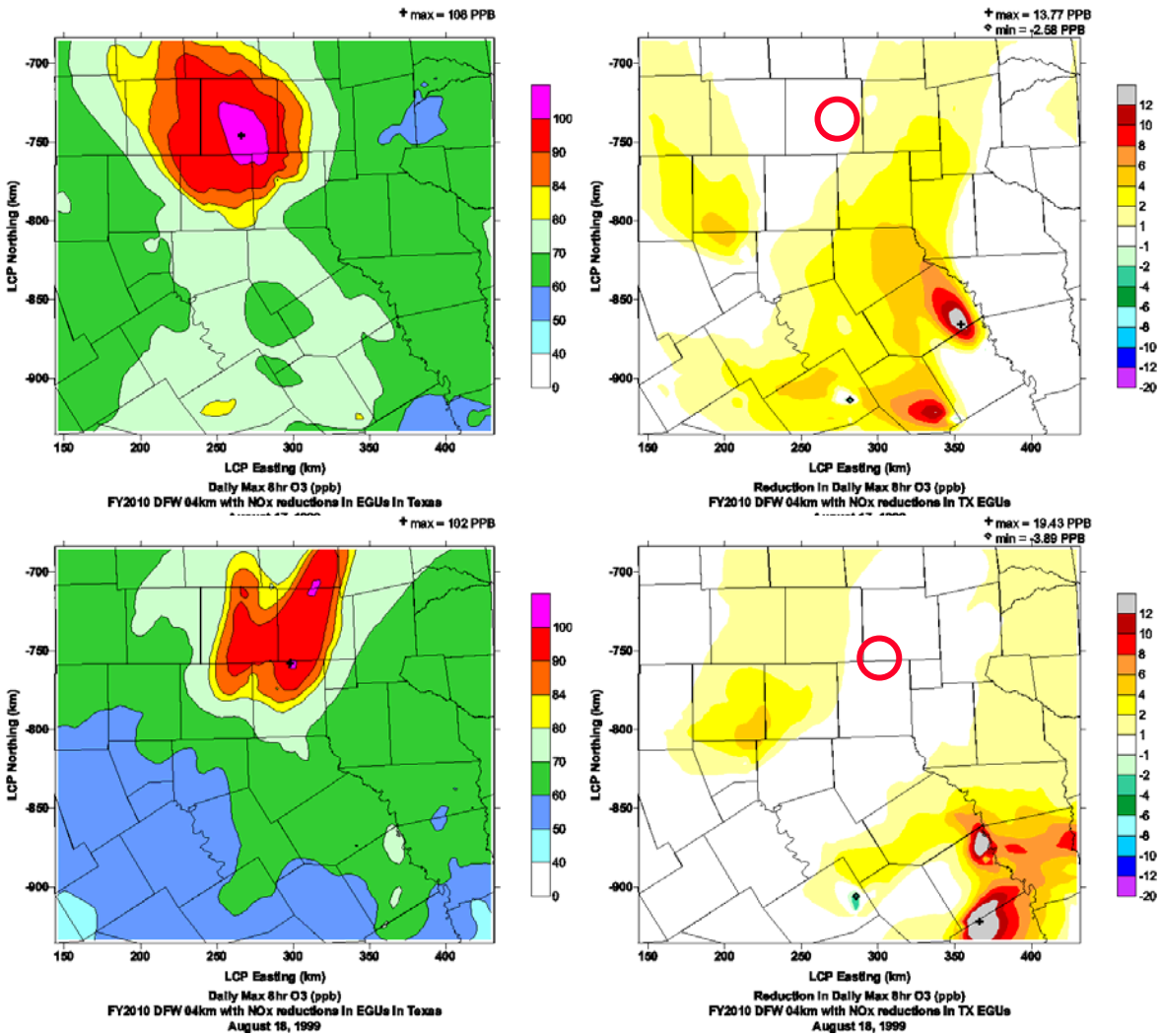
Green - Proposed



TCEQ/Breitenbach

Impact of East Tx EGU Controls DFW Area - August 17th and 18th

Max 8-Hour Ozone | Difference Plot



Change in DFW 2010 Design Value After EGU NOx Reductions

Site	Projected 2010 Design Value (ppb)		
	Future Base Case	EGU NOx Control	EGU NOx Benefit
Frisco C31	90.8	89.5	-1.3
Dallas C60	88.2	87.3	-0.9
Dallas C63	87.6	86.6	-1.0
Dallas C402	80.9	79.9	-1.0
Denton C56	88.6	87.8	-0.8
Midlothian C94	84.5	82.9	-1.6
Arlington C57	87.6	86.3	-1.3
Fort Worth C13	87.5	86.4	-1.1
Fort Worth C17	85.3	84.4	-0.9

The average reduction over all the DFW monitors was 1.1 ppb

Impact of EGU NOx Reductions

- Additional NOx reductions applied to East Texas EGUs in 2010 lead to widespread ozone reductions in northeast and central Texas, but 8-hour ozone benefits extend into the DFW area on all days.

- DFW Impacts:
  - DFW Design Value reduced 1.3 ppb at Frisco
  - Average DFW Design Value reduced 1.1 ppb

- Texas Impacts:
  - Average East Texas reduction in Daily Max is 15.13 ppb
  - Average NNA reduction on ‘high’ days is 4.38 ppb

2009 Modeling Underway

- Finalizing 2009 Emissions Inventory
  - ✓ Mobile Source Update (1999 and 2009)
  - ✓ Area/Nonroad (2009)
  - ✓ Point (1999 baseline and 2009)
- Core Episode Modeling
  - ✓ Redo 1999 Base Case with updated Mobile emissions
  - ✓ Run 1999 Baseline with generic (typical) emissions
  - – Run 2009 Future Base with mandated controls
  - – Calculate RRF, Determine Future DV
- Additional Controls
  - – Evaluate Impact of Transport (CENRAP 2002)
  - – Run Sensitivity Tests on Texas Regional Controls
  - – Run DFW/NCTCOG Local Control Packages

What's Next for the Dallas SIP?

- Future Design Value at Frisco is 90.8 ppb
- Need approximately 6 ppb reduction to get to 85 ppb
  - CAIR reductions will be included in the 2009 future case
  - Need ~ 180 tons/day of NOx reduction in 9-county area
- We have only identified about 3.5 ppb of reductions (based on sensitivity tests and preliminary estimates)
  - DFW controls may deliver as much as 2 ppb
  - EGU controls may reduce ozone about 1 ppb
  - Cement Kilns may reduce ozone about 0.5 ppb
- Where do we find the remainder of the reductions?