

# Overview of ozone exceedances in Houston and Dallas

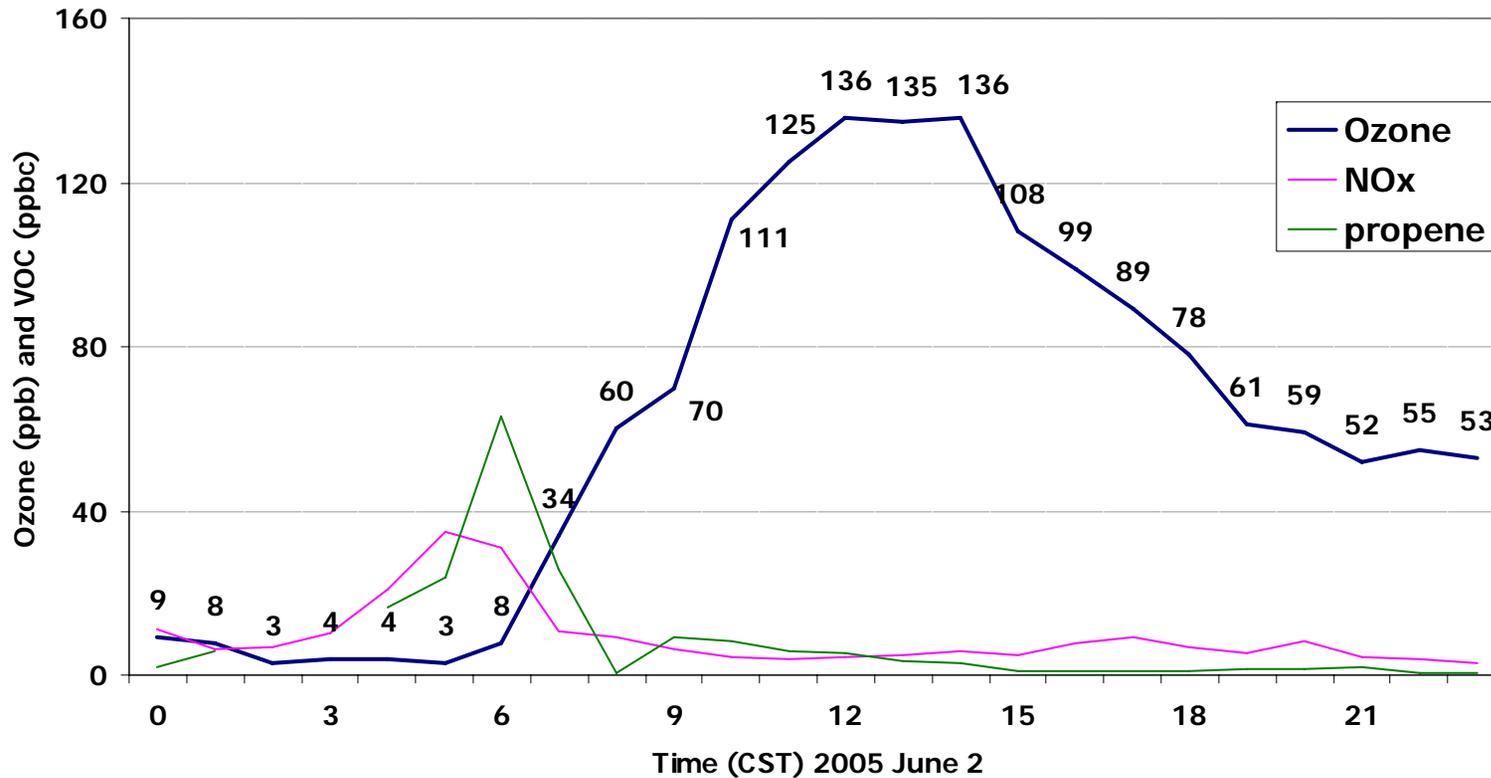
TCEQ Air Modeling and Data Analysis Section,  
Rapid Synthesis Briefing, October 12, 2006

# Four ozone metrics

- 8-hour ozone exceedance =  
 $\geq 85$  ppb O<sub>3</sub>, averaged over 8 hours
- 8-hour ozone design value = 4<sup>th</sup> highest 8-hr value for each year, averaged over 3 years
- 1-hour ozone exceedance =  
 $\geq 125$  ppb O<sub>3</sub>, averaged over 1 hour
- Transient High Ozone Event (THOE) = increase of  $\geq 40$  ppb O<sub>3</sub> in one hour. Arbitrary, but customary.

# EXAMPLE of three metrics

Wallisville Road CAMS 617  
"Transient" High Ozone Event, 8-hr exceedance, and 1-hr exceedance  
2 June 2005

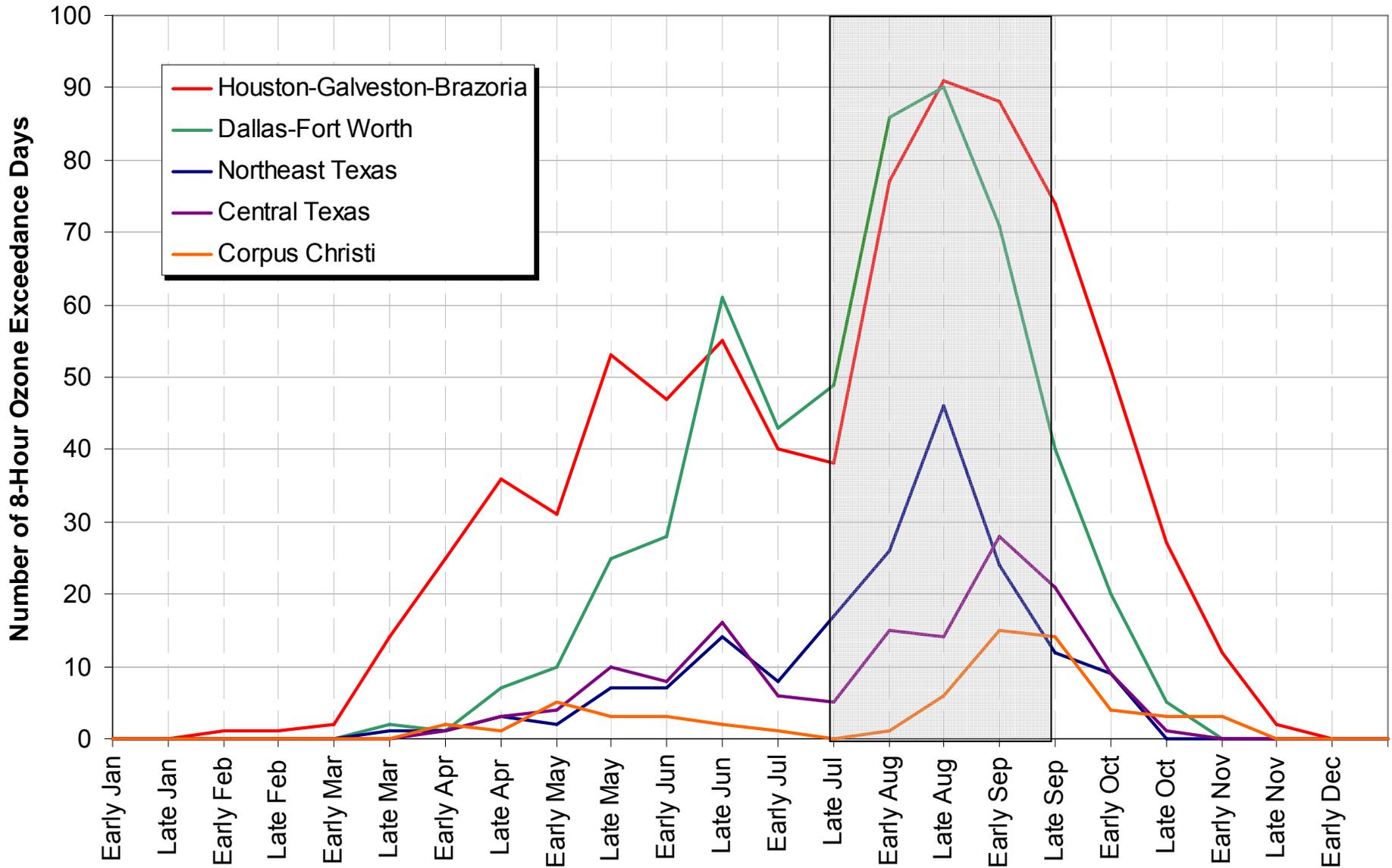


Max 1-hr change in  
ozone = 41 ppb/hr

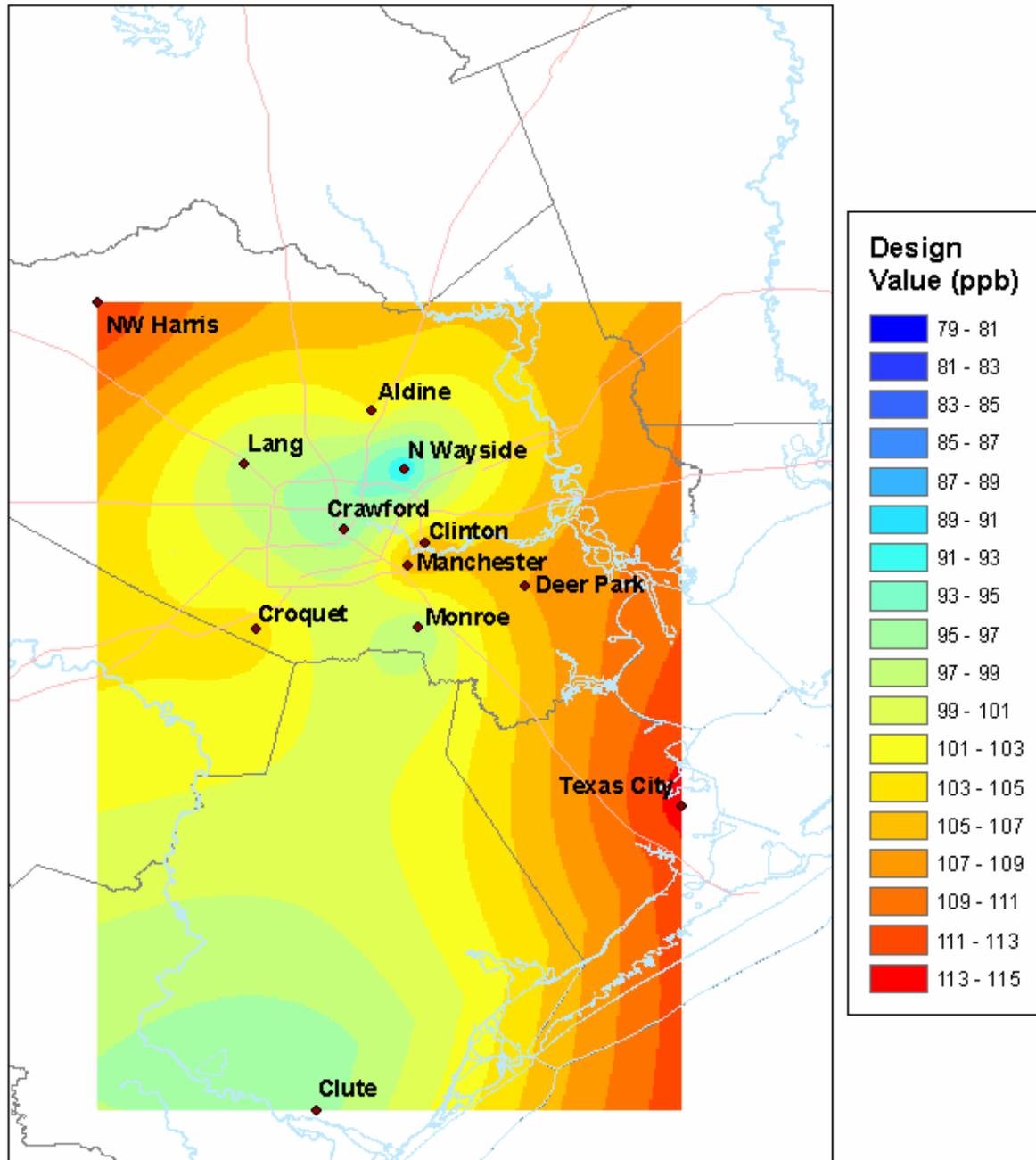
Max 1-hour avg. = 136 ppb

Max 8-hour  
avg. = 117 ppb

# 8-Hour Ozone Exceedance Days in Texas from 1990 to 2005

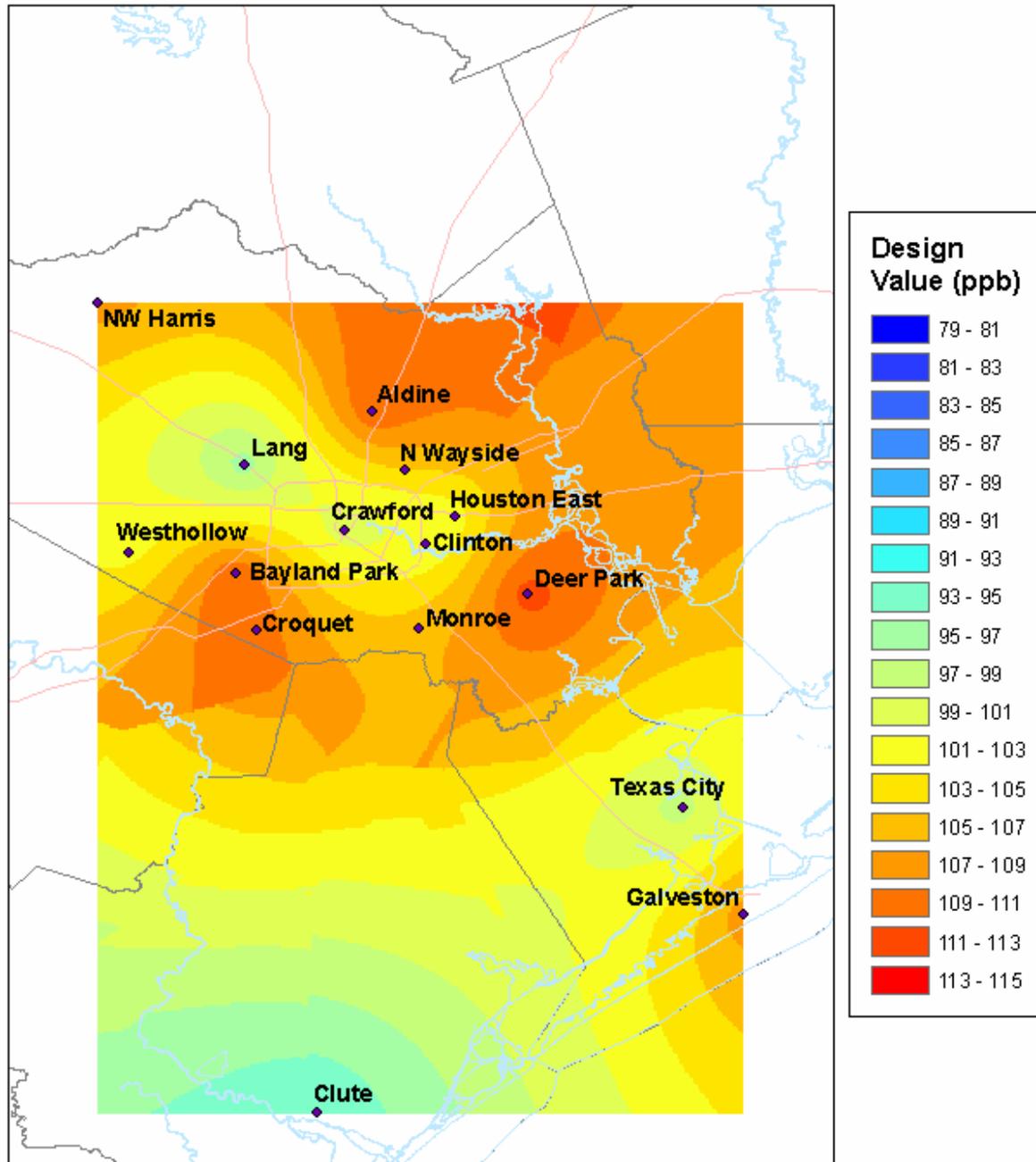


# 1995 8-Hour Ozone Design Values in the HGB Area



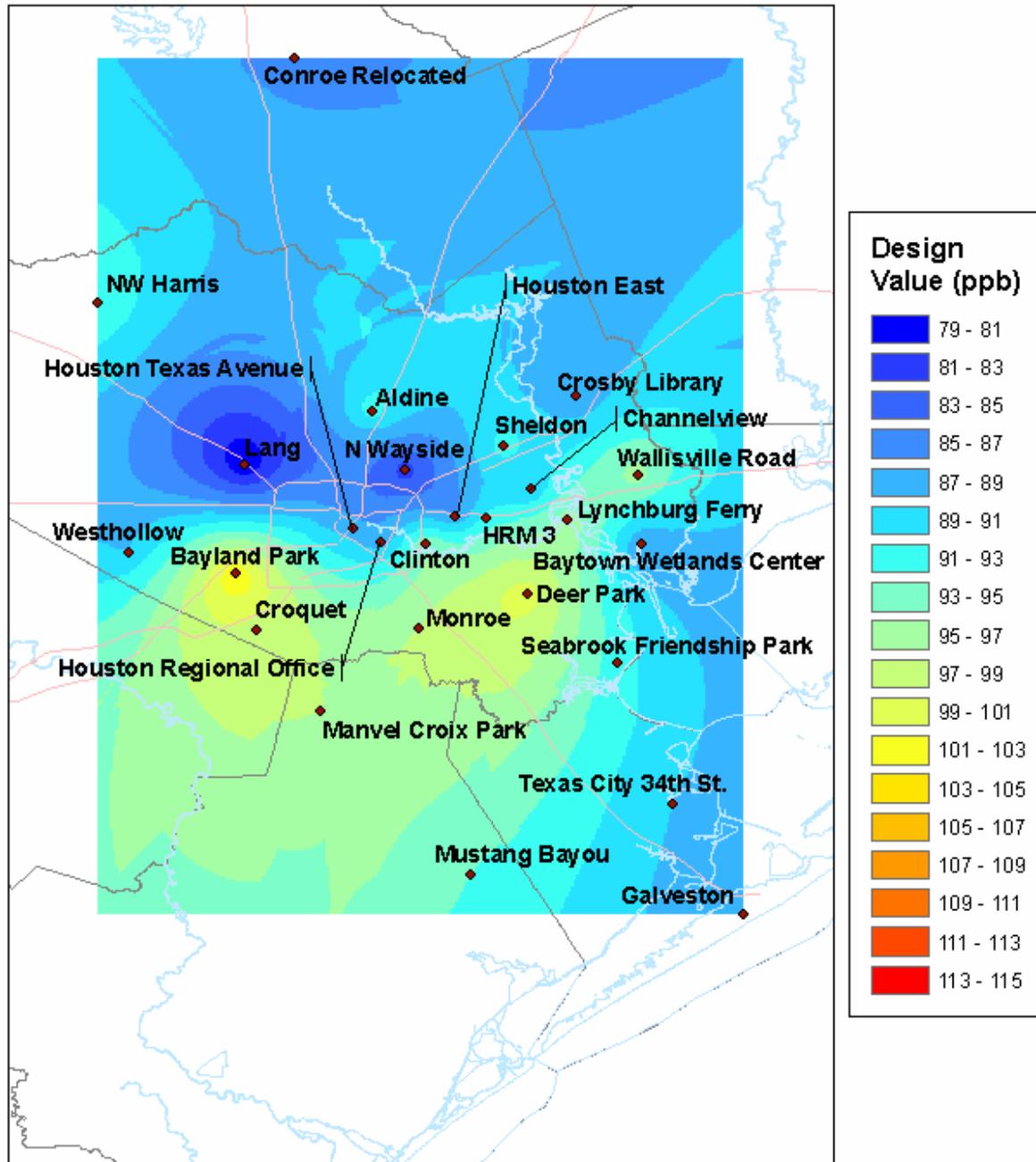
TCEQ Data Analysis,  
2006

## 2000 8-Hour Ozone Design Values in the HGB Area



TCEQ Data Analysis,  
2006

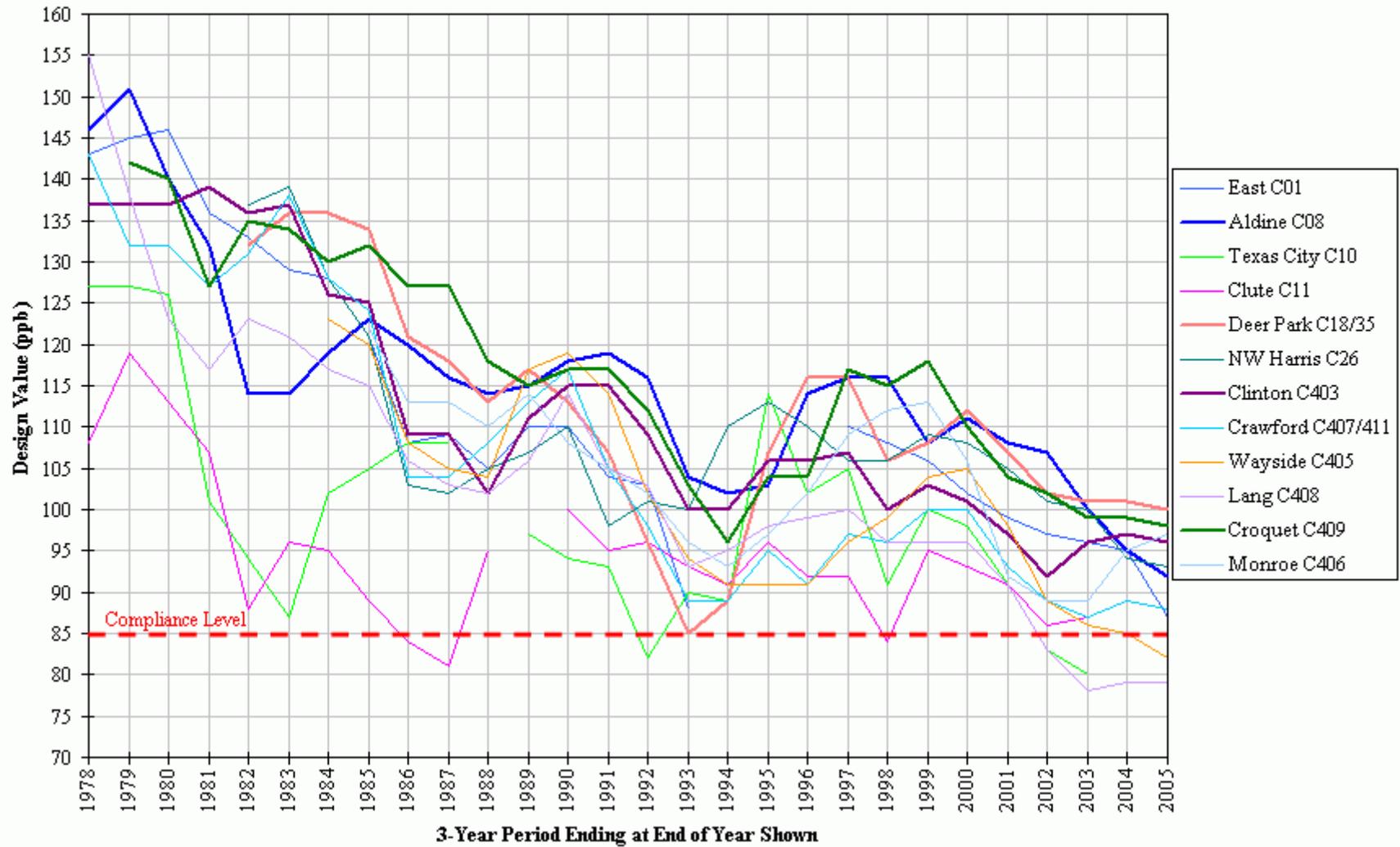
# 2005 8-Hour Ozone Design Values in the HGB Area



TCEQ Data Analysis,  
2006

## Houston Eight-Hour Ozone Design Value Trends by Site

Each Design Value Covers a 3-Year Period Ending with the Year Indicated

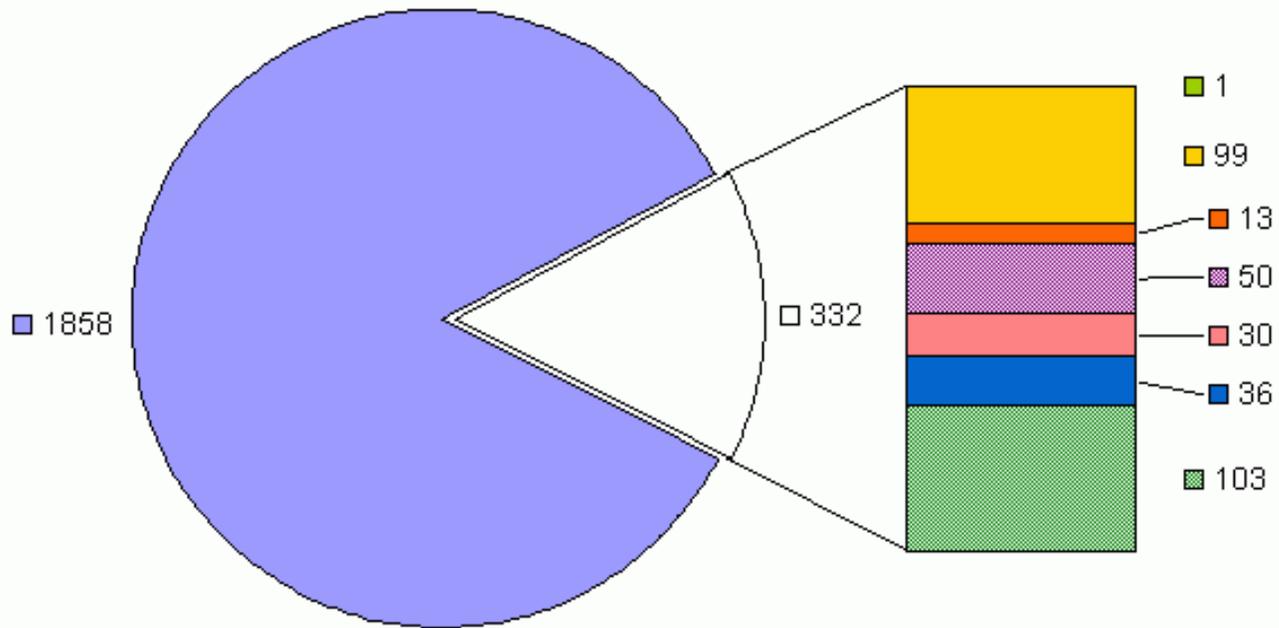


From Bryan Lambeth, TCEQ, 2006



Houston 2000-2005

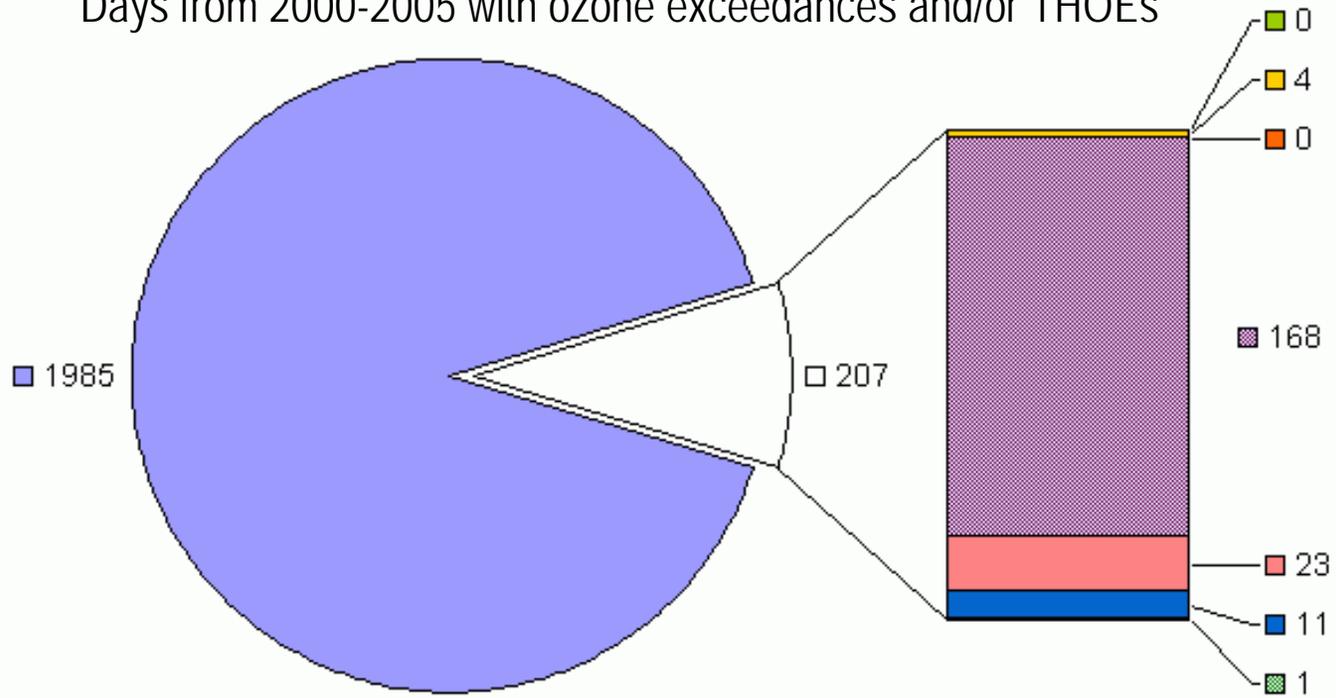
Days from 2000-2005 with ozone exceedances and/or THOEs



TCEQ Data  
Analysis, 2006

DFW 2000-2005

Days from 2000-2005 with ozone exceedances and/or THOEs



~8Hr, ~THOE, ~1Hr	~8Hr, ~THOE, 1Hr
~8Hr, THOE, ~1Hr	~8Hr, THOE, 1Hr
8Hr, ~THOE, ~1Hr	8Hr, ~THOE, 1Hr
8Hr, THOE, ~1Hr	8Hr, THOE, 1Hr;

TCEQ Data  
Analysis, 2006

# Comparison between Houston and Dallas

- Between 2000-2005, Houston had 219 eight-hour ozone exceedance days, and Dallas had 203 days.
- Houston had 147 days with 1-hr exceedances, and Dallas had 24 days.
- 61% of Houston 8-hr exceedance days were accompanied by 1-hr exceedances, but only 12% were in Dallas.
- In Houston, 63% of the 8-hr exceedance days were accompanied by THOEs, but in Dallas, only 6% were.

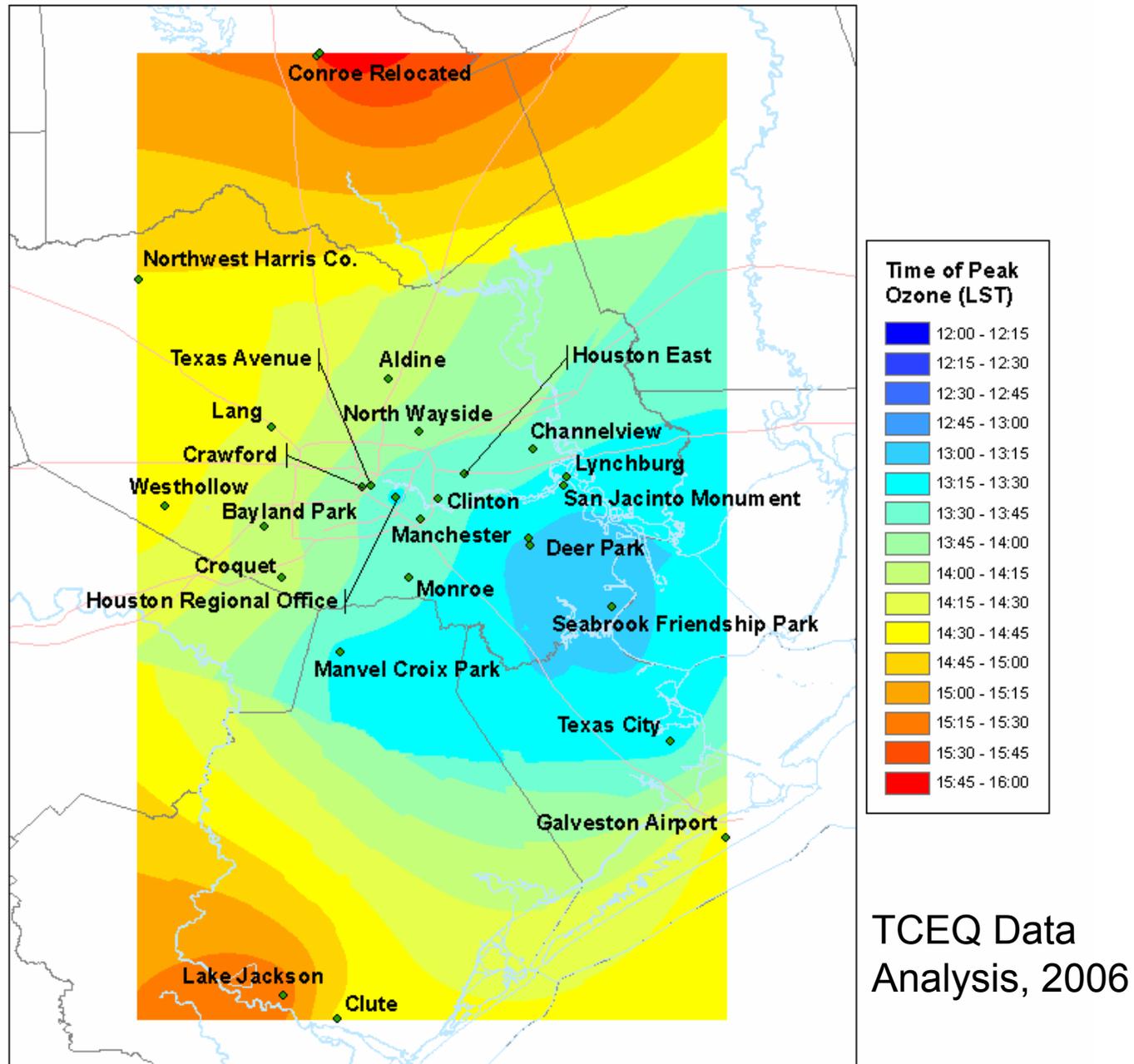
# Comparison between Houston and Dallas

- Houston had 251 days with THOEs, whereas Dallas had 16 days.
- In Houston, 99 THOE days (39%) were not accompanied by ozone exceedances.
- Caveat: Ozone networks are not perfect, and do not sample all events.

# Hypotheses to explain different ozone behavior in Dallas and Houston

- Rapid ozone formation from HRVOCs and NO<sub>x</sub> emitted by point sources in Houston create relatively narrow, intense plumes of ozone, and these strong ozone gradients are carried through the city by winds that shift direction.
- Shift in wind direction in Houston due to the bay breeze/coastal oscillation pushes moderately high ozone into an area with low ozone, resulting in a strong ozone gradient.
- Neither of these phenomena occur in Dallas.

## Average Time of Peak 1-Hour Ozone on 8-Hour Ozone Exceedance Days in the HGB Area (1995-2005)



# Conclusions

- Strong ozone gradients have been observed 15 times more often in Houston than in Dallas.
- Two possible explanations: Presence of strong point sources; wind shifts on high ozone days.
- Nonetheless, DFW still has about the same number of eight-hour ozone exceedances as Houston.