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CALGRID Modeling Overview

A First Look

A Modeling Effort by the OTC Modeling Committee

Presented by: Jeffrey Underhill, Ph.D.

NHDES

OTC/MANE-VU Annual Meeting

Philadelphia, PA

July 21-23, 2003

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Project Goals

- Enhance modeling capabilities for states of the OTR.
- Screen emission control strategies for urban and regional attainment
- Test and study EPA's Clear Skies multi-P modeling and assumptions
- Cross-compare other proposed multi-P Bills

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Background: 2010 vs. 2020

- OTC Modeling focuses on 2010 benefits.
- The vast majority of the 8-hour ozone nonattainment areas in the northeast will have attainment dates of 2010.
- Further, there are still 1-hour ozone nonattainment areas with attainment dates of 2007 and PM2.5 attainment dates are also in the same timeframe.
- Clear Skies has benefits in 2010 but focuses heavily on the 2020 benefits, which are 10 years too late for attainment needs.
 - Should the health benefits wait 10 additional years?

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Note:

- All modeling files were provided from EPA as modeled for CSI of 2002.
- OTC did not create the files, only reformatted files for use with the CALGRID model.
- Other Multi-P bills presented here today are approximated base on relativity to CSI 2010 files.

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Modeling Episodes

Ozone

June 12-24, 1995 (in progress)

July 5-15, 1995 (in progress)

May 15-September 15, 1996 (August 2003)

PM2.5

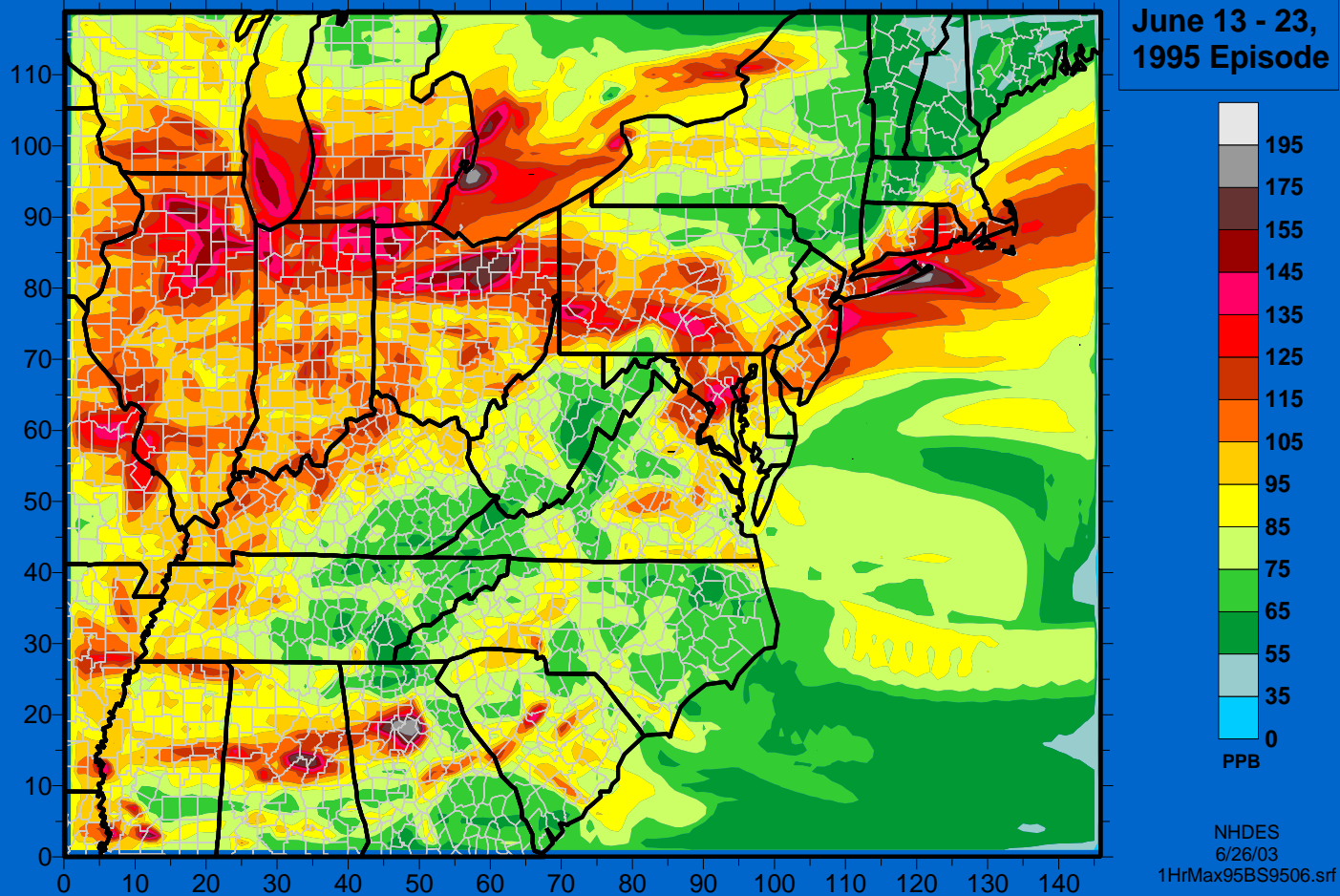
Annual 1996 (Fall 2003)

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Ozone Modeling Concentrations - CSI

Episode Maximum 1-Hour Ozone Concentrations 1995 Base Case Emissions

June
1995
Episode

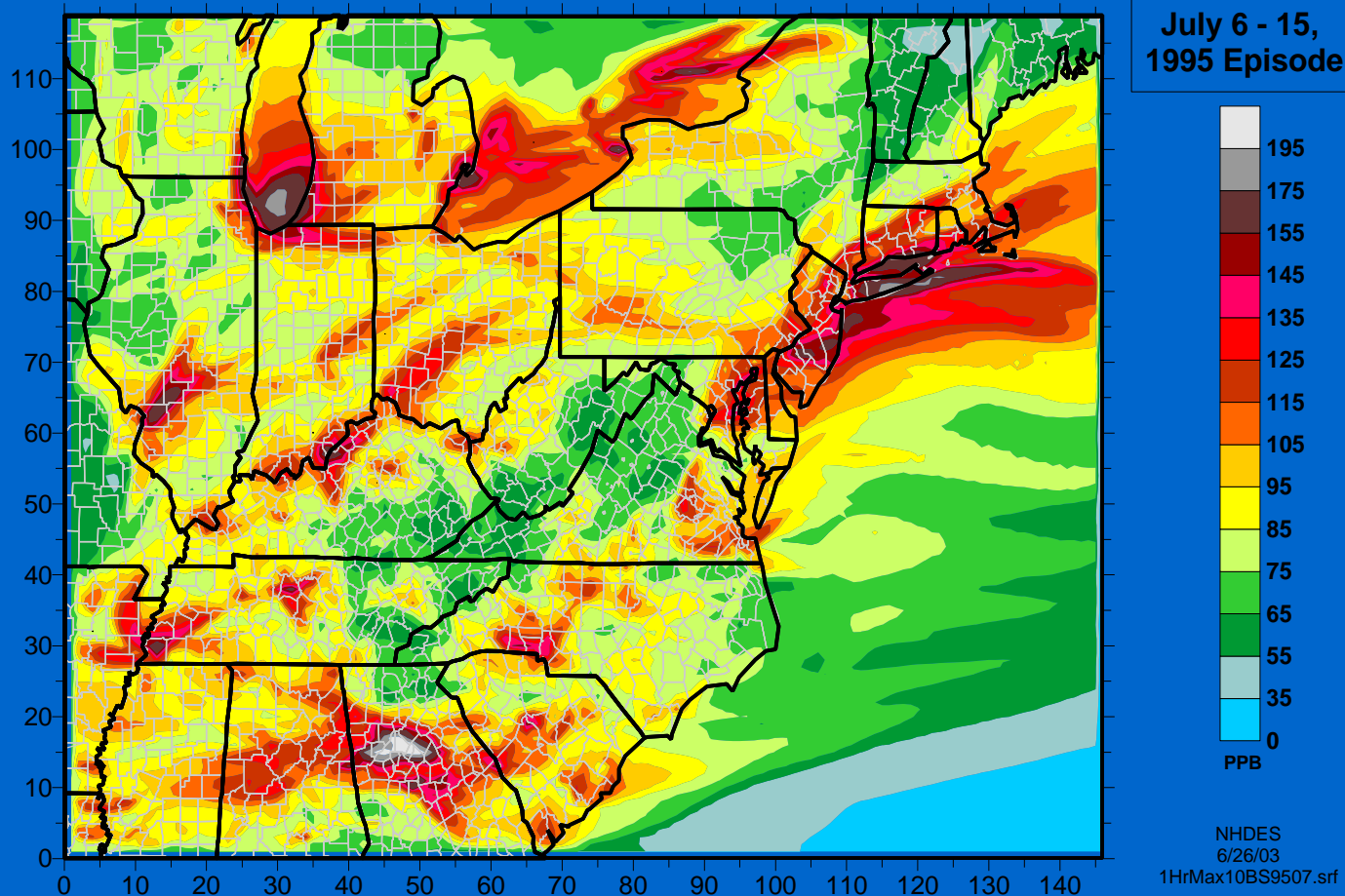


Ozone Modeling Concentrations

Episode Maximum 1-Hour Ozone Concentrations
2010 Base Case Emissions

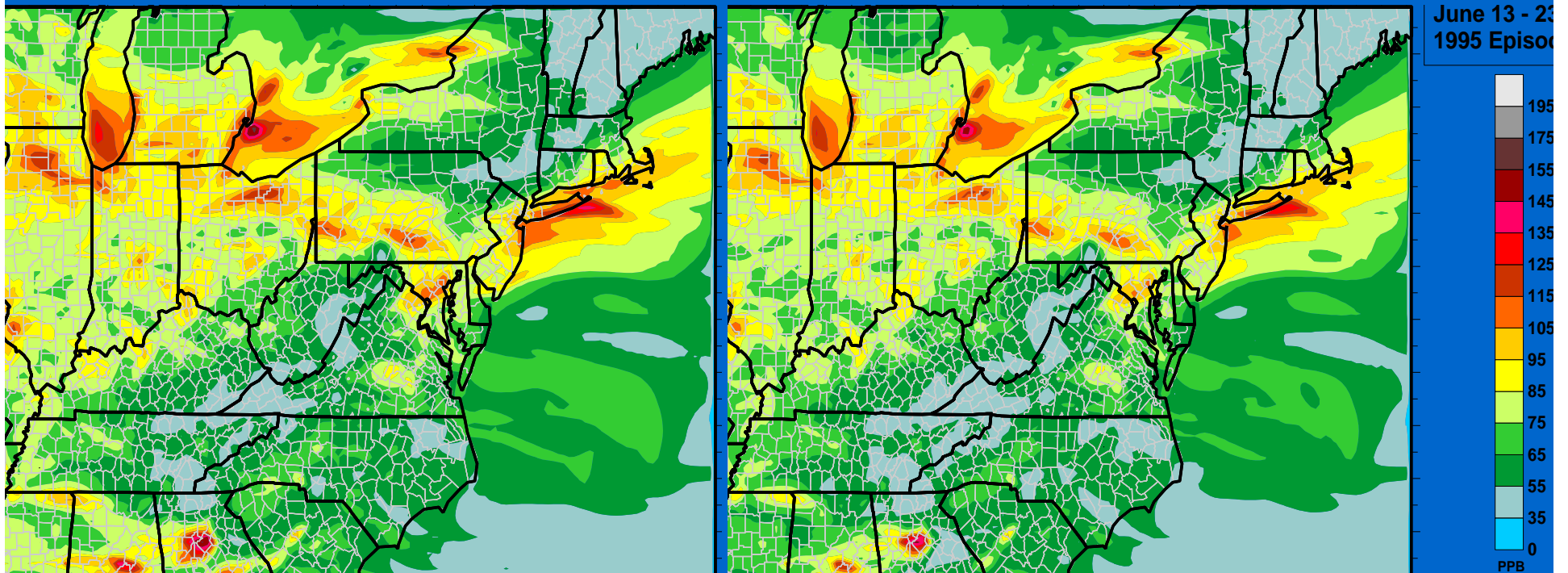
July
1995
Episode

2010
Clean
Air Act



2010 CAA vs CSI

8-Hour Ozone Modeling Concentrations for June 1995 Episode

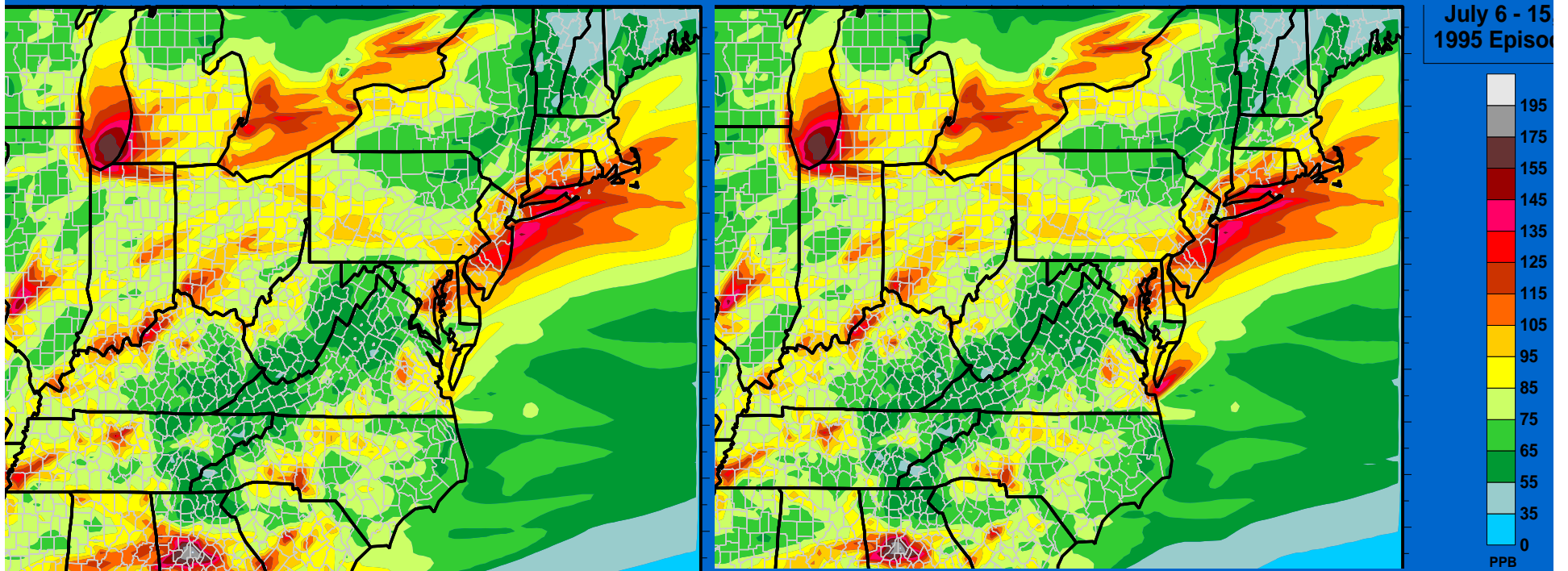


Clean Air Act

Clear Skies

2010 CAA vs CSI

8-Hour Ozone Modeling Concentrations for July 1995 Episode

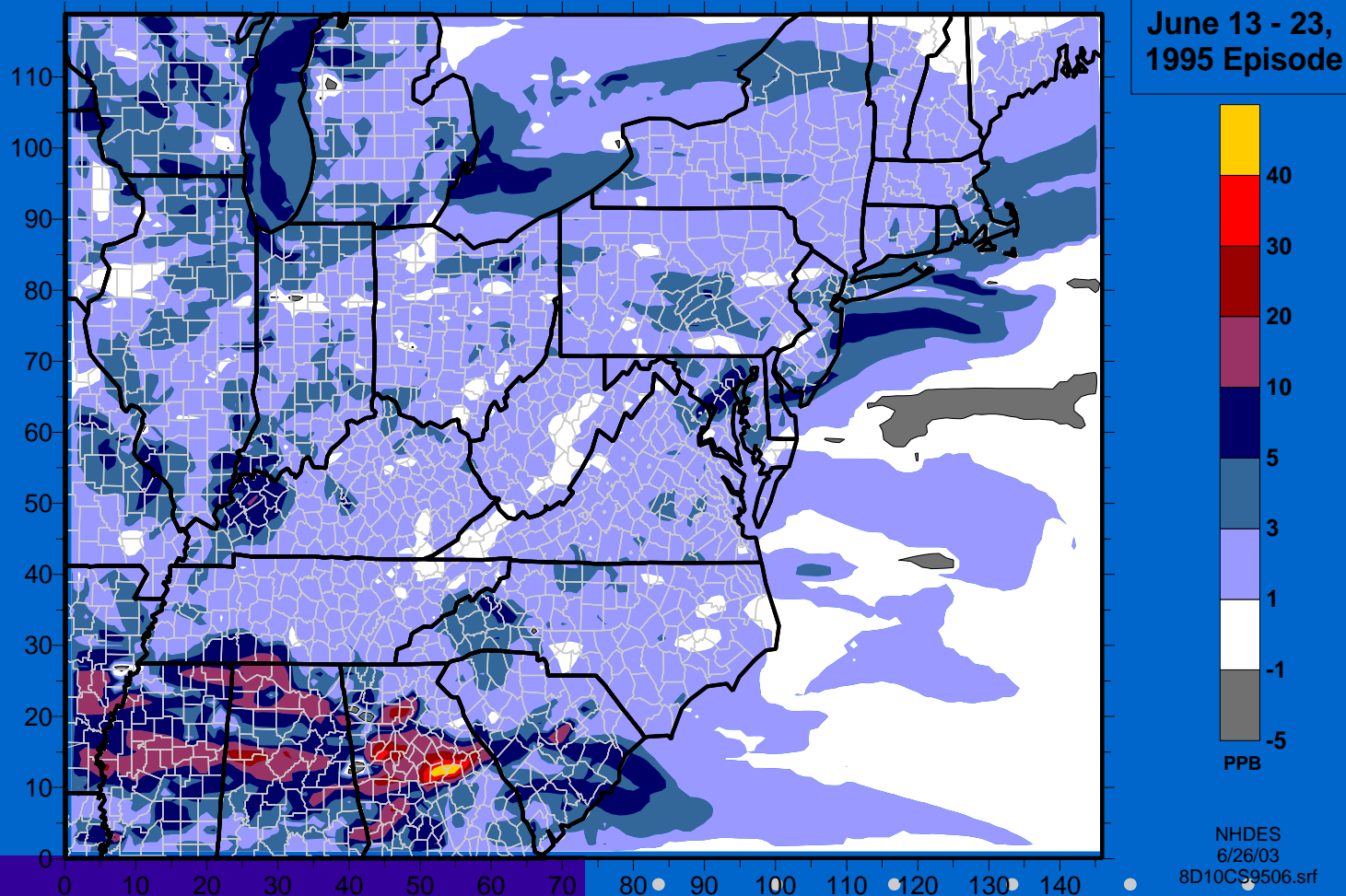


Clean Air Act

Clear Skies

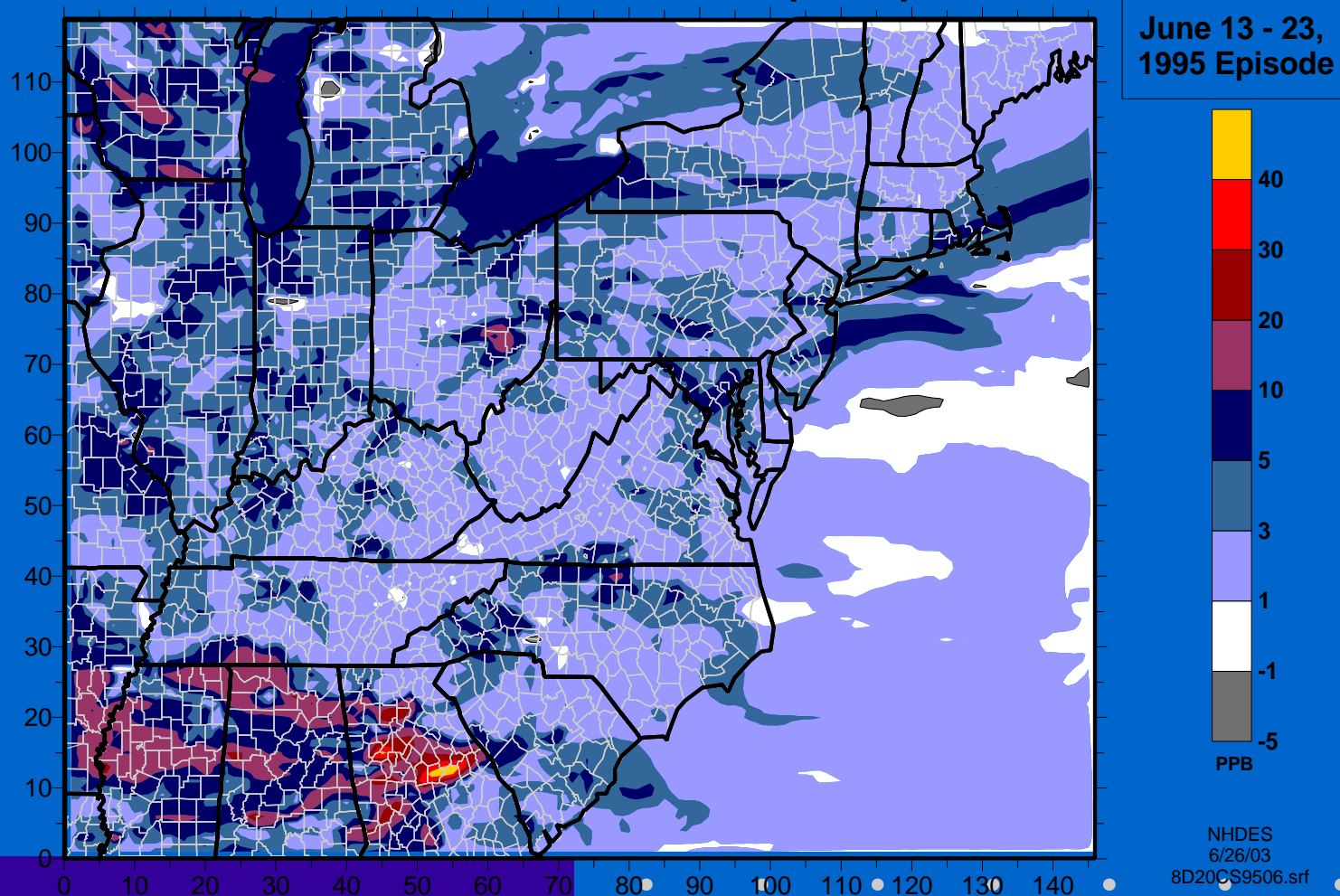
2010 CSI Improvement from CAA

Episode 8-Hour Ozone Difference Concentrations 2010 Base Case - Clear Skies (2002) Emissions



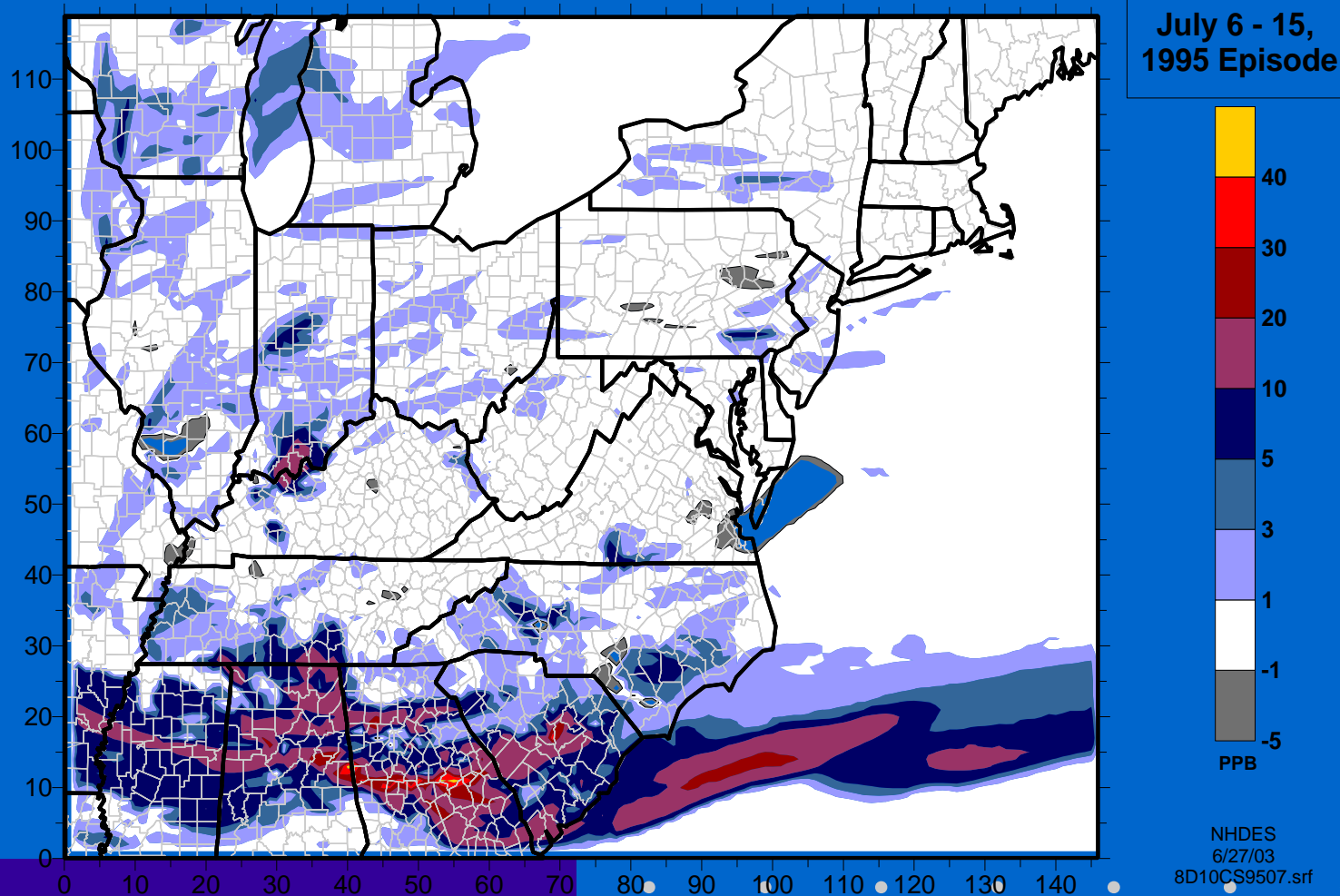
2020 Base Case minus CSI – June 1995

Episode 8-Hour Ozone Difference Concentrations 2020 Base Case - Clear Skies (2002) Emissions



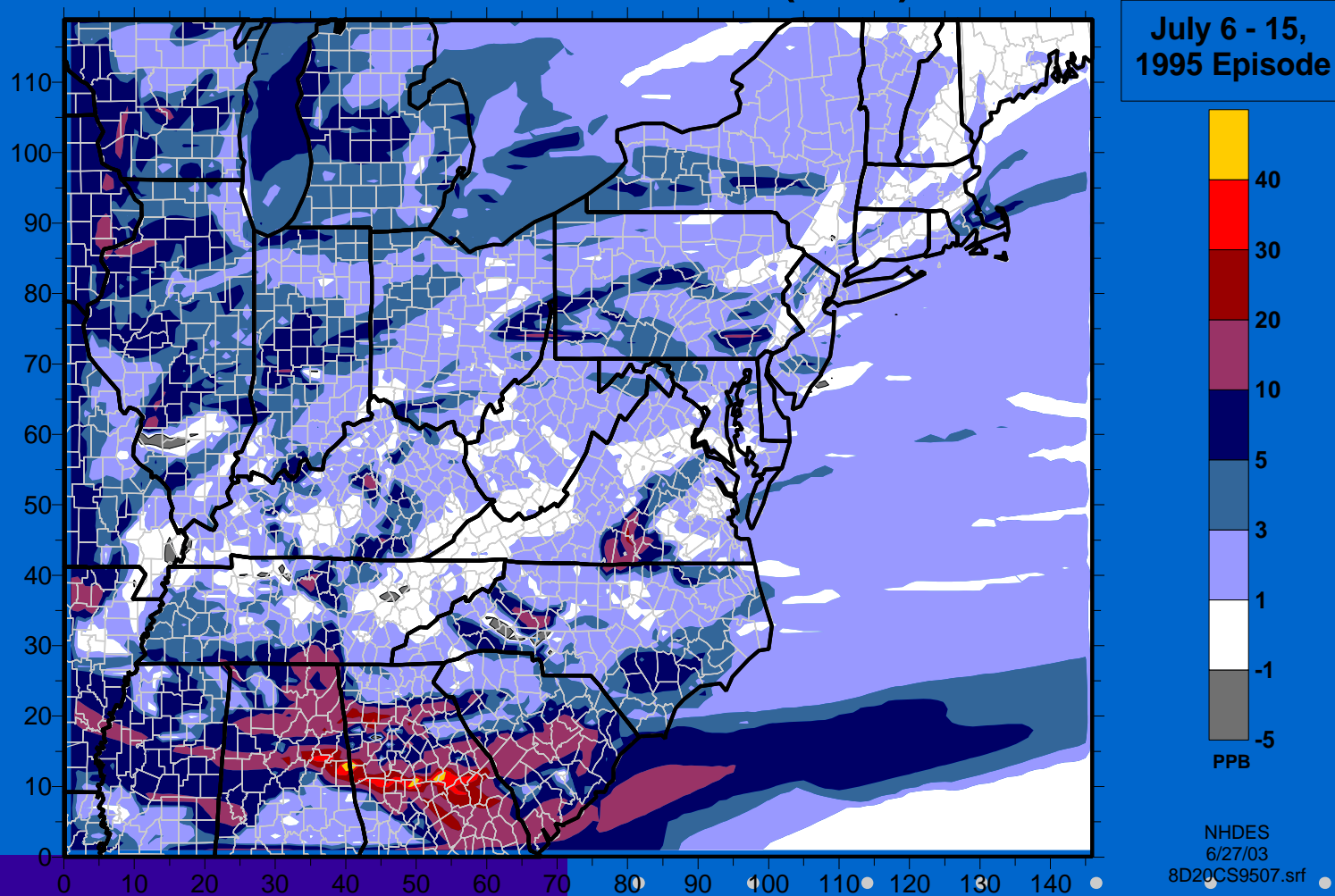
2010 Base Case minus CSI – July 1995

Episode 8-Hour Ozone Difference Concentrations 2010 Base Case - Clear Skies (2002) Emissions



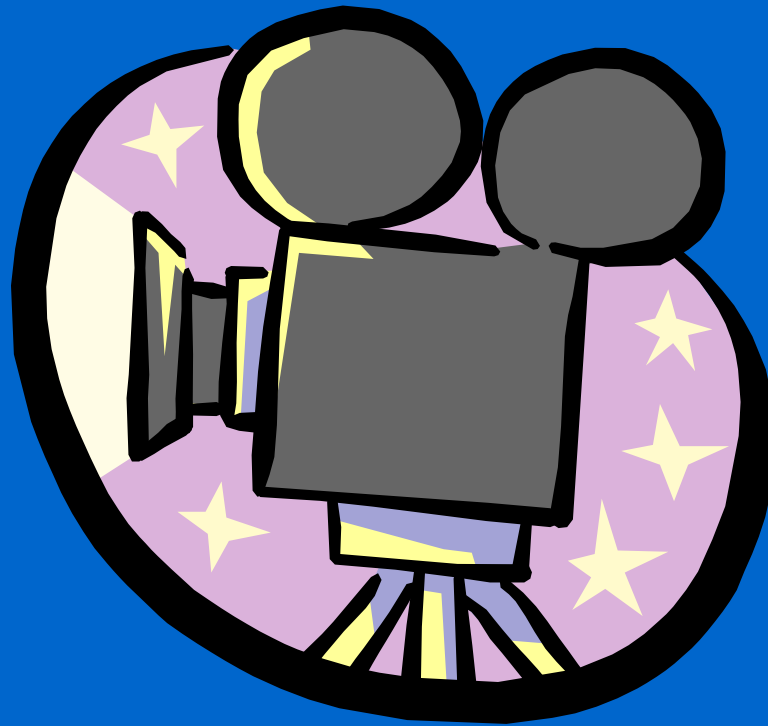
2020 Base Case minus CSI – July 1995

Episode 8-Hour Ozone Difference Concentrations
2020 Base Case - Clear Skies (2002) Emissions



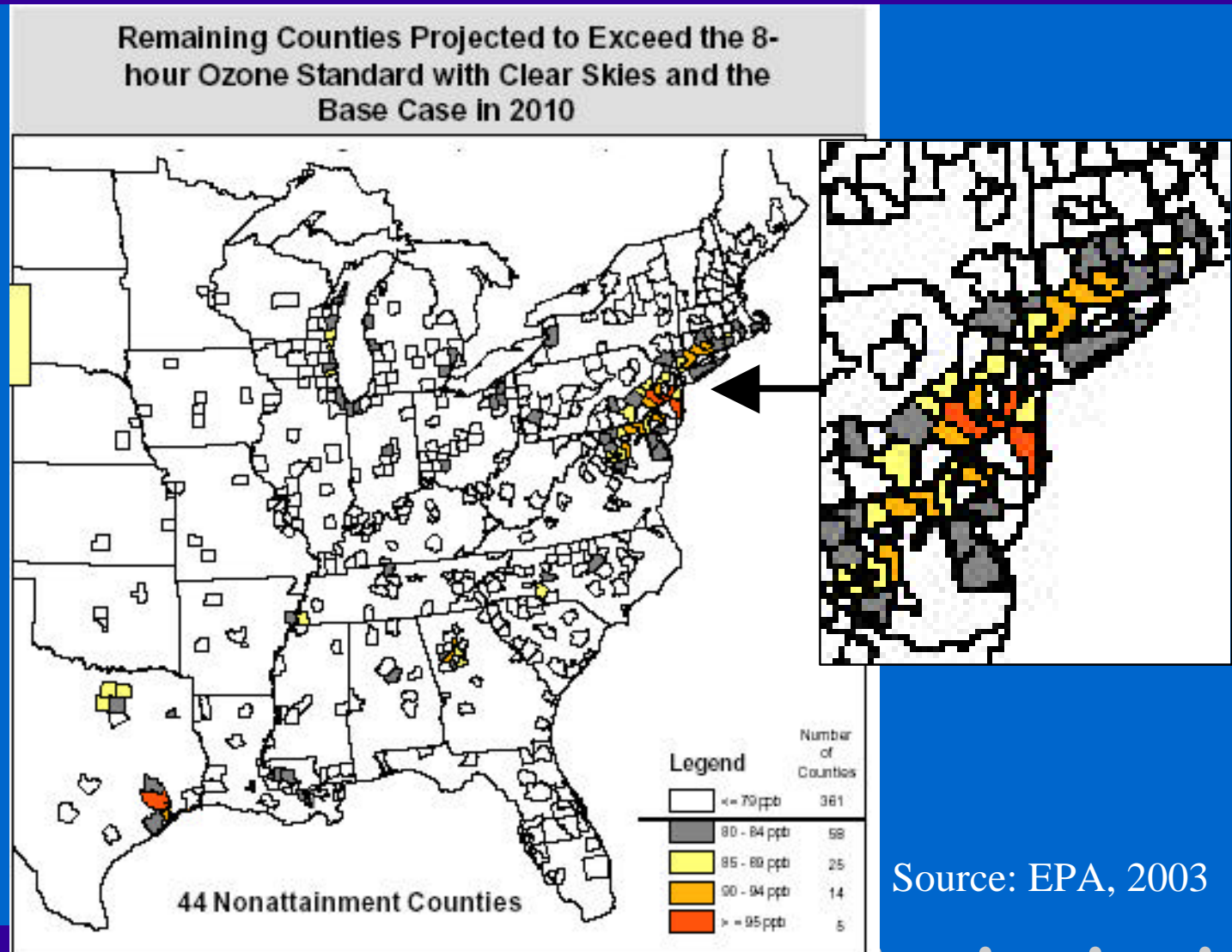
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Transport After CSI 2010



Clear Skies 2010 Ozone Nonattainment

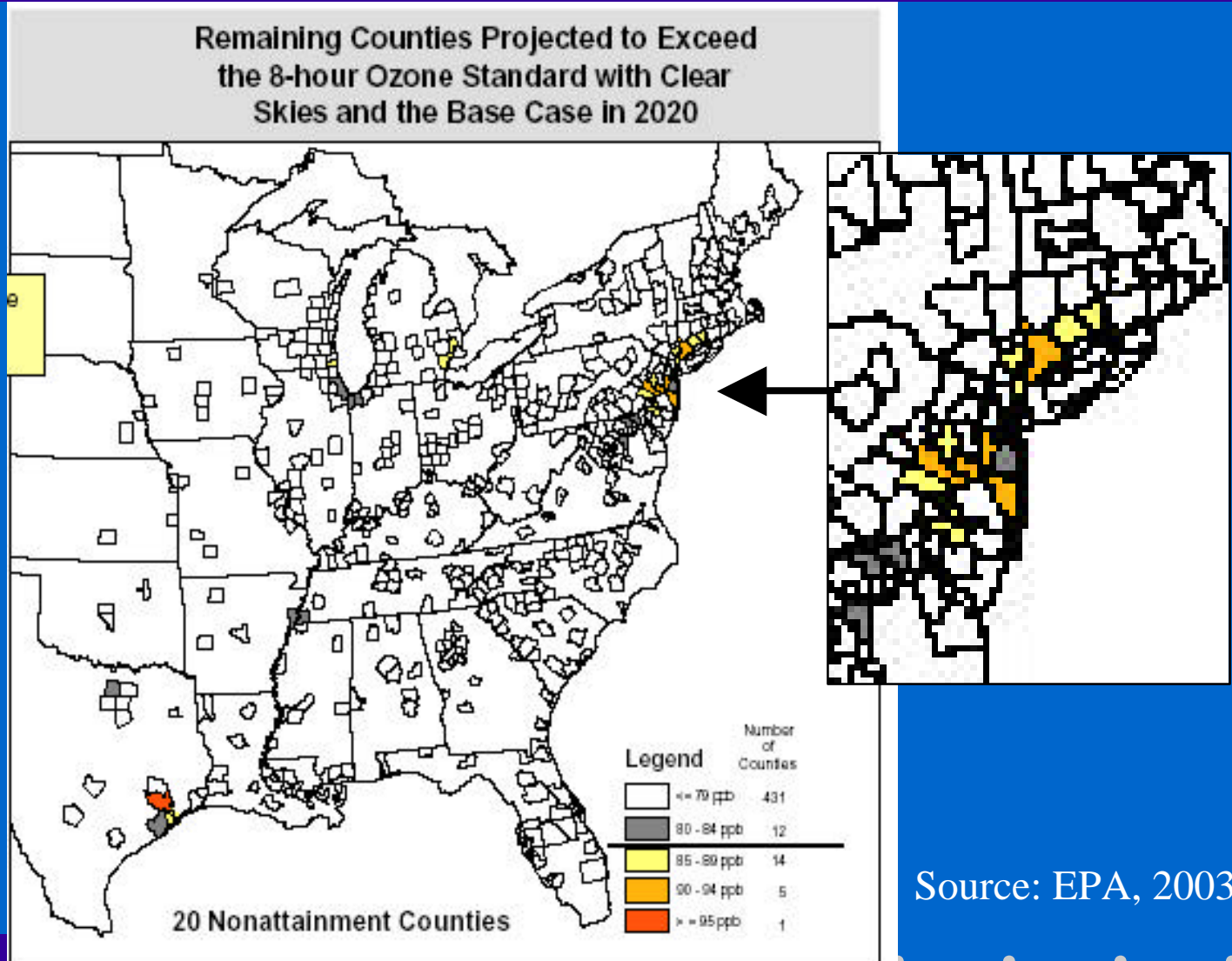
3 Counties
better than
2010 Clean
Air Act
Conditions



Source: EPA, 2003

Clear Skies 2020 Ozone Nonattainment

3 Counties
better than
2020 Clean
Air Act
Conditions



Source: EPA, 2003

CSI 2002 vs. CSI 2003

- “...*Clear Skies’ health benefits are higher than previously estimated.*” EPA, 2003
 - But CSA 2003 moves 2 states from the East Zone to the West, but does not shift the emissions caps.
 - Allows NOx emissions in East to increase by about 7% in 2010 over CSI of 2002
 - Allows NOx emissions in East to increase by about 9% in 2020 over CSI of 2002
- ? **But if emissions are up, why more benefits???**

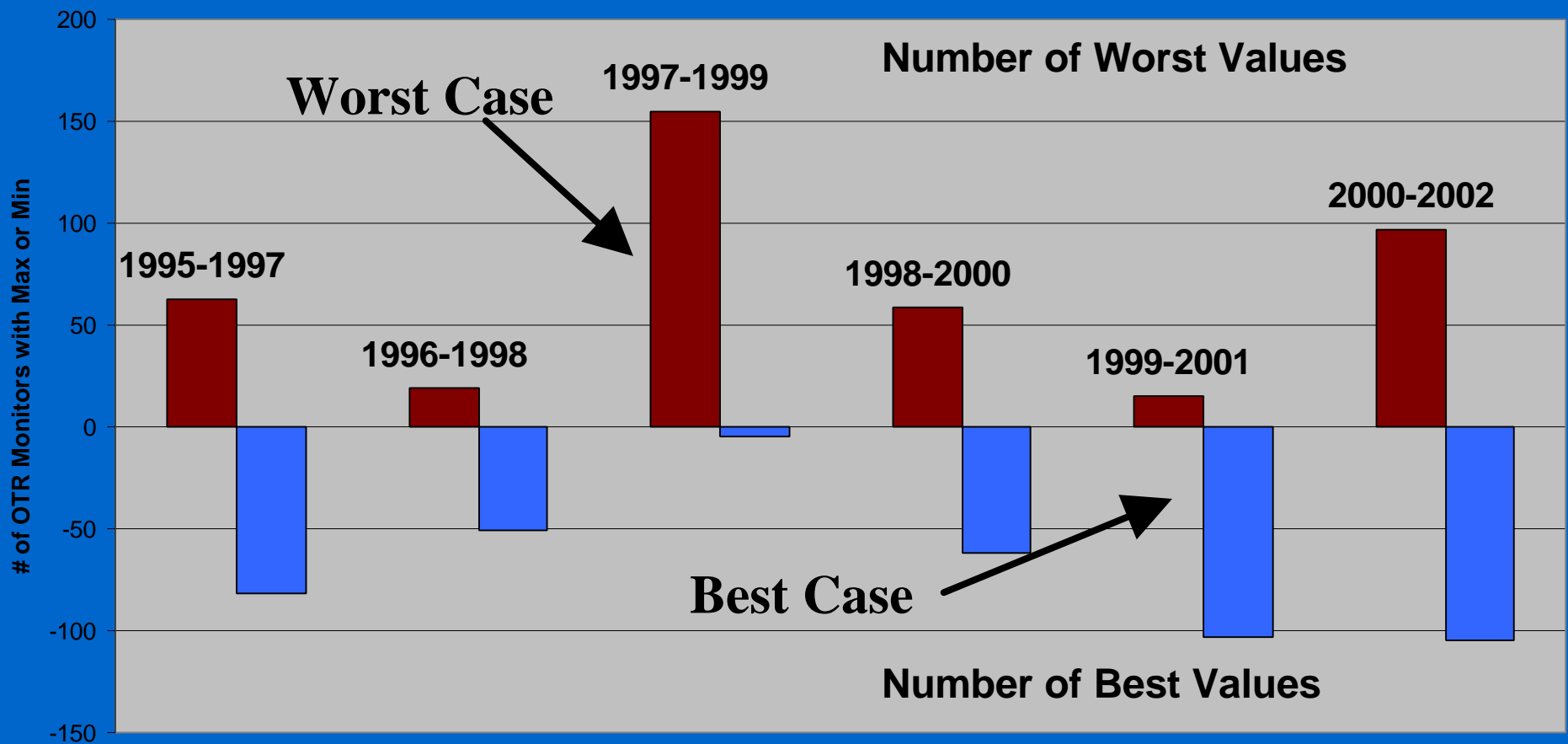
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Tipping the Scales

- New census data increases exposed population versus previous version.
- Changes in design value monitoring years applied, shifts calculations from worst case to best case.
 - Lowers the bar for passing the attainment test
 - ❖ Justified by growing emissions to interim/hybrid emission inventory year and most recent year available
 - ❖ But is most recent year typical?

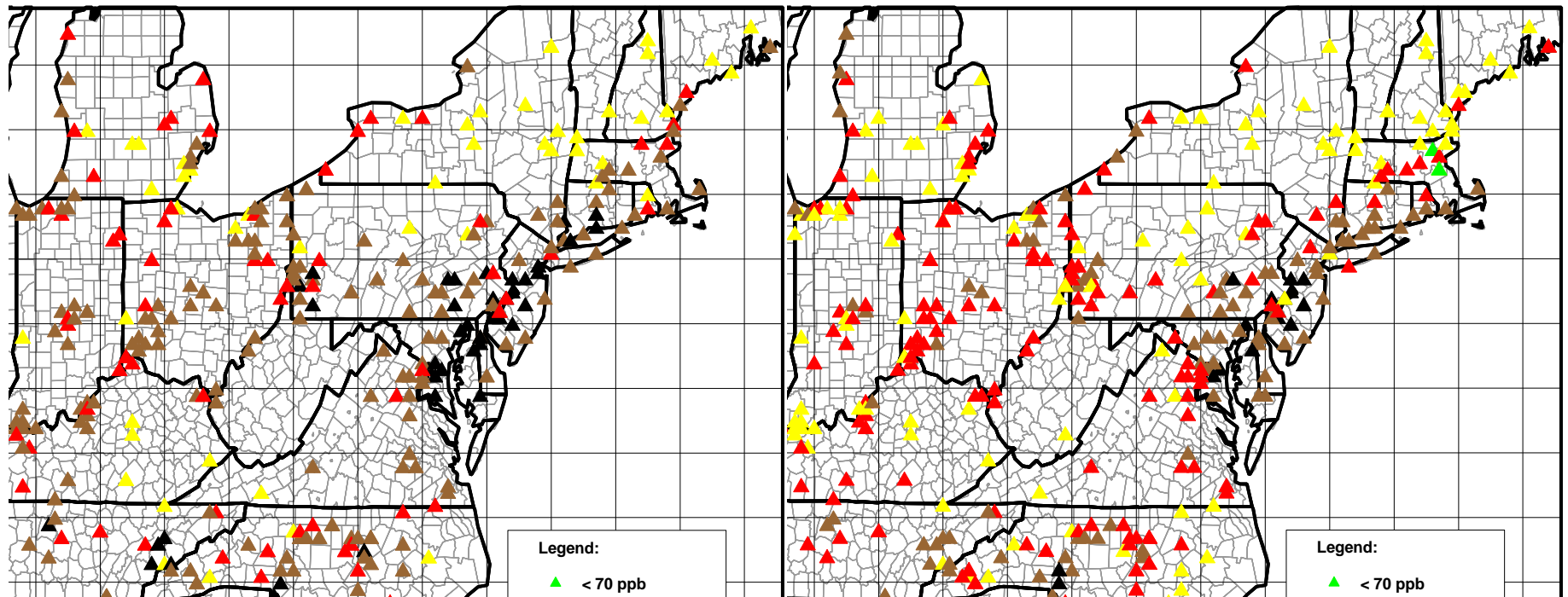
How Do the Years Compare?

Comparison of Design Values Within the OTR
During 6 Design Value Periods



8-Hour Ozone Design Values

Worst Case vs. Best Case



1997 - 1999 DV

1999 - 2001 DV

? <70, ? 70-80, ? 80-85, ? 85-90, ? 90-100, ? >100 (ppb)

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OTC Modeling

- Uses a different model (CALGRID) to cross-check EPA's modeling (CAMx).
- CALGRID model performance is comparable to that of CAMx and maybe a little better along the northeast corridor.
 - Sophisticated model
 - Emission adjustment routines simplified for throughput
- Follows EPA Guidance by using worst-case design values from 1995-97 and 99-2001 (episode and emission years). Included 1997-99 because EPA used it in CSI of 2002.

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Preliminary Modeling Results

- The following modeling results are adjusted based on a modified Relative Reduction Factor as recommended by EPA guidance.
 - The OTC modification simplifies the application of the calculations without biasing the results.

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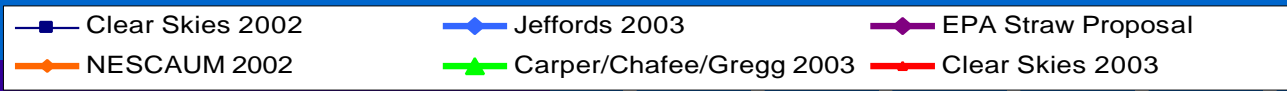
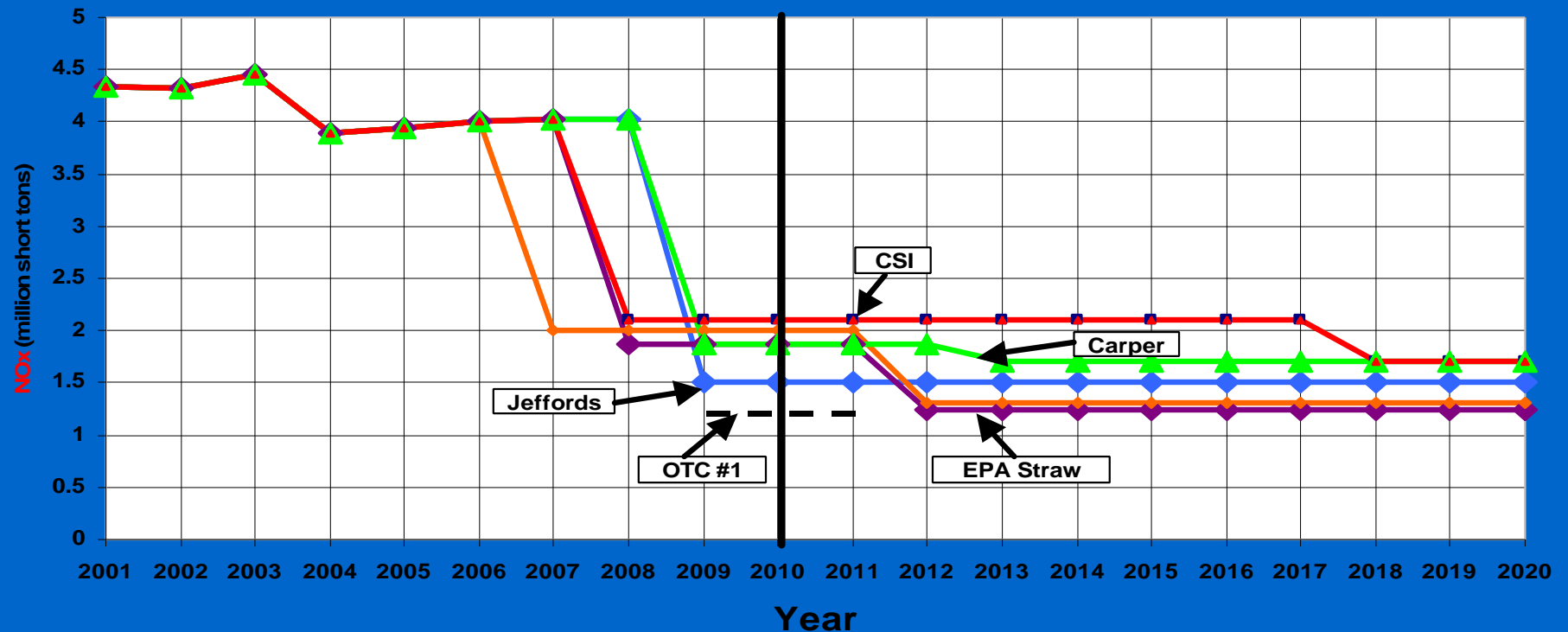
Preliminary Modeling Results

- Modeling results presented today are based on the June 1995 episode.
- Final modeling results will include the July 1995 episode and seasonal modeling for summer 1996.
 - Seasonal modeling will for the first time look at episodes that weren't selected for severe 1-hour ozone peaks. A truer test.

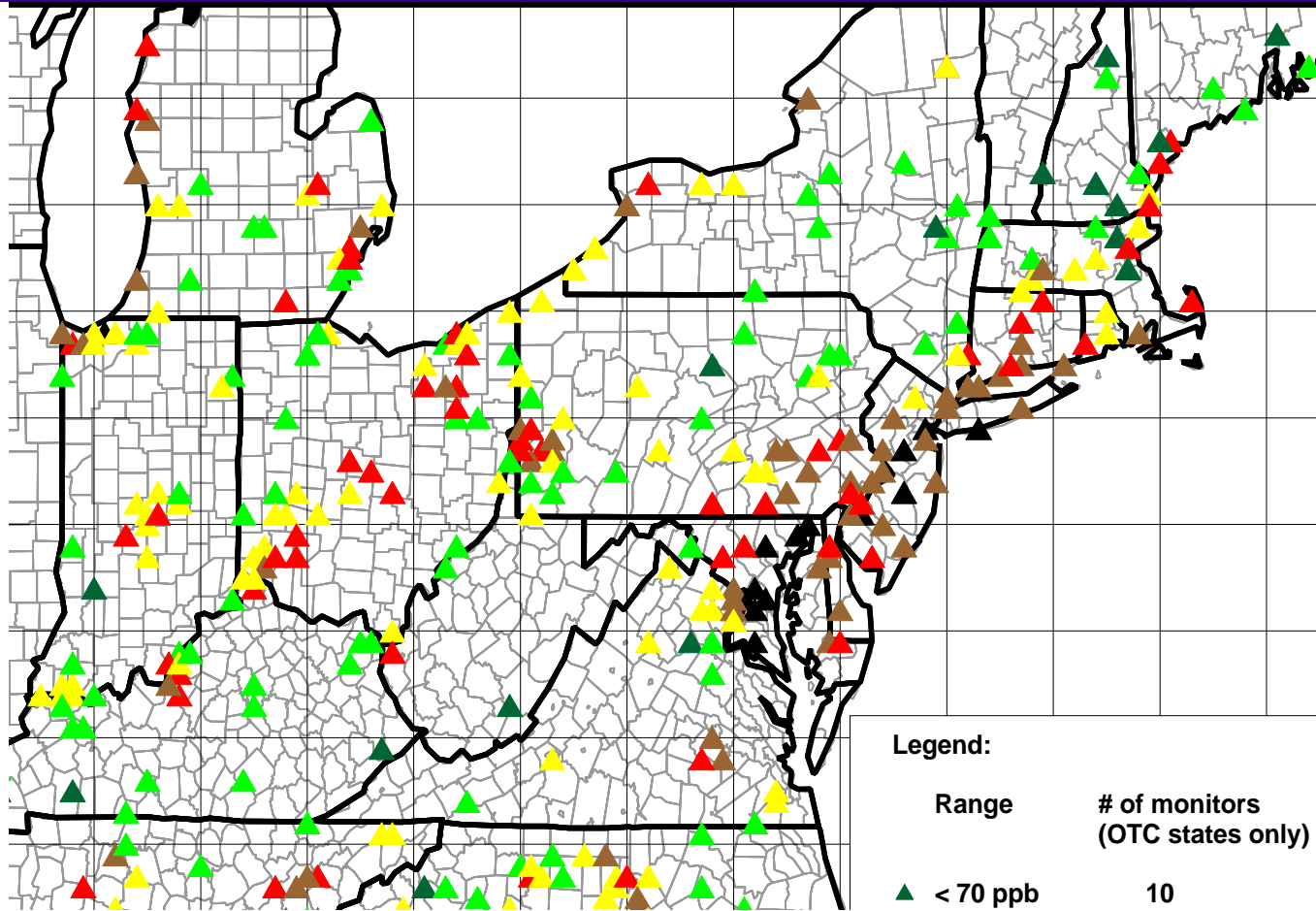
Comparison of Multi-P Bills for NOx

Comparison of Multi-pollutant proposals NOx emission caps for the National Electric Sector DRAFT NHDES 62003*

(*Actual NOx emissions will be higher than caps in first years following reduction of the cap level due to banked allowances)



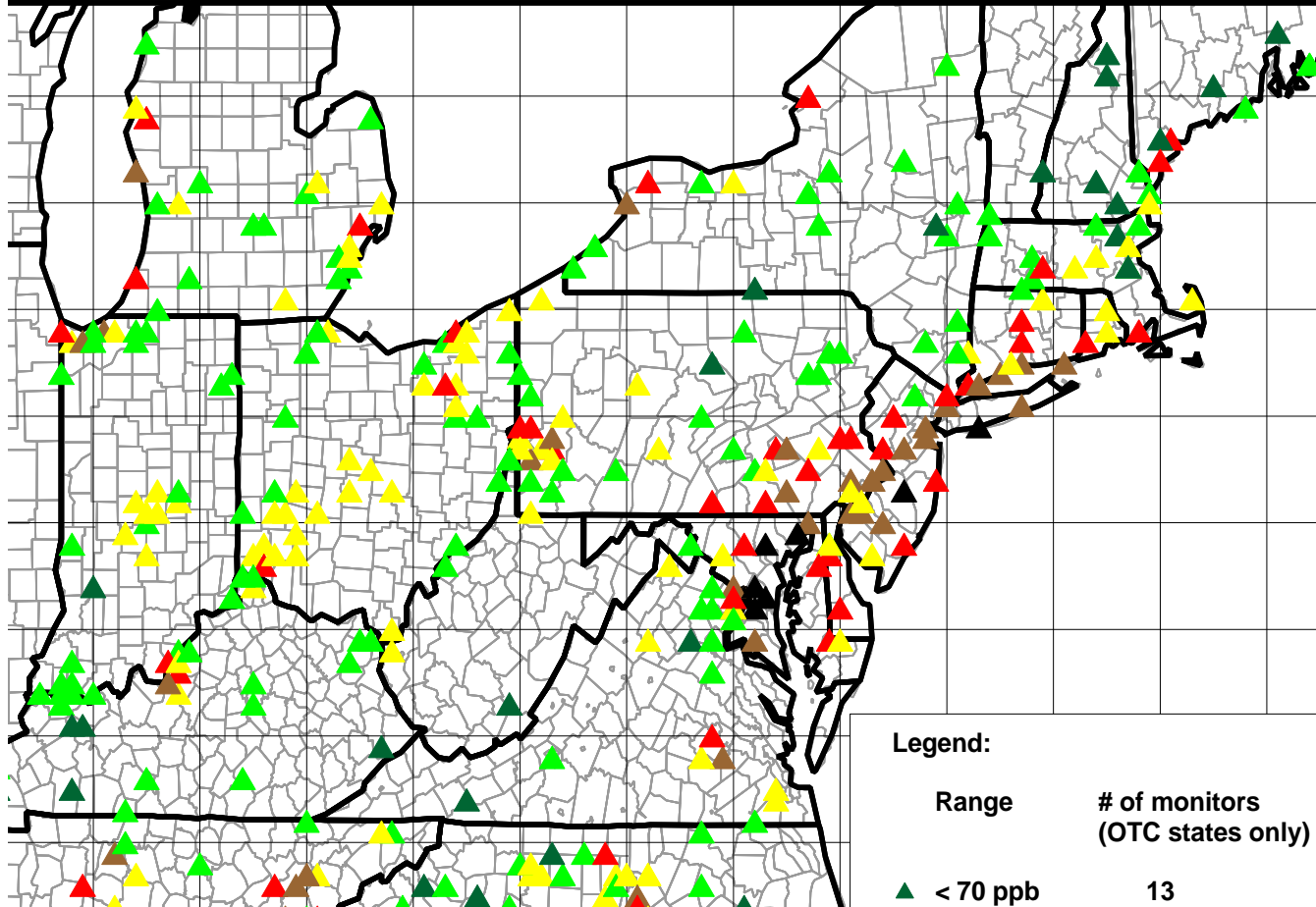
CAA 2010 (Adjusted)



? <70, ? 70-80, ? 80-85, ? 85-90, ? 90-100, ? >100 (ppb)

Preliminary: Based on June 1995 Episode

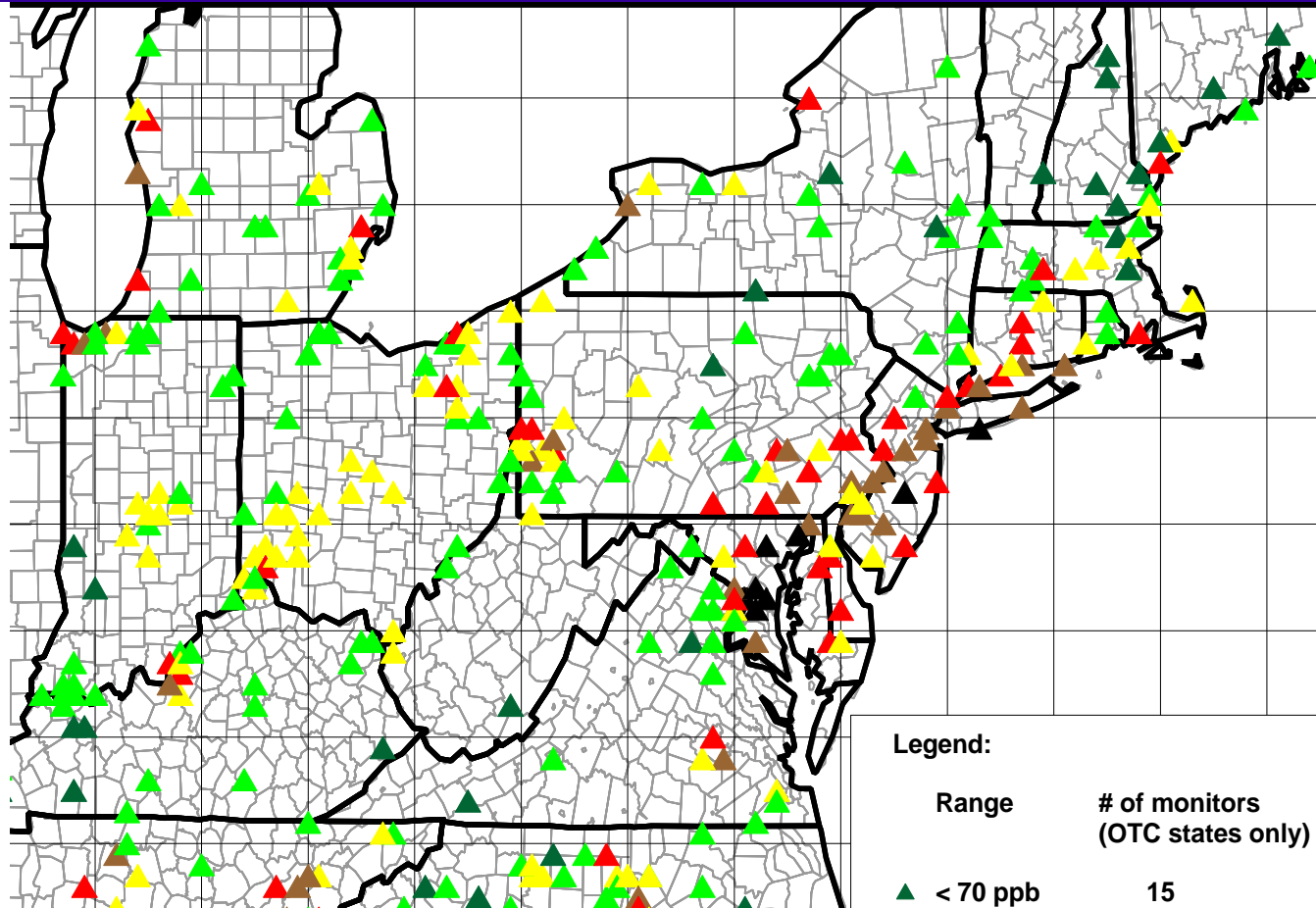
CSI 2010 (Adjusted)



? <70, ? 70-80, ? 80-85, ? 85-90, ? 90-100, ? >100 (ppb)

Preliminary: Based on June 1995 Episode

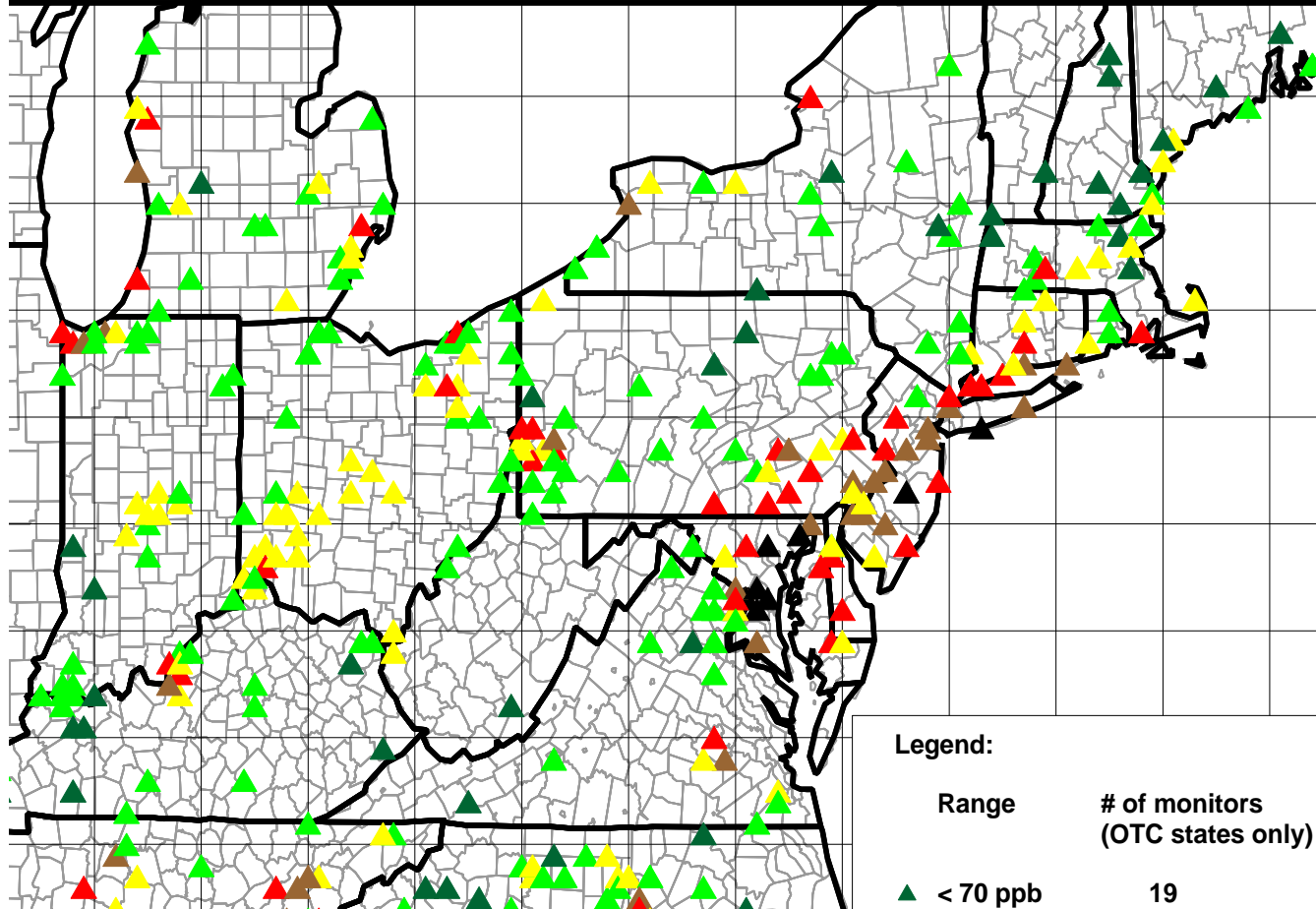
Carper 2010 (Adjusted)



? <70, ? 70-80, ? 80-85, ? 85-90, ? 90-100, ? >100 (ppb)

Preliminary: Based on June 1995 Episode

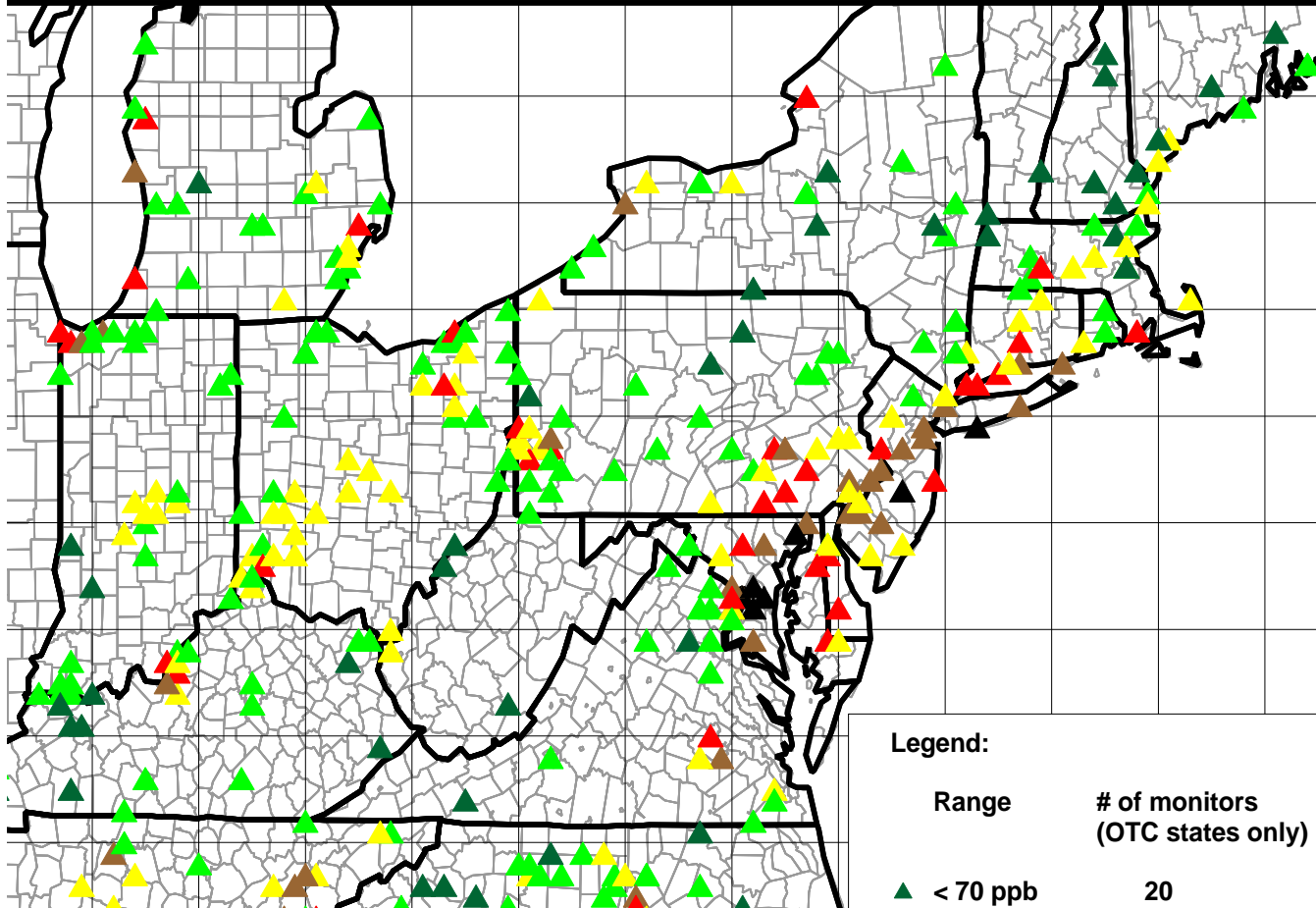
Jeffords 2010 (Adjusted)



? <70, ? 70-80, ? 80-85, ? 85-90, ? 90-100, ? >100 (ppb)

Preliminary: Based on June 1995 Episode

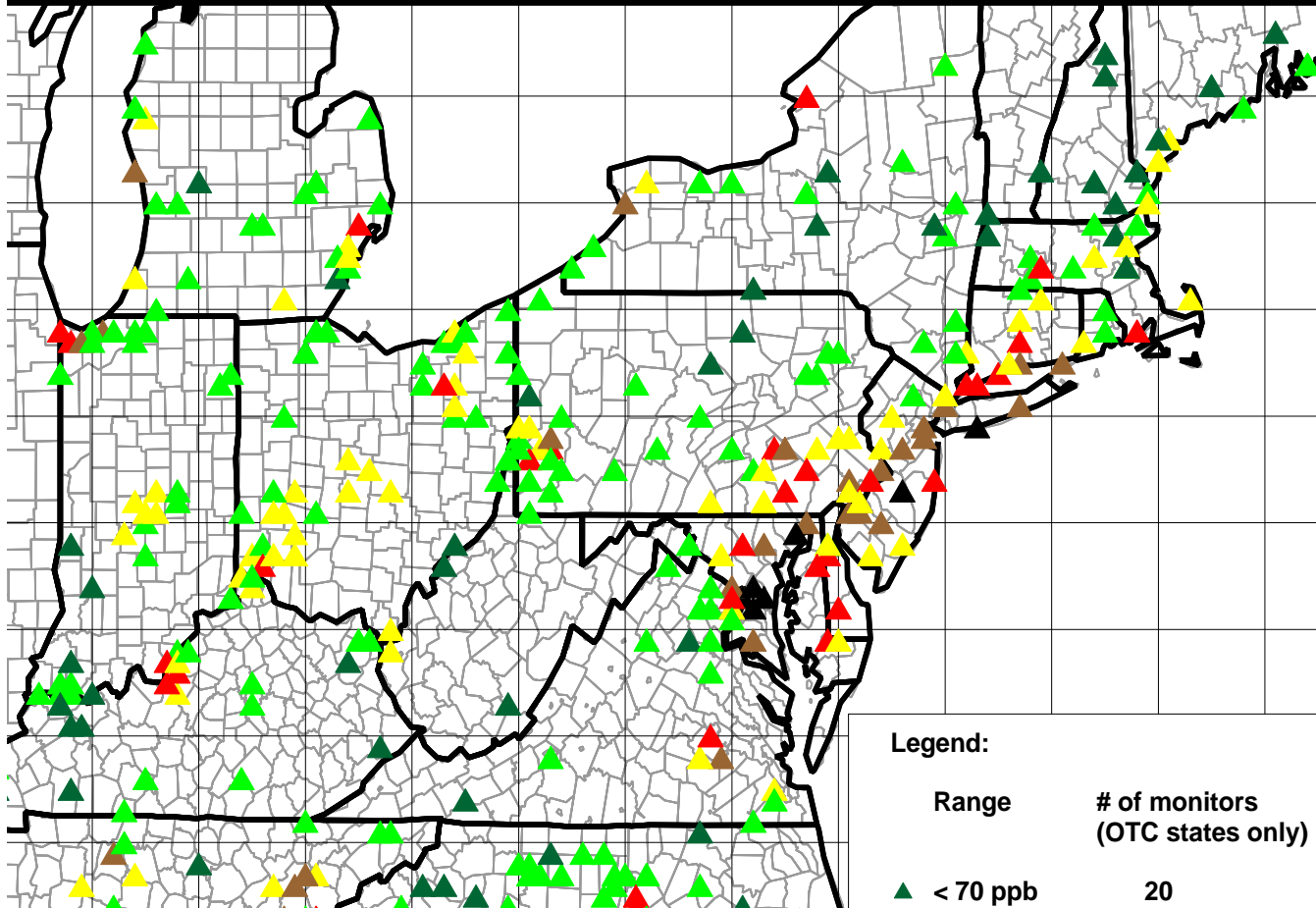
OTC #1 2010 (Adjusted)



? <70, ? 70-80, ? 80-85, ? 85-90, ? 90-100, ? >100 (ppb)

Preliminary: Based on June 1995 Episode

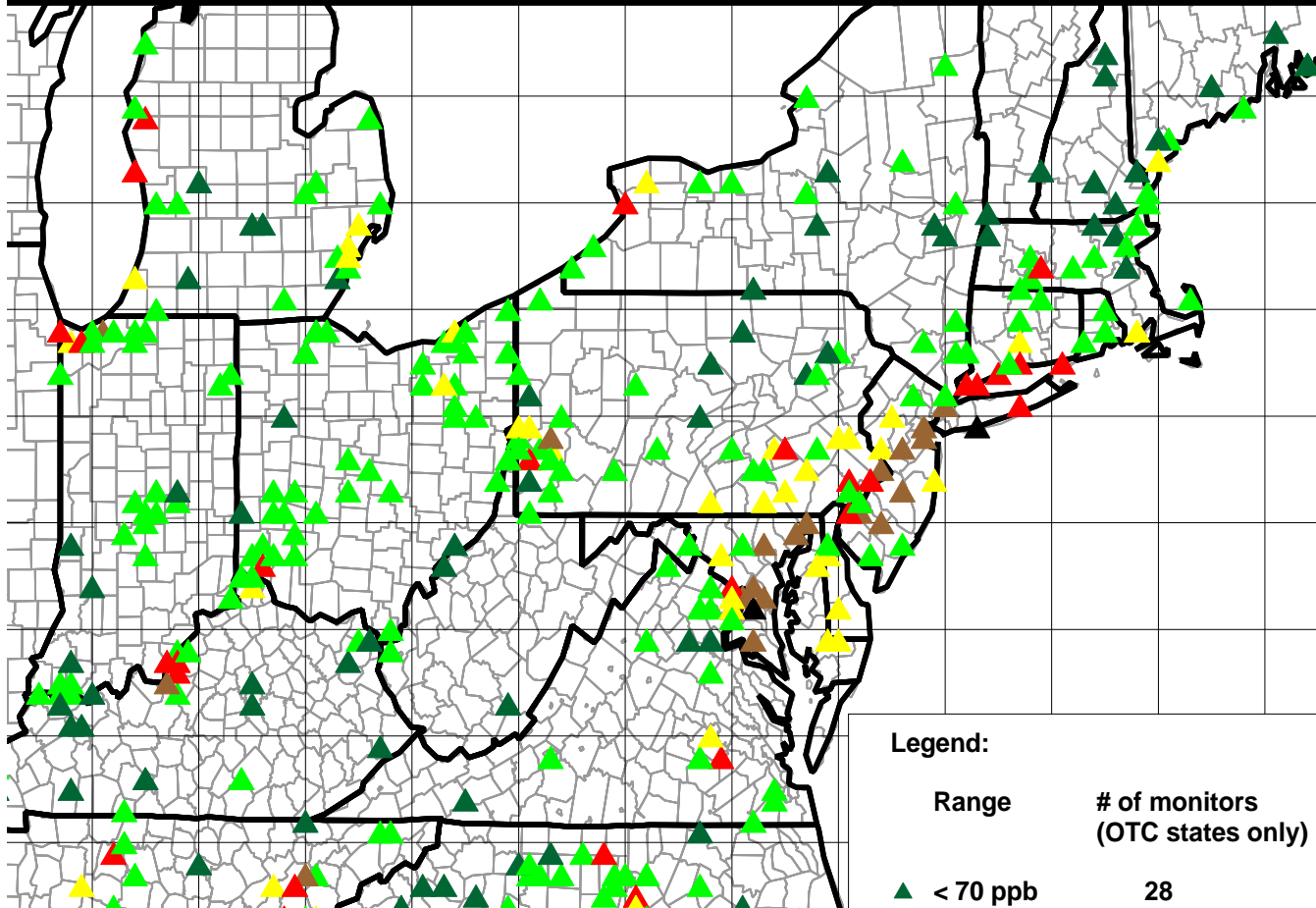
OTC #2 2010 (Adjusted)



? <70, ? 70-80, ? 80-85, ? 85-90, ? 90-100, ? >100 (ppb)

Preliminary: Based on June 1995 Episode

CSI Plus 25% Area & Mobile 2010 (Adjusted)



? <70, ? 70-80, ? 80-85, ? 85-90, ? 90-100, ? >100 (ppb)

Preliminary: Based on June 1995 Episode

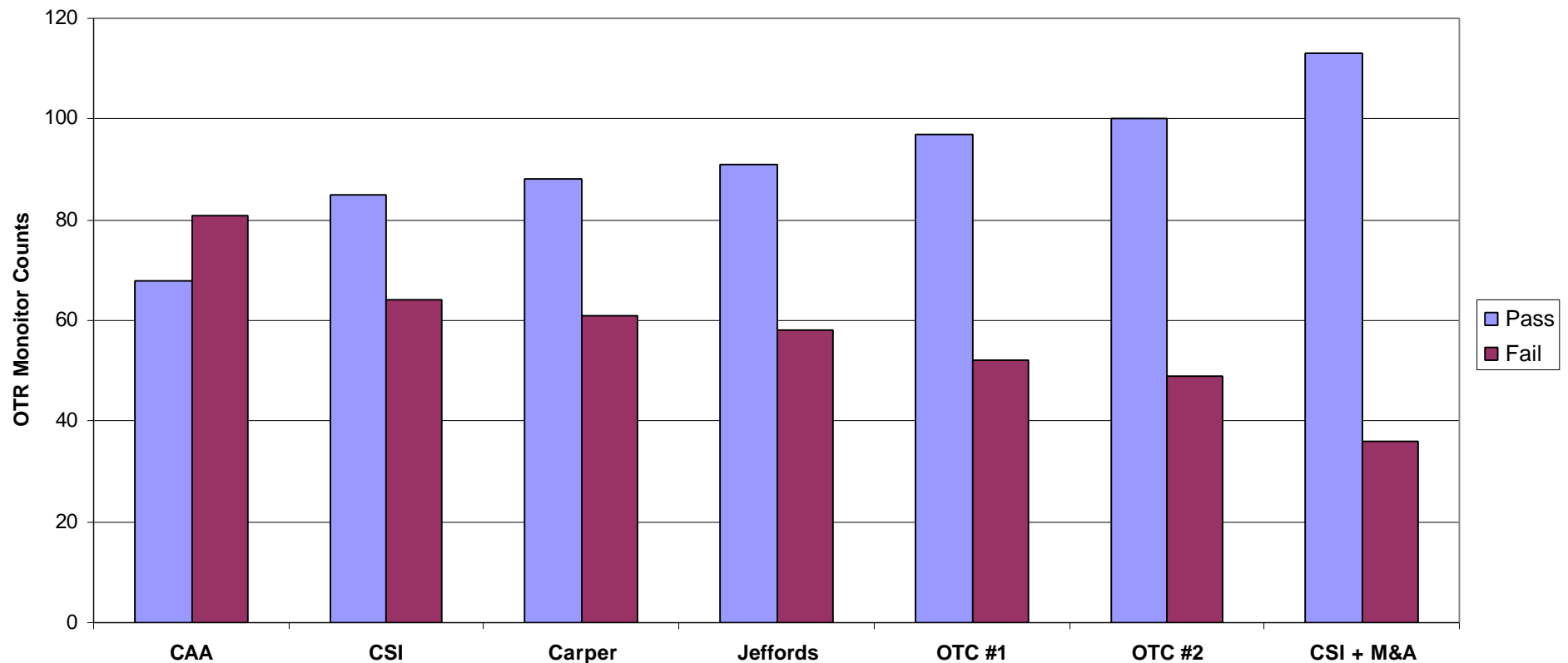
Comparison of Modeling for 2010

# of OTR Monitors	CAA	CSI 2002	Carper (approx)	Jeffords (approx)	OTC#1 (EGU =0.11 lb/MmBtu)	OTC#2 (All Pts =0.11 lb/MmBtu)	CSI +25% Area & Mobile
Good ?	10	13	15	19	20	20	28
Fair ?	30	43	43	44	43	48	62
Marginal ?	28	29	30	28	34	32	23
Unhealthy S/G ?	27	29	27	27	21	19	17
Unhealthy ?	40	27	26	23	24	23	17
Very Unhealthy ?	14	8	8	8	7	7	2

Preliminary: Based on June 1995 Episode

Summary of Proposals - 2002

Comparison of Multi-P Proposals



Note: The number of monitors does not include many of the areas with good air quality

Preliminary: Based on June 1995 Episode

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Other Issues:

- New “Safety Valve” feature where sources can borrow against the next year’s emissions, provides certainty for industry but uncertainty for states and their SIPs.
 - What can states count on for their SIPs?
 - Borrowing during critical years can actually knock-back reaching attainment by a year.

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Costs and Benefits

- Costs: \$6.3 Billion in 2020
 \$4.3 Billion in 2010
- Benefits: \$110 Billion in 2020
 \$53 Billion in 2010
- Visibility benefits add another \$3 Billion per year in 2020 (\$1 Billion in 2010).

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Summary

- It is troubling that Clear Skies technical summaries seem so focused on the 2020 benefits when attainment dates are around 2010 and the 2020 emission reductions are not locked-in.
- OTC modeling shows “Substantial” ozone nonattainment continuing after the 2010 attainment dates.
- Leaving what is left in ozone nonattainment to “local controls” is troubling when many of the most effective local controls are restricted at the federal level.

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A Parting Thought

Frequent Footnotes in CSA-2003 technical summaries:

“Additional federal and state programs must bring all counties into attainment by 2016 at the latest.”

If so, how do the heavily promoted 2020 Phase 2 CSA emission reductions fit in for ozone?

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Questions And Discussion