Attainment Modeling Status Report

Metropolitan Washington Air Quality Committee (MWAQC)

Technical Advisory Committee Meeting

March 10, 2006

Presented by: VA Department of Environmental Quality

Presentation Topics

- **Outline of Modeling Process**
  - Purpose of attainment modeling
  - Attainment modeling steps
- **Overview of Modeling Methodology**
  - Modeling platform
  - Selection of episodes
- **Review of 2009 Modeling Results**
  - Ozone Transport Commission (OTC) 2009 future base case
  - Two VADEQ “adjusted” future base cases simulations

Presentation Topics (continued...)

- **Next Steps**
  - Sensitivity analyses
  - Future control case modeling
  - Supplemental analyses & Weight of Evidence (WOE)
- **Other Related Modeling Efforts**
  - Comparison of OTC & Association for Southeastern Integrated Planning (ASIP) modeling results
- **Modeling Schedule**

Purpose of Attainment Modeling

- Meet EPA requirements & guidance
- Predict future air quality conditions
- Develop & test potential control strategies
- Translate emission reductions into air quality benefit
- Demonstrate desired air quality outcome

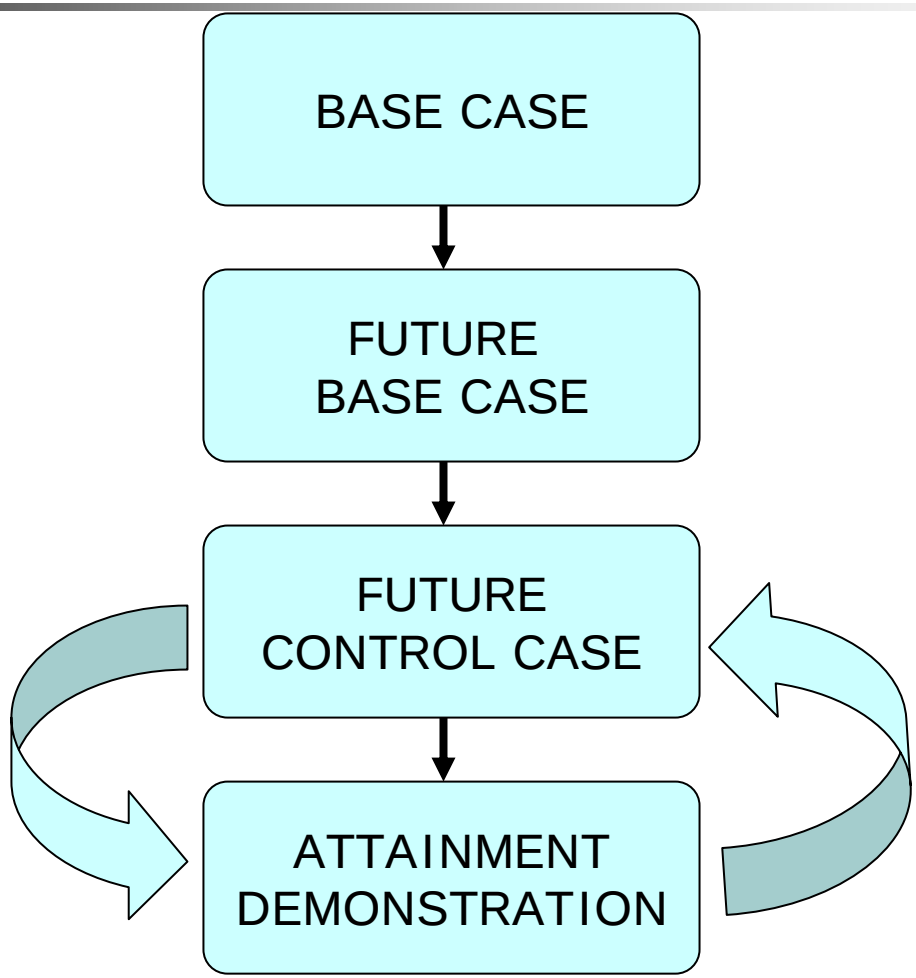
Attainment Modeling Steps

- **Historical Base Case Modeling**
  - Select representative high ozone events/ozone season
  - Develop event specific model data input
  - Run event simulation(s)
  - Compare model results to actual concentrations (model validation)
- **Future Base Case Modeling**
  - Develop future year emissions
  - Include known existing/future control measures
  - Run simulation(s)
  - Evaluate results
  - Perform sensitivity analyses as needed

Attainment Modeling Steps (continued...)

- **Future Control Case Modeling**
  - Develop potential control measures
  - Estimate emissions reductions
  - Test control strategies (iterative process)
  - Perform attainment test
  - Develop/document supporting analyses (Weight of Evidence)
  - Document results for inclusion in SIP

Attainment Modeling Steps (continued...)



Modeling Platform

- **All DC attainment analyses conducted using Ozone Transport Commission (OTC) modeling platform**
  - Community Multi-scale Air Quality (CMAQ) Modeling System
  - 12-km horizontal grid resolution
  - University of Maryland 2002 MM5 Meteorology

Selection of Ozone Episodes

- **OTC modeling conducted for entire ozone season**
  - May 1 – September 30
  - Encompasses full weather cycle associated with high ozone
  - NYSDEC responsible for conducting OTC 2009 future base case modeling for ozone season months

Selection of Ozone Episodes (continued...)

- **Shorter Ozone Episode Period for VADEQ "Adjusted" Future Base Cases**
  - Needed to reduce model run times & limit model output storage requirements
  - June 6 – August 16
    - Includes all 5 high ozone weather patterns in OTR
    - Model run from "cold start" (clean boundary conditions)
    - 15 days added to front of episode (May 22-June 5) to account for model "spin up" time

2009 Base Case
Ozone Transport Commission

- EPA/RPO (IPM) Utility Projections for CAIR
  - Emissions & controls
- Does not include all Virginia CAIR controls
- Does not include OTC VOC controls in NOVA

VADEQ Adjusted Base Case #1 Assumptions

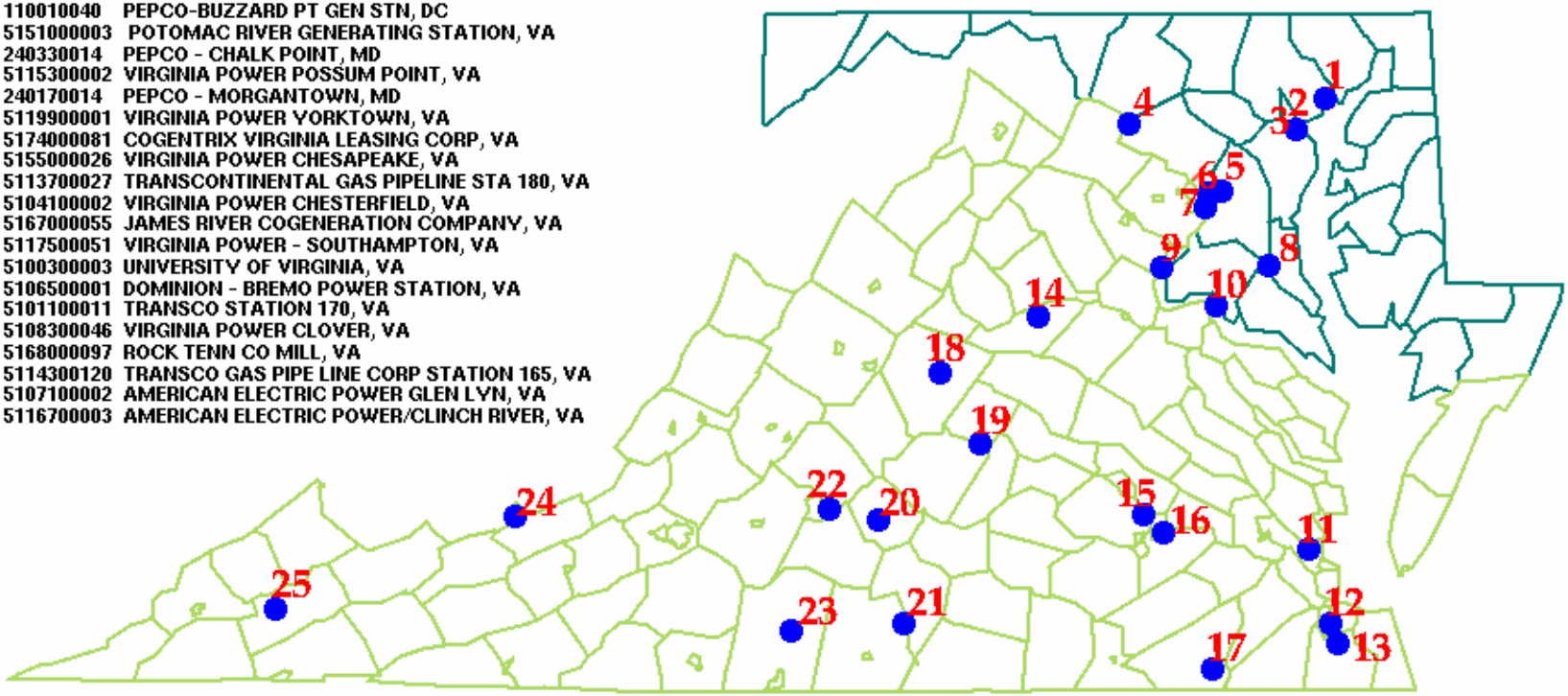
- Represents 2002 utility emissions levels & current controls with growth to 2009
- Does not include the MD Clean Power Rule
- Does not include Virginia CAIR controls
- Comparison to the OTC Base Case shows benefits of the of CAIR

VADEQ Adjusted Base Case #2 Assumptions

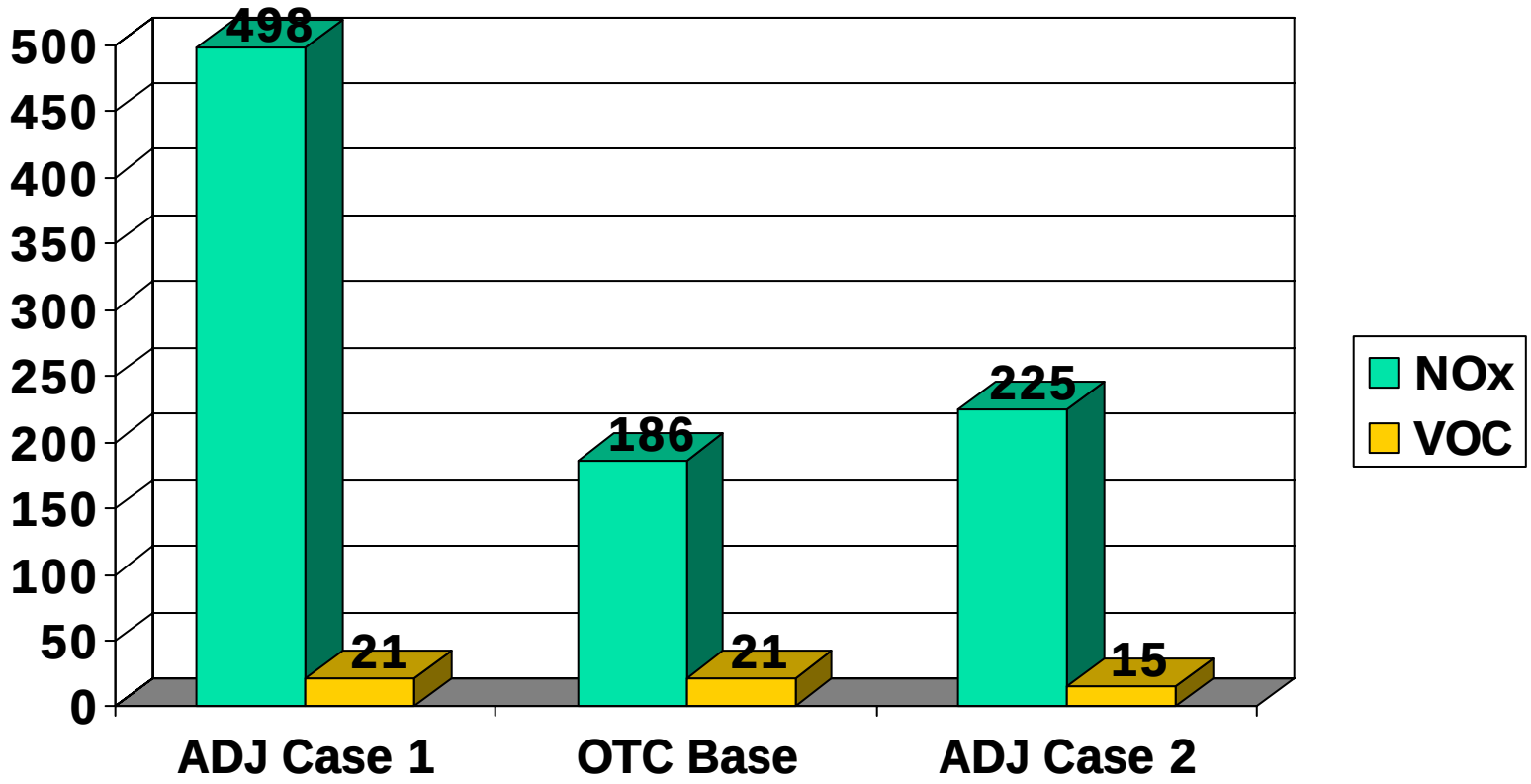
- Uses MD CPR & VA/DC CAIR emission reduction estimates
- Includes SIP Call Phase II reductions in VA
- Includes OTC VOC controls in NOVA
  - Rule 4-42, OTC Portable Fuel Containers
  - Rule 4-47, OTC Solvent Metal Cleaning
  - Rule 4-48, OTC Mobile Equipment Repair/Refinishing
  - Rule 4-49, OTC AIM
  - Rule 4-50, OTC Consumer Products

Location of Adjusted Emissions Sources

1	240050079	B G E - CRANE, MD
2	240030014	B G E - WAGNER STATION, MD
3	240030468	B G E - BRANDON SHORES, MD
4	240310019	PEPCO - DICKERSON, MD
5	110010001	BENNING, DC
6	110010040	PEPCO-BUZZARD PT GEN STN, DC
7	5151000003	POTOMAC RIVER GENERATING STATION, VA
8	240330014	PEPCO - CHALK POINT, MD
9	5115300002	VIRGINIA POWER POSSUM POINT, VA
10	240170014	PEPCO - MORGANTOWN, MD
11	5119900001	VIRGINIA POWER YORKTOWN, VA
12	5174000081	COGENTRIX VIRGINIA LEASING CORP, VA
13	5155000026	VIRGINIA POWER CHESAPEAKE, VA
14	5113700027	TRANSCONTINENTAL GAS PIPELINE STA 180, VA
15	5104100002	VIRGINIA POWER CHESTERFIELD, VA
16	5167000055	JAMES RIVER COGENERATION COMPANY, VA
17	5117500051	VIRGINIA POWER - SOUTHAMPTON, VA
18	5100300003	UNIVERSITY OF VIRGINIA, VA
19	5106500001	DOMINION - BREMO POWER STATION, VA
20	5101100011	TRANSCO STATION 170, VA
21	5108300046	VIRGINIA POWER CLOVER, VA
22	5168000097	ROCK TENN CO MILL, VA
23	5114300120	TRANSCO GAS PIPE LINE CORP STATION 165, VA
24	5107100002	AMERICAN ELECTRIC POWER GLEN LYN, VA
25	5116700003	AMERICAN ELECTRIC POWER/CLINCH RIVER, VA



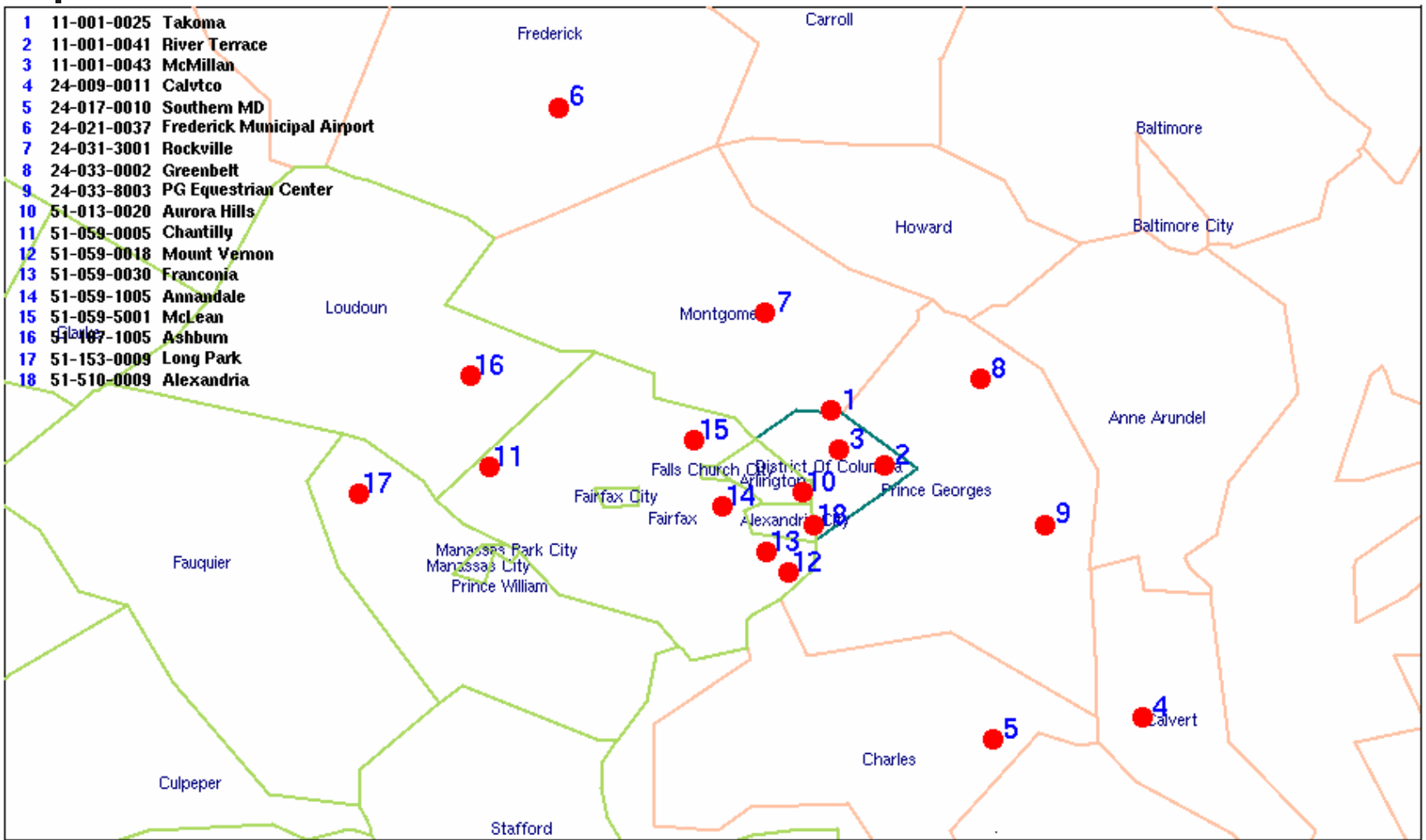
Summary of Adjusted Emissions *(Tons Per Day)*



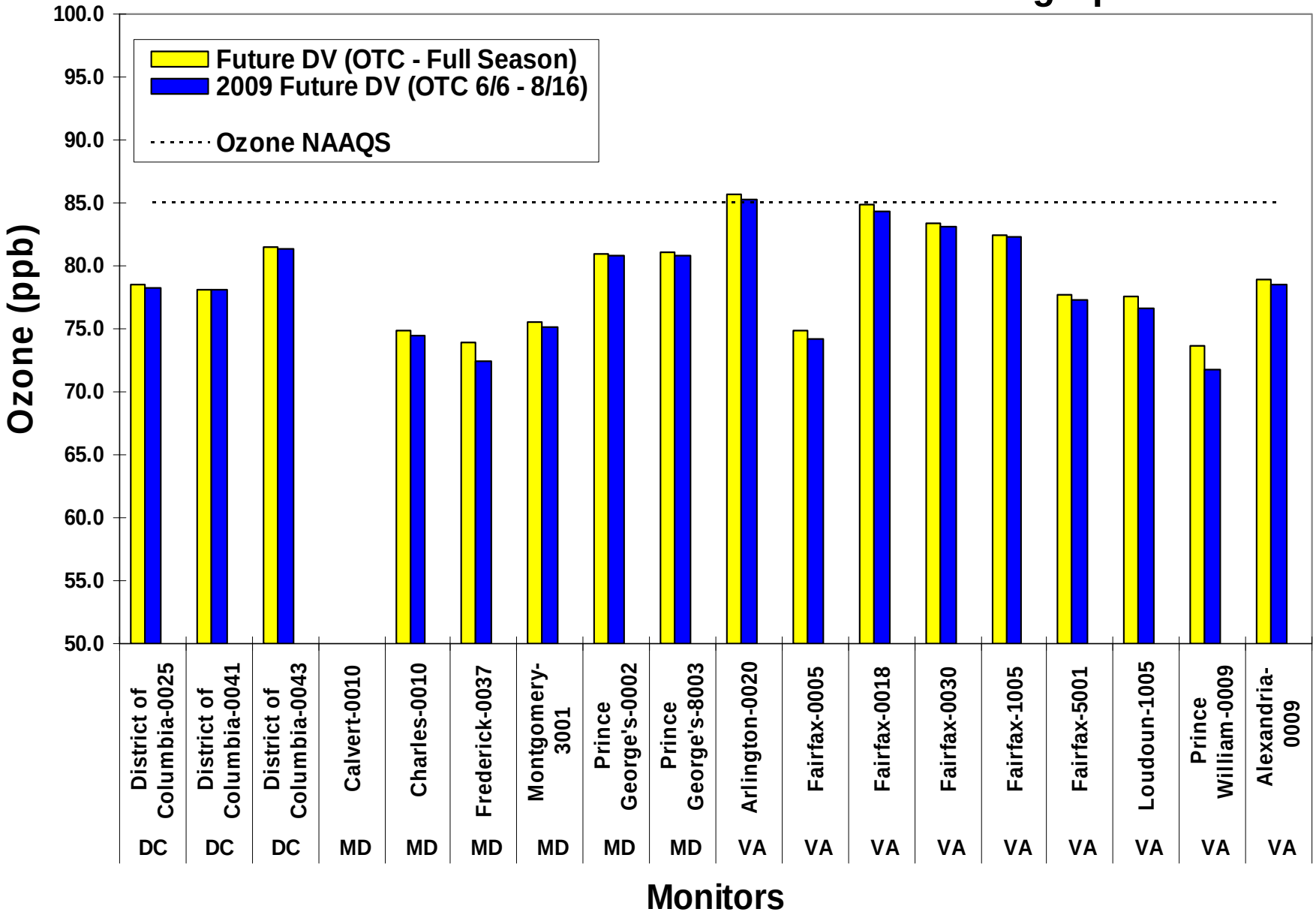
Design Value Calculations

- Current DV calculations for modeling based on EPA ozone guidance
  - 2002 DV is the average of three design values centered on 2002
  - Uses 85 ppb as the cutoff point when calculating DVs
  - 3 X 3 grid cell array around each monitor for RRF calculation

Location of Ozone Monitors

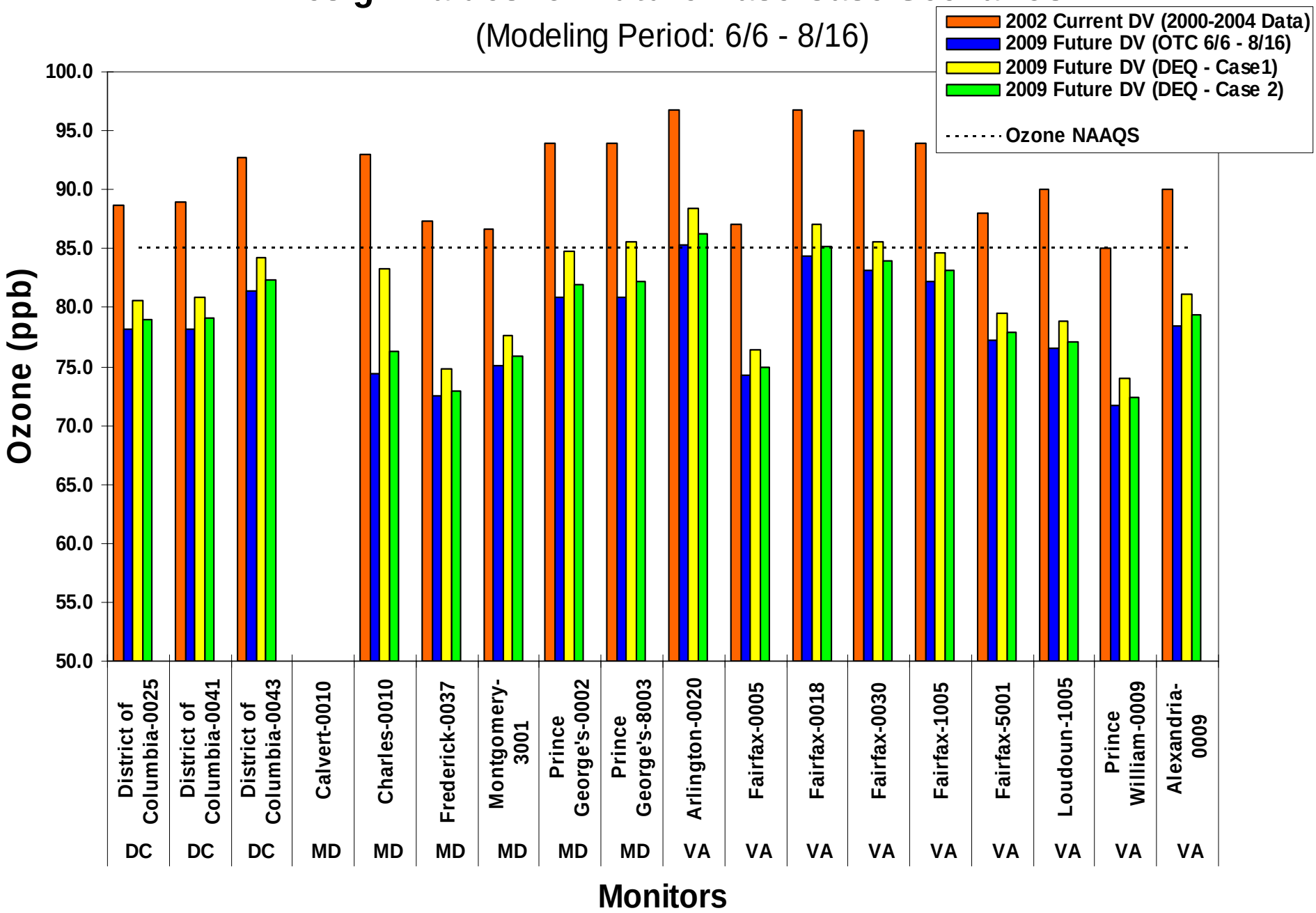


Comparison of 2009 Future Design Values
Full Ozone Season versus 6/6 - 8/16 Modeling Episode



Design Values for Future Base Case Scenarios

(Modeling Period: 6/6 - 8/16)



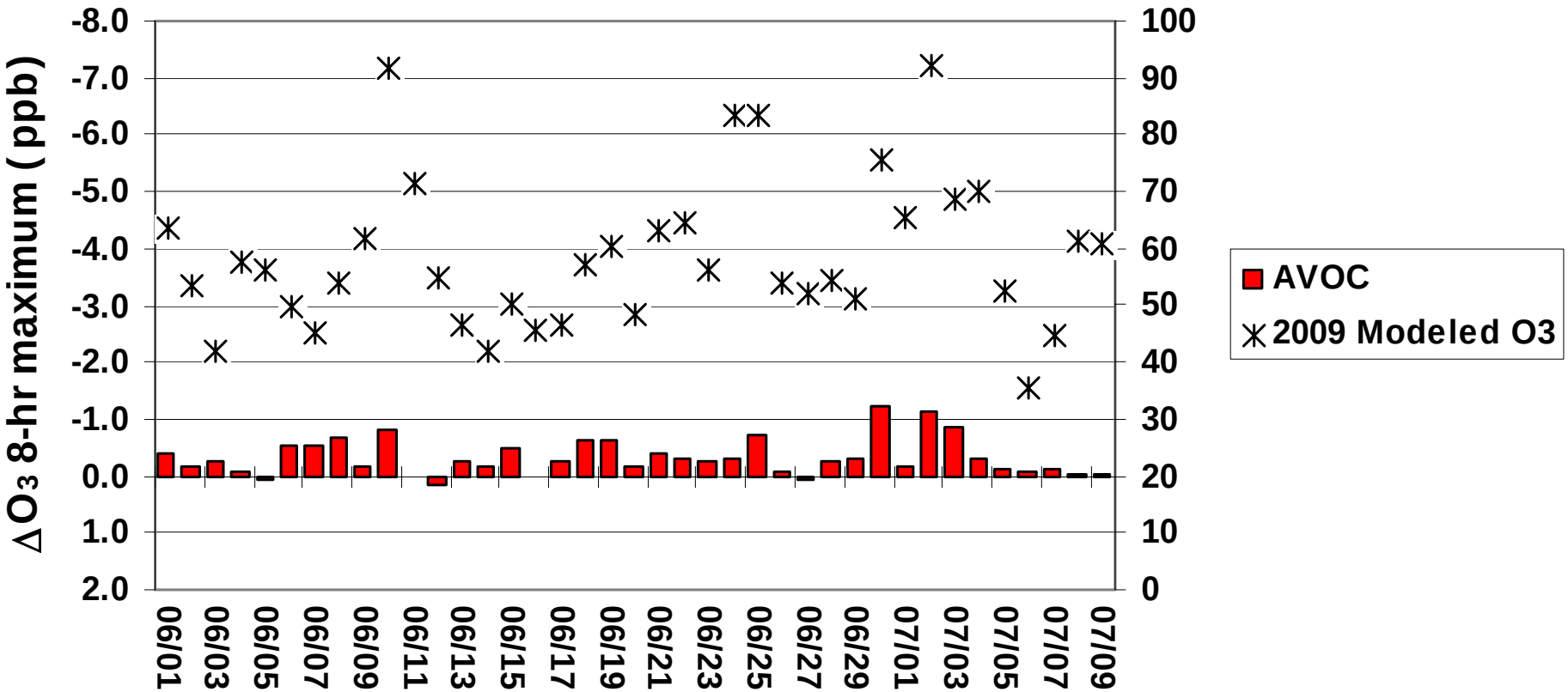
Attainment Modeling Next Steps

- **Perform sensitivity analyses**
  - What's more effective to further reduce ozone?
  - Pollutants & source categories?
  - Need to develop DC specific list
  - ASIP sensitivities may provide additional information

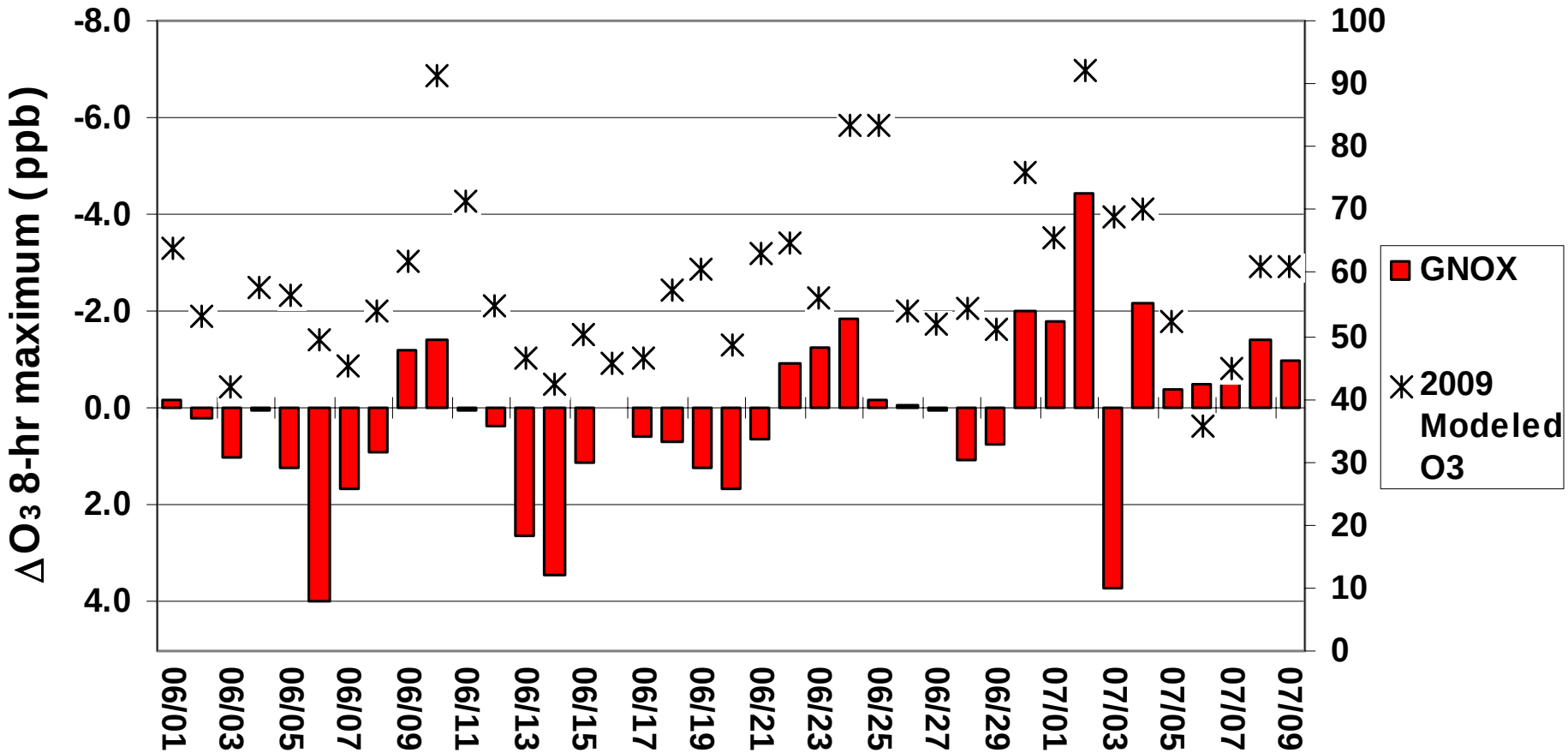
Attainment Modeling Next Steps (continued…)

- **Perform sensitivity analyses (continued…)**
  - Georgia Tech performed emission sensitivities for ASIP to examine the impact of emission reductions on 8-hour ozone concentrations
  - Examples of Sensitivity Analyses include:
    - 30% Reduction in anthropogenic VOCs for entire modeling domain
    - 30% Reduction in ground-level NOx for D.C. area nonattainment counties
    - 30% Reduction in Point Source NOx for Virginia as well as MANE-VU Regional Planning Organization
  - Model simulation from June 1 – July 10
  - 2002 Meteorological Data

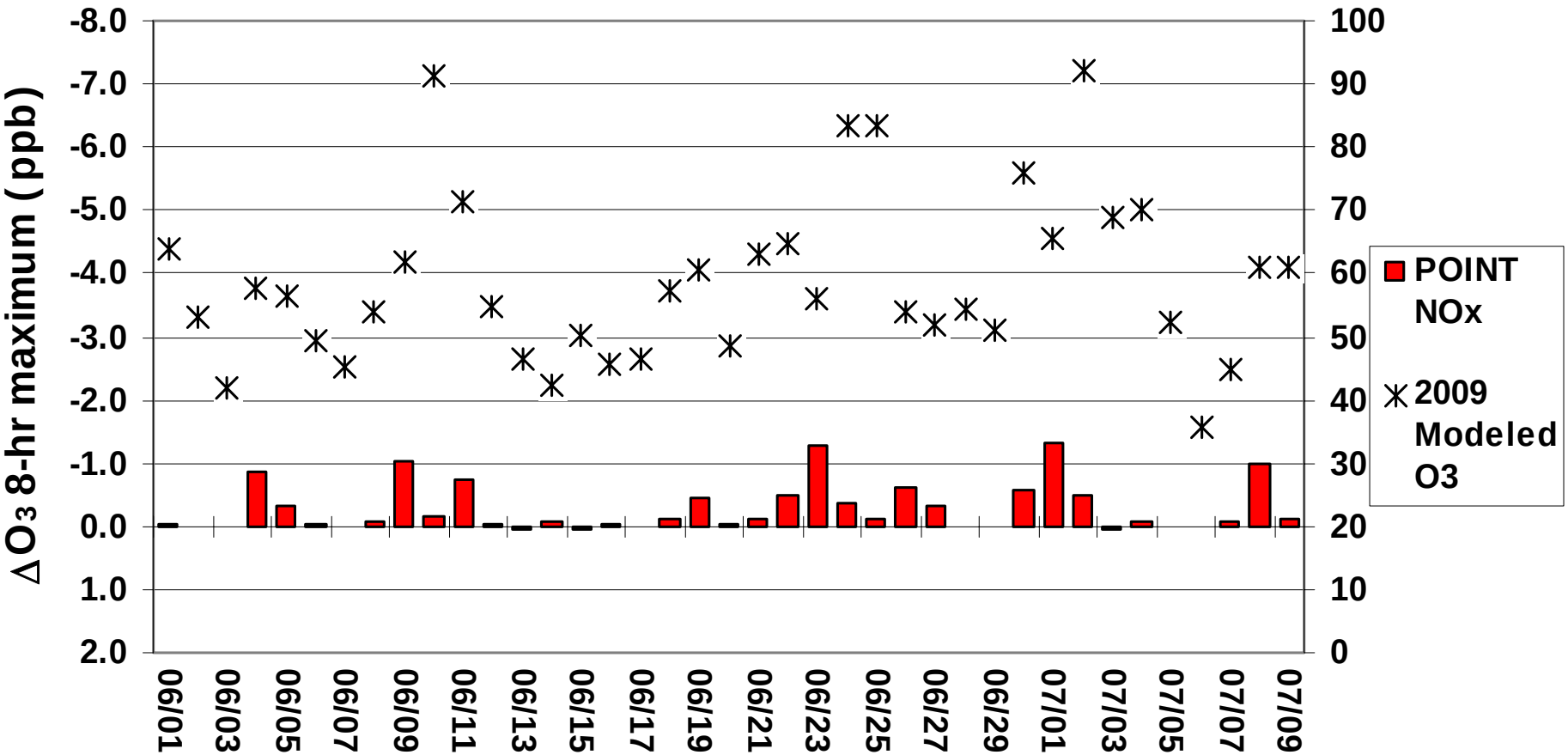
O_3 Response at Arlington County, VA to 30% Domain-Wide Reduction in Anthropogenic VOC (AVOC) Emissions

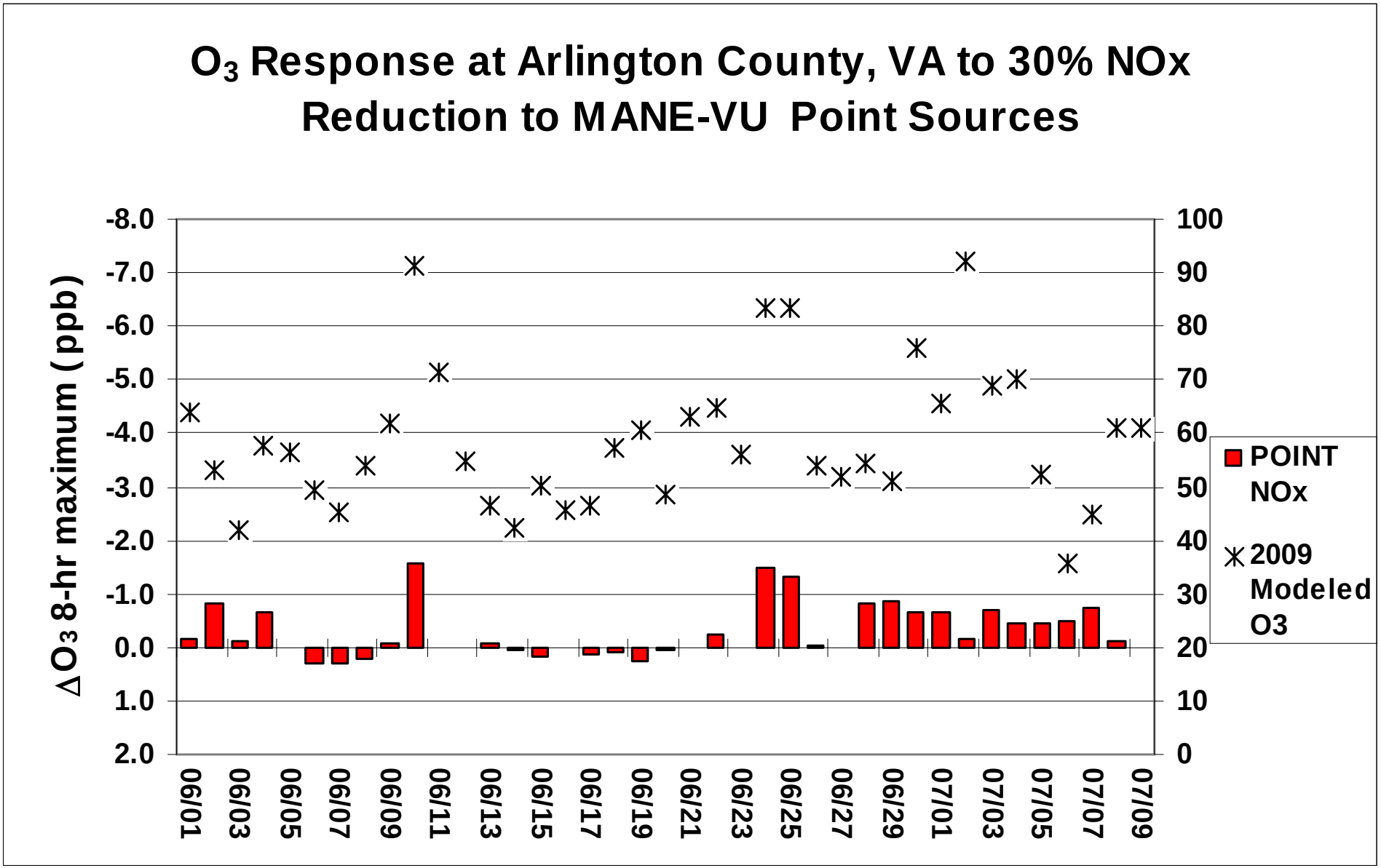


O_3 Response at Arlington County, VA to 30% Ground-Level NOx (GNOX) Reduction in D.C. Area



O_3 Response at Arlington County, VA to 30% NOx Reductions to Virginia Point Sources




O3 Response at Arlington County, VA to 30% NOx Reduction to MANE-VU Point Sources
ΔO3 8-hr maximum (ppb)
-8.0
-7.0
-6.0
-5.0
-4.0
-3.0
-2.0
-1.0
0.0
1.0
2.0
100
90
80
70
60
50
40
30
20
10
0
06/01
06/03
06/05
06/07
06/09
06/11
06/13
06/15
06/17
06/19
06/21
06/23
06/25
06/27
06/29
07/01
07/03
07/05
07/07
07/09
POINT NOx
2009 Modeled O3

Attainment Modeling Next Steps (continued...)

- **Future Control Case Modeling**
  - Identify & Quantify additional control emissions
    - Control Measure Workgroup, OTC Workgroups
  - Run control case model to test these control strategies
  - Perform attainment test (using Relative Reduction Factors)
  - Repeat process as needed to demonstrates attainment
  - Perform Supplemental analyses & Weight of Evidence (WOE)
  - Document results for inclusion in SIP

Weight of Evidence (WOE)

- Corroboratory information that accompanies attainment demonstration
- Describes analyses performed, databases used, key assumptions and outcomes
- Supports conclusion that area will attain NAAQS despite model predicted future DV (or conversely, demonstrate that reaching attainment is not likely despite passing the model attainment test)

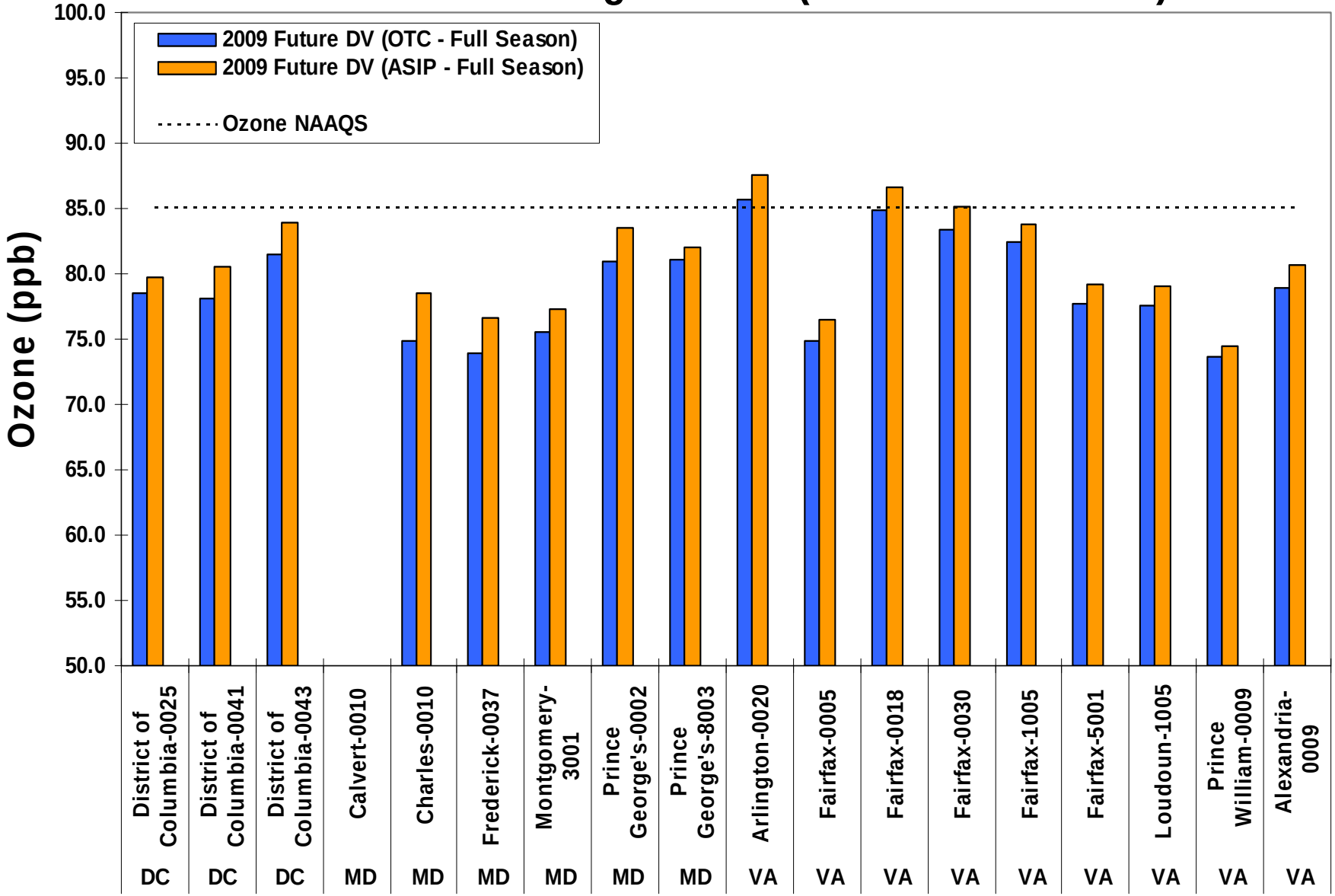
Weight of Evidence (WOE)

- **OTC has developed a matrix of WOE techniques**
  - Air quality and emissions trends
  - Meteorology analysis
  - Other modeling analyses
- **Need to develop D.C. specific list**

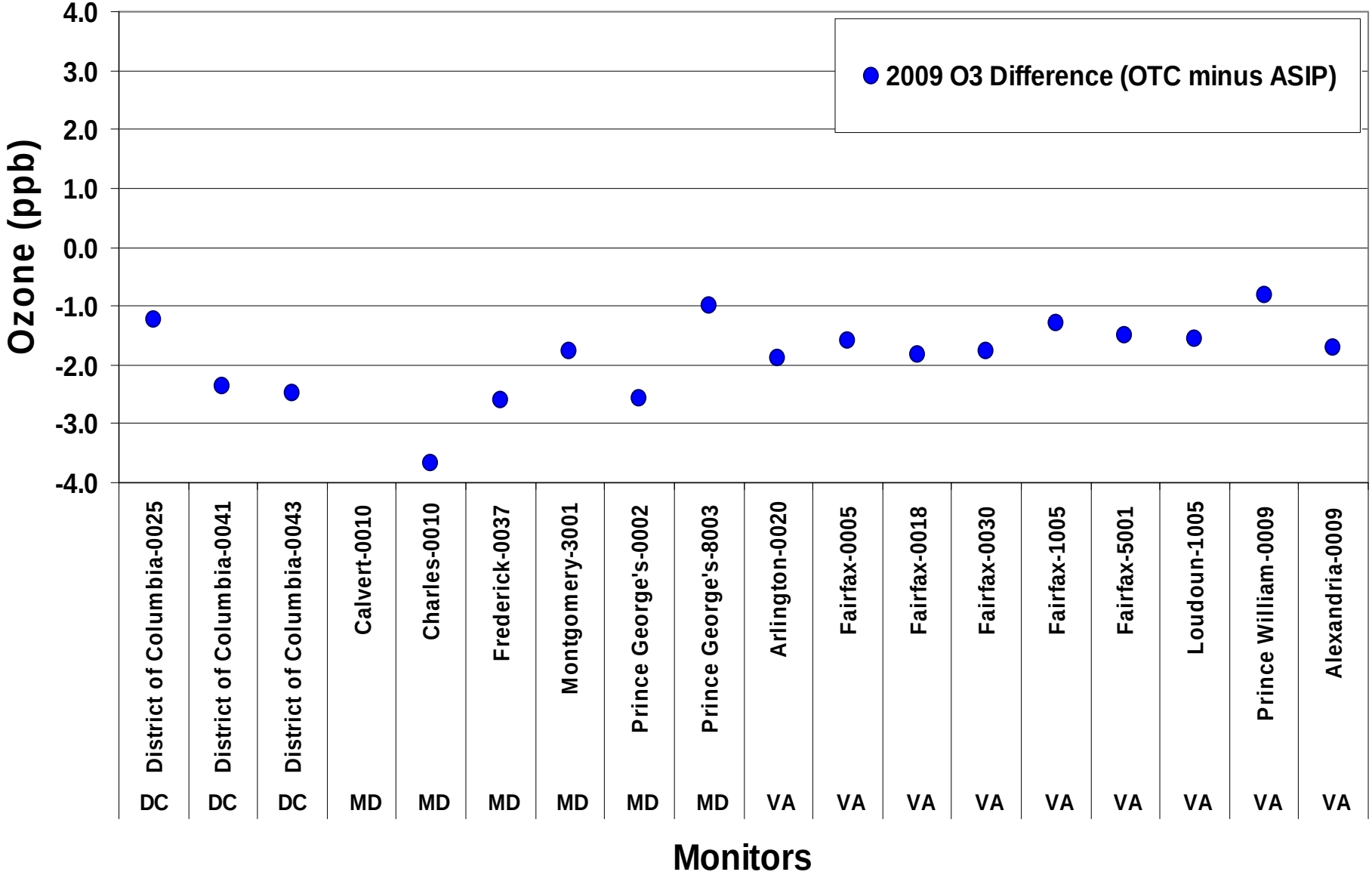
Other Related Modeling Efforts

- **Ozone Transport Commission (NY, NJ, MD, VA & NESCAUM)**
  - On a similar schedule for completion
  - Should be consistent with DC modeling since same platform
- **Association for Southeastern Integrated Planning (ASIP)**
  - Based on VISTAS modeling platform (emissions, met. data)
  - Preliminary 2009 base case results available
  - Have conducted series of sensitivity runs

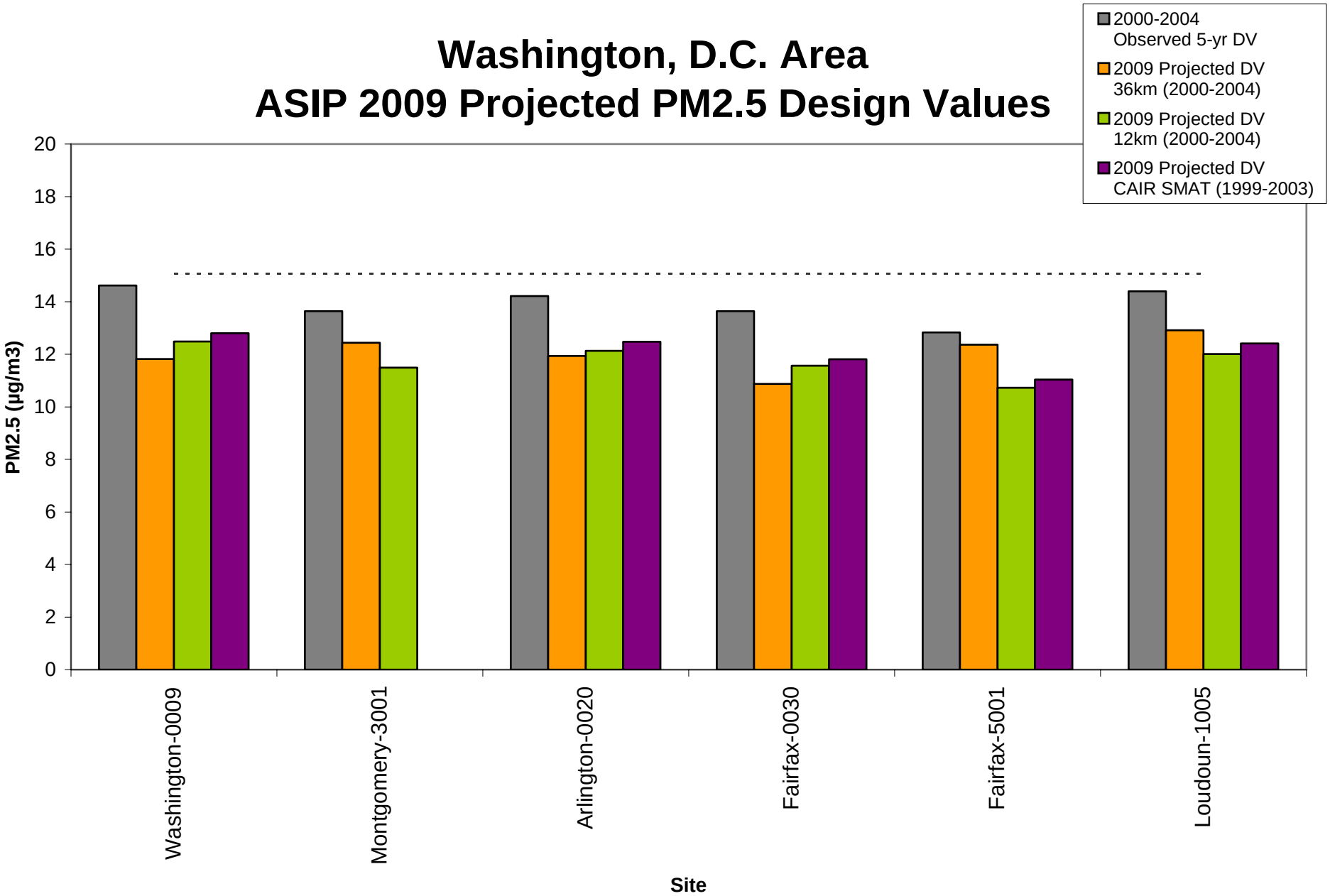
Comparison of OTC & ASIP
2009 Future Design Values (Full Ozone Season)



2009 Future Design Value Difference Plot (OTC minus ASIP)



Washington, D.C. Area
ASIP 2009 Projected PM2.5 Design Values



Attainment Modeling Schedule