Attainment Modeling Status Report

MWAQC Technical Advisory Committee Meeting

October 14, 2005

Presented by: VA Department of Environmental Quality

Presentation Topics

- Purpose of Attainment Modeling
- Overview of Modeling Process
- Progress to Date
- Next Steps/Schedule
- Other Modeling Efforts

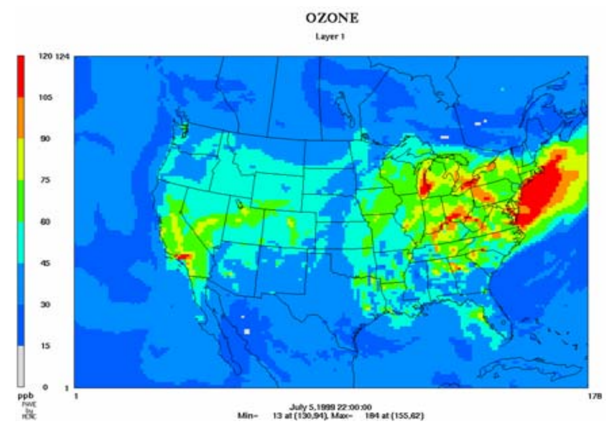
Purpose of Attainment Modeling

- 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

Overview of Modeling Process

Regional Photochemical Models:

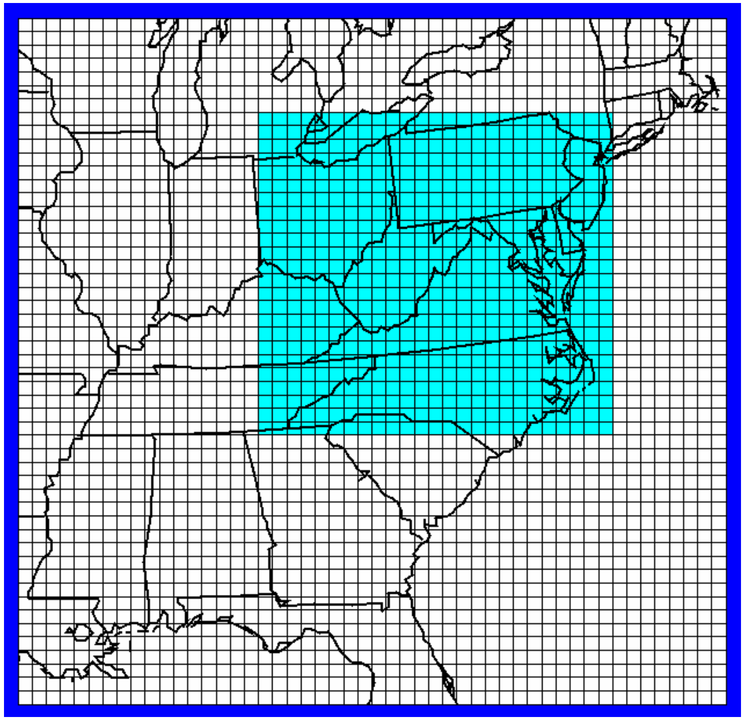
- Mathematical models that simulate actual air quality events (episodes)
- Three major components:
  - Meteorology
  - Emissions
  - Chemistry & Transport



- Data developed & allocated to grid system (horizontally & vertically) for model simulation

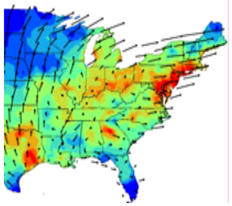
Use of Regional Scale Air Quality Models

- Regional scale modeling used to simulate & evaluate ozone transport impacts

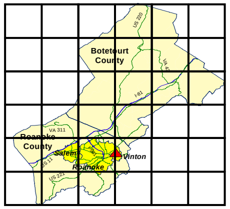


Regional Modeling Components

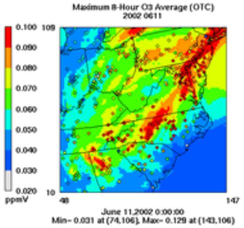
- Meteorology – Mesoscale Meteorological Model (MM5)



- Emissions – Sparse Matrix Operator Kernel Model (SMOKE)

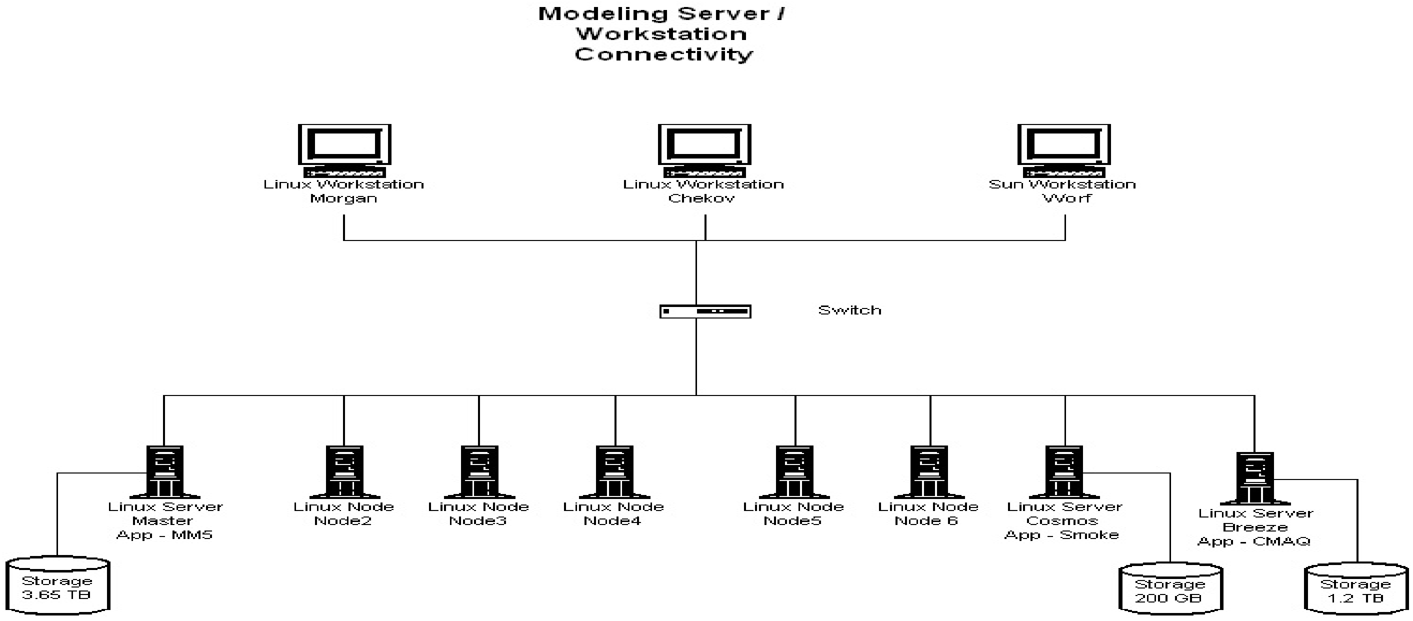


- Air Quality – Community Multi-scale Air Quality Model (CMAQ)



VDEQ Modeling Platform

- Linux Cluster System
- Multi-processing capabilities
- Storage capacity – 6.7 to 9.1 terabytes



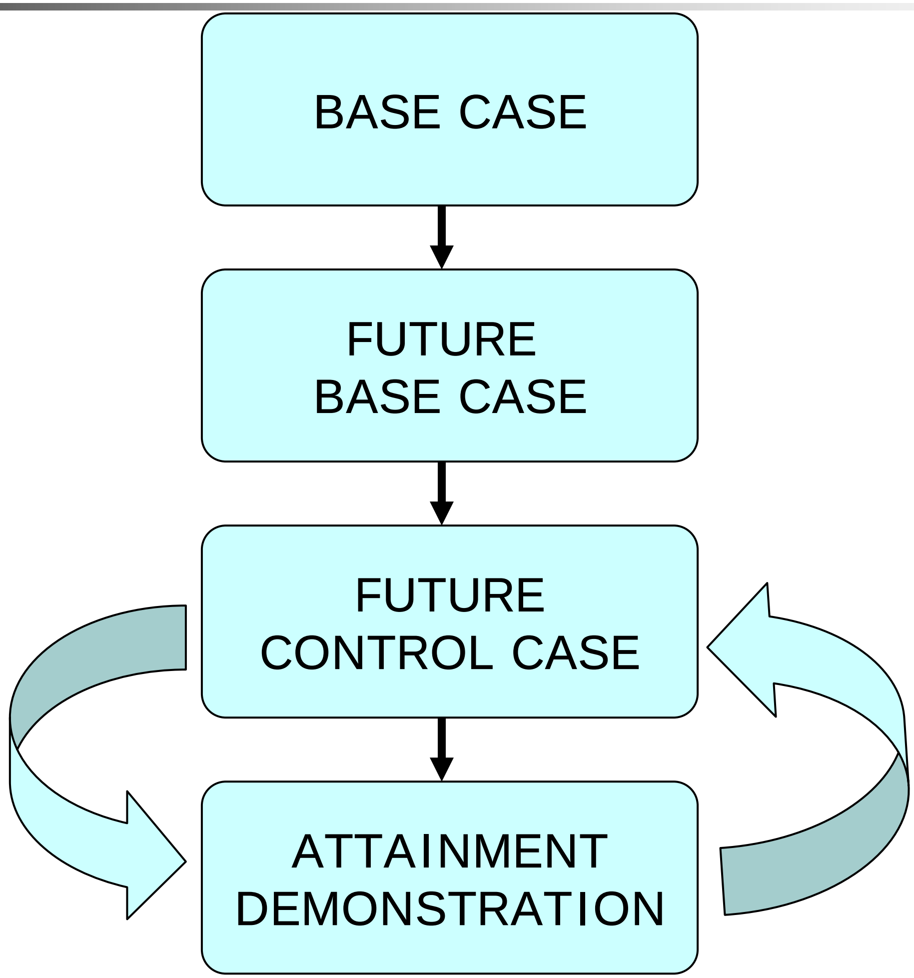
Attainment Modeling Steps

- Historical Base Case Modeling
  - Select representative high ozone events
  - 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

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

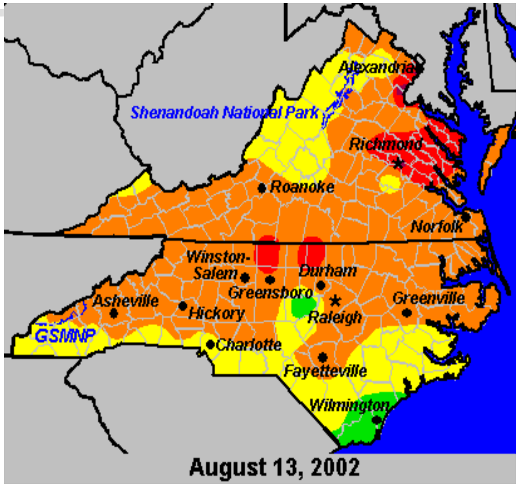
Attainment Modeling Steps



Attainment Modeling Progress to Date

- Draft modeling protocol
  - Waiting for final EPA guidance
  - Final document – Fall 2005
- Participation in OTC modeling efforts
  - Successful benchmark tests completed:
    - Emissions pre-processor (SMOKE)
    - Photochemical model (CMAQ)
  - PM Meteorological data processing (two months)
  - VDEQ modeling platform produces accurate and comparable results

Attainment Modeling Progress to Date (continued)

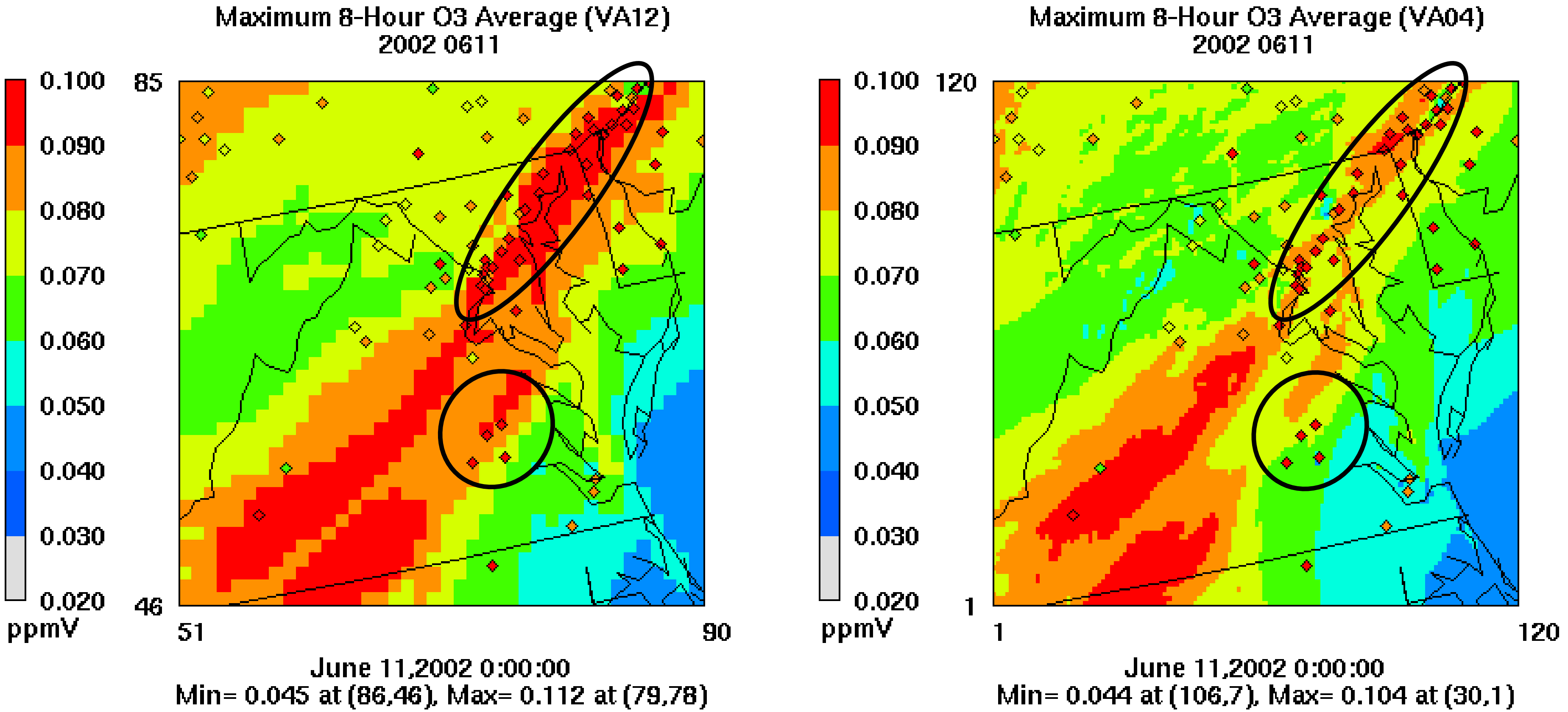


Base Case Modeling

- Base year for ozone modeling – 2002
- Selected episodes (54 total days)
  - June 6 to July 5, 2002
  - July 27 to August 16, 2002
  - September 5 to 12, 2002
- Covers all major high ozone meteorological conditions
- Base case modeling performed for entire period using VISTAS meteorology & emissions
- Comparison of results to OTC (NY) modeling performed
- Comparison of grid resolution (12 vs. 4 km) performed
- Final base case modeling (if needed) – Fall 2005

VADEQ Model Performance June 11, 2002 (12-km Versus 4-km)

12-km run does better job than 4-km run at capturing magnitude of peak ozone concentrations in I-95 corridor and Richmond.

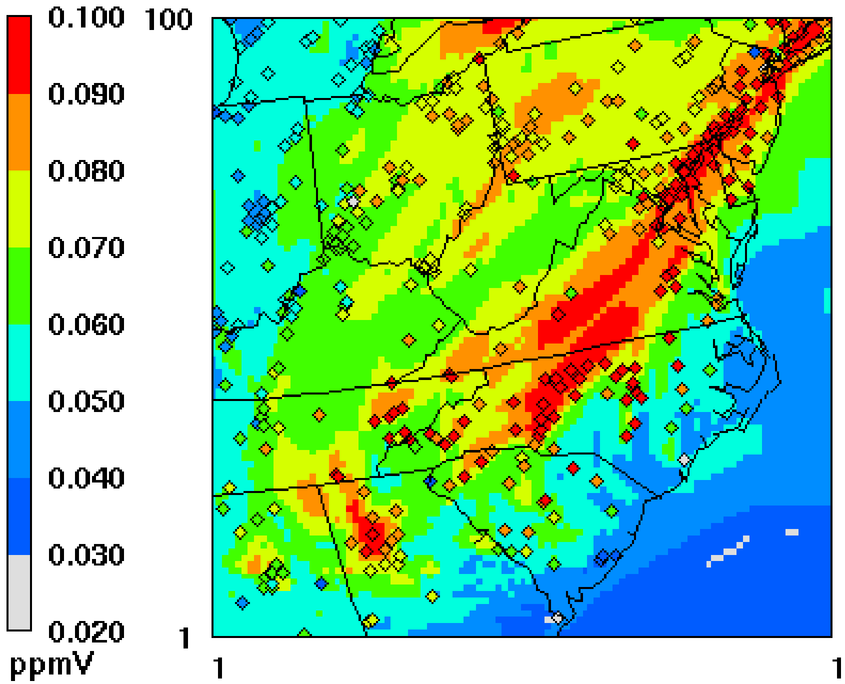


DEQ
Virginia Department of Environmental Quality

VADEQ & OTC Model Performance - June 11, 2002

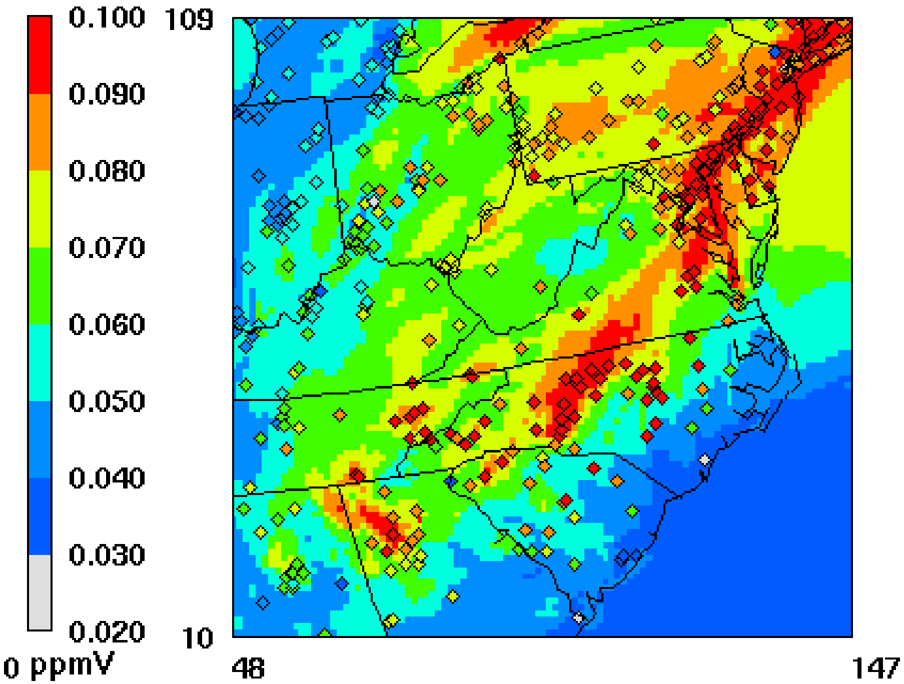
Both 12-km runs similar in the spatial pattern of the maximum ozone concentrations. OTC run slightly better in predicting the magnitude of the impacts.

Maximum 8-Hour O3 Average (VA)
2002 0611



June 11,2002 0:00:00
Min= 0.028 at (56,3), Max= 0.114 at (98,99)

Maximum 8-Hour O3 Average (OTC)
2002 0611



June 11,2002 0:00:00
Min= 0.031 at (74,106), Max= 0.129 at (143,106)

VDEQ/OTC & Resolution Evaluation Conclusions

- Models generally produce comparable results
- Both meet EPA performance criteria
- Both under-predict peak ozone levels
- OTC results slightly better in certain episodes
- No benefit gained from finer grid resolution
- Conclusions:
  - Use OTC platform/met. data for remaining SIP modeling
  - Remain at 12 km grid resolution

Attainment Modeling Next Steps

- **Future Base Case Modeling**
  - Future modeling year – 2009 (based on attainment date)
  - Waiting for "latest & Greatest" projection inventory (VISTAS)
    - Delayed from Sept to Nov/Dec
    - May begin work with previous 2009 inventory
  - Run future base case scenario
    - How close is DC to attainment?
  - Perform sensitivity analyses – What's more effective to further reduce ozone?
    - Pollutants & source categories?
    - Need to develop DC specific list
    - ASIP process may help

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 Weight of Evidence (WOE) analysis
    - Other modeling results
    - Air quality and emissions trends
    - Others (need to develop DC specific list)
  - Document results for inclusion in SIP

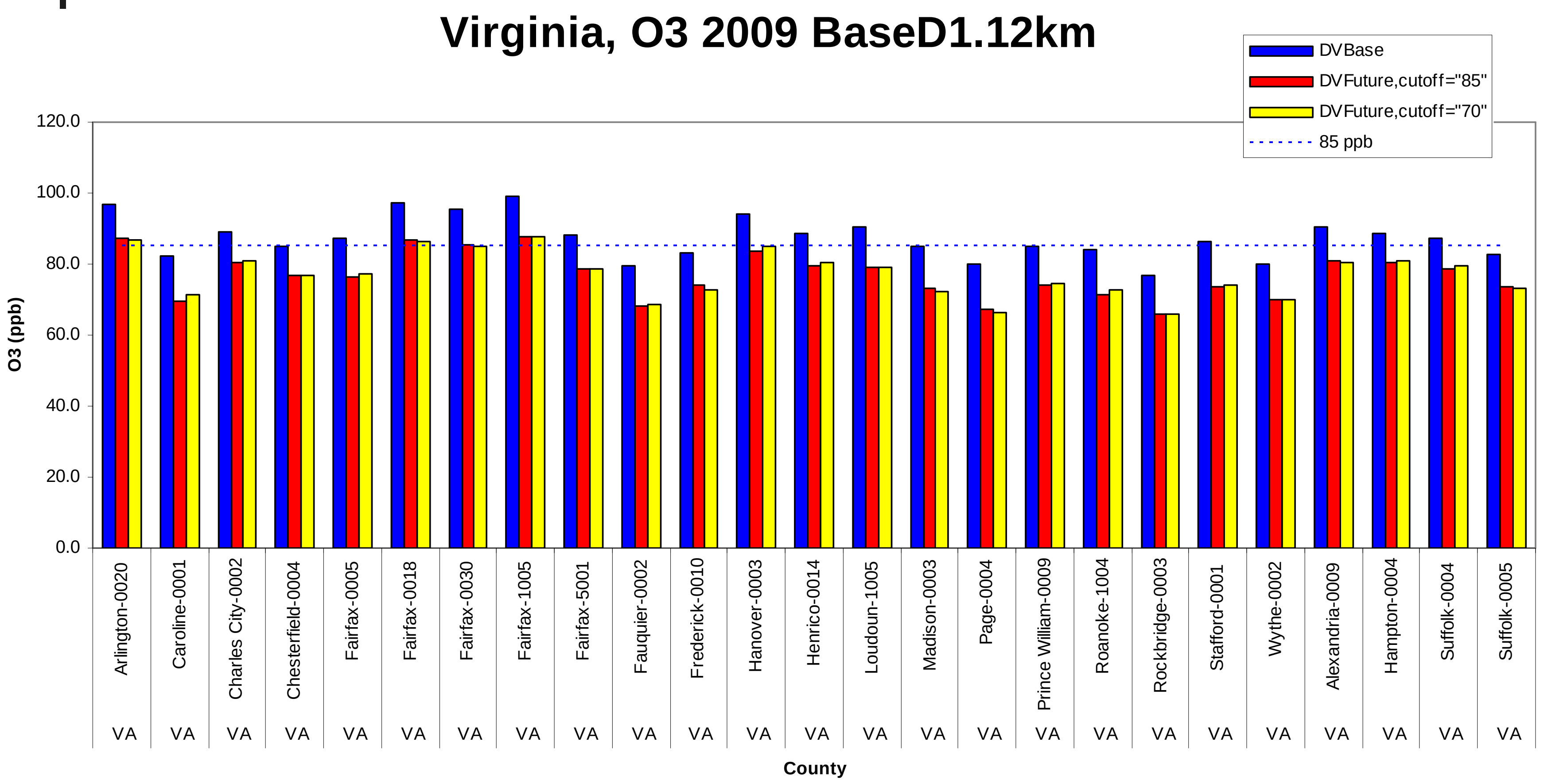
Attainment Modeling Schedule

- **Summer 05**: Model Evaluations (DEQ/OTC, 12 vs. 4km)
- **Fall 05**: 2002 Base Case Modeling
- **Winter 05**: Future Base Case
- **Spring 06**: Sensitivity Runs & Strategies Testing
- **Summer 06**: Future Control Case & Attainment Demo

Other Related Modeling Efforts

- Ozone Transport Commission (NY, NJ, MD, & NESCAUM)
  - On a similar schedule for completion
  - Should be consistent with DC modeling
- Association for Southeastern Integrated Planning (ASIP)
  - Based on VISTAS modeling platform (emissions, met. data)
  - Preliminary 2009 base case results available
  - Currently performing series of sensitivity runs
- Results could be used in WOE

Preliminary 2009 Base Case Results – ASIP (All Virginia)



Preliminary 2009 Base Case Results – ASIP (DC Monitors)