PM2.5 Attainment Modeling Status Report

Metropolitan Washington Air Quality Committee (MWAQC)

Technical Advisory Committee Meeting

July 9, 2007

Presented by: VA Department of Environmental Quality

Presentation Topics

- Review of Final EPA Modeling Guidance
- **S**peciated **M**odel **A**ttainment **T**est Methodology (SMAT)
- 2009 PM2.5 Modeling Results
- Next Steps
- Association for Southeastern Integrated Planning (ASIP) Projected Future Ozone Design Values - Implications of New NAAQS

Ozone/PM2.5/Regional Haze Modeling Guidance

- "Guidance on the use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze" http://www.epa.gov/scram001/guidance/guide/final-03-pm-rh-guidance.pdf
  - Original draft- January 2001
  - Draft final- September 2006
  - Final version- April 2007
- Final ozone guidance has been incorporated into the final PM2.5 and RH guidance (single, slimmed down, 253 page document)

What's in the Guidance?

- Generating Model Results
  - Conceptual description
  - Modeling protocol
  - Selecting a model(s)
  - Choosing days/episodes
  - Selecting domain & spatial resolution
  - Developing meteorological inputs
  - Developing emissions inputs
  - Evaluating model performance/diagnostic analyses

Recommendations for PM2.5 "Episode" Selection

- Annual PM2.5 NAAQS (15 µg/m3)
  - Model full year or >= 15 days per quarter
- 24-Hour NAAQS
  - Model days > 65 µg/m3 or "high end of distribution"
- EPA expects attainment test for new 24-hr PM2.5 standard (35 µg/m3) to be same or similar to procedures in current guidance.
  - Procedures to be revisited by EPA to ensure appropriateness

What's in the Guidance?

- Using Model Results – PM2.5
  - Modeled Attainment Test (Annual and 24-hr NAAQS)
  - Supplemental analyses/weight of evidence
    - Unmonitored area analysis
    - Local area analysis (observed high primary PM2.5 areas)
  - Activities to support Mid-Course review and future modeling
  - Required documentation
- This modeling guidance does not address:
  - Dispersion modeling of PM2.5 for NSR/PSD
  - Transportation conformity hot-spot analyses

Speciated **M**odel **A**ttainment **T**est (SMAT) for PM2.5

- 5 year weighted average (2000-2004) base design value
- All modeled attainment tests use model estimates in a “relative” sense (**R**elative **R**esponse **F**actors)
- The attainment test for PM2.5 uses separate RRFs for each PM2.5 species, each quarter
- Apply species concentrations from STN sites to PM2.5 mass collected at FRM sites
- Guidance recommends species adjustments based on Frank’s (2006) SANDWICH technique

Speciated PM2.5 Mass Components as defined in SMAT

- **$PM2.5_{FRM}$** = { [OCMmb] + [EC] + [SO4] + [$NO3_{FRM}$] + [$NH4_{FRM}$] + [PBW] + [Crustal] + [Blank] }
  - **OCM_{mb}**: organic carbon mass by difference
  - **EC** : measured elemental carbon
  - **SO4 :** measured sulfate ion
  - **$NO3_{FRM}$** : nitrate retained on the FRM filter
  - **$NH4_{FRM}$** : ammonium retained on the FRM filter
  - **PBW :** particle bound water mass attached to sulfate, nitrate, and ammonium
  - **Crustal :** soil and other inorganic mass
  - **Blank** : a constant 0.5 ug/m3 blank mass

EPA **M**odel **A**ttainment **T**est **S**oftware (MATS)

- Provides a consistent set of ambient data, including speciation data, for all States to use
- Released version with ozone and regional haze analyses in June 2007

http://www.epa.gov/scram001/modelingapps_mats.htm

- PM2.5 tests still undergoing QA – expected to be available at the end of Summer 2007

Unmonitored Area Analysis (UAA)

- The attainment test is a monitor based test
  - Future year design values should also be examined in unmonitored areas
- Unmonitored Area Analysis (UAA) is recommended
  - Uses interpolated ambient design values and model output
- UAA not designed to look for unmonitored PM micro-scale hot-spot issues
  - 12 km resolution is sufficient
- UAA is a supplemental analysis
  - If a problem area is identified, guidance recommends implementing emissions controls or placing new monitor(s) in the area

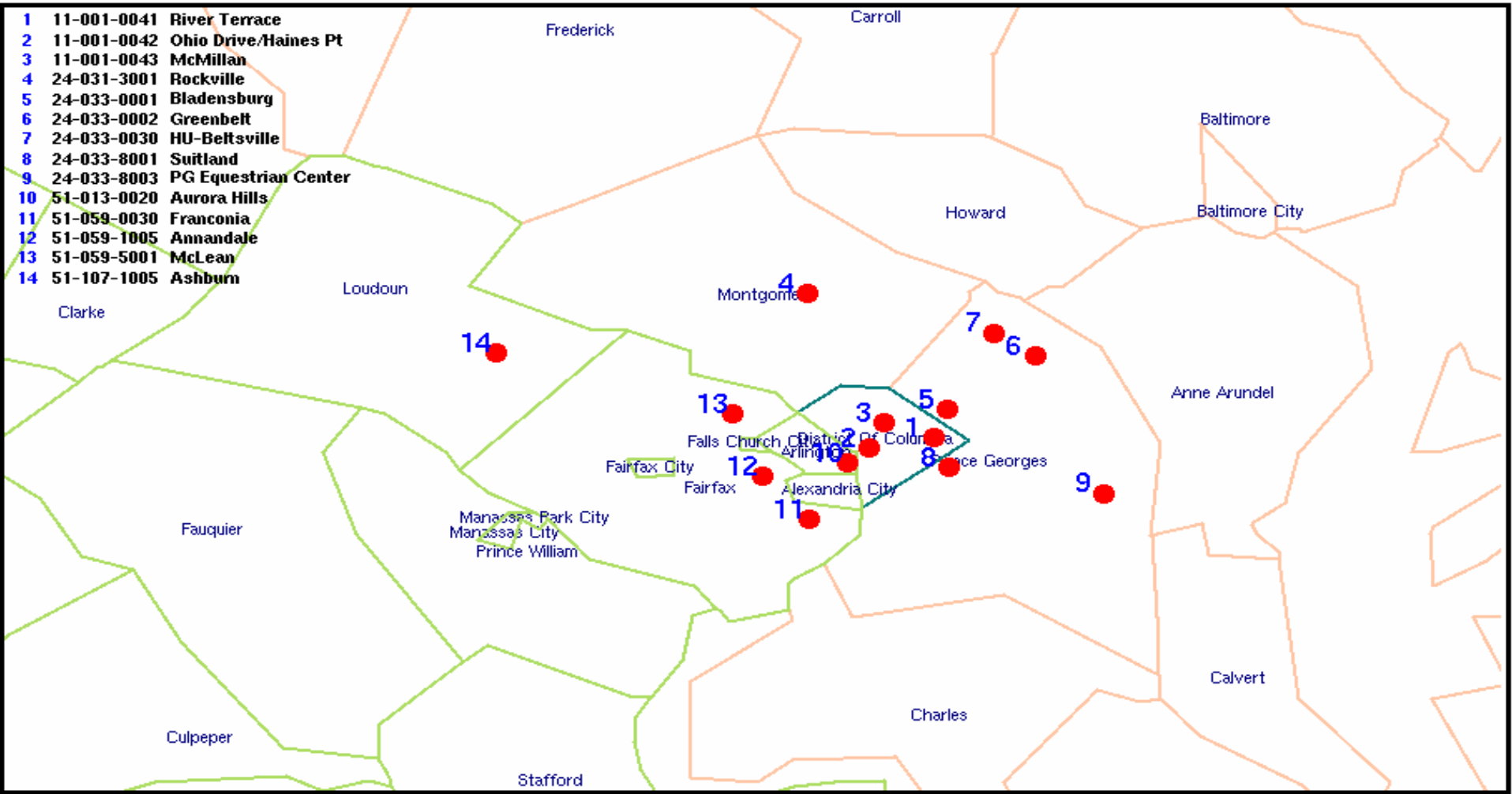
Local Area Analysis (LAA)

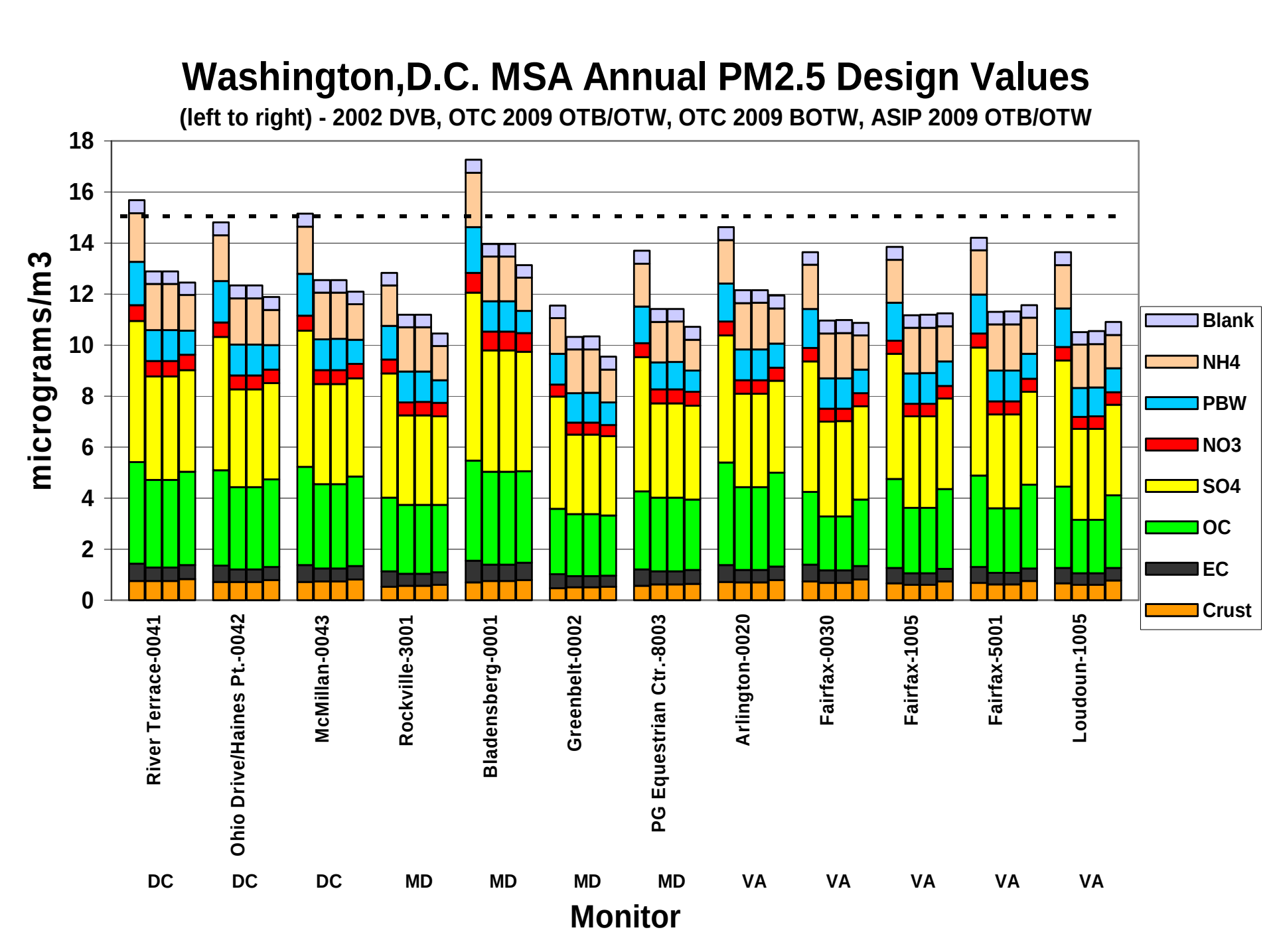
- Analysis to improve the accuracy of modeled emissions changes of local primary PM2.5
  - Local primary PM2.5 gradients cannot be accurately modeled with a relatively coarse grid model
  - LAA provides a more accurate assessment of the change in air quality at monitors, due to changes in local primary emissions
- Local area analysis can use either dispersion model or fine grid Eulerian model
  - Use relative change in concentration to adjust future year annual or 24-hour design values

2009 PM2.5 Design Values

- All DC MSA attainment modeling conducted using OTC platform
- Annual modeling simulations conducted for 2009 OTB/OTW and 2009 BOTW
  - Community Multi-scale Air Quality (CMAQ) Modeling System
  - 12-km horizontal grid resolution
  - University of Maryland 2002 MM5 Meteorology

Location of FRM Monitors




Washington,D.C. MSA Annual PM2.5 Design Values
(left to right) - 2002 DVB, OTC 2009 OTB/OTW, OTC 2009 BOTW, ASIP 2009 OTB/OTW
micrograms/m3
0
2
4
6
8
10
12
14
16
18
Blank
NH4
PBW
NO3
SO4
OC
EC
Crust
River Terrace-0041
Ohio Drive/Haines Pt.-0042
McMillan-0043
Rockville-3001
Bladensberg-0001
Greenbelt-0002
PG Equestrian Ctr.-8003
Arlington-0020
Fairfax-0030
Fairfax-1005
Fairfax-5001
Loudoun-1005
DC
DC
DC
MD
MD
MD
MD
VA
VA
VA
VA
VA
Monitor

ASIP Daily PM2.5 Projections

Monitor I.D.	Jurisdiction	2009	2018
11-001-0041	DC - District of Columbia	36	33
11-001-0042	DC - District of Columbia	31	30
11-001-0043	DC - District of Columbia	33	31
51-013-0020	VA - Arlington	32	30
51-059-0030	VA - Fairfax	29	28
51-059-5001	VA - Fairfax	28	26
51-107-1005	VA - Loudoun	28	26

PM2.5 Modeling - Next Steps

- Jurisdictions must verify base design values and composition fractions in MATS
- Calculate annual and 24-hour 2009 design values for DC FRM monitors using OTC platform with MATS
- Evaluate requirements for Unmonitored Area Analysis (UAA)
- Evaluate requirements for Local Area Analysis (LAA)
- Finalize PM2.5 Modeling Protocol – Fall 2007

ASIP 2009 and 2018 Ozone Projections

State	Jurisdiction	2009	2018
VA	Alexandria	80	72
VA	Prince William	74	64
VA	Loudoun	78	68
VA	Frederick	72	65
VA	Fairfax	86	77
VA	Arlington	87	77
MD	Washington	72	64
MD	Prince George's	83	73
MD	Montgomery	76	67
MD	Frederick	75	66
MD	Charles	79	68
DC	District of Columbia	84	74