

**2006 Modeling Plan
WRAP Regional Modeling Center**

**Regional Modeling and Analysis to
Support the Development of December 2007 Regional Haze SIPs/TIPs**

[Next] Final Draft Outline

March 27, 2006 – revised on RMC Project Management Call

1. Purpose

- a. Complete regional and source-specific modeling analyses of stationary sources required by BART and Regional Haze Rules
- b. Complete regional modeling analyses needed for WRAP region to address weight-of-evidence and implementation plan needs for jurisdictions submitting haze plans in December 2007
- c. Complete modeling analyses to evaluate the visibility improvements from air pollution control rules, strategies, and programs adopted or proposed for application by 2018 in the WRAP region, for sulfate, nitrate, organic and elemental carbon contributions to visibility impairment.

2. Introduction

- a. Background
 - i. Overview of Regional Haze Rule
 - ii. BART discussion
 - iii. Overview of WRAP
 - iv. Overview of RMC Responsibilities
 - v. Modeling Components of December 2007 Regional Haze Plans
- b. Topics and Purpose of Regional Simulations – in sequence
 - i. Identify RMC work on BART Modeling Analyses
 - ii. Perform other source-receptor visibility culpability assessments
 1. Source Attribution Approaches
 2. Zero-Out Modeling of Impacts (Brute Force)
 - iii. PM Source Apportionment Modeling of Impacts (See Appendix A)
 - iv. Evaluate point source emissions reductions options using control strategy analyses for EGU presumptive limits and possibly alternative Emissions Management scenarios
 - v. Perform final regional modeling analysis of 2002 (base02b) and 2000-04 baseline (planning02b) periods
 - vi. Simulate visibility changes from final 2018 “base case emissions projections” (base18b) and 2018 control scenarios to support regional haze implementation plans
 - vii. Evaluate model response to emissions at clean conditions’ levels
 - viii. Evaluate visibility improvements from fire management and other emissions control programs in regional sensitivity analyses as resources allow

- ix. Last in the regional modeling sequence, evaluate visibility improvements from all control strategies, rules, and control programs identified by WRAP region States, to be called the “2018 Final All Control Strategies” run
- c. Presentation of Results
 - i. WRAP RMC Simulation Specifications
 - ii. 2018 Uniform Rate of Progress model test following EPA guidance
 - iii. 2018 changes in controllable (anthropogenic) components of visibility
 - iv. 2018 changes by species concentrations (e.g., SO₄, NO₃, etc.)
 - v. Other to be determined
 - vi. Remaining Major RMC Report Deliverables
 - 1. 2006 Mid-year Report (report complete by August 1st)
 - 2. 2006 Final Report (complete final draft report by January 2007)

3. Types of RMC BART Modeling Assistance – in sequence

- a. RMC CALPUFF Modeling Assistance – purpose is to have States identify subject-to-BART list of sources for those States wishing RMC to conduct CALPUFF modeling for them – currently AK, NM, NV, SD, UT - AZ may be added
 - i. Specifically identify individual States’ BART analysis work to date and planned activities & reference existing CalPuff BART Modeling Protocols
 - ii. For States doing their own CalPuff subject-to-BART modeling – RMC will provide 2001-2003 MM5 data formatted for CalMet as desired
 - 1. Develop windows of MM5 data in CALMET format for four separate modeling domains at 36 km for 2001 through 2003 (domains will include States identified plus neighboring States’ Class I areas, centered on:
 - a. Arizona + New Mexico
 - b. Utah + Nevada
 - c. South Dakota
 - d. Montana
 - iii. For States NOT doing their own CalPuff subject-to-BART modeling – RMC will (currently AK, NM, NV, SD, and UT):
 - 1. Develop a WRAP region CALPUFF Modeling Protocol for States needing that support – separate protocol for Alaska CALPUFF modeling (see protocol outline in Appendix B). Interact with States on analysis.
 - 2. Prepare CALMET modeling databases for 2001, 2002 and 2003

3. Conduct CALPUFF threshold/culpability/subject-to-BART modeling for all WRAP region States not doing it on their own
4. Publish results of #3, above so States can complete BART engineering analyses to estimate likely source-specific NOx and SOx BART emissions reductions
5. Conduct CalPuff modeling to estimate benefits of source-specific BART emissions reductions
6. Publish results
- iv. Identification of BART sources in 2002 SMOKE database
 1. Cross reference list BART to IDA
- b. Exemption Modeling – use the regional models to screen BART-eligible sources for PM and VOC emissions
 - i. Assume doubled annual average approximates max 24-hour actual
 - ii. SMOKE for BART Sources VOC and PM only
 - iii. Subtract SMOKE BART from fully merged file to make Zero-Out BART emission inputs
 - iv. Add SMOKE BART to fully merged to make Double BART emission inputs
 - v. Two CMAQ runs (Zero-Out and Doubled BART)
 - vi. Post-processing visibility impacts at Class I Areas

4. RMC BART, Regional Sensitivity, Regional Control Strategy Modeling – in sequence

- a. Needs from States identified in #2 about for RMC BART Modeling Analysis and subsequent Regional BART and Alternative Programs Modeling Analysis
 - i. States identify their own BART-eligible Sources in priority order
 1. Confirm 2018 source-specific emissions data suitable for CalPuff subject-to-BART analysis identified in #2.a.iii.3, above
 2. Provide estimate of 2018 pollutant/stack-specific and State-wide emission reductions (for QA)
 3. RMC to identify timeline and formats for data
- b. Modeling Platforms
 - i. CAMx vs. CMAQ differences
 - ii. PSAT methodology
- c. RMC Planned Runs
 - i. Final 2002 base case regional modeling analysis (base02b)
 1. CMAQ at 36km, results at each Class I area
 - ii. Simulate visibility in 2000-04 baseline period using final “baseline period emissions” (planning02b)
 1. CMAQ at 36km, results at each Class I area as inputs to EPA guidance-specified method for forecasting future visibility conditions

2. CAMx with PSAT to identify contributions of sources to 2000-04 baseline period visibility impairment, including all other planning02b emissions [assuming *XXX source regions – Ralph or Gerry to provide #*], per Appendix A
- iii. Simulate visibility changes from final 2018 “base case emissions projections” (base18b)
 1. CMAQ at 36km, results at each Class I area as inputs to EPA guidance-specified method for forecasting future visibility conditions
 2. CAMx with PSAT to identify contributions of sources to 2018 visibility impairment, including all other base18b emissions [assuming *XXX source regions – Ralph or Gerry to provide #*], per Appendix A
- iv. 2018 Point and Area Source Control Scenarios to support regional haze implementation plans – (control18a,b,c)
 1. Using BART Rule NOx and SOx “presumptive limits” for emissions from EGUs, rerun SMOKE for point sources (control18a)
 - a. Merge with other emissions from base18b
 - b. CMAQ 36 km 2018 point source control case
 - c. Visibility projections
 - d. Report on results
 2. If chosen by States to pursue, perform a Cumulative Assessment of Alternative Program options, either Trading or Backstop Trading, rerun SMOKE for point sources (control18b)
 - a. Assume WRAP/States provide source-by-source emissions allocation numbers
 - b. Merged with other emissions from base18b
 - c. CMAQ 36 km 2018 point source control case
 - d. Visibility projections
 - e. Report on results
 3. Control strategy sensitivity run based on input on from individual states on their plans (control18c)
 - a. Modify individual point and area emissions sources as needed and merge with other emissions from base18b
 - b. Include effects of California NAAQS control strategies – if timing allows, if not, in “final18control”
 - c. Effects of 8-hour ozone and PM2.5 attainment/reasonable further progress plans in nonattainment areas
 - d. CMAQ 36 km 2018 point source control case
 - e. Visibility projections
 - f. Report on results

- v. 2018 Final All Control Strategies (final18control)
 - a. Last run, to be completed at the end of all other modeling runs
 - b. Include all emissions reductions that States plan to adopt in their haze implementation plans
 - c. For each State, use State-provided emissions allocation numbers for individual BART sources and/or individual sources in an Alternative Point Source Control programs - rerun SMOKE for 2018 point sources
 - d. Include effects of California NAAQS control strategies if these were not modeled in “control18c”
 - e. Merged with other emissions from base18b
 - f. Visibility projections
 - g. Report on results
- vi. 2018 Regional Sensitivity Scenarios (*1, 2, 3, 4, and 5 are identified as definitely needed in that order, others as resources allow/need indicates*)
 - 1. Clean Conditions Scenarios
 - a. Natural Emissions Only
 - i. Actual 2002 wildfires, biogenics, windblown dust (*modeling complete, analysis underway*)
 - 2. Ammonia emissions sensitivity (2) - % increase and % decrease regionally
 - 3. Road dust emissions sensitivity (zero-out run regionally)
 - 4. Fire - alternative future emissions scenarios
 - 5. Sensitivity of International Transport and Off-Shore Marine Emissions Sensitivity, including alternative growth and control options for marine vessels
 - 6. Alternative growth/control assumptions for Canada and Mexico
 - 7. Clean Conditions Scenarios
 - a. Natural Emissions Only
 - i. 2000-04 baseline wildfire, biogenics, only non-agricultural dust - 2002 complete (vi.1.a.i, above) – answer needed?
 - ii. GEOS-CHEM boundary conditions with no anthropogenic emissions – answer needed?
 - 8. Separate Dust Sensitivity – none planned

5. References

Appendix A: White Paper on PM Source Apportionment
 (http://pah.cert.ucr.edu/aqm/308/reports/PSAT_White_Paper_111405_final_draft1.pdf)
and Modeling Plan for using CAMx with PSAT

Applies to 2 regional modeling runs:

- planning02b case – represents emissions during 2000-04 regional haze baseline period – see specifications sheet
- base18b case – represents emissions forecasts to 2018 accounting for growth and control programs on the books through 2004, includes corrections from base18a run – see specifications sheet

Tracers - run SO_x, NO_x PSAT tracers, **?74?** source regions total, emissions processing steps and file formats are shown below

6 Emissions Categories

- Point (including stationary offshore)
 - All inland point sources + Pacific point
 - Gulf point
- Anthropogenic Fires (WRAP only)
 - WRAP agricultural fires and anthropogenic prescribed fires
- Total mobile (on-road, off-road, including planes, trains, ships in/near port, off-shore shipping)
 - WRAP on road
 - CENRAP on road
 - Eastern RPOs on road
 - Non US on road mobile
 - All Off road mobile with monthly or seasonal inventory
 - All Off road mobile with annual inventory
- Natural emissions (natural fire, WRAP only, biogenics)
 - WRAP wild fires
 - WRAP non federal rangeland and natural prescribed fires
 - WRAP wildland fire use
 - All biogenics
- Elevated fire sources in other RPOs
 - VISTAS and CENRAP fires
 - Canada fires
- Everything else (area, all dust, fugitive ammonia, non-elevated fire sources in other RPOs)
 - CENRAP area fires
 - Windblown dust
 - CENRAP ammonia
 - WRAP ammonia
 - All area sources
 - All road dust
 - All fugitive dust
 - Gulf offshore area

- Pacific offshore marine
- WRAP oil and gas

Emissions Processing Approach

- Stationary points:
 - Process through SMOKE; generate elevated ASCII + low-level CAMx emission files (do not merge low-level with any other sources)
- Anthropogenic fires:
 - Process through SMOKE; generate CMAQ 3-d emissions files
 - Use CMAQ2CAMx converter to get binary elevated and low-level CAMx point source files (do not merge low-level with any other sources)
- Total mobile:
 - Process through SMOKE; run SMKMERGE to merge all sources; run SMK2EMISS to get CAMx emission files.
- Natural Emissions:
 - Process fires through SMOKE; generate CMAQ 3-d emissions files
 - Merge natural fires with biogenics
 - Use CMAQ2CAMx converter to get binary elevated and low-level CAMx point source files
- Elevated fire sources in other RPO:
 - Process fires through SMOKE; generate CMAQ 3-d emissions files
 - Use CMAQ2CAMx converter to get binary elevated and low-level CAMx point source files
- Everything else:
 - Process through SMOKE; run SMKMERGE to merge all sources; run SMK2EMISS to get CAMx emission files.

Families:

Sulfur – 2 tracers [SO_{2i} Primary SO₂ emissions; and PS4_i Particulate sulfate ion from primary emissions plus secondarily formed sulfate]

Nitrogen – 7 tracers [RGN_i Reactive gaseous nitrogen including primary NO_x (NO + NO₂) emissions plus nitrate radical (NO₃), nitrous acid (HONO) and dinitrogen pentoxide (N₂O₅); TPN_i Gaseous peroxy acetyl nitrate (PAN) plus peroxy nitric acid (PNA); NTR_i Organic nitrates (RNO₃); HN3_i Gaseous nitric acid (HNO₃); PN3_i Particulate nitrate ion from primary emissions plus secondarily formed nitrate; NH3_i Gaseous ammonia (NH₃); and PN4_i Particulate ammonium (NH₄)

Areas:

- Each WRAP state
- Pacific Off-shore Region (Gerry to use/get grid cells from Chris/Alison)
- The group of CENRAP states touching WRAP
- Remaining contiguous US East, including Gulf of Mexico
- Mexico
- Canada

Appendix B: RMC BART CalPuff Modeling Protocol

a. Overview of Approach

| | Step A – BART Culpability Analysis (0.5 deciview threshold for 2002 actual maximum emissions rate*) | Step B – BART Engineering Analysis** | Step C – 2018 Visibility Benefit Analysis for estimated emissions reduction from BART application |
|---------------|--|--|--|
| AK | <i>WRAP RMC</i> | Alaska DEC | <i>WRAP RMC</i> |
| AZ | ? | Arizona DEQ | ? |
| CA | All by California ARB | | |
| CO | All by Colorado DPH&E: http://apcd.state.co.us/documents/techdocs.html | | |
| ID | Idaho DEQ issued RFP with OR and WA to do steps A & C with 12km MM5 met data - ID to do step B | | |
| MT | All by Montana DEQ, using <i>WRAP RMC 36km met data</i> | | |
| NV | <i>WRAP RMC</i> | Nevada DEP | <i>WRAP RMC</i> |
| NM | <i>WRAP RMC</i> | New Mexico ED | <i>WRAP RMC</i> |
| ND | All by North Dakota Department of Health | | |
| OR | Part of ID RFP with WA to do steps A and C - see ID note above - OR to do step B | | |
| SD | <i>WRAP RMC</i> | South Dakota DENR - 2 eligible sources, 1 is PM only | <i>WRAP RMC</i> |
| UT | <i>WRAP RMC</i> | Utah DEQ | <i>WRAP RMC</i> |
| WA | Part of ID RFP with OR to do steps A and C - see ID note above - WA to handle B? - the WA status is unknown because WA and Region X are working together | | |
| WY | All by Wyoming DEQ, using a contractor at 12 km or 4 km MM5 met data - 18 eligible sources | | |
| Tribal | All federal sources as far as is known, so these are up to their respective Regional Offices | | |

*- data to be provided by permitting agency

** - may be based on separate contract support funded by Stationary Sources Joint Forum

- b. Meteorological Modeling
 - i. MM5
 - ii. CALMET
- c. CALPUFF Modeling
 - i. CALPUFF Inputs
- d. Potential BART-Eligible Sources
 - i. ERG Report
 - ii. List Sources being Considered
- e. Visibility Assessment Approach