



**Western Regional Air Partnership (WRAP)
Regional Modeling Center (RMC)**

**Monthly Progress Report
for March 2006**

Prepared by

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Introduction

This is the March 2006 Monthly Progress Report that covers the activities of the Western Regional Air Partnership (WRAP) Regional Modeling Center (RMC).

Background

The WRAP RMC is composed of staff from the University of California, Riverside (UCR), ENVIRON International Corporation, and the University of North Carolina's Carolina Environmental Program (UNC-CEP). The Principal Investigator and Project Manager for the RMC is Dr. Gail Tonnesen of UCR (tonnesen@cert.ucr.edu). Mr. Ralph Morris (rmorris@environcorp.com) and Mr. Zac Adelman (zac@unc.edu) lead the RMC efforts at ENVIRON and UNC-CEP, respectively. The RMC is the contractor for meteorological, emissions, and air quality modeling and analysis performed for the WRAP region's states and tribes to provide the analytical results needed to address the requirements of the EPA Regional Haze Rule.

Current responsibilities of the RMC include:

- Emissions processing and modeling
- Air quality and visibility modeling simulations
- Analysis, display, and reporting of modeling results
- Storage and quality assurance of the modeling input and output files

The tasks and deliverables discussed in this report are based on the WRAP RMC 2005-06 work plan, which is available on the WRAP RMC web site:

<http://pah.cert.ucr.edu/aqm/308/docs.shtml>

The tasks are linked to and based on the WRAP Strategic Plan and the WRAP 2005 Work Plan, found at:

http://wrapair.org/WRAP/meetings/031014board/Tab_4_Strategic_Plan_Final.pdf

http://wrapair.org/WRAP/documents/041207WRAP_CY05_Final_Workplan.pdf

The WRAP Technical Coordinator (Tom Moore) and the cochairs of the WRAP Modeling Forum (John Vimont of the National Park Service, Mary Uhl of the New Mexico Environment Department, and Kevin Briggs of the Colorado Department of Public Health and Environment) provide day-to-day oversight of RMC activities, and the Modeling Forum oversees the activities of the RMC through monthly conference calls, topical conference calls, and periodic in-person meetings and workshops.

The WRAP is one of five Regional Planning Organizations (RPOs) consisting of states, tribes, federal and local agencies, and stakeholders charged with the responsibility for conducting technical analyses and assisting in the development of State Implementation Plans (SIPs) and Tribal Implementation Plans (TIPs) for regional haze in different areas of the United States.

Overview of WRAP RMC 2005-06 Work Effort

The WRAP RMC 2005-06 work effort is focused on the following activities (please refer to the 2005-06 work plan for background information):

- 1) Finalize the 2002 base case input data and the selection of models to be used for future-year 2018 modeling.
- 2) Implement final performance metrics, displays, and methods to project future-year model results.
- 3) Complete and analyze a 2018 base case modeling scenario.
- 4) Complete and analyze several emissions reduction and emissions sensitivity scenarios.
- 5) Perform additional source apportionment model simulations.
- 6) Complete the visibility modeling effort for Alaska.

The overall objective of the 2005-06 work plan is to complete all modeling studies and documentation needed for development of §308 SIPs and TIPs for regional haze. The WRAP visibility modeling system comprises the Sparse Matrix Operator Kernel Emissions (SMOKE) emissions model, the Fifth-Generation Mesoscale Model (MM5) meteorological model, and the Community Multiscale Air Quality (CMAQ) model. The WRAP modeling domain consists of a continental U.S. 36-km domain and a western U.S. 12-km domain. The WRAP RMC modeling efforts also include analysis of specific topics to support the other WRAP forums. The RMC's 2005-06 work effort as laid out in the work plan is divided into 12 tasks, listed below. Note that Task 3 is not covered in this report because it was essentially completed by the end of project year 2004.

- Task 1: Project Administration, Major Project Reports, and Computer Hardware and Systems Administration
- Task 2: Emissions Modeling, Processing, and Analysis
- Task 3: Test, Improve, Quality Control, Obtain External Peer Review, and Finalize 36-km and 12-km MM5 Simulations for Eventual Use in CMAQ (*completed in project year 2004*)
- Task 4: Air Quality Model Evaluation for 2002 Annual Simulation
- Task 5: Testing and Further Improvements to the Windblown Dust Emissions Modeling Methodology
- Task 6: BART Source Sensitivity Screening Using CALPUFF
- Task 7: Sensitivity Studies Designed to Evaluate Uncertainties in Fire Emissions

- Task 8: Preliminary Meteorological, Emissions, and Air Quality Modeling Activities for Alaska
- Task 9: Further Analysis of Model Performance in Regard to the Contribution of Natural Emissions to Visibility Impairment
- Task 10: Preparation and Reporting of Geographic Source Apportionment Results
- Task 11: Technology Transfer
- Task 12: Computer Hardware

Highlights for the March 2006 Reporting Period

- *Task 1—Project Administration, Major Project Reports, and Computer Hardware and Systems Administration:* As in February, much of this month's project management work was related to defining the 2006 work plan and budgets for the RMC. Numerous conference calls and iterations of the work plan and budgets occurred.
- *Task 2—Emissions Modeling, Processing, and Analysis:* We completed the data collection, modeling, and QA for the Base 2002 version B simulation (Base02b). We prepared the Base02b data for input to CMAQ and for a test simulation of CAMx with PSAT. We also began the BART source selection process and the preparation of worksheets that the states will use to confirm the selection of the BART-eligible sources.
- *Task 4—Air Quality Model Evaluation for 2002 Annual Simulation:* We completed the CMAQ 36-km Base 2002 version B simulation, which will be used in the final model performance evaluation (MPE). The MPE will be completed in April.
- *Task 5—Testing and Further Improvements to the Windblown Dust Emissions Modeling Methodology:* No work was performed during March. We are awaiting air quality modeling results with and without the windblown dust emissions in order to complete the final task report.
- *Task 6—BART Source Sensitivity Screening Using CALPUFF:* The RMC's role in assisting the States with their BART CALPUFF modeling was defined in March. We began processing the 2001, 2002, and 2003 MM5 data for CALPUFF modeling and four subdomains in the western U.S. Currently, we expect to perform the BART CALPUFF modeling for AK, NM, NV, SD, UT, and possibly AZ.
- *Task 8—Preliminary Meteorological, Emissions, and Air Quality Modeling Activities for Alaska:* We answered questions on the Alaska 2002 MM5 database processed for CALMET/CALPUFF from the Alaska DEQ.
- *Task 10—Preparation and Reporting of Geographic Source Apportionment Results:* We finalized plans for emissions source categories and source region groupings to be used in the

CAMx/PSAT simulation. The initial simulation will be performed with the 2002 Planning Case version B emissions, and will begin in April.

- *Task 11—Technology Transfer:* We responded to several questions and requests from WRAP members.
- *Task 12—Computer Hardware:* We conducted routine maintenance of computer systems.

March 2006 RMC Status Report

Below we discuss our progress during this monthly reporting period (March 2006) and expected activities during the next reporting period (April 2006). We also describe any difficulties encountered and their resolutions.

Task 1: Project Administration, Major Project Reports, and Computer Hardware and Systems Administration

Purpose:

Within Task 1, the project administration subtask includes deliverables tracking and display, coordination with modeling efforts supported by other RPOs, attending meetings, participating in conference calls, and general project management. The major project reports subtask covers preparation of four reports: the 2004 final report, the 2002 model performance report, the 2018 base case modeling report, and the RMC 2005-06 project final report. The computer hardware and systems administration subtask includes maintenance, updates, expansion, and optimization of the computing systems (software and hardware updates, maintenance of the project web site and listservs, and data backups and archiving).

Progress During This Reporting Period:

Project Administration:

UCR, ENVIRON, and UNC-CEP participated in monthly project administration and WRAP Modeling Forum conference calls. Each contractor also contributed to the monthly progress report and prepared invoices. We participated in numerous conference calls with the WRAP Modeling Forum to revise the RMC work plan and budget for 2006.

Major Project Reports:

None.

Expected Progress During the Next Reporting Period:

We will finalize the 2006 RMC work plan and budget in early April.

Difficulties Encountered and Resolutions:

None.

Task 2: Emissions Modeling, Processing, and Analysis

Purpose:

To develop final emissions inventories for the 2002 model performance evaluation case, a typical 2002 case, a 2018 base case, and several 2018 emissions control strategy cases.

Progress During This Reporting Period:

Technical Activities:

Our primary focus in March was to complete the modeling and QA of the Base 2002 version B simulation (Base02b). The corrections and updates that we included in Base02b encompassed many of the changes that we made to complete the typical 2002 version A simulation (Plan02a). The data and modeling updates that we made for Base02b included corrections to the temporal profiles for EGU sources outside of the WRAP region, and revisions to the Gulf of Mexico area-source offshore inventory. We included the stationary area, dust, on-road and nonroad mobile, commercial marine, offshore point, oil and gas, and foreign inventories from Plan02a, and the NH₃, biogenics, and fires data from Base02a to complete the Base02b dataset.

We also continued to devise an approach for completing a series of revised Base 2002, Planning 2002, and Base 2018 annual simulations, along with a group of emissions sensitivities, through the end of the project period. In addition, we began to select sources in the WRAP 2002 inventories that are eligible for control under the BART rule. We will identify all of the sources from the 2002 inventory that are BART-eligible and generate worksheets that we will distribute to the WRAP states and tribes to review. Based on the review results, we will include the BART sources in sensitivity simulations to assess their effects on the air quality modeling results.

Preparation of the 2002 Model Performance Report, 2018 Base Case Modeling Report, and 2005-06 Project Report:

We documented the changes to simulation Base02b relative to the Base02a and Plan02a simulations. We will include the documentation of these changes in the 2005-06 final project report. We also continued to compile a list of the changes that will be implemented in the Planning 2002 version B (Plan02b) and Base 2018 version B (Base18b) simulations relative to the initial versions of these simulations.

Expected Progress During the Next Reporting Period:

In April, we plan to begin version B of the Planning 2002 simulation. We will also complete work on the BART source selection and distribute the state and tribal worksheets to finalize those sources that we include in our BART sensitivity modeling.

Difficulties Encountered and Resolutions:

During March we discovered a group of emissions issues that we will address in future modeling. These issues include:

- Incorrect PM_{2.5} speciation profile for non-Federal rangeland fires. The RMC mistakenly applied the default PM_{2.5} speciation profile to this source. The result is that all of the emissions from non-Federal rangeland fires are speciated to a generic fine particulate (PMFINE) when they should instead go to a split between primary organic aerosol and

elemental carbon. As these emissions account for less than 1% of the total PM_{2.5} emissions in the WRAP region, we have decided to accept this error to conserve the resources that it would take to reprocess these data.

- Erroneous projection information for heavy duty diesel vehicles in MOBILE6 causes PM emissions to be overstated by these sources in projection years beyond 2007. We are still discussing how to address this issue.
- There are inconsistencies in the way that we applied transport factors for fugitive dust between the Plan02a and Base2018a inventories. We will correct these errors in version B of these simulations.

Task 4: Air Quality Model Evaluation for 2002 Annual Simulation

Purpose:

To complete the 2002 base-year air quality modeling performed with CMAQ and CAMx, 2000-2004 typical-year modeling, 2018 base case modeling, and a series of 2018 control strategy modeling runs. Also, to perform model bug fixes, model version updates, and sensitivity experiments.

Progress During This Reporting Period:

Technical Activities:

We completed the 2002 CMAQ 36-km Base version B simulation that will be used in the final model performance evaluation (MPE). We discovered a small error in the emissions processing for non-Federal rangeland fires that affected the chemical speciation of fire emissions. This resulted in about 0.8% of primary PM emissions being speciated as PMFINE instead of as a mixture of primary organic aerosol and small amounts of other PM species. We concluded that this error was small enough that it did not require redoing the model simulations.

In March EPA released CMAQ version 4.5.1, which includes mostly minor updates to CMAQ 4.5. The most significant change is the inclusion of a beta release of an updated CB-IV chemical mechanism, named CB-2005. We reviewed the release notes and concluded that there are no significant changes in the new release that would affect our current modeling activities, and we recommend completing the Section 308 modeling using CMAQ version 4.5. We also began a series of test simulations to investigate the effect on CMAQ results of using different numbers of CPUs in the simulations.

We completed a CMAQ sensitivity simulation in which windblown dust results were removed from the emissions, and are evaluating these results. Finally, we have created model simulation specification sheets for several planned model simulations. These “spec” sheets will be posted to the web page and will be used to summarize the objectives, input data, and results of each model simulation.

Preparation of the 2002 Model Performance Report, 2018 Base Case Modeling Report, and 2005-06 Project Report:

None.

Expected Progress During the Next Reporting Period:

In April, we will complete the MPE, as well as the series of test simulations to investigate the effect on CMAQ results of using different numbers of CPUs in the simulations. We will also finish evaluating the results from the CMAQ sensitivity simulation in which windblown dust results were removed from the emissions.

Difficulties Encountered and Resolutions:

None.

Task 5: Testing and Further Improvements to the Windblown Dust Emissions Modeling Methodology

Purpose:

To implement further improvements to the windblown dust emissions modeling methodology, and to test the effect of alternative schemes in CMAQ. (This is an optional task that is a follow-on to the 2004 task covering the same topic, and will be implemented only if we are directed to do so by the WRAP Dust Emissions Joint Forum.)

Progress During This Reporting Period:

Technical Activities:

No work was performed on this task. We are awaiting results from the CMAQ model with and without the windblown dust emissions in order to complete the analysis and the final task report.

Preparation of the 2002 Model Performance Report and 2005-06 Project Report:

None.

Expected Progress During the Next Reporting Period:

The windblown dust emissions model task report will be revised to discuss the updates to the model. CMAQ modeling runs and analyses will be performed using the new dust estimates. We will implement the new results and address the comments on the revised draft task report. Improvements to the methodologies will be incorporated as appropriate. This work will be performed by May 2006.

Difficulties Encountered and Resolutions:

None.

Task 6: BART Source Sensitivity Screening Using CALPUFF

Purpose:

To assist States in addressing the modeling requirements of the Best Available Retrofit Technology (BART) component of the Regional Haze Rule (RHR).

Progress During This Reporting Period:

Technical Activities:

It was determined that the role of the WRAP RMC in support of the States' BART CALPUFF modeling will be as follows:

- Process 2001, 2002, and 2003 36-km MM5 data for four subdomains in the western U.S. that can be used for CALMET/CALPUFF modeling of BART sources in AZ, MT, NM, NV, SD, and UT.
- Prepare a modeling protocol for the WRAP RMC BART CALPUFF modeling (we will use the Colorado BART CALPUFF modeling protocol as a starting point).
- Perform BART CALPUFF modeling for AK, NM, NV, SD, UT, and possibly AZ.

During March 2006 we finalized the MM5 window domains and began processing the MM5 data for CALPUFF modeling.

Preparation of the 2002 Model Performance Report, 2018 Base Case Modeling Report, and 2005-06 Project Report:

None.

Expected Progress During the Next Reporting Period:

We will continue processing of 2001, 2002, and 2003 36-km MM5 data for CALPUFF modeling. We will also prepare the WRAP RMC BART CALPUFF modeling protocol. Elements to be included are:

- 2001, 2002, and 2003 36-km MM5 data;
- 4-km grid resolution; and
- Running CALMET with the NOOBS option for selected States.

In addition, we will continue developing CALMET databases for 2001, 2002, and 2003 and four western states under study.

Difficulties Encountered and Resolutions:

None.

Task 7: Sensitivity Studies Designed to Evaluate Uncertainties in Fire Emissions

Purpose:

To perform additional modeling studies to evaluate sensitivity to uncertainty in the fire emissions inventory. Major uncertainties include the effect of the plume rise height for fire emissions, and the effects of small fires in or near Class I areas.

Progress During This Reporting Period:

Technical Activities:

In our previous comparisons of the default Fire Emissions Joint Forum (FEJF) plume rise profiles versus the Clear Skies plume rise formula based on heat flux, we identified substantial differences in the fire plume rise for these two different approaches. However, because the Clear Skies approach requires the operation of an MS Windows-based program, the Fire Emissions Production Simulator (FEPS), it is not possible to implement this approach on a routine basis in CMAQ simulations. In conversation with colleagues and with EPA, we learned that EPA is developing software to implement the Clear Skies plume rise algorithm more generally; however, we have not yet determined whether to pursue this approach.

Preparation of the 2002 Model Performance Report and 2005-06 Project Report:
None.

Expected Progress During the Next Reporting Period:

We will prepare a report describing the fire sensitivity simulations. In addition, after the initial comparison of the two plume rise algorithms, we will choose 5-6 other fire events to process and input to CMAQ for a sensitivity analysis assessing how each plume rise approach affects CMAQ predictions.

Difficulties Encountered and Resolutions:

None.

Task 8. Preliminary Meteorological, Emissions, and Air Quality Modeling Activities for Alaska

Purpose (exact purpose is TBD):

To model point and urban sources in Alaska using a 2002 modeling database based on the MM5, CALMET, and CALPUFF models.

Progress During This Reporting Period:

Technical Activities:

Previously we submitted a report on Alaska 2002 MM5 meteorological modeling. During February, we transferred the 2002 MM5 data in a CALMET-ready format to the Alaska DEQ, at their request. During March we answered questions from the Alaska DEQ on the 2002 CALMET/CALPUFF database provided to them.

Expected Progress During the Next Reporting Period:

We will continue preparing the Alaska CALPUFF modeling report.

Difficulties Encountered and Resolutions:

None.

Task 9. Further Analysis of Model Performance in Regard to the Contribution of Natural Emissions to Visibility Impairment

Purpose:

To identify the CMAQ “floor” (i.e., the minimum level to which visibility impairment could be reduced by controlling all anthropogenic emissions), and determine whether the base model runs are too “clean.”

Progress During This Reporting Period:

Technical Activities:

We performed no new work on this task during March.

Preparation of the 2002 Model Performance Report and 2005-06 Project Report:

None.

Expected Progress During the Next Reporting Period:

We will re-create the natural emissions simulation during the next two months, further refining the definition of natural emissions sources. We plan on re-creating the windblown dust emissions to differentiate between the natural and anthropogenic components of these data. There is also discussion on whether we should use the typical fire inventories or continue to use the actual 2002 data.

Difficulties Encountered and Resolutions:

None.

Task 10. Preparation and Reporting of Geographic Source Apportionment Results

Purpose:

To perform additional source apportionment simulations using either the CMAQ Tagged Species Source Apportionment (TSSA) or CAMx PM Source Apportionment Technology (PSAT) models, with the choice to be made based on further evaluation of both models.

Progress During This Reporting Period:

Technical Activities:

We finalized plans for emissions source categories and source region groupings to be used in the CAMx/PSAT simulation. The initial simulation will be performed with the 2002 Planning Case version B emissions.

Preparation of the 2002 Model Performance Report, 2018 Base Case Modeling Report, and 2005-06 Project Report:

None.

Expected Progress During the Next Reporting Period:

In April we will create the needed emissions files and begin the source apportionment model simulations. It could take several months to complete emissions processing and CAMx/PSAT modeling.

Difficulties Encountered and Resolutions:

None.

Task 11: Technology Transfer

Purpose:

To transfer the models, model evaluation tools, and data sets to the states and tribes so that they can perform additional studies of emissions reduction strategies, including supporting these groups in model setup and operation.

Progress During This Reporting Period:

Technical Activities:

We replied to several requests for data and information about the visibility modeling.

Preparation of information on the availability of data and tools, to be included in the 2002 Model Performance Report, 2018 Base Case Modeling Report, and 2005-06 Project Report:
None.

Expected Progress During the Next Reporting Period:

We will perform routine updates to the web site, as needed.

Difficulties Encountered and Resolutions:

None.

Task 12: Computer Hardware

Purpose:

To acquire new/additional equipment to support the RMC's work on the above tasks.

Progress During This Reporting Period:

We conducted routine maintenance and repair of computers and data storage systems.

Expected Progress During the Next Reporting Period:

None.

Difficulties Encountered and Resolutions:

None.