



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

**Monthly Progress Report
for July 2005**

Prepared by

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Introduction

This is the July 2005 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 July 2005 Reporting Period

- *Task 1—Project Administration, Major Project Reports, and Computer Hardware and Systems Administration:* On July 19-20, 2005, RMC staff participated in the kick-off meeting for the WRAP Technical Support System (TSS) held in Ft. Collins, CO, in conjunction with an Attribution of Haze Workgroup meeting.
- *Task 2—Emissions Modeling, Processing, and Analysis:* We continued the data collection and quality control process for the inventories to be used in the first iteration of the Base 2002 annual simulation. We had several conference calls to discuss the emissions modeling work plan, and continued work on modeling the 2002 inventories that we already have on hand. This month we completed modeling the commercial marine shipping sector; the WRAP, VISTAS, and Canadian fire sectors; and the non-WRAP on-road mobile-source sector. We began processing the stationary-point-source and stationary-area-source emissions sectors. In preparation for modeling the revised Canadian inventories, we created new spatial surrogates using improved Canadian Shapefiles. We also opened a discussion with ENVIRON and ERG on the approach for modeling oil and gas emissions and tribal inventories.
- *Task 4—Air Quality Model Evaluation for 2002 Annual Simulation:* No new model simulations will be completed until the Final 2002 version A emissions are completed in August. We are continuing to explore alternative approaches to completing the model evaluation, including unpaired-in-time and unpaired-in-space comparisons.
- *Task 6—BART Source Sensitivity Screening Using CALPUFF:* Previously we developed a preliminary design of the CALPUFF modeling approach to address the requirements of the BART provisions of the Regional Haze Rule. This task is now focused on developing a BART CALPUFF modeling protocol by mid-August.
- *Task 7—Sensitivity Studies Designed to Evaluate Uncertainties in Fire Emissions:* We are waiting for the new emissions to be processed before we begin the fire sensitivity simulations.
- *Task 8—Preliminary Meteorological, Emissions, and Air Quality Modeling Activities for Alaska:* We continued writing the Alaska MM5 modeling report and performing the Alaska

CALPUFF modeling. Preliminary modeling identified problems with the emissions that were corrected. The revised results are now being analyzed.

- *Task 11—Technology Transfer:* We are preparing technology transfer documents to be posted to the web site.
- *Task 12—Computer Hardware:* As of July 31, we were still attempting to install and configure the two new RAID5 disk systems.

July 2005 RMC Status Report

Below we discuss our progress during this monthly reporting period (July 2005) and expected activities during the next reporting period (August 2005). 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 July monthly progress report and prepared invoices. We finalized the subcontract modifications this month. On July 19-20, RMC staff attended the Attribution of Haze Workgroup and Technical Support System (TSS) kick-off meeting in Fort Collins, CO.

Major Project Reports:

Work continued on the 2004 RMC project final report.

Computer Hardware and Systems Administration:

Hardware activities are discussed under Task 12. In July, we made changes in the duct system and air handlers in our computer server room that have significantly improved the cooling system efficiency.

Expected Progress During the Next Reporting Period:

We will conduct the August Modeling Forum and project management calls, prepare the August progress report, and finish the 2004 RMC project final report.

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 July was to continue the collection, modeling, and QA of the data for the first iteration of the Base 2002 annual simulation (Base02a). We completed modeling the following emission sectors: non-WRAP on-road mobile-sources; WRAP, VISTAS, and Canadian fires; and commercial marine shipping. We began processing the stationary-point-source and stationary-area-source emissions sectors for the Base 2002 emissions simulation. Delays in delivering the WRAP inventories to the RMC voided the Base02a inventory lockdown date of July 15 and left the schedule ambiguous. As we are waiting to receive the WRAP on-road mobile-source inventory, parts of the nonroad mobile-source inventory, the WRAP stationary-area-source and stationary-point-source inventories, and several CENRAP inventories, we are unable to project when the final CMAQ-ready files for Base02a will be completed. The RMC also decided that because the revised Mexico emissions inventories are not close to being ready, we would fall back to using the BRAVO 1999 Mexican inventory for the Base02a simulation.

We continued to improve the ancillary emissions files used for modeling the new inventories. Scrutiny of the spatial allocation data used for the Canadian emissions sources revealed serious shortcomings in these data. As an example, there were no land-area-based Canadian surrogates (e.g., rural/urban land, forested land). We added the following surrogate categories to improve how we allocate the Canadian emissions to the model grid:

- Land Area
- Water Area
- Forest Area
- Agriculture Area
- Urban Land Area
- Rural Land Area
- Airports
- Ports
- Roads
- Rail

We also added several state-specific temporal profiles provided by various RPOs to the Base02a modeling configuration.

We are on the seventh iteration of the emissions modeling work plan that lays out our approach for emissions modeling through August 2006. We've added a new emissions sector to the work

plan—oil and gas well emissions—in anticipation of a new inventory that is being prepared by ENVIRON. In July the RMC, ENVIRON, and ERG had two conference calls to discuss the approaches for modeling these emissions and the form in which the data would be delivered. We also received word in July that the Mexican government authorized release of their new inventories, reviving the collaboration between ERG and the RMC to prepare these data for modeling. Finally, the RMC agreed to model the proprietary Canadian 2000 stationary-point-source inventory on the Unified RPO 36-km model grid and distribute the model-ready emissions to EPA.

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

We generated two additional versions of the 2005-06 emissions modeling work plan that explicitly define the various emissions simulations and their accompanying datasets. As we finalize this work plan for the Base 2002 simulation, we will make it available to the WRAP Modeling Forum via the RMC web site. We also began quality assurance on the model-ready emissions for the non-WRAP portions of the modeling domain for which we already have emissions inventories. The products of this QA work will be added to the 2002 model performance report.

Expected Progress During the Next Reporting Period:

We plan to continue modeling and QA work for the emissions sectors that are available for the Base02a simulation. The time frame for the final delivery of all of the inventory components of the Base02a simulation is not clear. As these new inventories arrive, we will model and QA them in preparation for combining them with the other inventories for the Base 2002 simulation.

Difficulties Encountered and Resolutions:

After learning that we would not be receiving the final WRAP stationary-area-source and stationary-point-source inventories until late July, we had to push the inventory lockdown date back to August 1. As of the writing of this report we have still not received these data. Our progress on completing the Base 2002 simulation is limited by the availability of the emissions inventories. We still do not have inventories for the following regions and sectors:

- WRAP stationary area
- WRAP anthropogenic dust
- WRAP, CENRAP, MRPO road dust
- WRAP CENRAP, MRPO aircraft, locomotive, shipping
- WRAP on-road mobile
- WRAP stationary point

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:

None.

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 further investigate the unpaired-in-space and unpaired-in-time approaches for model evaluation.

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:

Comments on the draft final task report were addressed. We continued analyzing results from running the CMAQ model both with and without the latest dust emission estimates. Model performance evaluations of the CMAQ results were conducted. A number of graphical displays of emission estimates and modeling results and analyses were revised for 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 and finalized with the latest emissions estimates, CMAQ modeling runs and analyses, and numerous revisions to presentation graphics. We will address the comments on the revised draft task report. Improvements to the methodologies will be incorporated as appropriate.

Difficulties Encountered and Resolutions:

None.

Task 6: BART Source Sensitivity Screening Using CALPUFF

Purpose:

To perform CALMET/CALPUFF modeling to address the Best Available Retrofit Technology (BART) modeling requirements in the final EPA BART Rule.

Progress During This Reporting Period:

Technical Activities:

Previously we developed a preliminary technical plan for performing CALPUFF modeling to address the BART requirements of the Regional Haze Rule. On June 15, EPA released the BART guidance. The content of this guidance did not require any substantial changes to the preliminary technical plan. Discussions with the States have indicated that the States will likely have various levels of involvement in and varied needs for the WRAP CALPUFF modeling. The States wish to see the plans for the WRAP BART CALPUFF modeling, so a modeling protocol will be developed for delivery in mid-August.

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 prepare the modeling protocol for BART modeling using CALPUFF.

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:

None.

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

None.

Expected Progress During the Next Reporting Period:

We will process the fire emissions for the small-fire (i.e., less than 100 acres) sensitivity simulation and to select cases for the plume rise sensitivity.

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:

Based on direction given at the April 26-27, 2005, joint meeting of the Tribal Data Development Workgroup and the Emissions Forum on WRAP issues related to Alaska, we began finalizing the Alaska 2002 MM5 modeling report. We also continued with the Alaska CALMET/CALPUFF modeling. Given below is the status of each action item identified during the June 29 conference call described in the previous monthly report:

- Finish Alaska MM5 meteorological modeling report: This report will be finished in early August.
- Finish Alaska CALPUFF modeling and write report, including chapter on potential Weight of Evidence (WOE) analysis that Alaska can use to project reasonable visibility progress for the visibility SIP: QA of the preliminary CALPUFF modeling identified errors in the emissions. These were corrected and the modeling was revised. The revised results are currently being analyzed.
- Contact Cathy Cahill at University of Alaska Fairbanks on what analysis they have been doing studying arctic haze: An e-mail was sent to Cathy Cahill in mid-July. No response has been received yet.
- Analyze WRAP fire emissions for Alaska and see whether they can be integrated into CALPUFF modeling: Work on the Alaska fire emissions was not started because they are being revised.

Preparation of 2005-06 Project Report (inclusion of this task in 2002 Model Performance Report and 2018 Base Case Modeling Report is TBD):

None.

Expected Progress During the Next Reporting Period:

We will finish the Alaska 2002 MM5 modeling report and preliminary CALPUFF runs for 2002.

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:

None.

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

None.

Expected Progress During the Next Reporting Period:

In the next two months we anticipate creating a test simulation of a prototype sea salt and surf zone emissions model for adding marine emissions to the WRAP modeling, and beginning development of a prototype model for lightning NO_x emissions estimates. We will also review the natural emissions modeling results from the Section 309 modeling that was completed in 2003.

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:

None.

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 compile and test CAMx PSAT on the WRAP 36-km modeling domain.

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 continued preparation of technology transfer documents for posting to the web site.

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 post an initial version of the FAQ list on technology transfer on the RMC web site.

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:

In May we ordered two new RAID5 data storage systems and an additional thirty-two 400-GB disk drives for archiving project data. We received these in mid-June and began archiving old project data to disk drives. We spent about six weeks attempting to configure and optimize the new disk systems. On July 31 we found a problem related to the bus speed. If we used our newer dual-CPU Opteron systems as a file server we were able to configure the RAID5 server. We still have less usable disk space in the RAID than we expected, but we are going ahead with the system as is since we urgently need the space now for processing the 2002 emissions inventory. We are also archiving data and moving data from older RAID5 disk systems so that we can install an updated OS on our older file servers. This involves a lot data management effort.

Expected Progress During the Next Reporting Period:

We will continue to work on configuring and optimizing the new RAID5 systems and on archiving and reorganizing data on the existing RAID5 disk systems.

Difficulties Encountered and Resolutions:

None.