TSD-1i

A Modeling Protocol for the OTC SIP Quality Modeling System for Assessment of the Ozone National Ambient Air Quality Standard in the Ozone Transport Region

December 31, 2006

The Modeling Committee of the
Ozone Transport Commission

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1 STUDY DESIGN

1.1 Background

Moderate non-attainment areas in the Ozone Transport Region (OTR) are required to attain the 8-hour ozone NAAQS by 2010. Modeled or monitored attainment is based on the summer ozone season preceding 2010, so the target year for attainment modeling is 2009 for moderate non-attainment areas. The Ozone Transport Commission (OTC) has embarked on the task of preparing a State Implementation Plan (SIP) ozone modeling system for exercising photochemical grid model(s) to assess the impact of candidate ozone control strategies in moderate and serious non-attainment areas in the OTR. The OTC Directors endorsed the Modeling Protocol for the OTC SIP Quality Modeling System For Assessment of the Ozone National Ambient Air Quality Standard in the Ozone Transport Region at the November 12-13, 2003 Fall meeting of the OTC. The subject protocol has been modified since then to incorporate CMAQ model modifications and emission inventory improvements.

This modeling protocol outlines procedures to prepare and use the OTC SIP ozone modeling system to help design an ozone attainment strategy to attain the ozone 8-hour NAAQS in the OTR. Emission inventories for point, area, on–road and off-road sources of NO_x, VOC and CO will be developed for a base year of 2002. BEIS3 will be used to estimate biogenic emissions. MM5 will be used at a 12 km grid resolution and, in the photochemical grid model, 4 km grid cells will be nested in urban areas where appropriate. A model performance evaluation will be prepared for 2002. If model performance is satisfactory, emission input files reflecting candidate control strategy scenarios for 2009 will be prepared, and 2009 ozone levels will be simulated with the modeling system. OTC States with moderate and serious non-attainment areas will then use these modeling results to help support required ozone attainment demonstrations. However, it has become apparent that modeling at a higher resolution than 12 km is not possible without improvements in the modeling system in terms of the physical and chemical formulation as well as the need for development of emissions estimates at spatial resolutions higher than county-level estimates.

1.2 Objective

The New York Department of Environmental Conservation has agreed to be the lead agency for developing a SIP quality ozone modeling system for assessing the future year attainment of the ozone 8-hour NAAQS in the OTR. The CMAQ model will be used to evaluate the effectiveness of control strategies in the OTR Modeling Domain. The regulatory objective will be to design an ozone control strategy that will result in attainment of the 8-hour ozone NAAQS in moderate non-attainment areas by 2009.

1.3 Photochemical Modeling System

The OTC Modeling Committee in its prior work exercised both CMAQ and CAMx and noticed that even though these models had performed similarly in estimating ozone on an over-all basis, the level of agreement between the simulated and measured concentrations varied from good to bad depending on the model and depending upon the simulation day. So, as part of this protocol, both models (which continue to be updated by their developers) will be applied for an episode that occurred in 2002. However, it was soon recognized that there was a need for application of a *one-atmosphere* modeling system that would provide estimates of both ozone and particulate matter and that the same base year emissions and meteorological data would be utilized in the development of appropriate SIPs. This together with USEPA's launching of the CMAS center that provides a venue for sharing information from other modelers led the OTC modeling committee to select the CMAQ model for application in its SIP Quality Ozone Modeling System for testing the effectiveness of proposed control strategies in the OTR.

The OTC Modeling Committee also examined the performances of two emissions processors (EMS2001 and SMOKE, both using CB4 chemistry) from prior work and concluded that there are differences between them that could be minimized by forcing the models to use a common speciation and surrogate database. Since CMAQ was the air quality model of choice, given that it handled inputs from SMOKE more readily than it did from the EMS2001 processor, the SMOKE emission processor was selected for constructing emission files for the SIP Quality Ozone Modeling System for the OTR Domain.

1.4 Deliverables

The key deliverables for the SIP quality ozone modeling system for the OTR are listed below.

- Select Ozone Episodes
- Prepare Meteorological Fields
- Prepare 2002 Emission Inventories for each OTC State
- Acquire 2002 Emission Inventories for non-OTC States in the OTR Domain
- Prepare 2002 Emission Input Files for the OTR Domain
- Complete 2002 Model Performance Evaluation for the OTR Domain
- Prepare 2009 CAA Emission Inventories for each OTC State
- Acquire 2009 CAA Emission Inventories for non-OTC States in the OTR Domain
- Prepare 2009 CAA Emission Input Files for the OTR Domain
- Complete Modeling Runs for 2009 CAA Scenarios
- Design Control Strategy for the OTR Modeling Domain.
- Prepare 2009 Emission Input Files for OTR Control Strategy
- Complete Modeling Runs for the OTR Control Strategy for 2009
- Complete Evaluation Report for 2009 Control Strategy

1.5 Schedule

The schedule for developing the SIP quality modeling system and the assessment of the ozone NAAQS in the Ozone Transport Region is provided in Appendix A. Because of delays encountered in developing, integrating and processing state-of-the-art emission inventories from Regional Planning Organizations in the MANE-VU modeling domain, schedule target dates have been moved back approximately 9 months (complete Modeling TSD report in March of 2007 instead of June of 2006).

2 MANAGEMENT STRUCTURE

2.1 OTR Oversight Committee (Appendix B)

OTC Air Directors will serve as the OTR Oversight Committee. The Air Directors will ensure that 2002 and 2009 CAA emission inventories are prepared for each OTC state in the OTR Modeling Domain, and will also be responsible for obtaining emission inventories for the non OTR States that are part of the OTR Modeling Domain. The Air Directors will oversee the design of ozone control strategies for the OTR, and will make the final decision on any funding needed to develop the OTC SIP Quality Modeling System. The Air Directors will review all OTC SIP Quality Modeling System documentation before it is released to interested parties. The state members of the OTC Modeling Committee will keep Air Directors informed of the development of the OTC SIP Quality Modeling System.

2.2 OTR Photochemical Modeling Workgroup (Appendix B)

OTR Photochemical Modeling Workgroup will be responsible for preparing the modeling assessment of the ozone NAAQS in the OTR. The Workgroup will be responsible for collecting and processing model input data, setting up all model input files, performing model runs, and interpreting and documenting the results of the modeling analyses for the OTR domain.
The Workgroup will prepare and submit all OTC SIP quality modeling system documentation to the OTC Air Directors.

2.3 OTR Meteorological Modeling Workgroup (Appendix B)

The OTR Meteorological Modeling Workgroup will be responsible for preparing and assessing MM5 meteorological fields for the OTR Modeling Domain. This Workgroup will also work with the OTR Photochemical Modeling Workgroup to prepare all meteorological input files for the OTC SIP quality modeling system.

2.4 OTR Emission Inventory Development Workgroup (Appendix B)

The OTR Emission Inventory Development Workgroup will be responsible for obtaining and developing guidance for preparing 2002 and 2009 state emission inventories for all states in the OTR. The OTC Air Directors will be responsible for obtaining emission inventories for non-OTR states in the OTR Modeling Domain. The Mid-Atlantic Regional Air Management Association (MARAMA) and the Mid-Atlantic /Northeast Visibility Union (MANE-VU) organizations will provide funding for contractors and work with OTR states to help prepare state-of-the-art 2002 emission files, 2009 CAA emission files and 2009 Control Strategy emission files for the OTR Modeling Domain.

2.5 OTR Control Strategy Development Workgroup (Appendix B)

The OTR Control Strategy Development Workgroup will be responsible for designing an ozone control strategy for the OTR Domain that will attain the ozone NAAQS by 2009 in moderate non-attainment areas and 2012 in serious non-attainment areas. The Workgroup will work with the

OTC stationary /area source committee and the OTC mobile source committee to design an effective ozone control strategy for the OTR domain.

3 OTR MODELING DOMAIN

3.1 Description

The OTR modeling domain (see Figure 1) follows the national grid adopted by the Regional Haze Regional Planning Organizations (RPOs), but with focus on the eastern U.S. The areal extent of the domain was selected such that the northeastern areas of Maine are inside the domain. Based upon the existing computer resources, the southern and western boundaries were limited to the region shown in Figure 1. At a horizontal grid resolution of 12 km, there are 172 grids in the east-west and 172 grids in north-south direction. Details of the modeling system setup can be found at ftp://ftp.dec.state.ny.us/dar/air_research/gsistla/otc-mm5-cmaq-grid-def.doc

3.2 Horizontal Grid Size

Following EPA and as noted above, a 12 km grid resolution will be used for the domain. A coarser mesh may not be appropriate for urban area applications. Modeling at a higher resolution than 12 km will not be performed at this time; to do would require improvements in the modeling system in terms of the physical and chemical formulation as well as the need for development of emissions at a higher spatial resolution than that for the currently available county-level estimates.

3.3 Number of Vertical Layers

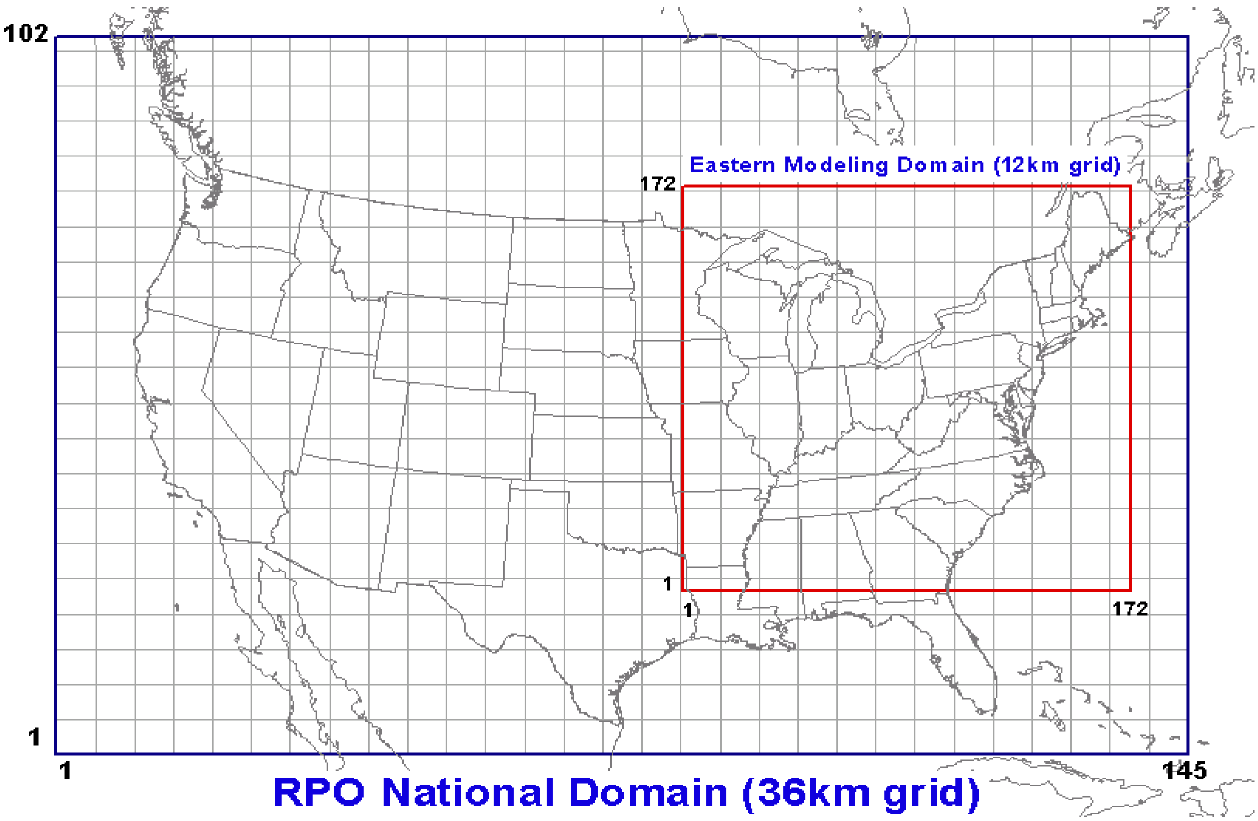
Similar to the horizontal grid spacing which is fixed by the default set forth in the design of the meteorological model, in this case 12 km, the definition of the vertical structure could also be adopted one-to-one based upon the meteorological model which has 29 layers. However, given the computational resources and runtime needs the number of vertical layers in the photochemical model was limited to 22, of which the lower 16 layers (approximately 3km) were set one-to-one with those of the meteorological model.

4 OZONE EPISODES

4.1 Episode Selection Criteria

Since it would be impractical to model every violation day, EPA has recommended targeting a select group of episode days for ozone attainment demonstrations. Such episode days should be (1) meteorologically representative of typical high ozone exceedance days in the domain, and (2) so severe that any control strategies predicted to attain the ozone NAAQS for that episode day would also result in attainment for all other exceedance days.

Figure 1: OTC Modeling Domain with areal extent of 12km and 36km grids



4.2 Proposed Episode Selection Procedure

While the above-suggested approach is perhaps feasible for isolated urban areas, such an approach may not be meaningful given the areal extent of concern and the modeling domain. Also, selection of episodes from different years would require the generation of the meteorological fields and emissions database, which would be an extremely difficult proposition given the modeling domain. The 2002 ozone season had a significant number of exceedance days (the spatial distribution of the daily 1-hr and 8-hr maxima over the eastern U. S. can be examined at the site ftp://ftp.state.ny.us/dar/air_research/htdocs/index.html). It was decided that the 5-month ozone season of 2002 would be simulated with the OTC SIP Quality Modeling System which will involve investigating numerous ozone episodes and would provide for better assessment of the simulated pollutant fields. The Environ report “Determination of Representativeness of 2002 Ozone Season for Ozone Transport Region SIP Modeling” demonstrated that 2002 episode days are (1) meteorologically representative of typical high ozone exceedance days in the domain, and (2) are probably so severe that control strategies predicted to attain the ozone NAAQS for those episode day would also result in attainment for all other exceedance days.

5 METEOROLOGICAL FIELDS

5.1 MM5 Meteorological Fields

The MM5 setup has been described by Zhang (2000) for generating meteorological fields based on a modified Blackadar scheme for the boundary layer. Since there are a variety of options that can be exercised in the application of MM5, initial testing was performed for a high ozone event of 2002 with the most commonly used default options as well as with modified boundary layer schemes (Zhang and Zheng 2004). A set of options was selected and used by Prof. Zhang of UMD in consultation with NYDEC Staff for running MM5 for the 2002 5-month ozone season.

5.2 Quality Assurance of Meteorological Fields

As a part of this effort, the simulated meteorological fields will be compared to data collected under CASTNET as well as with observations from the National Weather Service (NWS). Prior experience has shown that these approaches provide for an independent assessment of the simulated meteorological conditions. Also, data from any other special measurements will be sought and compared with the simulated fields. This analysis should provide a degree of confidence in the simulated meteorological fields and their use in photochemical grid modeling. This work will be coordinated through the meteorological model work group.

6 BASE CASE EMISSION INVENTORIES FOR 2002

6.1 2002 Base Case Emission Inventories for OTC states

Each state in the OTR Domain will prepare a 2002 base year emission Inventory that include VOC, NO_x, and CO for a typical ozone summer day. States are to follow EPA guidance documents for this base year inventory, which is due to EPA by June 1, 2004. Note this inventory may also qualify as the consolidated emissions regulatory report (CERR).

Emissions for all categories will be estimated for each county and state and the seasonal factors will facilitate spatial and temporal adjustments for modeling. Point and area source data will be submitted by individual states to EPA for uploading to EPA's National Emission Inventory (NEI) database using the required EPA format. MOBILE6.2 input files and VMT data will be submitted to NEI so that EPA can generate on-road mobile emissions for each state by county in a format that can be easily gridded and speciated. Similarly, off-road input files will be sent to EPA for running the latest NONROAD model.

It is anticipated that these state inventories will follow the EPA prescribed approach and should be formatted in a consistent manner. While this protocol deals with 8-hr ozone issues, the inventory would also contain the necessary information for exercising the particulate option of the photochemical model. This would be of help in those cases where the one-atmosphere option is to be exercised in the assessment. Biogenic emissions will be estimated with EPA's BEIS-3 emissions model.

6.2 2002 Base Case Emission Inventories for All Other States in the OTR Domain

A 2002 base year emission inventory that includes VOC, NO_x, and CO for a typical ozone summer day will be obtained for all non-OTC states in the OTR domain. It is anticipated that these inventories will be developed following EPA guidance, and will be formatted in a consistent manner.

7 BASE CASE EMISSION INPUT FILES FOR 2002

7.1 Preparation of 2002 Emission Input Files for the OTR Domain

Emissions data will be processed using SMOKE. The surrogate data files for the OTR grid have been previously developed by NY DEC and will be used in this study. For those pollutants that depend upon ambient temperature, MM5 layer-1 gridded temperature fields will be used.

7.2 Quality Assurance of 2002 Emission Input Files for the OTR Domain

The processing of the emissions data will include several quality checks before the data are exercised in the simulations. Prior experience has shown that considerable time and resources are often invested in developing the gridded emissions data. While there are many avenues to improve or correct the data, based upon consensus of the OTC Photochemical Modeling Workgroup, a definite closure of the emissions processing will be adhered to and any further changes or corrections will be archived and incorporated at a later date. In performing this work, close attention will be paid to the emissions within the OTR and, if necessary, corrections will be incorporated on the advice of the OTC Photochemical Modeling Workgroup.

Biogenic emissions will be prepared for each episode day using BEIS-3. The temperature data from MM5 layer-1 will be used along with cloud cover information obtained from MM5.

8 AIR QUALITY DATA

8.1 Initial Conditions

Prior experience has shown that a 3-day ramp-up period is sufficient to establish pollutant levels that are encountered in the beginning of the ozone episode. In this application clean conditions will be assumed for the 1st hour of the simulation along with the emissions and boundary conditions as described below. Since the application was to be in one-atmosphere mode using a common platform, it was determined that a longer ramp-up period of 15 days was needed because experiments indicated that some of the $PM_{2.5}$ species from the initial conditions (IC) were retained for ramp-up periods of 10 days or less. Thus the CMAQ model run will start on May 1, 2002; the first 15 days are assumed to be ramp-up days and will not used for performance evaluation purposes.

8.2 Boundary Conditions

In prior studies attempts were made to include any available information from ozonesondes and monitors that are near the western and northern boundaries of the modeling domain. For this study, similar attempts will be made to obtain pollutant data at the boundaries.

For boundary conditions, NY DEC will run CMAQ with the continental 36 km grid using GEOS-CHEM simulation data for 2002. The GEOS-CHEM information will be obtained by NESCAUM from Prof. Daniel Jacob's group of Harvard University. Hour by hour boundary conditions will then be extracted from the continental 36 km CMAQ run results and used for the OTR 12 km modeling domain.

8.3 Ambient Air Quality Data

Ambient air quality data will be extracted from the EPA AQS archive for ozone, CO, NO_x, and total and speciated hydrocarbons reported as part of the PAMS network. Also, data from CASTNET will be obtained. Since the OTR modeling domain extends over two time zones, while the model simulations are reflective of a single time zone, EST, there will be a need to ”correct” the clock and assemble the ambient air quality database. Any special measurements that are relevant to this study during the summer of 2002 will also be acquired, including upper air measurements.

9 DIAGNOSTIC ANALYSES

9.1 Quality Assurance Tests of Input Components

Before proceeding with modeling, all air quality, emissions, and meteorological data will be reviewed to ensure completeness, accuracy, and consistency. Any errors, missing data or inconsistencies will be addressed using appropriate methods that are consistent with standard practices.

9.2 Diagnostic Tests

Attempts will be made to perform diagnostic tests to ensure that the simulated ozone patterns are in agreement with observed patterns over the entire simulation period. While it is unrealistic to expect day-to-day agreement between the measured and predicted data, close attention will be paid to the changes in pattern of the measured ozone levels and the ability of the model to capture such changes.

10 MODEL PERFORMANCE EVALUATION

10.1 Performance Criteria

This is an area that will likely require dialog among member states. While there are many statistical tests that can be applied to predicted ozone concentrations, it is important to define a priori some of the conditions of the analysis and the targets of evaluation. Also, it is important to define the areal extent for which the assessment needs to be done to address the performance of the model. Statistical tests are to be applied to the precursor data as well, recognizing that all tests applied to the ozone data may or may not be valid.

As part of the model assessment, qualitative analysis will also be performed by comparing predicted and measured pollutant fields to establish if the spatial patterns are captured by the modeling system. This is a critical step, since the measured concentrations may fall into a neighboring grid cell (but not at the measured location itself) and may be found to be in good agreement.

Another area that is quite important is the predictive ability of the model with respect to height. Recognizing that the pollutants trapped above the mixed layer during the overnight hours would mix down during the daytime, comparison will be made between measurements and model predictions. Special attention will be paid to elevated monitoring stations, such as the television tower near Durham, North Carolina; the Sears Tower in Chicago, Illinois, and monitors located at elevated rural stations at Whiteface Mountain, NY.

10.2 Statistical Performance Measures

The recommended EPA procedures will be used to calculate the recommended performance measures. At a minimum, the following three statistical performance measures will be used to assess CAMx model performance for each episode.

- Unpaired highest-prediction accuracy

  This measure quantifies the difference between the highest observed eight-hour value in the domain and the highest predicted value in the domain. The acceptable performance range is plus or minus 15-20 percent.

- Normalized bias

  This measure indicates the degree to which simulated eight-hour values are over or under-predicted. The acceptable performance range is plus or minus 5-15 percent.

- Gross error of all pairs above 40 ppb

  This measure indicates the average discrepancy between predicted and observed values and provides an overall assessment of model performance. The acceptable performance range is 30-35 percent.

11 CAA EMISSION INVENTORIES FOR 2009

11.1 CAA Emission Inventories for OTR States for 2009

Each OTC state in the OTR Domain will prepare a 2009 CAA emission **i**nventory that is consistent with the regulations and rules adopted or expected to be in-place. The inventory will be developed consistent with EPA guidance. The states will develop the information on growth factors and controls used in the development of the inventory. Each state will submit a report on the development of these future year inventories.

Since the electric energy generation and use are highly inter-connected, coupled with the existing rules on trading and banking of pollutants, it is expected that an inventory consistent with this information would be developed for all electric energy generation units using models such as IPM**.**

Recognizing that any prediction of future emissions are subject to changes, the OTC Modeling Committee would develop a decision framework on obtaining these emissions to be consistent with the OTC SIP quality modeling system schedule (Appendix A).

11.2 CAA Emission Inventories for all non-OTR States for 2009

A 2009 CAA emission inventory that includes VOC, NO_x, and CO for a typical ozone summer day will be obtained for all non-OTC states in the OTR. It is anticipated that these inventories will be developed following EPA guidance, and will be formatted in a consistent manner.

12 CAA EMISSION INPUT FILES FOR 2009 FOR THE OTR DOMAIN

12.1 CAA Emission Input Files for OTR Domain for 2009

2009 CAA emissions data will be processed using SMOKE. For pollutants that depend on ambient temperature, MM5 layer-1 gridded temperature fields will be used to estimate hourly emission rates. The biogenic emission input files prepared for the base 2002 will be used as a surrogate for 2009 biogenic emissions. These emissions data will be processed using the quality assurance checks described in section 7.2.

It should be noted that the CAA means all on the books and on the way control measures (OTB/OTW) scheduled to be in effect by 2009.

13 OTR DOMAIN OZONE CONTROL STRATEGY

13.1 OTC CALGRID System Screening Runs

A series of CALGRID screening runs will be performed to investigate the level of emissions reductions needed both within and outside of the OTR. This will help identify potential emission reductions scenarios that can be used for CMAX future year SIP modeling runs.

13.2 OTC SIP Modeling Platform Runs

OTC SIP modeling platform CAA runs for 2009 will be reviewed to help determine the level of emissions reductions needed to attain the ozone NAAQS.   VOC and NOX sensitivity runs will also be performed to help identify potential emission reductions scenarios that can be used to lower ozone levels in the OTR.

13.3   Analysis of Available Air Quality and Emission Databases

A review of air quality and emission databases (for example, EPA Clear Skies and Transport Rule emission files) will be performed to help identify potential source sectors of ozone precursors. Analysis of available EPA modeling results will also be performed to help identify potential source sectors of ozone precursors in, and upwind, of the OTR domain.

13.4 Ozone Control Strategy for the OTR Domain

The OTR Control Strategy Development Team will review CALGRID results, other available databases**,** and EPA databases, to help identify potential control programs. The Team will work with OTR states and the OTC stationary, area and mobile source committees to design ozone control strategies for the OTR Domain with the goal of meeting regulatory target dates.

14 OZONE CONTROL STRATEGY EMISSION INPUT FILES

14.1 Ozone Control Strategy Emission Input Files for the OTR Domain for 2009

Emissions files for the selected ozone control strategy for the OTR Domain for 2009 will be prepared in a consistent manner as per schedule. If necessary, additional IPM simulations may be performed to obtain EGU emission estimates.

15 OZONE PREDICTIONS FOR 2009

15.1 Initial Conditions

The initial conditions at the startup will be “clean”. The OTR Modeling Team will use the 2002 initial condition files as a surrogate for initial conditions for 2009 modeling runs.

15.2 Boundary conditions

EPA will be consulted for guidance in estimating boundary conditions for 2009 or, under default, would utilize those adapted for the Base 2002 base year simulation. It should be noted that the default option was used for the 2009 CMAQ simulation.

15.3 CAA Ozone Predictions for 2009

The model will be run with the CAA emission files developed for 2009. Tile plots, difference plots, and model statistics will be prepared to help characterize the extent of any remaining non-attainment areas predicted in the OTR in 2009.

15.4 Ozone Control Strategy Predictions for 2009.

The model will be run with OTR control strategy emission files prepared for 2009. Tile plots, difference plots and model statistics will be prepared to help characterize the extent of any remaining non-attainment areas predicted in the OTR for the year 2009.

16 DOCUMENTATION

A report titled “Assessment of the Ozone National Ambient Air Quality Standards in the Ozone Transport Region will be prepared by the OTR Modeling Team”. The report would cover model performance evaluation, and an evaluation of the OTR control strategy runs for 2009. This technical document will be made available to all interested parties and will be used by the member States in their SIP submission documentation as needed.

17 REFERENCES

Environ (2006): Determination of Representativeness of 2002 Ozone Season for Ozone Transport Region SIP Modeling

Dalin Zhang (2000): Development of meteorological database for summer 1997 using MM5 at 12 km resolution in Photochemical Model Simulations

Dalin Zhang and William Zheng (2004): Diurnal cycles of surface winds and temperatures as simulated by five boundary-layer parameterizations, Journal of Appl. Meteorology 43, 157-169

Gopal Sistla (1999): Development of a surrogate database for use in Regional/Urban-scale Modeling at 4 km spatial resolution (see http://envpro.ncsc.org/emcenter/)

Wick Havens (2000): Development of an Emissions Inventory for Regional/Urban-scale Modeling, MARAMA-RTC (see http://www.marama.org/)

APPENDIX A

Workgroups for the Development and Application of the OTC SIP Quality Modeling System for Assessment of the Ozone National Ambient Air Quality Standard in the Ozone Transport Region

OTC Photochemical Modeling Workgroup

State Lead	Gopal Sistla
OTC contact	Tom Frankiewicz
Chair OTC Modeling Committee	Barbara Kwetz

Delaware	Mohammed Majeed
DC	Rama Tangirala
Maine	Tom Downs
Maryland	Mike Woodman
Massachusetts	Steve Dennis
New Hampshire	Jeff Underhill
New York	Gopal Sistla
Pennsylvania	Tim Leon Gurrero
NESCAUM	Gary Kleiman
EPA	Invited for selected discussions

OTC Meteorological Modeling Workgroup

State Lead	Mike Woodman
OTC contact	Tom Frankiewicz
Connecticut	Dave Wackter
Delaware	Mohammed Majeed
DC	Rama Tangirala
Maine	Tom Downs
Maryland	Tad Aburn Matt Seybold Mike Woodman Jeff Stehr
Massachusetts	Rich Fields
New Hampshire	Jeff Underhill
New Jersey	Alan Dresser
New York	Gopal Sistla
Pennsylvania	Tim Leon Gurrero
Vermont	Paul Wishinski
Virginia	Kirit Chaudhar
MARAMA	Serpil Kayin
NESCAUM	Gary Kleiman
EPA	Invited for selected discussions

OTC Emission Inventory Development Workgroup

State Lead	Ray Malenfant
OTC contact	Tom Frankiewicz
Connecticut	Bill Simpson
Delaware	Dave Fees
DC	Rama Tangirala
Maine	Dave Wright
Maryland	Roger Thgunell
Massachusetts	Ken Santlal
New Hampshire	Mike Fitzgerald Andy Bodnarik
New Jersey	Joan Held
New York	Jim Ralston
Pennsylvania	Dean Van Orden
Rhode Island	Karen Slattery
Vermont	Jeff Merrell
Virginia	Tom Ballou
MARAMA	Serpil Kayin
EPA	Invited for selected discussions

OTC/MANE-VU Control Strategies Workgroup

State Lead	Jeff Underhill
OTC contact	Tom Frankiewicz
Connecticut	Dave Wackter Kurt Kebschull
Delaware	Ray Malenfant Mohammed Majeed
Maine	Jeff Crawford Tom Downs
Maryland	Tad Aburn Matt Seybold Mike Woodman Jeff Stehr
Massachusetts	Eileen Hiney Steve Dennis
New Hampshire	Jeff Underhill Andy Bodnarik
New Jersey	Bob Stern Ray Papalski Alan Dresser Robert Huizer
New York	Gopal Sistla
Pennsylvania	Wick Havens Tim Leon Gurrero
Rhode Island	Barbara Morin
Vermont	Paul Wishinski
Virginia	Kirit Chaudhar
MARAMA	Serpil Kayin Megan Schuster
NESCAUM	Leah Weiss Gary Kleiman
EPA	Invited for selected discussions

APPENDIX B

Work Plan for the Development and Application of the OTC SIP Quality Modeling System.

Work plan for the Development and Application of the OTC SIP Quality Modeling System†

Task No.	Activity or Task	Initial Target Date	Organization(s) Performing Task	Remarks & Status Notes & Revisions
	Initial Planning			
1	Prepare a Work plan and a Modeling Protocol for the development of the OTC SIP quality modeling system to address ozone non-attainment problems in the OTR.	Nov 03	NY, MA	Completed
	Meteorology			
2 3 4	Complete MM5 modeling for 2002 (May thru Sep) Episode evaluation and assessment Evaluate MM5 data and process for photochemical models.	Dec 04 Dec 04 Mar 05	MD (UMCP), NY Contract Support MD (UMCP), NY	In progress In progress Inn progress
	Emissions Inventories			
5	Prepare 2002 emission inventories for MANEVU states in the OTR Domain.	Jan 05	MARAMA	
6	Obtain 2002 emission inventories for non-MANEVU states in the OTR Domain.	Jan 05	MARAMA	
7	Prepare 2009 CAA emission inventories for MANEVU states in the OTR Domain.	Aug 05	MARAMA	
8	Obtain 2009 CAA emission inventories for non-MANEVU states in the OTR Domain.	Aug 05	MARAMA	
	Emission Input files			
9	Prepare 2002 emission files for the OTR domain with SMOKE and /or EMS2001, and QA emissions data.	Nov 04	NY	Delayed until Jan 05
10	Prepare 2009 CAA emission files for the OTR domain with SMOKE and /or EMS2001, and QA emissions data.	Nov 05	NY	
11	Prepare 2009 emission files for OTR control strategy with SMOKE and /or EMS2001, and QA emissions data.	Nov 05	NY	

Task No.	Activity or Task	Initial Target Date	Organization(s) Performing Task	Remarks & Status Notes & Revisions
	Modeling			
12	Complete 2002 model performance evaluation for OTR Domain.	May 05	NY	
13	Test model sensitivity to NOx, VOC reductions and potential control measure options.	Sep 05	NY	
14	Complete modeling runs for 2009 CAA scenarios.	Jan 06	NY	
15	Complete modeling runs for 2009 OTR control strategy	Jan 06	NY	
	OTR Control Strategy Development			
16	Perform screening runs with OTC CALGRID modeling system	Mar 05	OTR Control Strategy Development Workgroup	
17	Review air quality and emission databases to help identify potential sources of ozone in the OTR.	Jul 05	OTR Control Strategy Development Workgroup	
18	Design Control Strategy for the OTR Domain	Sep 05	OTR Control Strategy Development Workgroup	
	Reports			
19	Complete technical support documents presenting regional OTR modeling and air quality/emission database analyses. (These two documents will provide technical support for state ozone SIPs.	Jun 06	NY, other OTC states	This will allow states nine months to prepare SIP revisions due in April 2007.
	Management			
20	Day-to-day management and coordination.	on-going	OTC Modeling Committee	
21	Provide direction, oversight, and obtain any necessary funding.	on-going	OTC Air Directors	

† To be used as needed for Ozone SIPs in the OTR. Based on EPA draft guidance, Ozone SIPs expected submission by April 2007.