Appendix G

Quality Assurance of the Emissions Inventories

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List of Acronyms

Acronym	Definition
CERR	Consolidated Emissions Reporting Rule
EIIP	Emission Inventory Improvement Program
NIF	National Emissions Inventory Input Format
QA	Quality Assurance
SCC	Source Classification Code
SIWG	Special Interest Workgroup
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
VISTAS	Visibility Improvement State & Tribal Association of the Southeast

1.0 Introduction

The attainment modeling for the Charlotte-Gastonia-Rock Hill, NC-SC 8-hour ozone nonattainment area (the Metrolina area) was performed in conjunction with the regional haze modeling being done by the Southeast Regional Planning Organization, Visibility Improvement State and Tribal Association of the Southeast (VISTAS) and the fine particulate matter (PM2.5) and ozone modeling being done by the Association of Southeastern Integrated Planning (ASIP). VISTAS and ASIP are run by the ten Southeast states (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia and West Virginia. Since the regional haze and PM2.5 modeling uses annual simulations and includes an intermediate year that is the attainment year required for the Metrolina nonattainment area, the North Carolina Division of Air Quality (NCDAQ) decided to use the this modeling for its attainment demonstration. The sections below discuss the quality assurance (QA) procedures used by NCDAQ and the VISTAS/ASIP emissions inventory contractors.

2.0 Quality Assurance Of Area And Nonroad Mobile Sources Emissions Inventories

Many emission estimation methods are based on AP-42 factors located on the U.S. Environmental Protection Agency (USEPA) website at http://www.epa.gov/ttn/chief/ap42/, factors given in the Procedures document, and factors given in the documents of the Emission Inventory Improvement Program (EIIP) website located at http://www.epa.gov/ttn/chief/eiip/. Sources of error would primarily be associated with multiplier values, data entry errors, and the accuracy of formulas.

For the portion of the base 2002 inventory developed by North Carolina, specific QA procedures were followed. Under the direction of the QA coordinator, emission sources whose contribution were either at the high or low end of the range of estimates were scrutinized more closely to ensure that the emission estimates were estimated correctly. In addition, the raw data used in the calculations were verified to make sure transference to the spreadsheets was accomplished accurately. Furthermore, the formulas used to calculate the emissions were reviewed and checked for correctness. Random independent checks of the calculations were also performed to ensure the accuracy of the inventory.

For the portion of the inventory developed by the VISTAS/ASIP contractor, MACTEC, specific QA procedures were followed. These procedures are outlined in the report entitled, *Documentation of the Base G 2002 Base Year, 2009, and 2018, Emission Inventories for VISTAS* prepared for VISTAS by MACTEC, Inc. (a copy of this report is attached to Appendix F).

Throughout the inventory development process, QA steps were performed to ensure that no double counting of emissions occurred, and to ensure that a full and complete inventory was developed for VISTAS/ASIP. QA was an important component to the inventory development process and MACTEC performed the following QA steps on the area source component of the 2002 and 2009 inventories:

1. All Consolidated Emissions Reporting Rule (CERR) and National Emissions Inventory (NEI) Input Format (NIF) format State supplied data submittals were run through the USEPA's Format and Content checking software.

2. Source Classification Code (SCC) level emission summaries were prepared and evaluated to ensure that emissions were consistent and that there were no missing sources.

3. Fields were either added or used within each NIF data table to track the sources of data for each emission record.

4. Data product summaries were provided to both the VISTAS Emission Inventory Technical Advisor and to Area Source and Fires Special Interest Workgroup (SIWG) representatives for review and comment. Changes based on these comments were implemented in the files.

5. Version numbering was used for all inventory files developed. The version numbering process used a decimal system to track major and minor changes. For example, a major change would result in a version going from 1.0 to 2.0. A minor change would cause a version number to go from 1.0 to 1.1. Minor changes resulting from largely editorial changes would result in a change from 1.00 to 1.01.

6. All final NIF files were checked using the USEPA's Format and Content checking software and summary information by State and pollutant were prepared comparing the current inventory to the previous version of the inventory.

In addition for the 2009 projection inventories, Tier comparisons (by pollutant) were developed between the 2002 base year inventory and the 2009 projection inventories. Also, total VISTAS/ASIP pollutant summaries were prepared to compare total emissions by pollutant between versions of the inventory.

For the fires inventory, data related to fuel loading and fuel consumption was reviewed and approved by the VISTAS Fire Special Interest Work Group (SIWG) to ensure that values used

for each type of fire and each individual fire were appropriate. Members of the VISTAS Fire SIWG included representatives from most State Divisions of Forestry (or equivalent) as well as U.S. Forest Service and National Park Service personnel.

3.0 Quality Assurance Of Point Source Emissions Inventory

3.1 Initial Data Evaluation

The VISTAS/ASIP contractor, MACTEC, conducted an initial review of the 2002 point source CERR data in accordance with the QA procedures specified in the (Quality Assurance Project Plan) QAPP for this project (a copy of the QAPP is attached to this Appendix). The following evaluations were completed to identify potential data quality issues associated with the CERR data:

- Compared the number of sites in the CERR submittal to the number of sites in the VISTAS/ASIP draft 2002 inventory; the number of sites in the CERR submittal was less than in the VISTAS/ASIP draft 2002 inventory, since the CERR data was limited to major sources, while the VISTAS/ASIP draft 2002 inventory contained data for both major and minor sources; verified with state and local contacts that minor sources not included in the CERR point source inventory were included in the CERR area source inventory.

- Checked for correct pollutant codes and corrected to make them NIF-compliant.

- Checked for types of particulate matter codes reported (i.e., PM-FIL, PM-CON, PM-PRI, PM_{10}-PRI, PM10-FIL, PM25-PRI, PM25-FIL); corrected codes with obvious errors (i.e., changed PMPRI to PM-PRI). (The PM augmentation process for filling in missing PM pollutants is discussed in Appendix F).

- Converted all emission values that were not in tons to tons to allow for preparation of emission summaries using consistent units.

- Checked start and end dates in the Emissions Period record (PE) and Emissions record (EM) tables to confirm consistency with the 2002 base year.

- Compared annual and daily emissions when daily emissions were reported; in some cases, the daily value was non-zero (but very small) but the annual value was zero. This was generally the result of rounding in a state or local agency's submittal.

- Compared ammonia emissions as reported in the CERR submittals and the 2002 Toxics Release Inventory; worked with state and local agencies to resolve any outstanding discrepancies.

- Compared sulfur dioxide (SO2) and nitrogen oxide (NOx) emissions for Electric Generating Units (EGUs) to the USEPA's Clean Air Markets Division continuous emission monitoring (CEM) database to identify any outstanding discrepancies. (A full discussion of the EGU emissions analysis is discussed in Appendix F)

- Prepared State-level emission summaries by pollutant for both the EGU and non-EGU sectors to allow state and local agencies to compare emissions as reported in the 1999 NEI Version 2, the VISTAS/ASIP draft 2002 inventory, and the CERR submittals.

- Prepared facility-level emission summaries by pollutant to allow state and local agencies to review facility level emissions for reasonableness and accuracy.

MACTEC communicated the results of these analyses through email/telephone exchanges with the state and local point source contacts as well as through Excel summary spreadsheets. The state and local agencies submitted corrections and updates as necessary to resolve any QA issues from these checks.

3.2 Follow up Review Performed by NCDAQ

The following QA checks were performed both together and separate for EGU and non-EGU point sources by the NCDAQ:

- Data product summaries and raw NIF 3.0 data files were examined.

- NIF files were examined to identify problems with latitude and longitude, as well as, stack parameters.

- County emissions totals were examined to assure the counties with the highest emissions were consistent with what was expected.

- PAVE plots were generated to check to ensure emissions where showing up in all counties in North Carolina. Scale was lowered to make sure no emissions were omitted.

- PAVE plots were animated over a 24-hr period to ensure diurnal changes in emissions were as they should be.

- PAVE plots were visually inspected to make sure emissions were highest/lowest in logical places.

- Errors detected in earlier model runs were rechecked with each successive model run to assure their correction was carried forward in subsequent runs.

- The Integrated Planning Model (IPM) parsed files were examined (i.e., Excel spreadsheets that provide unit-level results derived from the model plant projections obtained by the IPM) for accuracy.

- Facility level emission summaries for 2009 were examined for both the base case and CAIR case to ensure that emissions were consistent and that there were no missing sources.

- Emissions and controls for Duke Energy and Progress Energy were compared to their latest updated plans for complying with North Carolina's Clean Smokestack Act. (These plans varied substantially from the IPM results both in terms of current and future controls and timing of these controls. As a result, the NCDAQ replaced the IPM emission projections for 2009 with projections from the Duke Energy and Progress Energy compliance plans.

- Ensured that stack parameters were modified appropriately and where necessary at facilities where new controls are scheduled to be installed.

- Input files were examined to assure there were no double counted facilities (example would be if a facility was known by two different names and counted under each).

3.3 Emission Inventory QA Review

Throughout the inventory development process, QA steps were performed to ensure that double counting of emissions did not occur and to ensure that a full and complete inventory was developed for VISTAS/ASIP. QA was an important component to the inventory development process and MACTEC performed the following QA steps on the point source component of the VISTAS/ASIP revised 2002 base year inventory:

1. Facility level emission summaries were prepared and evaluated to ensure that emissions were consistent and that there were no missing sources.

2. State-level EGU and non-EGU comparisons (by pollutant) were developed between the 2002 base year inventory, the draft VISTAS 2002 inventory, and the 1999 NEI Version 2 inventory.

3. Data product summaries and raw NIF 3.0 data files were provided to the VISTAS Emission Inventory Technical Advisor and to the Point Source, EGU, and non-EGU Special Interest Work Group representatives for review and comment. Changes based on these comments were reviewed and approved by the state and local point source contact prior to implementing the changes in the files.

4. Version numbering was used for all inventory files developed. The version numbering process used a decimal system to track major and minor changes.

3.4 Eliminating Double Counting of EGU Units

The following procedures were used to avoid double counting of EGU emissions in the 2009 point source inventory. The 2002 VISTAS point source emission inventory contains both EGUs and non-EGUs. Since this file contains both EGUs and nonEGU point sources, and EGU emissions are projected using the IPM, it was necessary to split the 2002 point source file into two components. The first component contains those emission units accounted for in the IPM forecasts. The second component contains all other point sources not accounted for in IPM.

The VISTAS/ASIP contractor, Pechan, developed 2009 NIF files for EGUs from the IPM parsed files. All IPM matched units were initially removed from the 2009 point source inventory to create the non-EGU inventory (which was projected to 2009 using the non-EGU growth and control factors). This was done on a unit-by-unit basis based on a cross-reference table that matches IPM emission unit identifiers (ORISPL plant code and BLRID emission unit code) to VISTAS NIF emission unit identifiers (FIPSST state code, FIPSCNTY county code, State Plant ID, State Point ID). When there was a match between the IPM ORISPL/BLRID and the VISTAS emission unit ID, the unit was assigned to the EGU inventory; all other emission units were assigned to the non-EGU inventory.

If an emission unit was contained in the NIF files created by Pechan from the IPM output, the corresponding unit was removed from the initial 2009 point source inventory. The NIF 2009

EGU files from the IPM parsed files were then merged with the non-EGU 2009 files to create the base 2009 point source files.

Next, MACTEC prepared several ad-hoc QA queries to verify that there was no double-counting of emissions in the EGU and non-EGU inventories. MACTEC reviewed the IPM parsed files to identify EGUs accounted for in IPM. MACTEC compared this list of emission units to the non-EGU inventory derived from the VISTAS cross-reference table to verify that units accounted for in IPM were not double-counted in the non-EGU inventory. As a result of this comparison, MACTEC made a few adjustments in the cross-reference table to add emission units for four plants to ensure these units accounted for in IPM were moved to the EGU inventory.

MACTEC reviewed the non-EGU inventory to identify remaining emission units with a Standard Industrial Classification (SIC) code of "4911 Electrical Services" or Source Classification Code of "1-01-xxx-xx External Combustion Boiler, Electric Generation". MACTEC compared the list of sources meeting these selection criteria to the IPM parsed file to ensure that these units were not double-counted.

MACTEC asked state and local agencies to review the 2009 point source inventory to verify whether there was any double counting of EGU emissions.

3.5 EGU Quality Assurance steps

Quality assurance was an important component to the inventory development process and MACTEC performed the following QA steps on the EGU component of the VISTAS/ASIP revised 2009 EGU inventory:

1. Provided IPM parsed files (i.e., Excel spreadsheets that provide unit-level results derived from the model plant projections obtained by the IPM) to the VISTAS EGU SIWG for review and comment.

2. Provided facility level emission summaries for 2009 to the VISTAS EGU SIWG to ensure that emissions were consistent and that there were no missing sources.

3. Compared State-level emissions from the IPM parsed files with the post-processed NIF files to verify that the post-processed NIF files were consistent with the IPM parsed file results.

VISTAS/ASIP requested state and local contacts to review of these files. The NCDAQ completed a detailed review of the inventory prepared by the VISTAS/ASIP contractor. The NCDAQ submitted a number of corrections to the 2002 and 2009 point source emissions inventories and the VISTAS/ASIP contractor incorporated these changes into the final inventory.

4.0 Quality Assurance of On-Road Mobile Source Emissions Inventory

Quality Assurance is one of the most important steps in performing an air quality modeling study. Because emissions inventory development is tedious, time consuming and involves complex manipulation of many different types of large data sets, errors are frequently made and, if rigorous QA measures are not in place, these errors may remain undetected. For the on-road mobile source category, QA can be broken into two components: 1) input files/data, and 2) SMOKE outputs/summaries.

On-road mobile input data, such as speeds and vehicle miles traveled (VMT), was collected from the North Carolina Department of Transportation (NCDOT) and the Charlotte Department of Transportation (CDOT). The NCDAQ checked the speed information provided against previous sets of speeds for reasonableness. VMT and vehicle mix are additional data elements that are checked after they are formatted for SMOKE. This file is checked against the original source of the VMT and vehicle mix. Additionally, the following data elements are checked for accuracy in the input files prior to use in the modeling: pollutants, fuel Reid Vapor Pressure (RVP), inspection and maintenance program settings, anti-tampering program settings, calendar year, and evaluation month. All input files are printed and checked by hand against a "key" with the original source of the information. A person other than the one who generated the files always performs this QA step. If any discrepancies are found, they are marked on the hard copy and supplied back to the person who generated the input files for correction. Vehicle age distribution is another input referenced in the actual MOBILE6.2 input file. This file is checked against the original spreadsheet from which it is generated. Again, if any discrepancies are found, they are noted and returned to the person responsible for generating those files.

Upon completion of the modeling, VISTAS supplied the emissions output summary files to the NCDAQ. The modeling was an iterative process. To ensure the latest information was incorporated into the current modeling effort, the latest version of the county emissions were compared to previous draft versions of the county emissions. The NCDAQ also graphed each county per pollutant for both 2002 and 2009 to check for reasonableness. Last, the NCDAQ compared the input files VISTAS used for modeling against the mobile input parameters supplied by the NCDAQ to ensure the correct mobile input parameters were utilized in the modeling process.