

**FINAL REPORT**

**DEVELOPMENT OF THE  
DRAFT 2002 VISTAS EMISSION INVENTORY  
FOR REGIONAL HAZE MODELING**

**AREA SOURCE METHODOLOGY**

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- Appendix C — Emission Factors Used for Fire Emission Calculations

## **OVERVIEW**

Under contract with VISTAS, MACTEC was tasked to develop the 2002 base year inventory for both point and area source sectors. This document details the methods used to develop the area source component of the inventory.

Work to develop the area source inventory was performed using a stepwise process. The steps in this process were:

1. Receive area source data from State and local agencies within the VISTAS region.
2. Evaluate the data received by the State and local agencies to determine whether or not the data were usable and if so which pollutants and categories were covered by the submitted data. This included a quality assurance step performed to ensure that the submitted data contained all necessary information needed to develop 2002 emission estimates.
3. Prepare growth factors for projecting emissions from State/local supplied data.
4. Run the Carnegie Mellon University (CMU) ammonia model to produce ammonia emissions for large area source categories (livestock, fertilizers, etc.).
5. Obtain State specific animal populations to use to grow CMU model estimates to 2002.
6. Obtain data on wildfires, prescribed burns, agricultural burning and waste/land clearing burning activities from State and Federal fire officials. Data on acres burned, fuel loadings and emission factors were sought from these officials.
7. Quality assured the data submitted by fire officials for completeness and for location information.
8. Develop fire emission estimates.
9. Updated the National Emission Inventory Input Files (NIF) for the VISTAS States to include the updated emission data.

Once these steps were completed, the preliminary version of the inventory was provided to the State/local agencies for review.

Version 1 of the inventory was then submitted to the States for review and comment. Several changes were made to Version 1 of the inventory based on these reviews as well as the re-runs of the CMU model in order to update from version 3.0 to 3.1 and to update prescribed fires data for AL, FL, GA, MS, and SC, and to add wildfire data for FL that was inadvertently left out of version 1. Finally Version 2 of the VISTAS base year inventory was converted from NIF 2 to NIF 3. Minor corrections were made based on State comments to move the inventory to version 3.1 (version 3.1 fixed one minor error in version 3.0).

### **Submittal of State/Local/Tribal Agency Emissions Data**

VISTAS solicited emissions data from all State, local and Tribal air quality entities within the VISTAS region. The request specified that if these entities had 2002

emissions data to provide that, otherwise data from 1999, 2000 or 2001 were acceptable and that if possible the submittal format should be NIF version 2. The request also indicated that the default data that would be used should State, local or Tribal agencies not submit data would be the 1999 National Emission Inventory (NEI) version 2.

Data were submitted by almost all of the States in the VISTAS region as well as several local agencies. No Tribes submitted data directly. Data received for the initial version of the VISTAS area source emission inventory is summarized in Table 1.

The general procedure we used for updating data in the database is provided below. Most States only provided VOC, CO and NO<sub>x</sub> emissions however some states provided additional pollutants.

We generated all Version 1 data files in NIF version 2.0 format. Version 2 and 3 files were generated in NIF version 3.0 format. The information that follows describes the general procedure we used to process each individual file in the NIF format.

The emission process file (EP file type) was processed to add records for processes not found in the NEI version 2 (but submitted by the State in their submittal). Then corresponding records in each data set were matched and the State supplied data fields were updated. All new and changed records had the NAICS field marked with “SS” which stands for State Supplied. Generally, we preferred to use “blank” fields to mark State supplied records, however the Access version of the NIF version 2.0 (and version 3.0) format does not provide a blank field for the EP table. We found no entries in the NAICS field for any of the VISTAS states in the 1999 NEI version 2 file, thus we used this field for this table to mark changed or updated records.

For the control table (CE table), we appended new records that did not exist in the current NEI version 2 to ensure that SCCs and pollutants that didn’t exist in the NEI had corresponding records in the final file. We then updated matching records with the State supplied data and marked all new and updated records with “SS” in the blank field. Finally we performed a “widow” check to make sure that no widowed records existed after all the updates.

Similar operations were performed for the emissions period table (PE table). Non-matching records were appended to the current NEI version 2 table, then updates were made for matching records to update the data fields to the State supplied values. We then updated the blank field to SS on new and updated records to designate that they were supplied by the State. Finally we deleted orphan records.

Finally for the emissions table (EM table), each State was handled somewhat differently. When States had submitted only VOC, CO, and NO<sub>x</sub> records, we deleted all VOC, NO<sub>x</sub> and CO records. We treated the State supplied data as if it was a full and complete inventory for those pollutants. We then appended the State supplied data for VOC, CO and NO<sub>x</sub> to the emissions table. If a State supplied all pollutants, we completely replaced the EM table. For other States, more involved updates specific to those States were

performed. For those States that only submitted VOC, CO, and NO<sub>x</sub> data, we provided them with a list of missing SCCs found in their submittal and in the 1999 NEI version 2.0 so they could determine if the missing SCCs needed additional pollutants. Specific details on the processing of each of the sets of inventory data provided by State/local agencies are given below.

**TABLE 1**  
**SUMMARY OF STATE AND LOCAL AGENCY AREA SOURCE SUBMITTALS**

<b>State</b>	<b>Agency</b>	<b>Comments on Original Submittal</b>	<b>Year</b>	<b>Response to Initial QA/QC Checks</b>
AL	AL DEM	Sent 1999 NEI data, with some minor corrections.	1999	Data passed cleanly through EPA's QA/QC software, except for a few minor issues. AL DEM personnel provided corrections and responses to issues in the QA/QC report.
FL	FL DEP	Florida supplied area source emissions for several source categories including (for 1999) commercial fuel use, auto refinishing, dry cleaners, industrial coatings, industrial fuel use, agricultural pesticides, residential fuel use, solvent cleaning, (and for 2000) bakeries, asphalt batching, architectural coatings, consumer and commercial solvents, graphic arts, stage 1 and stage 2 controls, tank breathing loss, traffic markings, and transit losses.	1999 2000	The data were provided in spreadsheets and included activity data and annual and seasonal emissions. The format was not NIF format so it could not be QA/QC'ed using the EPA QA/QC tool.
FL	West Palm Beach	Supplied emission inventory information in a spreadsheet for 2001. The spreadsheet provided annual emissions only from point, area and mobile sources (including nonroad).	2001	The data provided was summarized in broad categories, not by source classification code (SCC). For example one of the categories was Residential Fuel Combustion but contained no information on emissions by type of fuel for the residential fuel combustion category. These data were not processed for use in the inventory

**TABLE 1 (cont.)**

<b>State</b>	<b>Agency</b>	<b>Comments on Original Submittal</b>	<b>Year</b>	<b>Response to Initial QA/QC Checks</b>
GA	GA DNR	Sent 1999 data for 13 counties in the Atlanta area (VOC, NOx, CO only). Indicated that the 1999 NEI should be used for other counties.	1999	Data passed cleanly through EPA's QA/QC software, with a few minor problems concerning field lengths of numeric values, throughput units and seasonal percentages. These were updated in concurrence with GA DNR personnel.
KY	KY DEP	Kentucky supplied data for 11 counties (Oldham, Bullitt, Boyd, Greenup, Fayette, Scott, Edmonson, Daviess, Hancock, Livingston, and Marshall).	1999 2000	They provided emissions for VOC, CO, and NOx, both annual and summer day emissions. The file format was ASCII NIF format. The data were a mixture of 1999 and 2000 emissions. The data were imported into Access and submitted to the EPA QA/QC tool. One minor problem with duplicate records was fixed by MACTEC with KY DEQ concurrence.
MS	MS DEQ	Mississippi sent an area source file in MS Access NIF format.	1999	The file sent included only records for fireplaces and woodstoves for CO, NOx, PM10-PRI, VOC and SO2.
NC	NC DENR	NC indicated that the current versions of the NEI (1999 version 2) was suitable for their submission without change.	1999	Used 1999 NEI version 2. Minor updates made to Mecklenburg County emissions in version 3.0 of the VISTAS inventory.
SC	SC DHEC	No data submitted	1999	Used 1999 NEI version 2.

**TABLE 1 (cont.)**

<b>State</b>	<b>Agency</b>	<b>Comments on Original Submittal</b>	<b>Year</b>	<b>Response to Initial QA/QC Checks</b>
TN	TN DEC	Tennessee provided annual NH <sub>3</sub> values for area sources for all counties. These values were supplied in an Excel format and were developed by the University of Tennessee. They recommended using the 1999 NEI version 2 for all other area sources. They also recommend that all emissions from livestock be maintained at current levels since levels over the last 20 years have remained essentially constant with the exception of hogs where activity levels have been declining. They also recommended that hog activity levels remain constant.	1999	TN supplied NH <sub>3</sub> values used for all matching categories. 1999 NEI version 2 used for all remaining inventory categories.
TN	Memphis-Shelby County	The Memphis and Shelby County Health Department sent area source emission inventory data in MS Access NIF format.	1999	EPA's QA/QC software identified a number of issues with the data submitted. MACTEC worked with Shelby County to resolve many of these issues but not all could be resolved.
VA	VA DEQ	Virginia submitted a MS Access database in NIF format that contained VOC, NO <sub>x</sub> , and CO emissions with both annual and ozone season emissions included.	1999	Data passed fairly cleanly through EPA's QA/QC software, except for a few out-of-range or other types of messages. One independent city set of records was found to no longer be a legitimate FIPS code, but emissions for that city were added to the corresponding county emissions.
WV	WV DEP	West Virginia initially provided only county fire statistics (both number of fires and acres burned) by county for 2000 and 2001 (both spring and fall). They later provided a NIF format file of records to delete from the 1999 NEI version 2 for WV.	1999	Records provided in NIF format for deletion processed. Records were marked for deletion and removed from NIF version 2.0 for WV

## Alabama

Alabama supplied a version of the 1999 NEI that had been updated for a couple of source categories. We processed the data through the QA/QC tool, found some minor problems which were corrected by Alabama DEM personnel and then their data were inserted into the database. Their data included all pollutants.

## Florida

Florida's submittal was in an Excel spreadsheet format and included emissions for separate years (1999 and 2000). The data were provided in spreadsheets and included activity data and annual and seasonal emissions. The format was not NIF format so it could not be QA/QC'ed using the EPA QA/QC tool. We then identified all SCCs provided by Florida that were not in the current NEI and determined whether or not those sources could be added to the inventory. In some cases, addition of those sources would have resulted in double counting of emissions so not all of the data could be used.

For 1999, the following data sources were added to the inventory:

2102011000 external fuel combustion, kerosene  
2401050000 sheet, strip and coil metal coating – added but data from NEI for 2401045000 was removed to avoid double counting  
2415030000 electronics coatings  
2415045000 manufacturing coatings  
2415065000 auto repair  
2420010000 dry cleaning added to replace 2420010055 and 2420010379 to avoid double counting

Data for 2461850000, agricultural pesticides was not added since the NEI already included 2461800000 all pesticides and no good method existed to ensure that double counting did not occur.

For the 2000 data, the following sources were added:

2401002000 architectural surface coating, solvent based added and 2401001000 architectural solvents all solvent types was removed to avoid double counting  
2401003000 architectural surface coating water based solvents added and 2401001000 all solvent types was removed to avoid double counting  
2460000000 consumer/commercial solvents all processes all solvent types was added and six separate SCCs in the NEI were removed to avoid double counting  
2461022000 asphalt paving emulsified  
2501060053 gasoline service stations stage 1 balanced submerged filling added with a control effectiveness of 95 percent and a rule effectiveness of 80 percent  
2501070051 diesel service stations stage 1 submerged filling added with a rule effectiveness of 80 percent for all counties except 061 and 103

- 2501070053 diesel service stations stage 1 balanced submerged filling added with rule effectiveness of 80 percent except for county 105
- 2501070201 underground storage tanks breathing and emptying – diesel added

Data for 2501070100 diesel service stations stage 2 records were not added since those emissions were covered in the on-road and non-road inventories. In addition, 2505030090 distillate tank trucks in transit were not added since they would have resulted in double counting.

In addition to these specific updates, all SCCs provided by Florida that were identical matches to NEI sources were updated to include the Florida supplied parameters (activity data, throughput, control efficiency, etc.).

### **Florida – West Palm Beach County**

West Palm Beach County submitted data for very broad sources that were insufficient to be utilized in producing emissions for use in the VISTAS inventory. Double counting would have resulted from the use of the spreadsheet provided by West Palm Beach County so the 1999 NEI was used in producing emission from West Palm Beach.

### **Georgia**

Georgia also only submitted VOC, CO and NO<sub>x</sub> for 13 counties in the Atlanta area in NIF format. Our examination of the original NIF file using the EPA QA/QC tool found some problems with seasonal throughputs not summing to 100 percent, some issues with the emission factor units in the EM table, and some numeric values that were too long for the fields. The seasonal throughputs were adjusted based on emails with GA DNR personnel. In all cases if an adjustment had to be made to make the final value sum to 100, the winter value was changed to cause the sum to reach 100. This was only necessary when the correction method instituted to update each seasonal value ended up rounding to a number one percent above or below 100.

Data for only the 13 counties submitted for VOC, CO and NO<sub>x</sub> were updated. All other GA data is reflective of the 1999 NEI version 2.

### **Kentucky**

Kentucky submitted data for 11 counties. The data received from Kentucky was in an ASCII NIF format and had a few problems when run through the EPA QA/QC tool. Duplicate records were found in the CE table for SCC 2275900101 for VOC and widowed records were found in the PE table for SCC 2660000000. Those problems were corrected and the data were resubmitted to the QA/QC program and no further problems were identified. One further modification was made to the EP table. Records identified as commercial aircraft refueling were converted to aircraft refueling in order to keep 1999 NEI records for PM and SO<sub>2</sub> after the corresponding VOC, CO and NO<sub>x</sub> records were deleted.

## Memphis - Shelby County Tennessee

Shelby County initially provided a NIF format Access database. When we submitted the file to EPA's QA/QC software it identified a number of issues with the data submitted. Shelby County provided an updated spreadsheet file several months later that corrected some but not all of the errors found in the first version. MACTEC worked with Shelby County to resolve many of these issues but not all could be resolved. The data that were processed included SCCs which matched the 1999 NEI version 2 and new SCCs not included in the 1999 NEI version 2. For those SCCs that matched, the relevant information and emissions were updated. The information detailed below describes how the SCCs that weren't in the 1999 NEI version 2 were handled.

- 2104008000 residential wood combustion total all wood stoves. These data were inserted into the inventory database and SCCs that would have resulted in double counting were removed. However, the original SCCs for this category for pollutants not submitted were maintained in the database.
- 2401050000 solvent utilization surface coating miscellaneous finished metal parts all solvents. These emissions were added to the database.
- 2401065000 solvent surface coating electronic parts all solvents. Emission were added to the database
- 2415000000 solvent degreasing all processes/all industries all solvents. These emissions were added to the data base and emissions from 18 separate SCCs found in the 1999 NEI were deleted to avoid double counting.
- 2420000000 solvent usage dry cleaning all processes all solvents. These emissions were added and three SCCs were removed from the 1999 NEI to avoid double counting
- 2461000000 solvents miscellaneous non-industrial commercial all processes all solvents was added and 2461800000 pesticides was removed from the 1999 NEI to avoid double counting
- 2465000000 solvents miscellaneous non-industrial consumer all products/processes all solvents was added and four SCCs from the 1999 NEI were removed to avoid double counting.
- 2501060000 storage and transport petroleum products gasoline service stations, total all gasoline/processes was added and SCCs from the 1999 NEI were removed to avoid double counting.
- 2505030000 storage and transport petroleum products trucks total all products was added and 2505030120 was deleted to avoid double counting
- 2610000000 waste disposal open burning all categories total was added and 2610000500, land clearing of debris was replaced to avoid double counting
- 2620000000 waste disposal landfills all total was added and 2620030000 landfills municipal total was removed from the 1999 NEI to avoid double counting
- 2630000000 waste disposal, waste water treatment, all total was added and 2630020000 publicly owned treatment works were removed with the exception of NH3 emissions

There were several records for PM that could not be added for Shelby County because the pollutant codes were unclear as to whether they were PM10 or PM2.5 or whether they were primary or filterable emissions. MACTEC requested verification from Shelby County several times but no information was received to reconcile these records prior to the deadline for delivering the draft emission inventory.

### **Mississippi**

Mississippi submitted NIF format records but the file sent included only records for fireplaces and woodstoves for CO, NO<sub>x</sub>, PM10-PRI, VOC and SO<sub>2</sub>. We deleted the records for the corresponding categories in the NEI and replaced them with the records from Mississippi. We added records for PM2.5-PRI which were set equal to the PM10-PRI values.

### **Virginia**

As indicated in Table 1, Virginia provided a NIF format file for CO, VOC, and NO<sub>x</sub>. In examining the file submitted we found that there were non-road mobile source records in the file. We deleted all records for SCCs that started with 22750 and 228. After that we processed each file type in the NIF format.

For the EP file, only seasonal throughputs, days per week, and weeks per year that were supplied by the State were updated. All other NEI field values were maintained.

In the CE file, Virginia had included the text “Must Code Each County” and “Individually for CE and Device type” in the blank and Control System Description fields. These appeared to be file instructions and had no bearing on the final inventory file so they were deleted.

### **West Virginia**

West Virginia only supplied records that should be deleted from the 1999 NEI version 2. MACTEC deleted those records so that the 1999 NEI version 2 for West Virginia only included records that West Virginia had reviewed for EPA.

## **GROWTH OF EMISSIONS TO 2002**

With the exception of NH<sub>3</sub> categories that were calculated using the CMU Ammonia model and for forest wildfires and prescribed burning, all other emissions were grown from the base year submitted to 2002. The growth factors were developed using the Economic Growth Analysis System (EGAS) version 4.0.

Three different sets of EGAS based growth factors were used to project the emissions to 2002. The first set was taken directly from EGAS. They represent growth factors for a particular State, County, and SCC. Values were determined for 1996, 1999, 2000, 2001, and 2002. EGAS growth factors are based on a 1996 base year so in order to determine a

growth factor for projecting from 1999 to 2002 you must take the ratio of the values for 2002/1999 in order to obtain the growth factor. We calculated all of the growth factors on the fly for two reasons. First we could simply calculate the growth factors from the raw EGAS growth factors while calculating the projected emissions rather than calculating actual values from the values generated from EGAS and then using those values. Second, some States provided 2000 emissions, thus similarly, the 2002/2000 ratio would provide the growth factor value. We used the year portion of the start date field to determine which ratio (2002/1999 or 2002/2000) should be used for the emission factor. Once the emissions were calculated, then the blank field was marked with either a G9 or a G0 to signify that the record was grown from 1999 or 2000 NEI data respectively. For State supplied data, the SS value in the blank field was modified to be either S9 or S0 to represent that the emissions were grown from 1999 or 2000 State-supplied data respectively.

In some cases, the State/County/SCC level growth factors weren't available for a particular State/County/SCC combination. In that case we developed a State-wide growth factor for each SCC. We then used those factors to perform the emission growth using the same ratio method. The State level growth factors were generated at the State/SCC level by taking the average of all county level growth factors for that State. In some cases, we still didn't have a growth factor for that State/SCC combination. After attempting to perform the growth with the State/County/SCC and the State/SCC growth factor files, we then used a VISTAS region file at the SCC level. That file was developed from the State/County/SCC level file by averaging the growth factor by SCC for all States in the VISTAS region. Again records were grown on the fly using the ratios of the growth factors and all records were marked as grown where applicable. If after these three attempts were made to grow the emissions no growth factor was available, the 1999 value was maintained (i.e., growth factor = 1).

We solicited additional information from the State/Local/Tribal agencies on control programs and changes in rule penetration and rule effectiveness for 2002 but no information was provided by these agencies for 2002. Thus no additional controls were assumed in growing emissions from 1999 (or 2000) to 2002.

There was one exception to the above approach and that was for Stage 2 refueling emissions. Emissions for Stage 2 refueling were developed by the VISTAS on-road/non-road emissions contractor and provided to MACTEC for inclusion in the emission inventory. This was done to ensure that the emissions for Stage 2 refueling were calculated consistently. As a consequence, any State submitted Stage 2 refueling emission estimates were removed from the inventory. Stage 1 estimates were left in.

### **NH3 EMISSIONS ESTIMATES**

Ammonia is a pollutant of particular interest to VISTAS in this inventory. We obtained a draft version of the Carnegie Mellon University (CMU) Ammonia Tool (version 3.0). That emission estimation software was used to develop emission estimates for Version 1 of the VISTAS inventory. Categories other than livestock were developed from the

CMU model and used directly in the emission inventory. As such those estimates may actually be representative of emission years other than 2002, but for the purposes of this inventory, they are treated as if they are 2002 emission estimates. The categories developed directly from the CMU model included:

Fertilizer Application	Anhydrous Ammonia
Fertilizer Application	Aqua Ammonia
Fertilizer Application	Nitrogen Solutions
Fertilizer Application	Urea
Fertilizer Application	Ammonium Nitrate
Fertilizer Application	Ammonium Sulfate
Fertilizer Application	Ammonium Thiosulfate
Fertilizer Application	N-P-K
Fertilizer Application	Calcium Ammonium Nitrate
Fertilizer Application	Potassium Nitrate
Fertilizer Application	Diammonium Phosphate
Fertilizer Application	Monoammonium Phosphate
Fertilizer Application	Liquid Ammonium Polyphosphate
Fertilizer Application	Miscellaneous Fertilizers
Goats Waste Emissions	Angora Goats
Goats Waste Emissions	Milk Goats
Cats	Total
Dogs	Total
Bears	Black Bears
Bears	Grizzly Bears
Elk	Total
Deer	Total
Human Perspiration	Total

In addition to these categories that were developed directly from the model using default inputs, we also developed projected emission estimates for the following categories:

Cattle and Calves Waste Emissions	Milk Cows
Cattle and Calves Waste Emissions	Beef Cows
Cattle and Calves Waste Emissions	Heifers and Heifer Calves
Cattle and Calves Waste Emissions	Steers, Steer Calves, Bulls, and Bull Calves
Hogs and Pigs Composite	Total
Poultry Waste Emissions	Pullet Chicks and Pullets less than 13 weeks old
Poultry Waste Emissions	Pullets 13 weeks old and older but less than 20 weeks old
Poultry Waste Emissions	Layers
Poultry Waste Emissions	Broilers
Poultry Waste Emissions	Ducks
Poultry Waste Emissions	Geese
Poultry Waste Emissions	Turkeys

Horses and Ponies Composite	Total
Sheep and Lambs Composite	Total

The default activity data used to develop emission estimates for these categories were taken from the 1997 Census of Agriculture. We investigated the potential availability of the 2002 Census of Agriculture (the Census of Agriculture, which is updated every five years, serves as the data source for activity data for both the CMU tool and the NEI), however data from the 2002 Census of Agriculture were not scheduled to be available until February 2004 (actual release was in May 2004). We did find that many States had State (and in a couple of cases) county level data for 2002 on their individual State agriculture department websites. As a consequence we decided to use State animal populations to project the emissions from 1997 to 2002. We decided to use State level data (rather than county level when available) for all animal types in order to keep the methodology consistent from State-to-State. Using this approach we were able to develop growth factors for each livestock category listed above with the exception of West Virginia. No State data for 2002 was found on their website, nor was it provided following email requests from the State department of agriculture personnel contact listed on their website. We kept growth factors for all livestock categories for West Virginia as one, so their values for these categories are the same as produced by the CMU model (using 1997 data).

In some cases, States had data for all of the subcategories (beef cows, milk cows, heifers and calves, etc.). In other cases, they only had total values (e.g., cattle). If the specific data were available for the category, then we calculated specific growth factors. If not then the more general category (cattle or pig or chicken) growth factor was used for all subcategories for that State. The values used to grow the livestock categories in each State for ammonia are provided in Appendix A.

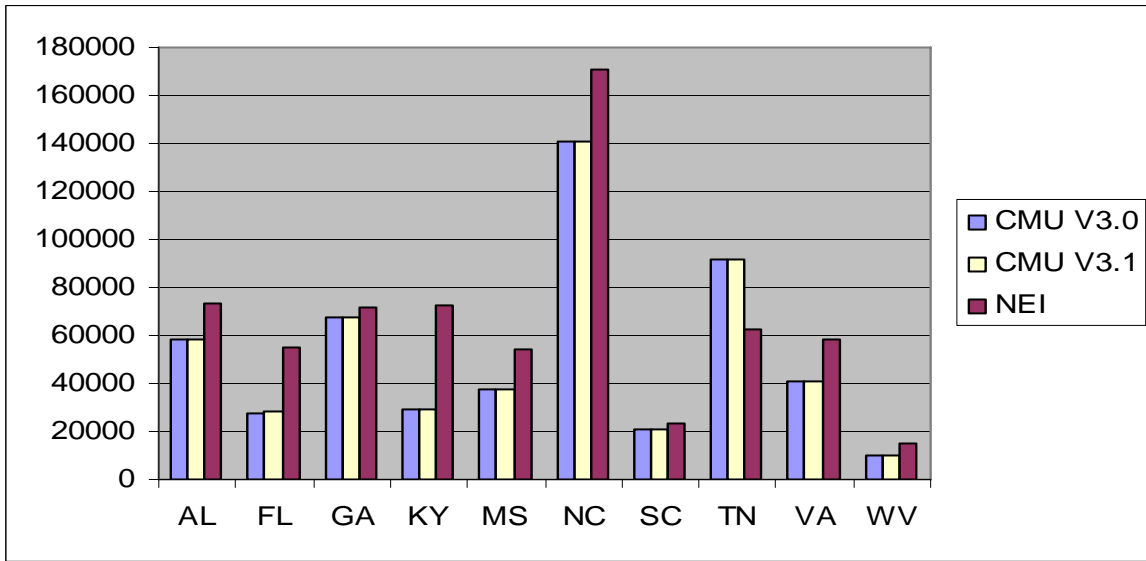
There was one exception to this approach. Tennessee had provided 1999 data by county and livestock type for the entire State. In their data submittal, Tennessee had also recommended that the 1999 data not be projected to 2002 since animal populations had been fairly constant since that time. Thus, we used their data as provided with the exception that we did not include their information for NH<sub>3</sub> from fires and we added the CMU model values for categories that they did not include (i.e., cats, dogs, bears, etc.). Figure 1 shows the difference between CMU and 1999 NEI version 2 ammonia emissions for livestock operations. Figure 2 shows the difference between fertilizer ammonia emissions from the CMU model and the 1999 NEI version 2.

In order to keep track of the database records that were developed using the CMU model, the blank fields of the NIF format tables were updated with “CMU” to indicate that the data were derived from the CMU model.

For Versions 2 and 3 of the VISTAS area source inventory, we developed updated values for NH<sub>3</sub> from version 3.1 of the CMU model. Changes resulting from use of version 3.1 of the CMU model only affected dairy cattle emissions. All other procedures used for the inventory development were identical to what is described above.

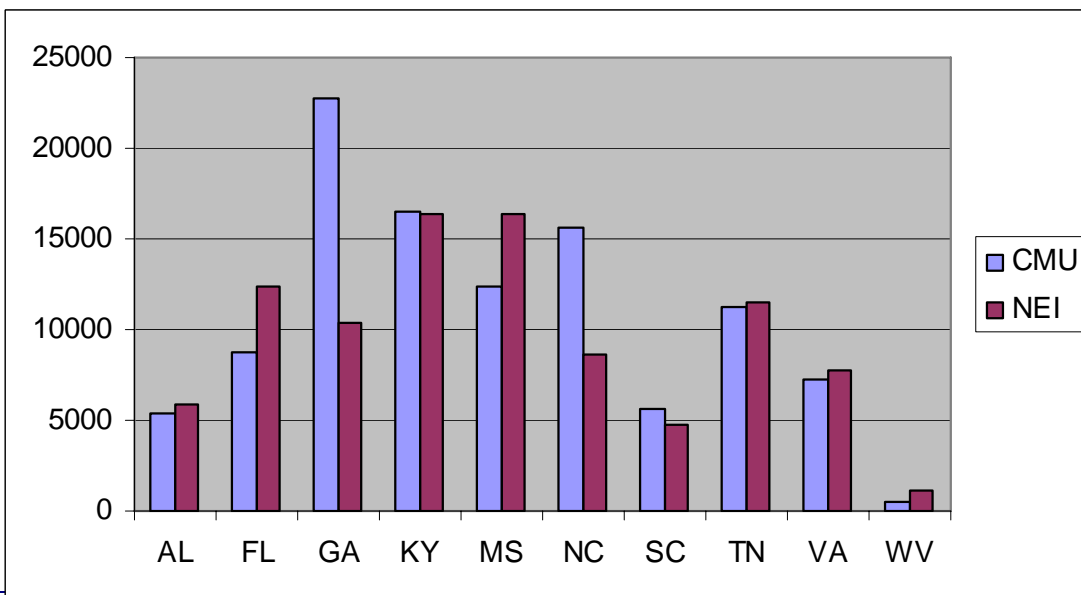
**FIGURE 1.**

**COMPARISON OF AMMONIA EMISSION ESTIMATES FOR LIVESTOCK CATEGORIES BY STATE BETWEEN THE CMU MODEL (VERSIONS 3.0 AND 3.1) AND 1999 NEI VERSION 2.**



**FIGURE 2.**

**COMPARISON OF AMMONIA EMISSION ESTIMATES FOR FERTILIZER USAGE BY STATE BETWEEN THE CMU MODEL AND 1999 NEI VERSION 2.**



## **FIRE EMISSION ESTIMATES**

### **Data Requested**

In early 2003, VISTAS requested that State forestry personnel provide information necessary to calculate fire emissions from wildfires, prescribed burning, agricultural fires and land clearing of debris. Specifically, VISTAS requested the following information:

#### **Wildfires:**

- Number of acres burned
- Date of fire – Actual days were preferred with information on the month that the fire occurred in being the minimum information provided
- Type of material burned (pine, oak, etc.)
- Fuel loading (tons/acre)
- Location of fire – Latitude/longitude information was preferred, but if not available, the minimum acceptable information was the county in which the fire was located. For fires that spanned counties, VISTAS requested a breakdown of the acres per county.

#### **Prescribed fires:**

- Number of acres burned
- Date of fire – Actual days were preferred with information on the month that the fire occurred in being the minimum information provided
- Type of material burned (short needle conifer, long needle conifer, logging slash debris, hardwood, palmetto, etc.)
- Fuel loading (tons/acre)
- Location of fire - Latitude/longitude information was preferred, but if not available, the minimum acceptable information was the county in which the fire was located. For fires that spanned counties, VISTAS requested a breakdown of the acres per county.

In addition for each of these fire types, VISTAS requested an estimate regarding the percentage of the fire that occurred in the flaming, smoldering and actual fire stages.

#### **Agricultural burning:**

- Number of acres burned
- Date of fire – Actual days were preferred with information on the month that the fire occurred in being the minimum information provided Type of material burned (crop type)
- Fuel loading (tons/acre)
- Location of fire - Latitude/longitude information was preferred, but if not available, the minimum acceptable information was the county in which the fire was located. For fires that spanned counties, VISTAS requested a breakdown of the acres per county.

### **Land clearing of debris:**

- Number of acres burned
- Date of fire – Actual days were preferred with information on the month that the fire occurred in being the minimum information provided Type of material burned (grass, wood debris, etc.)
- Fuel loading (tons/acre)
- Location of fire - Latitude/longitude information was preferred, but if not available, the minimum acceptable information was the county in which the fire was located. For fires that spanned counties, VISTAS requested a breakdown of the acres per county.

### **Data Supplied**

Data returned from the State forestry contacts varied by State both in the types of fire information returned (e.g., wildfires, prescribed, agricultural or land clearing) and in the detail provided. Some States provided information on each fire by latitude and longitude while others provided only the county location. In other cases very detailed information was provided on the fire date (including reported date, control date and fire out date, for example) while others only provided the month the fire occurred. For States that only provided the month the fire occurred we set the date to the first of the month. Some States provided fairly detailed information on the fuel type and loading while others provided no data at all on the fuel type (or loading). No States provided estimates on the smoldering or flaming stages of the fire. Finally most States provided information in electronic format; however several only provided hard copy. For those that provided hard copy data, we scanned the data and inserted it into spreadsheets. The spreadsheets were reviewed against the original materials to ensure that the data were translated correctly.

VISTAS also requested information from Federal agencies on fires on Federal lands. The following Federal agencies were requested to submit data:

- Forest Service;
- Fish and Wildlife Service;
- National Park Service;
- Bureau of Land Management; and
- Bureau of Indian Affairs.

Data for wildfires was provided by all Federal agencies. However, prescribed burning data were only provided by the U.S. Forest Service. No other Federal agencies provided prescribed burning data to VISTAS.

Tables 2 and 3 provide an overview of the data supplied by State and Federal agencies for fires for VISTAS.

**TABLE 2.**

**FIRES DATA PROVIDED BY STATE AGENCIES BY FIRE TYPE**

State	Agriculture	Prescribed	Silviculture	Land Clearing	Waste Burning	Wildfires
AL	✓	✓		✓		✓
FL	✓	✓	✓	✓		✓
GA	✓		✓	✓		✓
KY						✓
MS		✓				
NC						✓
SC	✓			✓	✓	✓
TN						✓
VA						✓
WV						✓

**TABLE 3.**

**FIRES DATA PROVIDED BY FEDERAL AGENCIES BY FIRE TYPE**

Agency	Agriculture	Prescribed	Silviculture	Land Clearing	Waste Burning	Wildfires
USFS		✓				✓
FWS						✓
NPS						✓
BLM						✓
BIA						✓

## Data Manipulation/Augmentation

Once all the data had been provided by the State and Federal agencies, MACTEC compiled the data into a master database containing common pieces of information necessary to identify the fire location and date as well as the data necessary to calculate emissions. That database was used to calculate fires on a fire-by-fire basis for all data submitted.

Prior to inserting data into the master database however, separate databases for each State and Federal submittal were developed. The first step in completing these databases was to ensure that sufficient location information was available so that the emissions could eventually be summed at the county level for the annual inventory.

For those data submittals that provided only latitude and longitude, we imported the data into a geographic information system (GIS) program and used the GIS program to add information on the State and county where the fire was located. In many cases this involved converting the data on latitude and longitude. Data on latitude and longitude were submitted in both degrees:minutes:seconds format as well as decimal degrees. All data were converted to decimal degrees. For some of these records, the data either 1) fell outside of the State that the submittal was for or 2) fell in the ocean. Fires that fell outside of the State, in the ocean, or in the wrong State were dropped. This resulted in less than three percent of the acreage submitted for any State being deleted. Some State agencies submitted section, township and range data, however converting these data to latitude/longitude was too labor intensive for the current scope of work so we simply used the county information provided to locate these fires.

For data submitted with only State and county information, we placed the fires at the county centroid location. For that work we used a file on the EPA website that listed the location of the county centroid in decimal degrees. All records where the location information was the county centroid were marked in the database.

Once the location information was completed for all data, we then proceeded to augment the fuel loading information in the database. The general approach used for augmenting fuel loading was as follows:

- State-supplied data – if provided, these values were always used
- National Fire Danger Rating System (NFDRS) Model value assigned fuel loading
- Material burned type (a NFDRS value was assigned if the material burned could be easily matched to a NFDRS fuel model)
- State specific defaults calculated where no material burned type was provided
- AP-42 values for fires other than wildfires or prescribed burns

Values for fuel loading were then assigned to each individual fire (either State or Federal) based on this priority scheme. If the State supplied a value for fuel loading (even if the value was for the whole State) that value was used for all fires of that type (e.g., wildfires, prescribed fires, etc.). Similarly, if the Federal agency supplied fuel loading

data for the fire, it was always used. Where no State or Federal value was provided but a NFDRS fire model designation was provided, the default value for that fire model designation was used for the fuel loading. If the data included the type of material burned and it could be matched with a similar material described by the vegetation type of a NFDRS fire model category, then the fuel loading for that NFDRS category was used. If the material could not be matched or was not provided, then an average State fuel loading based on a State-wide average of different NFDRS fuel models was used. Finally, for some fire types (e.g., agricultural burning or land clearing of debris), AP-42 fuel loadings were utilized. For those fire types, AP-42 was the primary source of fuel loading information unless information was provided by the State. In a few cases, we also used values from the 1999 NEI based on the NEI documentation.

The default values for the NFDRS fuel models were provided by Bruce Bayle, USFS. NFDRS classifies fuel models using an alphabetic system that describes the general type of material that is consumed in the fire. Table 4 shows the list of NFDRS fuel models and the vegetative types associated with each model.

**TABLE 4.**

**NFDRS FUEL MODEL DESIGNATIONS AND VEGETATION TYPES**

<b>NFDRS Fuel Model</b>	<b>Vegetation</b>
A	Annual grass and forbs
B	Mature chaparral
C	Open timber/grass
D	Southern rough
E	Hardwoods (winter)
F	Intermediate brush
G	Closed, short-needle conifer (heavy dead)
H	Closed, short-needle conifer (normal dead)
I	Heavy slash
J	Medium slash
K	Light slash
L	Perennial grass
N	Sawgrass
O	Pocosin
P	Southern plantation
Q	Alaskan black spruce
R	Hardwoods (summer)
S	Alaskan tundra
T	Sagebrush/grass
U	Western, long-needle conifer

The information provided by Bruce Bayle was in the form of fuel loadings, by size class of fuel, for each NFDRS fuel model. Data on the fuel size class were provided for one hour, 10 hour, 100 hour, and 1000 hour fuels. The one hour fuel designation means that the fuel is of a size that will burn in the first hour of the fire. Similar meanings can be assigned to the other size class categories. In addition, information was provided on live

woody and live herbaceous materials. Totaling the fuel loading for each size class (along with the live woody and herbaceous material) provided an overall average fuel loading for each NFDRS fuel model type. These values were summed to provide the fuel loadings for each fuel model.

The summation of these values was performed using a weighting scheme provided by Bruce Bayle. For each respective southern fuel model, we used the following percentages to calculate a typical tonnage per acre:

Include 100% of the 1 and 10 hour fuels (1h + 10h).

Include 50% of the 100 hour fuels (100h).

Include 10% of the 1,000 hour fuels (1,000h).

Include 40% of the "live woody" fuels.

Include 10% of the "live herbaceous" fuels.

The above percentages represent an average/typical wildfire and average/typical weather conditions/environmental factors in the southeast.

The values calculated using this weighting scheme were then compared to the default State fuel loadings from Table 4 of the report entitled "Data Needs and Availability for Wildland Fire Emission Inventories - Short-term Improvements to the Wildland Fire Component of the National Emissions Inventory" June 5, 2003, prepared under EPA Contract No. 68-D-02-064, Work Assignment No. I-08 for Tom Pace (known as the Pace Report). A spreadsheet was prepared with the summarized fuel loading values provided by Bruce Bayle along with those from the Pace Report. That spreadsheet was then reviewed by Bruce Bayle, Mark Clere (Fire Planning Specialist, National Forests in Florida, Tallahassee, FL), and Charlie Kerr (Fire Management Officer, Francis Marion & Sumter National Forests, Columbia, SC) to ensure that the data used were optimal for southeastern forests. Suggestions for modifying the values in the spreadsheet were made by the reviewers and implemented as the standard values for use with the different NFDRS fuel models. Appendix B contains a table with the initial values for each NFDRS fuel model calculated using the weighting scheme, the default EPA values from the Pace report and the final values used based on the review of both the initial calculated values and the Pace report defaults.

When the type of material burned wasn't known, default values had to be calculated. Table 3 of the Pace report provides a State-wide method for calculating fuel loadings based on the fraction of total state acreage in each NFDRS model. These fractions were used with the Bayle revised fuel loading values discussed above to calculate a State default value when the type of material burned could not be determined. For example in KY, 0.001 of State land is classified as NFDRS model C, 0.199 as L, 0.048 as P and 0.752 as R. This yields a State default for wildfires (where the fuel type was not specified) of 1.69. These values were used whenever there was insufficient information to assign an actual value based either on the NFDRS model or the type of vegetation (material) burned.

Once the fuel loading had been assigned to each fire, the remaining information necessary to calculate emissions was emission factors. Each fire was assigned a “fire model” designation for the purposes of assigning an emission factor to the fire. In the cases where the fires had designated NFDRS fire models already, the “fire model” designation was identical to the NFDRS letter designation. There were other designations that were assigned to other fire types (agricultural burning fires, etc.). In some cases the material burned type was used to assign the “fire model” emission factor assignment. Emission factors were assigned for all fire types.

The basis for the emission factors for many of these fires was Table 2 of the Pace report. The emission factors used differ from Table 2 of the Pace report slightly for a few of the “fire models”. This is because per note 3 for Table 2 in the Pace report, emission factors for fuel models other than NFDRS types A, B, C, F, and L should be augmented by 17% and 8.5% for wildfires and prescribed fires respectively. We did augment the values by those percentages.

The emission factors for each fuel model are provided in Appendix C.

Once all of the data required to calculate emissions were acquired or assigned, we then put all of the State data into the master database. The master database contains the following data fields:

StateFIPS	State FIPS code
CountyFIPS	County FIPS code
SCC	Source Classification Code
Date	Date of Fire
Acres	Number of Acres burned
Latitude	Latitude in decimal degrees
Longitude	Longitude in decimal degrees
LatLongIsCountyCent	True/False field indicating whether the latitude and longitude value is the county centroid – value is “True” if it is
FireType	Type of fire - prescribed and silviculture burning were both assigned the prescribed burning SCC, waste burning and land clearing of debris burning were both assigned the waste burning SCC
Material	Type of material burned if known
Fuel Loading	Fuel loading value in tons/acre
Default Fuel Loading	True/false field indicating if the fuel loading value is a default value – “True” if it is
Default Material	True/false field indicating if the material field value is a default value – “True” if it is
Fuel Loading Source	Source for the fuel loading value
Emission Factor Code	Code used to look up emission factor values in the emission factor table - NFDRS fuel model if available
Pollutant	Pollutant for emissions

Emissions	Emissions value in tons
Emission Factor	Emission factor in lbs/ton of material burned
Agency	Agency that submitted data
DataSource	Who supplied the data (State or Federal or other)
StateFederal	One character indicator field that indicates if the record is a State (S) or federal (F) data record.

The master database file contains the raw fire-by-fire information used to estimate most (but not all) emissions in all versions of the VISTAS area source inventory. Summing emissions for the individual fires in the master database will not provide the same annual values found in the inventory in all cases. This is because of the replacement scheme used to determine fire emissions for the annual inventory. Because Federal agencies did not all submit prescribed fire acreage, some values for prescribed fire emissions from the 1999 NEI Version 2 were maintained if that county had federal land in it. This was done to avoid double counting of emissions. Following publication of Version 1 of the VISTAS inventory, AL, FL, GA, MS and SC fire contacts indicated that the prescribed fire data submitted included Federal and State lands. For those States, the prescribed fire emission values in the master fire database match the NIF version. For those States that did not include Federal lands in their submittals, MACTEC obtained a GIS file that contained federal land information in it. We used that data to determine which counties contained federal lands. If the county contained federal lands, then the 1999 NEI version 2 prescribed fire emissions were maintained for that county in order to avoid double counting. Prior to producing Version 3.1 of the VISTAS inventory, three States (AL, FL, and SC) indicated that fuel loading values for prescribed fires were too high (original values were default values). Updated values for fuel loading for prescribed fires in those States were inserted in the database and prescribed fire emissions for those States were recalculated.

Similarly, one State (MS) did not submit wildfire information. For that State, the data in the master fire database file will not match the annual emission inventory values. For MS, the 1999 NEI version 2 values were maintained, again to avoid double counting or underestimating.

Figures 3 through 6 provide an overview of the replacement process used to allocate fire emissions from either the master fire database or maintained from the 1999 NEI version 2.

FIGURE 3.

**GENERAL APPROACH TO ESTIMATING EMISSIONS FOR FIRES (APPLIES TO WILDFIRES AND PRESCRIBED FIRES).**

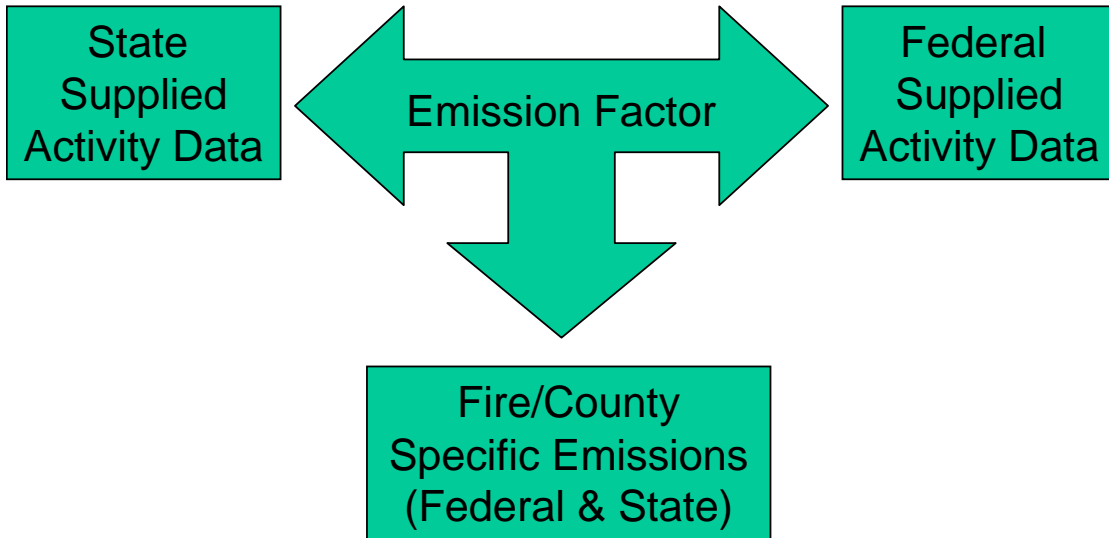
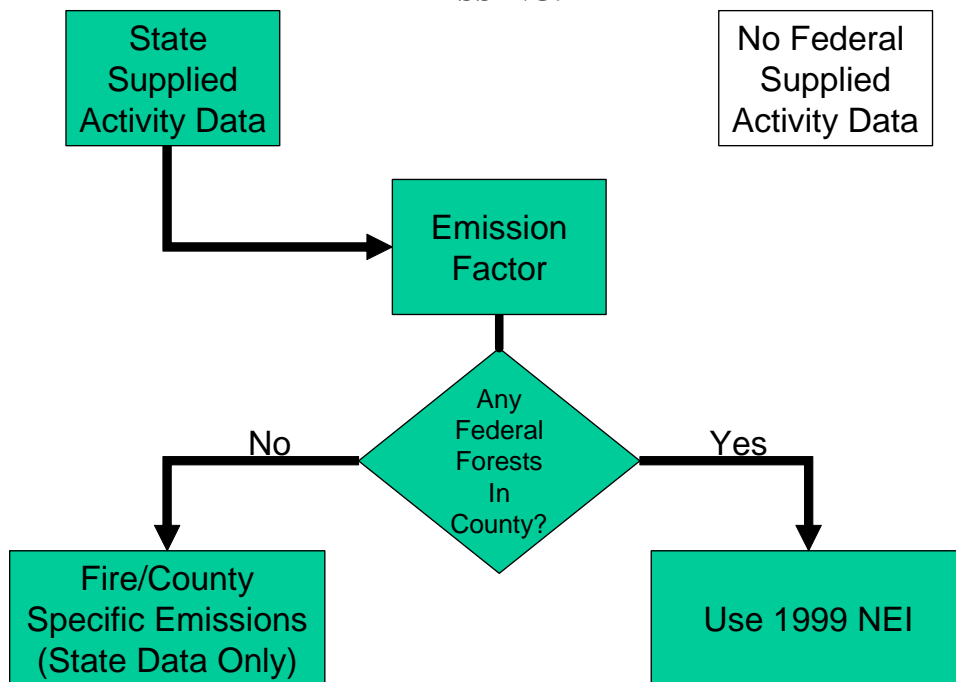


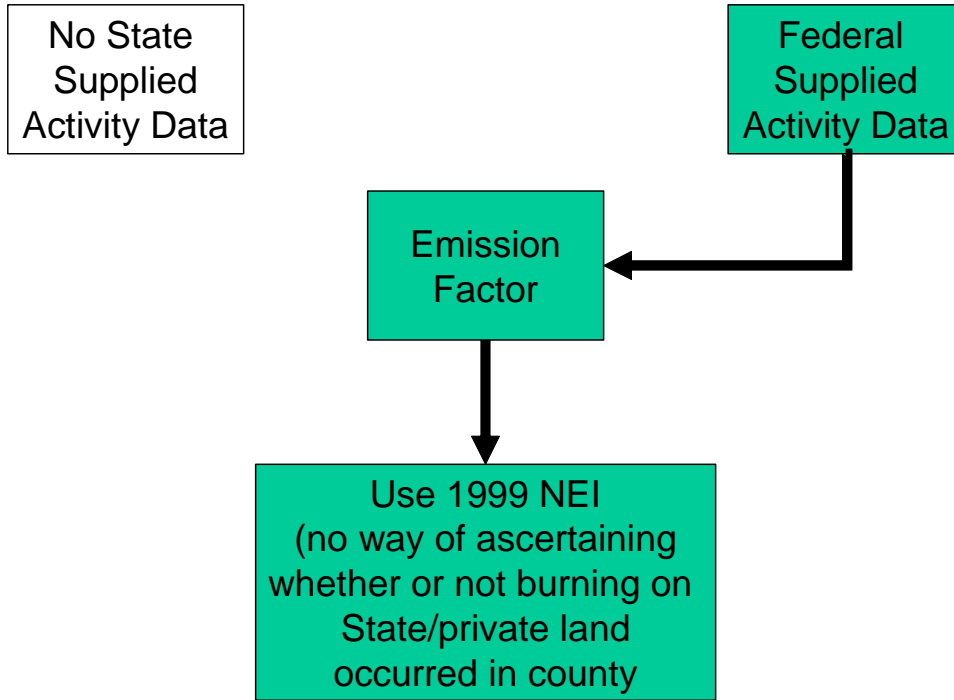
FIGURE 4.

**APPROACH USED FOR CALCULATING FIRES IF FEDERAL DATA WERE MISSING.**



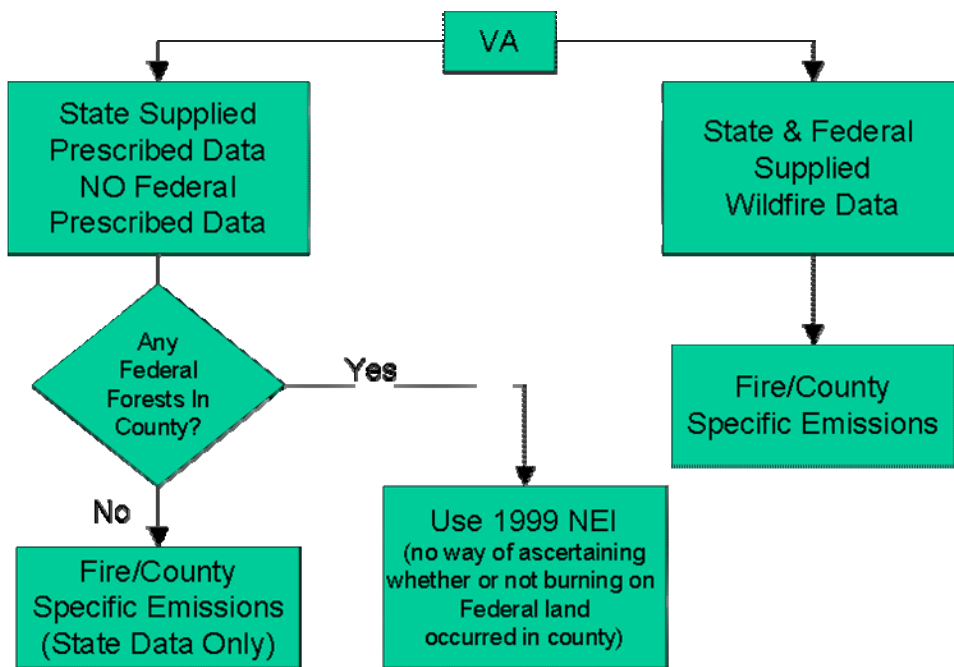
**FIGURE 5.**

**APPROACH USED FOR CALCULATING FIRES IF STATE DATA WERE MISSING.**



**FIGURE 6.**

**EXAMPLE OF THE APPROACH USED FOR VA COUNTIES BASED ON ACTUAL REPORTED DATA.**



## RESULTS

Tables 5 through 11 and figures 7 through 13 provide an overview of the emissions for all versions of the draft 2002 VISTAS emission inventory (Versions 1, 2 and 3 [3.1]) and the 1999 NEI Version 2 that was used as the starting point for the VISTAS inventory, by State and pollutant.

Table 5 shows that the CO emissions for the VISTAS region decreased by approximately 600,000 tons for 2002 compared with 1999 levels for Version 1 of the VISTAS inventory. However, Version 2 shows an increase of over 2 million tons compared to Version 1. This is due to the inclusion of the prescribed burning emissions calculated from the data submitted by AL, FL, GA, MS, and SC rather than using the State supplied/NEI V2 blended approach used for Version 1 of the VISTAS inventory. The majority of the increase was for fires in FL. However, Version 3.1 of the VISTAS 2002 inventory shows much lower levels for AL, FL, and SC. These values are reflective of changes made in the fuel loading for prescribed burning based on State-supplied comments for those categories. MACTEC found that incorrect fuel loading values had been used in those States. NC shows a slight reduction in CO emissions based on comments received concerning a few small stationary area sources.

Similarly, Table 6 shows a decrease of approximately 58,000 tons of NO<sub>x</sub> from 1999 to 2002 Version 1 but only a 21,000 ton decrease relative to 2002 Version 2. By Version 3.1 the decrease is approximately 70,000 tons. This is again caused by the correction to prescribed fire fuel loadings between Version 2 and Version 3.1. Table 7 indicates that SO<sub>2</sub> emissions have increased over the 1999-2002 period by 20,000 tons for Version 1 and 37,000 tons for Version 2. By Version 3.1, the increase is back to approximately 20,000 tons (again attributable to the change in prescribed fire fuel loadings). VOC emissions (Table 8) are showing a slight increase (3,000 tons) from 1999 to 2002 Version 1, but a substantially larger increase (65,000 tons) for Version 2. With the implementation of the prescribed fire fuel loading changes to the inventory, VOC shows a net decrease by Version 3.1 of approximately 60,000 tons relative to the 1999 NEI Version 2 levels. PM emissions increase by 200,000 and 41,000 tons for PM-10 and PM-2.5 respectively (Tables 9 and 10) for Version 1 but increases for Version 2 are approximately 425,000 and 240,000 tons (respectively) for Version 2. By Version 3.1, the increase for PM-10 is only 160,000 tons and only 1,400 tons for PM-2.5. Finally, NH<sub>3</sub> emissions decreased slightly (9,000 tons) from 1999 to 2002 Version 1 but show a slight increase for Version 2 (produced by the use of the updated CMU Version 3.1 model). The increase for Version 2 is offset by the reduction in prescribed burning in Version 3.1 and levels of NH<sub>3</sub> in Version 3.1 are approximately the same as those in Version 1.

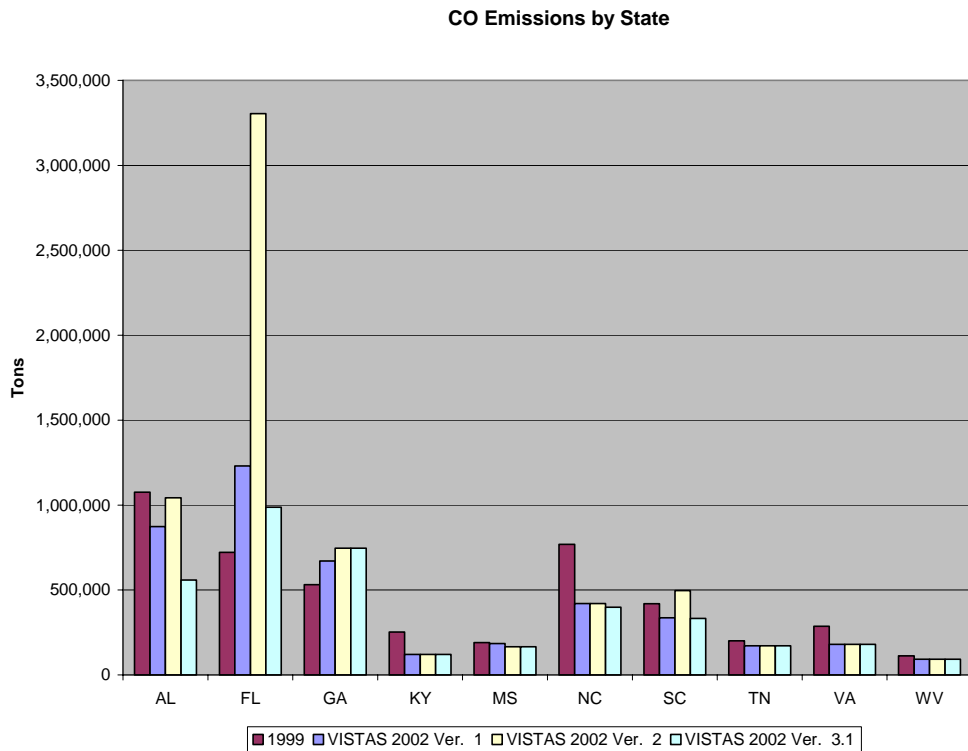
**TABLE 5.**

**AREA SOURCE CO EMISSIONS (ALL VALUES IN TONS)**

	1999 NEI V2	VISTAS 2002 Draft Version 1	VISTAS 2002 Draft Version 2	VISTAS 2002 Draft Version 3.1
<b>AL</b>	<b>1,075,786</b>	<b>873,217</b>	<b>1,042,996</b>	<b>559,200</b>
<b>FL</b>	<b>721,708</b>	<b>1,230,603</b>	<b>3,304,602</b>	<b>988,225</b>
<b>GA</b>	<b>531,628</b>	<b>671,607</b>	<b>746,574</b>	<b>746,574</b>
<b>KY</b>	<b>252,902</b>	<b>120,848</b>	<b>120,847</b>	<b>120,847</b>
<b>MS</b>	<b>191,706</b>	<b>184,693</b>	<b>166,308</b>	<b>166,308</b>
<b>NC</b>	<b>769,251</b>	<b>420,198</b>	<b>420,198</b>	<b>399,152</b>
<b>SC</b>	<b>419,406</b>	<b>336,945</b>	<b>496,354</b>	<b>333,014</b>
<b>TN</b>	<b>200,639</b>	<b>171,912</b>	<b>171,912</b>	<b>171,912</b>
<b>VA</b>	<b>287,071</b>	<b>180,077</b>	<b>180,076</b>	<b>180,076</b>
<b>WV</b>	<b>112,027</b>	<b>93,496</b>	<b>93,496</b>	<b>93,496</b>
<b>Total</b>	<b>4,564,122</b>	<b>4,283,596</b>	<b>6,743,364</b>	<b>3,758,805</b>

**FIGURE 7.**

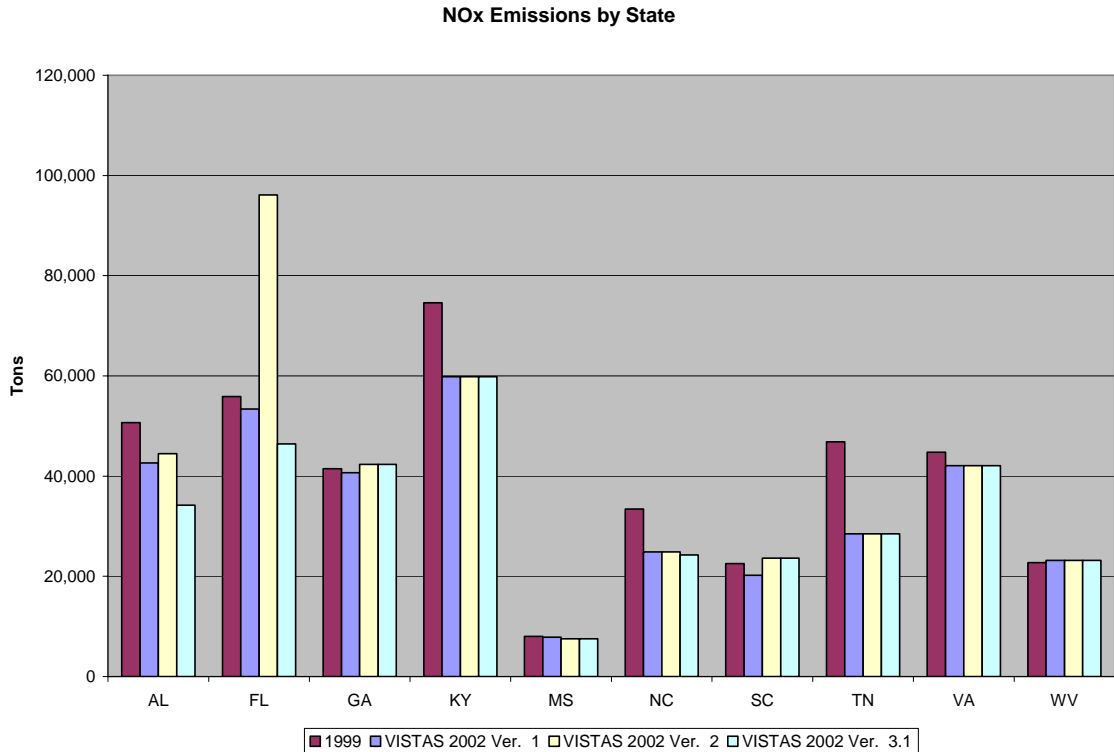
**CO EMISSIONS BY STATE FOR 2002 AND 1999 NEI VERSION 2.**



**TABLE 6.**  
**AREA SOURCE NOX EMISSIONS (ALL VALUES IN TONS)**

	1999 NEI V2	VISTAS 2002 Draft Version 1	VISTAS 2002 Draft Version 2	VISTAS 2002 Draft Version 3.1
AL	50,694	42,603	44,470	34,178
FL	55,882	53,411	96,130	46,436
GA	41,505	40,664	42,338	42,338
KY	74,603	59,843	59,843	59,843
MS	8,034	7,853	7,526	7,526
NC	33,443	24,880	24,879	24,257
SC	22,534	20,197	23,635	23,635
TN	46,843	28,479	28,479	28,479
VA	44,778	42,106	42,106	42,106
WV	22,726	23,167	23,167	23,167
<b>Total</b>	<b>403,040</b>	<b>343,203</b>	<b>392,573</b>	<b>331,964</b>

**FIGURE 8.**  
**NOX EMISSIONS BY STATE FOR 2002 AND 1999 NEI VERSION 2.**



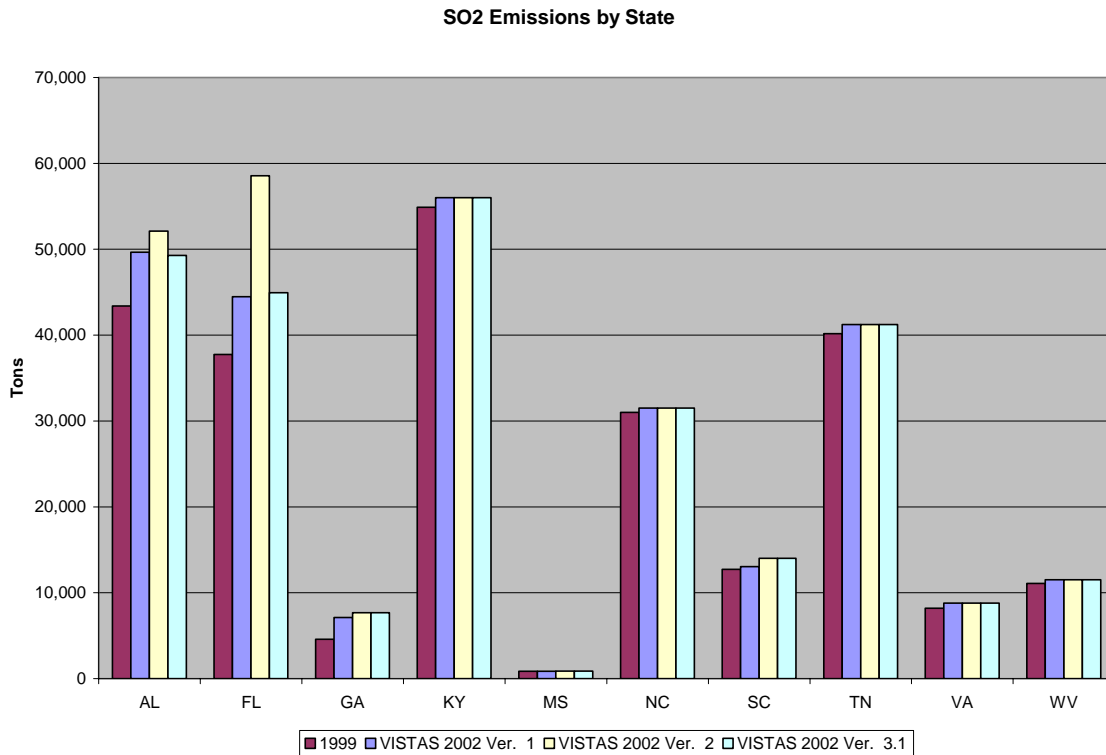
**TABLE 7.**

**AREA SOURCE SO<sub>2</sub> EMISSIONS (ALL VALUES IN TONS)**

	1999 NEI V2	VISTAS 2002 Draft Version 1	VISTAS 2002 Draft Version 2	VISTAS 2002 Draft Version 3.1
<b>AL</b>	<b>43,394</b>	<b>49,653</b>	<b>52,106</b>	<b>49,284</b>
<b>FL</b>	<b>37,736</b>	<b>44,469</b>	<b>58,566</b>	<b>44,940</b>
<b>GA</b>	<b>4,583</b>	<b>7,120</b>	<b>7,685</b>	<b>7,685</b>
<b>KY</b>	<b>54,909</b>	<b>56,003</b>	<b>56,003</b>	<b>56,003</b>
<b>MS</b>	<b>840</b>	<b>848</b>	<b>870</b>	<b>870</b>
<b>NC</b>	<b>31,009</b>	<b>31,500</b>	<b>31,500</b>	<b>31,500</b>
<b>SC</b>	<b>12,705</b>	<b>13,037</b>	<b>14,009</b>	<b>14,009</b>
<b>TN</b>	<b>40,186</b>	<b>41,230</b>	<b>41,230</b>	<b>41,230</b>
<b>VA</b>	<b>8,206</b>	<b>8,783</b>	<b>8,782</b>	<b>8,782</b>
<b>WV</b>	<b>11,087</b>	<b>11,517</b>	<b>11,517</b>	<b>11,517</b>
<b>Total</b>	<b>246,653</b>	<b>264,161</b>	<b>282,268</b>	<b>265,820</b>

**FIGURE 9.**

**SO<sub>2</sub> EMISSIONS BY STATE FOR 2002 AND 1999 NEI VERSION 2.**



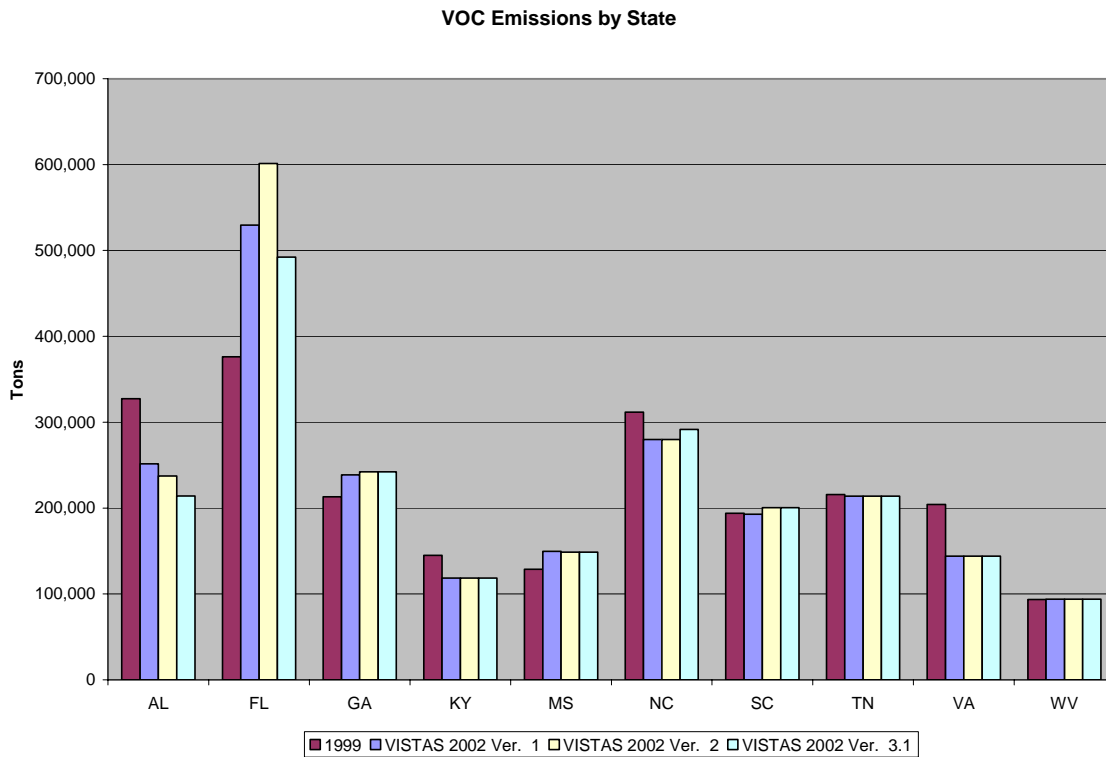
**TABLE 8.**

**AREA SOURCE VOC EMISSIONS (ALL VALUES IN TONS)**

	1999 NEI V2	VISTAS 2002 Draft Version 1	VISTAS 2002 Draft Version 2	VISTAS 2002 Draft Version 3.1
<b>AL</b>	<b>327,400</b>	<b>251,368</b>	<b>237,233</b>	<b>214,031</b>
<b>FL</b>	<b>376,173</b>	<b>529,506</b>	<b>601,158</b>	<b>492,152</b>
<b>GA</b>	<b>213,204</b>	<b>238,690</b>	<b>242,202</b>	<b>242,202</b>
<b>KY</b>	<b>144,764</b>	<b>118,453</b>	<b>118,453</b>	<b>118,453</b>
<b>MS</b>	<b>128,694</b>	<b>149,610</b>	<b>148,728</b>	<b>148,728</b>
<b>NC</b>	<b>311,716</b>	<b>279,897</b>	<b>279,896</b>	<b>291,567</b>
<b>SC</b>	<b>193,951</b>	<b>192,833</b>	<b>200,330</b>	<b>200,330</b>
<b>TN</b>	<b>215,671</b>	<b>213,886</b>	<b>213,885</b>	<b>213,885</b>
<b>VA</b>	<b>204,245</b>	<b>143,908</b>	<b>143,908</b>	<b>143,908</b>
<b>WV</b>	<b>93,644</b>	<b>93,937</b>	<b>93,938</b>	<b>93,938</b>
<b>Total</b>	<b>2,211,461</b>	<b>2,212,088</b>	<b>2,279,730</b>	<b>2,159,193</b>

**FIGURE 10.**

**VOC EMISSIONS BY STATE FOR 2002 AND 1999 NEI VERSION 2.**



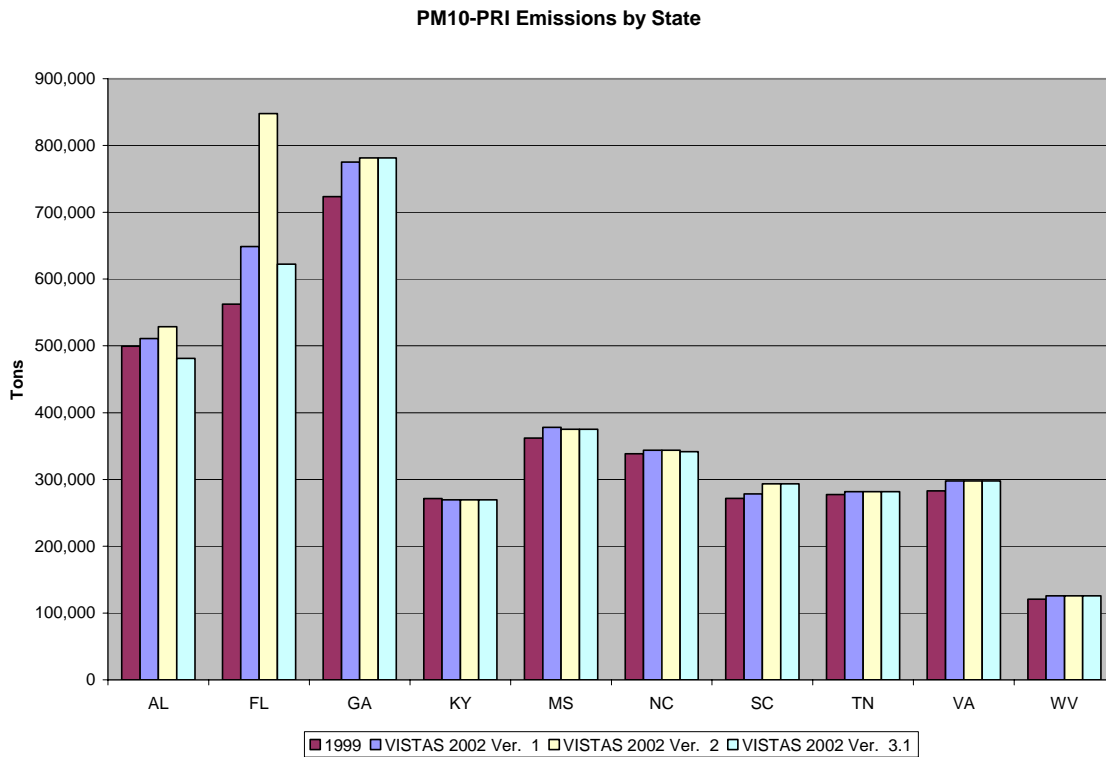
**TABLE 9.**

**AREA SOURCE PM10-PRI EMISSIONS (ALL VALUES IN TONS)**

	1999 NEI V2	VISTAS 2002 Draft Version 1	VISTAS 2002 Draft Version 2	VISTAS 2002 Draft Version 3.1
<b>AL</b>	<b>499,591</b>	<b>511,026</b>	<b>528,626</b>	<b>481,251</b>
<b>FL</b>	<b>562,376</b>	<b>648,848</b>	<b>847,601</b>	<b>622,376</b>
<b>GA</b>	<b>723,576</b>	<b>775,212</b>	<b>781,485</b>	<b>781,485</b>
<b>KY</b>	<b>271,436</b>	<b>269,497</b>	<b>269,497</b>	<b>269,497</b>
<b>MS</b>	<b>361,991</b>	<b>378,091</b>	<b>375,249</b>	<b>375,249</b>
<b>NC</b>	<b>338,368</b>	<b>343,761</b>	<b>343,761</b>	<b>341,644</b>
<b>SC</b>	<b>271,671</b>	<b>278,217</b>	<b>293,435</b>	<b>293,435</b>
<b>TN</b>	<b>277,322</b>	<b>281,620</b>	<b>281,620</b>	<b>281,620</b>
<b>VA</b>	<b>282,905</b>	<b>297,891</b>	<b>297,891</b>	<b>297,891</b>
<b>WV</b>	<b>120,622</b>	<b>125,656</b>	<b>125,656</b>	<b>125,656</b>
<b>Total</b>	<b>3,711,856</b>	<b>3,909,820</b>	<b>4,144,821</b>	<b>3,870,103</b>

**FIGURE 11.**

**PM10-PRI EMISSIONS BY STATE FOR 2002 AND 1999 NEI VERSION 2.**



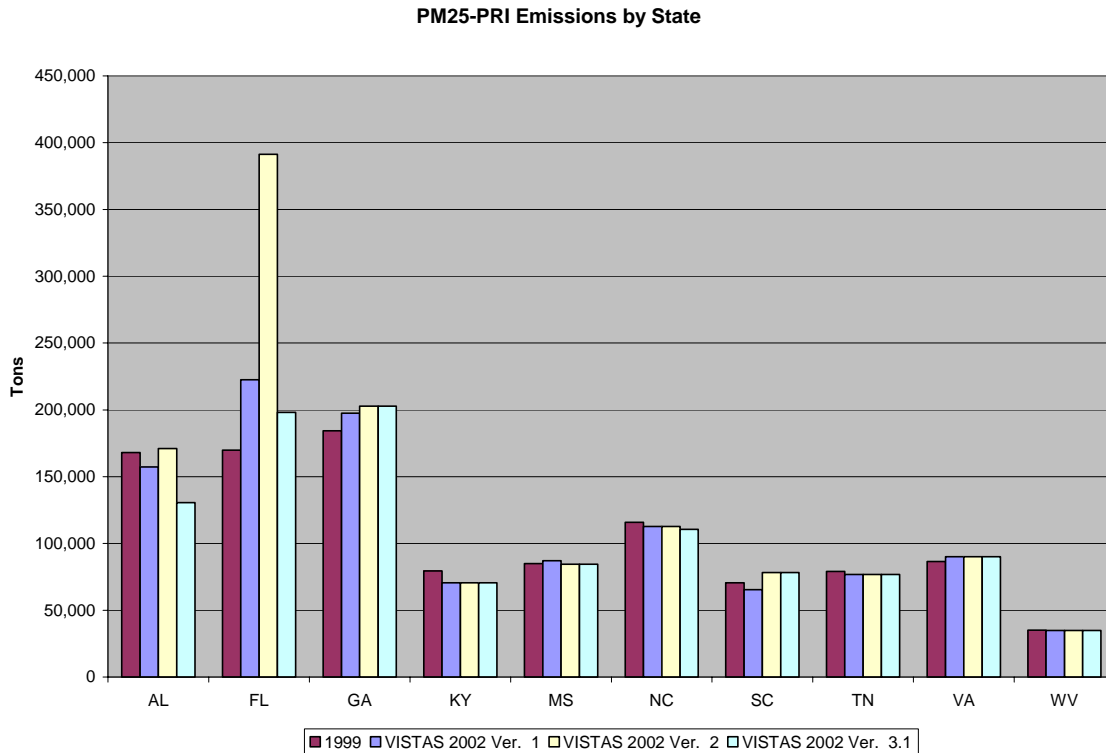
**TABLE 10.**

**AREA SOURCE PM2.5-PRI EMISSIONS (ALL VALUES IN TONS)**

	1999 NEI V2	VISTAS 2002 Draft Version 1	VISTAS 2002 Draft Version 2	VISTAS 2002 Draft Version 3.1
<b>AL</b>	<b>168,103</b>	<b>157,235</b>	<b>171,116</b>	<b>130,446</b>
<b>FL</b>	<b>169,910</b>	<b>222,539</b>	<b>391,296</b>	<b>198,131</b>
<b>GA</b>	<b>184,224</b>	<b>197,549</b>	<b>202,789</b>	<b>202,789</b>
<b>KY</b>	<b>79,396</b>	<b>70,432</b>	<b>70,431</b>	<b>70,431</b>
<b>MS</b>	<b>84,982</b>	<b>87,057</b>	<b>84,474</b>	<b>84,474</b>
<b>NC</b>	<b>115,722</b>	<b>112,691</b>	<b>112,690</b>	<b>110,573</b>
<b>SC</b>	<b>70,553</b>	<b>65,296</b>	<b>78,309</b>	<b>78,309</b>
<b>TN</b>	<b>79,053</b>	<b>76,762</b>	<b>76,762</b>	<b>76,762</b>
<b>VA</b>	<b>86,499</b>	<b>90,157</b>	<b>90,156</b>	<b>90,156</b>
<b>WV</b>	<b>35,023</b>	<b>34,764</b>	<b>34,764</b>	<b>34,764</b>
<b>Total</b>	<b>1,075,465</b>	<b>1,114,482</b>	<b>1,312,787</b>	<b>1,076,835</b>

**FIGURE 12.**

**PM2.5-PRI EMISSIONS BY STATE FOR 2002 AND 1999 NEI VERSION 2.**



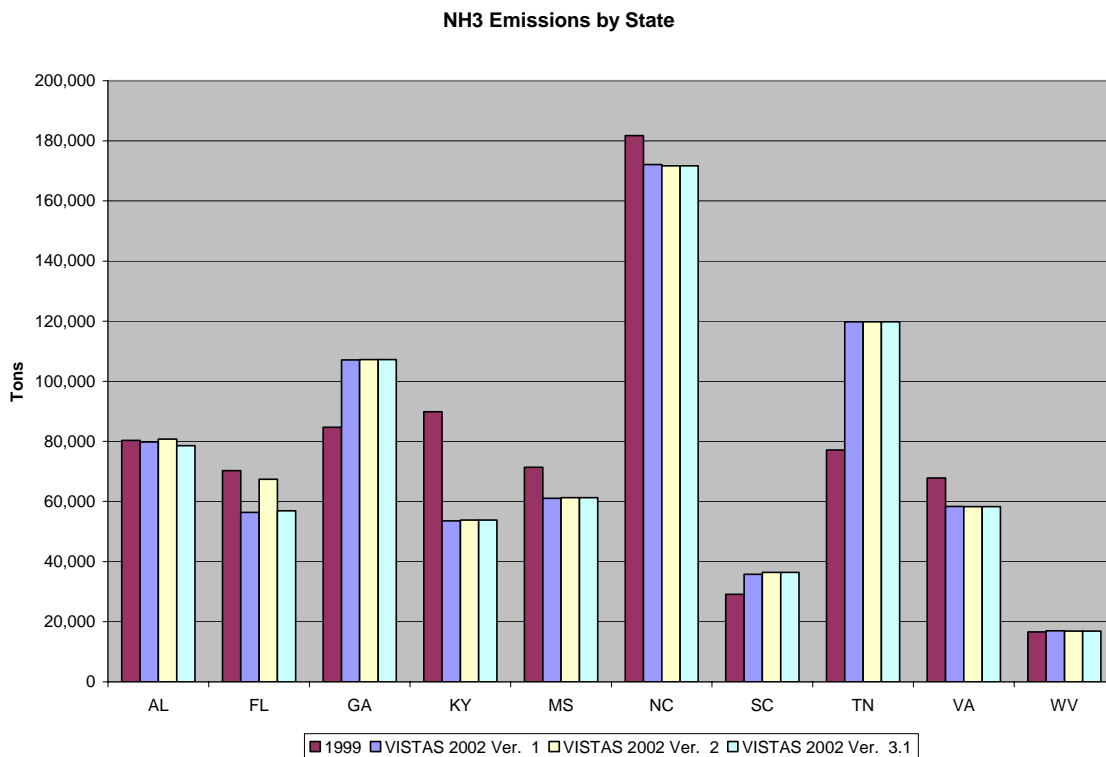
**TABLE 11.**

**AREA SOURCE NH3 EMISSIONS (ALL VALUES IN TONS)**

	1999 NEI V2	VISTAS 2002 Draft Version 1	VISTAS 2002 Draft Version 2	VISTAS 2002 Draft Version 3.1
<b>AL</b>	<b>80,343</b>	<b>79,807</b>	<b>80,733</b>	<b>78,575</b>
<b>FL</b>	<b>70,313</b>	<b>56,412</b>	<b>67,368</b>	<b>56,949</b>
<b>GA</b>	<b>84,683</b>	<b>107,089</b>	<b>107,230</b>	<b>107,231</b>
<b>KY</b>	<b>89,851</b>	<b>53,553</b>	<b>53,810</b>	<b>53,810</b>
<b>MS</b>	<b>71,346</b>	<b>61,023</b>	<b>61,256</b>	<b>61,256</b>
<b>NC</b>	<b>181,801</b>	<b>172,085</b>	<b>171,734</b>	<b>171,734</b>
<b>SC</b>	<b>29,124</b>	<b>35,782</b>	<b>36,374</b>	<b>36,374</b>
<b>TN</b>	<b>77,141</b>	<b>119,790</b>	<b>119,790</b>	<b>119,790</b>
<b>VA</b>	<b>67,814</b>	<b>58,343</b>	<b>58,241</b>	<b>58,241</b>
<b>WV</b>	<b>16,602</b>	<b>16,979</b>	<b>16,864</b>	<b>16,864</b>
<b>Total</b>	<b>771,019</b>	<b>760,864</b>	<b>773,400</b>	<b>760,822</b>

**FIGURE 13.**

**NH3 EMISSIONS BY STATE FOR 2002 AND 1999 NEI VERSION 2.**



## **Appendix A**

### **NH<sub>3</sub> Growth Factors for Livestock Operations**

**TABLE A-1. LIVESTOCK NH3 GROWTH FACTORS AND ANIMAL POPULATIONS**

State	FIPST	SCC	Category	2002 Population (1000s)	1997 Population (1000s)	Growth Factor
AL	01	2805020003	All Cattle/calves	1370	1,531	0.89484
AL	01	2805020003	Cows and Heifers that have Calved			0.89484
AL	01	2805020002	Beef Cows	750	832	0.90144
AL	01	2805020001	Milk Cows			0.89484
AL	01	2805020003	Heifers 500 lbs or over			0.89484
AL	01	2805020002	For beef cow replacement			0.89484
AL	01	2805020001	For milk cow replacement			0.89484
AL	01	2805020003	Other heifers			0.89484
AL	01	2805020004	Steers 500 lbs+			0.89484
AL	01	2805020004	Bulls 500 lbs +			0.89484
AL	01	2805020004	Calves < 500 lbs			0.89484
AL	01	2805020003	Cattle and calves on feed			0.89484
AL	01	2805025000	All Hogs and Pigs			1.00000
AL	01	2805025000	Breeding stock hogs and pigs			1.00000
AL	01	2805025000	Market Hogs/Pigs			1.00000
AL	01	2805030003	All Chickens	15256	18605	0.81999
AL	01	2805030003	Hens and Pullets - laying age	9645	13433	0.71801
AL	01	2805030002	Pullets 13-19 weeks		2729	0.71801
AL	01	2805030001	Pullets < 13 weeks		2443	0.71801
AL	01	2805030004	Other Chickens	1051303	871123	1.20684
AL	01	2805040000	Sheep			1.00000
AL	01	2805040000	Breeding Ewes			1.00000
AL	01	2805040000	Lamb Crop			1.00000
FL	12	2805020003	All Cattle/calves	1780	1,970	0.90355
FL	12	2805020003	Cows and Heifers that have Calved			0.90355
FL	12	2805020002	Beef Cows	958	1,072	0.89366
FL	12	2805020001	Milk Cows	152	158	0.96203
FL	12	2805020003	Heifers 500 lbs or over			0.90355
FL	12	2805020002	For beef cow replacement			0.90355
FL	12	2805020001	For milk cow replacement			0.90355
FL	12	2805020003	Other heifers			0.90355
FL	12	2805020004	Steers 500 lbs+			0.90355
FL	12	2805020004	Bulls 500 lbs +			0.90355
FL	12	2805020004	Calves < 500 lbs			0.90355
FL	12	2805020003	Cattle and calves on feed			0.90355
FL	12	2805025000	All Hogs and Pigs	35	65	0.53846
FL	12	2805025000	Breeding stock hogs and pigs			0.53846
FL	12	2805025000	Market Hogs/Pigs			0.53846
FL	12	2805030003	All Chickens	125331	142265	0.88097
FL	12	2805030003	Hens and Pullets - laying age	10631	9865	1.07765
FL	12	2805030002	Pullets 13-19 weeks			1.07765
FL	12	2805030001	Pullets < 13 weeks			1.07765
FL	12	2805030004	Other Chickens	114700	132400	0.86631
FL	12	2805040000	Sheep			1.00000
FL	12	2805040000	Breeding Ewes			1.00000
FL	12	2805040000	Lamb Crop			1.00000

State	FIPST	SCC	Category	2002 Population (1000s)	1997 Population (1000s)	Growth Factor
GA	13	2805020003	All Cattle/calves	1240	1,390	0.89209
GA	13	2805020003	Cows and Heifers that have Calved			0.89209
GA	13	2805020002	Beef Cows			0.89209
GA	13	2805020001	Milk Cows			0.89209
GA	13	2805020003	Heifers 500 lbs or over			0.89209
GA	13	2805020002	For beef cow replacement			0.89209
GA	13	2805020001	For milk cow replacement			0.89209
GA	13	2805020003	Other heifers			0.89209
GA	13	2805020004	Steers 500 lbs+			0.89209
GA	13	2805020004	Bulls 500 lbs +			0.89209
GA	13	2805020004	Calves < 500 lbs			0.89209
GA	13	2805020003	Cattle and calves on feed			0.89209
GA	13	2805025000	All Hogs and Pigs	345	514	0.67121
GA	13	2805025000	Breeding stock hogs and pigs			0.67121
GA	13	2805025000	Market Hogs/Pigs			0.67121
GA	13	2805030003	All Chickens	29553	30318	0.97477
GA	13	2805030003	Hens and Pullets - laying age	20900	19869	1.05189
GA	13	2805030002	Pullets 13-19 weeks			1.05189
GA	13	2805030001	Pullets < 13 weeks			1.05189
GA	13	2805030004	Other Chickens	1290500	1017521	1.26828
GA	13	2805040000	Sheep			1.00000
GA	13	2805040000	Breeding Ewes			1.00000
GA	13	2805040000	Lamb Crop			1.00000
KY	21	2805020003	All Cattle/calves	2430	2,600	0.93462
KY	21	2805020003	Cows and Heifers that have Calved	1240	1,330	0.93233
KY	21	2805020002	Beef Cows	1120	1,180	0.94915
KY	21	2805020001	Milk Cows	120	150	0.80000
KY	21	2805020003	Heifers 500 lbs or over	350	367	0.95368
KY	21	2805020002	For beef cow replacement	175	195	0.89744
KY	21	2805020001	For milk cow replacement	45	57	0.78947
KY	21	2805020003	Other heifers	130	115	1.13043
KY	21	2805020004	Steers 500 lbs+	220	205	1.07317
KY	21	2805020004	Bulls 500 lbs +	75	78	0.96154
KY	21	2805020004	Calves < 500 lbs	540	620	0.87097
KY	21	2805020003	Cattle and calves on feed	10	20	0.50000
KY	21	2805025000	All Hogs and Pigs	370	570	0.64912
KY	21	2805025000	Breeding stock hogs and pigs	40	70	0.57143
KY	21	2805025000	Market Hogs/Pigs	330	500	0.66000
KY	21	2805030003	All Chickens	6195	4939	1.25430
KY	21	2805030003	Hens and Pullets - laying age	4350	3501	1.24250
KY	21	2805030002	Pullets 13-19 weeks	845	678	1.24631
KY	21	2805030001	Pullets < 13 weeks	805	760	1.05921
KY	21	2805030004	Other Chickens	195	16378	0.01191
KY	21	2805040000	Sheep	22	22	1.00000
KY	21	2805040000	Breeding Ewes	14	15	0.93333
KY	21	2805040000	Lamb Crop	16	18	0.88889
MS	28	2805020003	All Cattle/calves	1100	1,260	0.87302
MS	28	2805020003	Cows and Heifers that have Calved			0.87302

State	FIPST	SCC	Category	2002 Population (1000s)	1997 Population (1000s)	Growth Factor
MS	28	2805020002	Beef Cows	576	632	0.91139
MS	28	2805020001	Milk Cows	34	48	0.70833
MS	28	2805020003	Heifers 500 lbs or over			0.87302
MS	28	2805020002	For beef cow replacement			0.87302
MS	28	2805020001	For milk cow replacement			0.87302
MS	28	2805020003	Other heifers			0.87302
MS	28	2805020004	Steers 500 lbs+			0.87302
MS	28	2805020004	Bulls 500 lbs +			0.87302
MS	28	2805020004	Calves < 500 lbs			0.87302
MS	28	2805020003	Cattle and calves on feed			0.87302
MS	28	2805025000	All Hogs and Pigs	275	220	1.25000
MS	28	2805025000	Breeding stock hogs and pigs			1.25000
MS	28	2805025000	Market Hogs/Pigs			1.25000
MS	28	2805030003	All Chickens	10814	11073	0.97661
MS	28	2805030003	Hens and Pullets - laying age			0.97661
MS	28	2805030002	Pullets 13-19 weeks			0.97661
MS	28	2805030001	Pullets < 13 weeks			0.97661
MS	28	2805030004	Other Chickens			0.97661
MS	28	2805040000	Sheep			1.00000
MS	28	2805040000	Breeding Ewes			1.00000
MS	28	2805040000	Lamb Crop			1.00000
NC	37	2805020003	All Cattle/calves	920	941	0.97768
NC	37	2805020003	Cows and Heifers that have Calved			0.97768
NC	37	2805020002	Beef Cows	417	435	0.95862
NC	37	2805020001	Milk Cows	63	78	0.80769
NC	37	2805020003	Heifers 500 lbs or over			0.97768
NC	37	2805020002	For beef cow replacement			0.97768
NC	37	2805020001	For milk cow replacement			0.97768
NC	37	2805020003	Other heifers			0.97768
NC	37	2805020004	Steers 500 lbs+			0.97768
NC	37	2805020004	Bulls 500 lbs +			0.97768
NC	37	2805020004	Calves < 500 lbs			0.97768
NC	37	2805020003	Cattle and calves on feed			0.97768
NC	37	2805025000	All Hogs and Pigs	9800	9624	1.01829
NC	37	2805025000	Breeding stock hogs and pigs			1.01829
NC	37	2805025000	Market Hogs/Pigs			1.01829
NC	37	2805030003	All Chickens	17042	16162	1.05445
NC	37	2805030003	Hens and Pullets - laying age			1.05445
NC	37	2805030002	Pullets 13-19 weeks			1.05445
NC	37	2805030001	Pullets < 13 weeks			1.05445
NC	37	2805030004	Other Chickens	735200	591248	1.24347
NC	37	2805040000	Sheep			1.00000
NC	37	2805040000	Breeding Ewes			1.00000
NC	37	2805040000	Lamb Crop			1.00000
SC	45	2805020003	All Cattle/calves	435	454	0.95815
SC	45	2805020003	Cows and Heifers that have Calved			0.95815
SC	45	2805020002	Beef Cows	210	229	0.91703
SC	45	2805020001	Milk Cows	20	25	0.80000

State	FIPST	SCC	Category	2002 Population (1000s)	1997 Population (1000s)	Growth Factor
SC	45	2805020003	Heifers 500 lbs or over			0.95815
SC	45	2805020002	For beef cow replacement			0.95815
SC	45	2805020001	For milk cow replacement			0.95815
SC	45	2805020003	Other heifers			0.95815
SC	45	2805020004	Steers 500 lbs+			0.95815
SC	45	2805020004	Bulls 500 lbs +			0.95815
SC	45	2805020004	Calves < 500 lbs			0.95815
SC	45	2805020003	Cattle and calves on feed			0.95815
SC	45	2805025000	All Hogs and Pigs	300	305	0.98361
SC	45	2805025000	Breeding stock hogs and pigs			0.98361
SC	45	2805025000	Market Hogs/Pigs			0.98361
SC	45	2805030003	All Chickens	5372	5711	0.94064
SC	45	2805030003	Hens and Pullets - laying age			0.94064
SC	45	2805030002	Pullets 13-19 weeks			0.94064
SC	45	2805030001	Pullets < 13 weeks			0.94064
SC	45	2805030004	Other Chickens	192900	158679	1.21566
SC	45	2805040000	Sheep			1.00000
SC	45	2805040000	Breeding Ewes			1.00000
SC	45	2805040000	Lamb Crop			1.00000
TN	47	2805020003	All Cattle/calves	2270	2,145	1.05828
TN	47	2805020003	Cows and Heifers that have Calved	1190	1,151	1.03388
TN	47	2805020002	Beef Cows	1106	1,039	1.06449
TN	47	2805020001	Milk Cows	84	112	0.75000
TN	47	2805020003	Heifers 500 lbs or over			1.05828
TN	47	2805020002	For beef cow replacement			1.05828
TN	47	2805020001	For milk cow replacement			1.05828
TN	47	2805020003	Other heifers			1.05828
TN	47	2805020004	Steers 500 lbs+			1.05828
TN	47	2805020004	Bulls 500 lbs +			1.05828
TN	47	2805020004	Calves < 500 lbs			1.05828
TN	47	2805020003	Cattle and calves on feed			1.05828
TN	47	2805025000	All Hogs and Pigs			1.00000
TN	47	2805025000	Breeding stock hogs and pigs			1.00000
TN	47	2805025000	Market Hogs/Pigs			1.00000
TN	47	2805030003	All Chickens	2200	2478	0.88781
TN	47	2805030003	Hens and Pullets - laying age	1256	1654	0.75937
TN	47	2805030002	Pullets 13-19 weeks	317	567	0.55908
TN	47	2805030001	Pullets < 13 weeks	453	257	1.76265
TN	47	2805030004	Other Chickens	186400	120830	1.54266
TN	47	2805040000	Sheep			1.00000
TN	47	2805040000	Breeding Ewes			1.00000
TN	47	2805040000	Lamb Crop			1.00000
VA	51	2805020003	All Cattle/calves	1,650	1,780	0.92697
VA	51	2805020003	Cows and Heifers that have Calved	810	850	0.95294
VA	51	2805020002	Beef Cows	690	725	0.95172
VA	51	2805020001	Milk Cows	120	125	0.96000
VA	51	2805020003	Heifers 500 lbs or over	250	270	0.92593
VA	51	2805020002	For beef cow replacement	120	130	0.92308

State	FIPST	SCC	Category	2002 Population (1000s)	1997 Population (1000s)	Growth Factor
VA	51	2805020001	For milk cow replacement	60	65	0.92308
VA	51	2805020003	Other heifers	70	75	0.93333
VA	51	2805020004	Steers 500 lbs+	175	195	0.89744
VA	51	2805020004	Bulls 500 lbs +	40	45	0.88889
VA	51	2805020004	Calves < 500 lbs	375	420	0.89286
VA	51	2805020003	Cattle and calves on feed	27	30	0.90000
VA	51	2805025000	All Hogs and Pigs	410	400	1.02500
VA	51	2805025000	Breeding stock hogs and pigs			1.02500
VA	51	2805025000	Market Hogs/Pigs			1.02500
VA	51	2805030003	All Chickens	4554	4660	0.97725
VA	51	2805030003	Hens and Pullets - laying age			0.97725
VA	51	2805030002	Pullets 13-19 weeks			0.97725
VA	51	2805030001	Pullets < 13 weeks			0.97725
VA	51	2805030004	Other Chickens	271500	259400	1.04665
VA	51	2805040000	Sheep			1.00000
VA	51	2805040000	Breeding Ewes			1.00000
VA	51	2805040000	Lamb Crop			1.00000
WV	54	2805020003	All Cattle/calves			1.00000
WV	54	2805020003	Cows and Heifers that have Calved			1.00000
WV	54	2805020002	Beef Cows			1.00000
WV	54	2805020001	Milk Cows			1.00000
WV	54	2805020003	Heifers 500 lbs or over			1.00000
WV	54	2805020002	For beef cow replacement			1.00000
WV	54	2805020001	For milk cow replacement			1.00000
WV	54	2805020003	Other heifers			1.00000
WV	54	2805020004	Steers 500 lbs+			1.00000
WV	54	2805020004	Bulls 500 lbs +			1.00000
WV	54	2805020004	Calves < 500 lbs			1.00000
WV	54	2805020003	Cattle and calves on feed			1.00000
WV	54	2805025000	All Hogs and Pigs			1.00000
WV	54	2805025000	Breeding stock hogs and pigs			1.00000
WV	54	2805025000	Market Hogs/Pigs			1.00000
WV	54	2805030003	All Chickens			1.00000
WV	54	2805030003	Hens and Pullets - laying age			1.00000
WV	54	2805030002	Pullets 13-19 weeks			1.00000
WV	54	2805030001	Pullets < 13 weeks			1.00000
WV	54	2805030004	Other Chickens			1.00000
WV	54	2805040000	Sheep			1.00000
WV	54	2805040000	Breeding Ewes			1.00000
WV	54	2805040000	Lamb Crop			1.00000

\* WV had no data available on 2002 populations so all growth factors = 1.0000

**Appendix B –  
Fire Fuel Loading Values**

**TABLE B-1. FUEL LOADING VALUES USED TO PRODUCE FIRE EMISSION VALUES FOR NFDRS CLASSIFIED FIRES**

NFDRS Fuel Model	Vegetation					live	live	Average	EPA	EPA	Bayle revised*
		1h	10h	100h	1000h	woody	herb.	fuel loading	wildfire fuel loading	prescribed fuel loading	
A	Annual grass and forbs	0.2					0.3	0.23	0.5	0.5	0.5
B	Mature chaparral	3.5	4	0.5		11.5		12.35	19.5	19.5	12.35
C	Open timber/grass	0.4	1			0.5	0.8	1.68	4.7	4.7	2
D	Southern rough	2	1			3	0.75	4.275	15.6	10.6	4.275
E	Hardwoods (winter)	1.5	0.5	0.25		0.5	0.5	2.375			2.375
F	Intermediate brush	2.5	2	1.5		9		8.85	3.8	3.8	8.85
G	Closed, short-needle conifer (heavy dead)	2.5	2	5	12	0.5	0.5	8.45	73.5	25.6	8.45
H	Closed, short-needle conifer (normal dead)	1.5	1	2	2	0.5	0.5	3.95	27.5	15	3.95
I	Heavy slash	12	12	10	12			30.2	55.1	49.1	30.2
J	Medium slash	7	7	6	5.5			17.55	34	31.2	12
K	Light slash	2.5	2.5	2	2.5			6.25	14.4	13.1	6.25
L	Perennial grass	0.25					0.5	0.3	0.8	0.8	0.3
N	Sawgrass	1.5	1.5			2		3.8	5	5	3.8
O	Pocosin	2	3	3	2	7		9.5	46.1	45.1	9.5
P	Southern plantation	1	1	0.5		0.5	0.5	2.5	16.4	10.2	2.5
Q	Alaskan black spruce	2	2.5	2	1	4	0.5	7.25	57.6	48.8	7.25
R	Hardwoods (summer)	0.5	0.5	0.5		0.5	0.5	1.5	3.1	3.1	2
S	Alaskan tundra	0.5	0.5	0.5	0.5	0.5	0.5	1.55			1.55
T	Sagebrush/grass	1	0.5			2.5	0.5	2.55	4.5	4.5	2.55
U	Western, long-needle conifer	1.5	1.5	1		0.5	0.5	3.75	19.1	10.3	3.75

\* Bayle revised values were the values used to produce the emission inventory.

## **Appendix C**

### **Emission Factors Used for Fire Emission Calculations**

**TABLE C-1. FIRE EMISSION FACTORS (LB/TON OF FUEL CONSUMED)**

Fuel Model <sup>1</sup>	Vegetation	Pollutant	Wildfires <sup>2</sup>	Prescribed - piled fuel	Prescribed - nonpiled	Source
A	Annual grass and forbs	CH4	13.6	7.7	13.6	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	CO	289	74.3	289	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	EC	1.5	0.6	1.5	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	NH3	1.3	0.5	1.3	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	NOX	6.2	6.2	6.2	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	OC	11.6	4.3	11.6	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	PM10	28.1	8	28.1	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	PM25	24.1	8	24.1	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	SO2	1.7	1.7	1.7	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	TSP	34.1	12	34.1	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	VOC	13.6	6.3	13.6	Table 2 Data Needs and Availability - Pace Report
AGGRAIN	Agriculture-Grain	CH4	5.43	5.43	5.43	AP-42 Table 2.5-5 Avg of Oat/Barley/Wheat
AGGRAIN	Agriculture-Grain	CO	140.66	140.66	140.66	AP-42 Table 2.5-5 Avg of Oat/Barley/Wheat
AGGRAIN	Agriculture-Grain	PM10	29.33	29.33	29.33	AP-42 Table 2.5-5 Avg of Oat/Barley/Wheat
AGGRAIN	Agriculture-Grain	PM25	29.33	29.33	29.33	AP-42 Table 2.5-5 Avg of Oat/Barley/Wheat
AGGRAIN	Agriculture-Grain	VOC	18	18	18	AP-42 Table 2.5-5 Avg of Oat/Barley/Wheat
AGHAY	Agriculture-Hay (pasture/range)	CH4	5	5	5	AP-42 Table 2.5-5 Hay
AGHAY	Agriculture-Hay (pasture/range)	CO	139	139	139	AP-42 Table 2.5-5 Hay
AGHAY	Agriculture-Hay (pasture/range)	PM10	32	32	32	AP-42 Table 2.5-5 Hay
AGHAY	Agriculture-Hay (pasture/range)	PM25	32	32	32	AP-42 Table 2.5-5 Hay
AGHAY	Agriculture-Hay (pasture/range)	VOC	17	17	17	AP-42 Table 2.5-5 Hay
AGSC	Agriculture-Hay (pasture/range)	CH4	2.5	2.5	2.5	AP-42 Table 2.5-5 Hay
AGSC	Agriculture-Sugar Cane	CO	70.5	70.5	70.5	AP-42 Table 2.5-5 Sugar Cane
AGSC	Agriculture-Sugar Cane	PM10	7.2	7.2	7.2	AP-42 Table 2.5-5 Sugar Cane
AGSC	Agriculture-Sugar Cane	PM25	7.2	7.2	7.2	AP-42 Table 2.5-5 Sugar Cane

<b>Fuel Model<sup>1</sup></b>	<b>Vegetation</b>	<b>Pollutant</b>	<b>Wildfires<sup>2</sup></b>	<b>Prescribed - piled fuel</b>	<b>Prescribed - nonpiled</b>	<b>Source</b>
AGSC	Agriculture-Sugar Cane	VOC	8	8	8	AP-42 Table 2.5-5 Sugar Cane
AGUNSP	Agriculture-Unspecified	CH4	5.4	5.4	5.4	AP-42 Table 2.5-5 Unspecified
AGUNSP	Agriculture-Unspecified	CO	117	117	117	AP-42 Table 2.5-5 Unspecified
AGUNSP	Agriculture-Unspecified	PM10	21	21	21	AP-42 Table 2.5-5 Unspecified
AGUNSP	Agriculture-Unspecified	PM25	21	21	21	AP-42 Table 2.5-5 Unspecified
AGUNSP	Agriculture-Unspecified	VOC	18	18	18	AP-42 Table 2.5-5 Unspecified
B	Mature chaparral	CH4	13.6	7.7	13.6	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	CO	289	74.3	289	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	EC	1.5	0.6	1.5	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	NH3	1.3	0.5	1.3	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	NOX	6.2	6.2	6.2	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	OC	11.6	4.3	11.6	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	PM10	28.1	8	28.1	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	PM25	24.1	8	24.1	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	SO2	1.7	1.7	1.7	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	TSP	34.1	12	34.1	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	VOC	13.6	6.3	13.6	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	CH4	13.6	7.7	13.6	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	CO	289	74.3	289	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	EC	1.5	0.6	1.5	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	NH3	1.3	0.5	1.3	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	NOX	6.2	6.2	6.2	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	OC	11.6	4.3	11.6	Table 2 Data Needs and Availability - Pace Report

<b>Fuel Model<sup>1</sup></b>	<b>Vegetation</b>	<b>Pollutant</b>	<b>Wildfires<sup>2</sup></b>	<b>Prescribed - piled fuel</b>	<b>Prescribed - nonpiled</b>	<b>Source</b>
C	Open timber/grass	PM10	28.1	8	28.1	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	PM25	24.1	8	24.1	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	SO2	1.7	1.7	1.7	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	TSP	34.1	12	34.1	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	VOC	13.6	6.3	13.6	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report

Fuel Model <sup>1</sup>	Vegetation	Pollutant	Wildfires <sup>2</sup>	Prescribed - piled fuel	Prescribed - nonpiled	Source Report
E	Hardwoods (winter)	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	CH4	13.6	7.7	13.6	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	CO	289	74.3	289	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	EC	1.5	0.6	1.5	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	NH3	1.3	0.5	1.3	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	NOX	6.2	6.2	6.2	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	OC	11.6	4.3	11.6	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	PM10	28.1	8	28.1	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	PM25	24.1	8	24.1	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	SO2	1.7	1.7	1.7	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	TSP	34.1	12	34.1	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	VOC	13.6	6.3	13.6	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report

<b>Fuel Model<sup>1</sup></b>	<b>Vegetation</b>	<b>Pollutant</b>	<b>Wildfires<sup>2</sup></b>	<b>Prescribed - piled fuel</b>	<b>Prescribed - nonpiled</b>	<b>Source</b>
G	Closed, short-needle conifer (heavy dead)	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report

Fuel Model <sup>1</sup>	Vegetation	Pollutant	Wildfires <sup>2</sup>	Prescribed - piled fuel	Prescribed - nonpiled	Source Report
I	Heavy slash	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report

<b>Fuel Model<sup>1</sup></b>	<b>Vegetation</b>	<b>Pollutant</b>	<b>Wildfires<sup>2</sup></b>	<b>Prescribed - piled fuel</b>	<b>Prescribed - nonpiled</b>	<b>Source</b>
K	Light slash	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
K	Light slash	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
K	Light slash	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
K	Light slash	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
K	Light slash	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
K	Light slash	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
K	Light slash	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
K	Light slash	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
K	Light slash	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
K	Light slash	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
K	Light slash	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	CH4	13.6	7.7	13.6	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	CO	289	74.3	289	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	EC	1.5	0.6	1.5	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	NH3	1.3	0.5	1.3	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	NOX	6.2	6.2	6.2	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	OC	11.6	4.3	11.6	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	PM10	28.1	8	28.1	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	PM25	24.1	8	24.1	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	SO2	1.7	1.7	1.7	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	TSP	34.1	12	34.1	Table 2 Data Needs and Availability - Pace Report

Fuel Model <sup>1</sup>	Vegetation	Pollutant	Wildfires <sup>2</sup>	Prescribed - piled fuel	Prescribed - nonpiled	Source Report
L	Perennial grass	VOC	13.6	6.3	13.6	Table 2 Data Needs and Availability - Pace Report
LC	Land Clearing - All types	CO	169	169	169	Table 2 Data Needs and Availability - Pace Report
LC	Land Clearing - All types	NOX	5	5	5	Table 2 Data Needs and Availability - Pace Report
LC	Land Clearing - All types	PM10	17	17	17	Table 2 Data Needs and Availability - Pace Report
LC	Land Clearing - All types	PM25	17	17	17	Table 2 Data Needs and Availability - Pace Report
LC	Land Clearing - All types	VOC	11.6	11.6	11.6	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report

<b>Fuel Model<sup>1</sup></b>	<b>Vegetation</b>	<b>Pollutant</b>	<b>Wildfires<sup>2</sup></b>	<b>Prescribed - piled fuel</b>	<b>Prescribed - nonpiled</b>	<b>Source</b>
O	Pocosin	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
			14.23054	14.2305454		
PREMISC	Prescribed - Miscellaneous types	CH4	5	5	14.230545	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	CO	302.3990	302.399090	302.39909	Average of all used fuel models

Fuel Model <sup>1</sup>	Vegetation	Pollutant	Wildfires <sup>2</sup>	Prescribed - piled fuel	Prescribed - nonpiled	Source
			9	9		
PREMISC	Prescribed - Miscellaneous types	EC	1.569545	1.569545		
			5	5	1.569545	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	NH3	1.360272	1.360272		
			7	7	1.360272	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	NOX	6.487454	6.487454		
			5	5	6.487454	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	OC	12.13781	12.13781		
			8	8	12.13781	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	PM10	29.40281	29.40281		
			8	8	29.40281	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	PM25	25.21736	25.21736		
			4	4	25.21736	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	SO2	1.778818	1.778818		
			2	2	1.778818	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	TSP	35.681	35.681		
			14.23054	14.23054	35.681	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	VOC	14.23054	14.23054		
			5	5	14.23054	Average of all used fuel models
Q	Alaskan black spruce	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report

<b>Fuel Model<sup>1</sup></b>	<b>Vegetation</b>	<b>Pollutant</b>	<b>Wildfires<sup>2</sup></b>	<b>Prescribed - piled fuel</b>	<b>Prescribed - nonpiled</b>	<b>Source</b>
R	Hardwoods (summer)	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report

Fuel Model <sup>1</sup>	Vegetation	Pollutant	Wildfires <sup>2</sup>	Prescribed - piled fuel	Prescribed - nonpiled	Source Report
S	Alaskan tundra	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report

Fuel Model <sup>1</sup>	Vegetation	Pollutant	Wildfires <sup>2</sup>	Prescribed - piled fuel	Prescribed - nonpiled	Source
U	Western, long-needle conifer	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
WASTE	Waste Burning (all categories)	CH4	13	13	13	NEI values
WASTE	Waste Burning (all categories)	CO	85	85	85	NEI values
WASTE	Waste Burning (all categories)	NOX	6	6	6	NEI values
WASTE	Waste Burning (all categories)	PM10	38	38	38	NEI values
WASTE	Waste Burning (all categories)	PM25	34.8	34.8	34.8	NEI values
WASTE	Waste Burning (all categories)	VOC	30	30	30	NEI values
PREHARD	Prescribed - Hardwoods	CH4	15.912	8.3545	14.756	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	CO	338.13	80.6155	313.565	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	EC	1.755	0.651	1.6275	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	NH3	1.521	0.5425	1.4105	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	NOX	7.254	6.727	6.727	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	OC	13.572	4.6655	12.586	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	PM10	32.877	8.68	30.4885	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	PM25	28.197	8.68	26.1485	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	SO2	1.989	1.8445	1.8445	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	TSP	39.897	13.02	36.9985	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	VOC	15.912	6.8355	14.756	Hardwood fuel model values
SILVI	Silviculture-All types	CH4	14.23054	14.2305454	14.230545	Average of all used fuel models
SILVI	Silviculture-All types	CO	302.3990	302.399090	302.39909	Average of all used fuel models
SILVI	Silviculture-All types	EC	1.569545	1.56954545	1.5695455	Average of all used fuel models
SILVI	Silviculture-All types	NH3	1.360272	1.36027272	1.3602727	Average of all used fuel models
SILVI	Silviculture-All types	NOX	6.487454	6.48745454	6.4874545	Average of all used fuel models
SILVI	Silviculture-All types	OC	12.13781	12.1378181	12.137818	Average of all used fuel models
SILVI	Silviculture-All types	PM10	29.40281	29.4028181	29.402818	Average of all used fuel models
SILVI	Silviculture-All types	PM25	8	8	8	Average of all used fuel models

<b>Fuel Model<sup>1</sup></b>	<b>Vegetation</b>	<b>Pollutant</b>	<b>Wildfires<sup>2</sup></b>	<b>Prescribed - piled fuel</b>	<b>Prescribed - nonpiled</b>	<b>Source</b>
			25.21736	25.2173636		
SILVI	Silviculture-All types	PM25	4	4	25.217364	Average of all used fuel models
SILVI	Silviculture-All types	SO2	1.778818	1.77881818	1.7788182	Average of all used fuel models
SILVI	Silviculture-All types	TSP	35.681	35.681	35.681	Average of all used fuel models
SILVI	Silviculture-All types	VOC	14.23054	14.2305454	14.230545	Average of all used fuel models
SILVI	Silviculture-All types	VOC	5	5	14.230545	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	CH4	14.86109	14.8610909	14.861091	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	CH4	1	1	14.861091	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	CO	315.7981	315.798181	315.79818	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	CO	8	8	315.79818	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	EC	1.639090	1.63909090	1.6390909	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	EC	9	9	1.6390909	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	NH3	1.420545	1.42054545	1.4205455	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	NH3	5	5	1.4205455	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	NOX	6.774909	6.77490909	6.7749091	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	NOX	1	1	6.7749091	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	OC	12.67563	12.6756363	12.675636	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	OC	6	6	12.675636	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	PM10	30.70563	30.7056363	30.705636	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	PM10	6	6	30.705636	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	PM25	26.33472	26.3347272	26.334727	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	PM25	7	7	26.334727	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	SO2	1.857636	1.85763636	1.8576364	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	SO2	4	4	1.8576364	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	TSP	37.262	37.262	37.262	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	TSP	14.86109	14.8610909	14.861091	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	VOC	1	1	14.861091	Average of all used fuel models
WILDLEAF	Wildfire-Leaf and needle mix	CH4	15.912	15.912	15.912	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	CO	338.13	338.13	338.13	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	EC	1.755	1.755	1.755	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	NH3	1.521	1.521	1.521	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	NOX	7.254	7.254	7.254	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	OC	13.572	13.572	13.572	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	PM10	32.877	32.877	32.877	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	PM25	28.197	28.197	28.197	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	SO2	1.989	1.989	1.989	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	TSP	39.897	39.897	39.897	Average of fuel models E & H

<b>Fuel Model<sup>1</sup></b>	<b>Vegetation</b>	<b>Pollutant</b>	<b>Wildfires<sup>2</sup></b>	<b>Prescribed - piled fuel</b>	<b>Prescribed - nonpiled</b>	<b>Source</b>
WILDLEAF	Wildfire-Leaf and needle mix	VOC	15.912	15.912	15.912	Average of fuel models E & H
DE	Southern Rough/Hardwood (winter)	CH4	15.912	8.3545	14.756	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	CO	338.13	80.6155	313.565	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	EC	1.755	0.651	1.6275	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	NH3	1.521	0.5425	1.4105	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	NOX	7.254	6.727	6.727	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	OC	13.572	4.6655	12.586	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	PM10	32.877	8.68	30.4885	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	PM25	28.197	8.68	26.1485	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	SO2	1.989	1.8445	1.8445	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	TSP	39.897	13.02	36.9985	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	VOC	15.912	6.8355	14.756	Same as Emission Factors for D and E

<sup>1</sup> Single Character Fuel Models correspond to the same value NFDRS models

<sup>2</sup> Emission factors listed in the wildfire and prescribed emission factor columns for other fire types are all identical. They do not truly represent wildfire or prescribed emission factors but rather the emission factors for that type of fire.