Development of the VISTAS Draft 2002 Mobile Source Emission Inventory (February 2004 Version)

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ACRONYMS AND ABBREVIATIONS

ATADS	Air Traffic Activity Data System
ATP	anti-tampering program
BTS	Bureau of Transportation Statistics
BTU	British thermal unit
CMV	commercial marine vessels
CNG	compressed natural gas
CO	carbon monoxide
DOT	Department of Transportation
EIA	Energy Information Administration
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration
FIPS	Federal Information Processing Standards
GF	growth factor
HDDV	heavy-duty diesel vehicle
HDGV	heavy-duty gasoline vehicle
HPMS	Highway Performance Monitoring System
I/M	inspection and maintenance
LDDT	light-duty diesel truck
LDDV	light-duty diesel vehicle
LDGT	light-duty gasoline truck
LDGV	light-duty gasoline vehicle
LPG	liquified petroleum gas
LTO	landing and takeoff
MC	motorcycle
mg	milligram
NAPAP	National Acid Precipitation Assessment Program
NEI	National Emission Inventory
NH_3	ammonia
NO_x	oxides of nitrogen
OTAQ	Office of Transportation and Air Quality
Pechan	E.H. Pechan & Associates, Inc.
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers
PM_{10}	particulate matter with an aerodynamic diameter less than or equal to 10 micrometers
ppmv	parts per million volume
RFG	reformulated gasoline
RVP	Reid vapor pressure
SCC	source classification code
S/L/T	State/Local/Tribal
SO_2	sulfur dioxide
USACE	U.S. Army Corps of Engineers
VISTAS	Visibility Improvement-State and Tribal Association of the Southeast
VMT	vehicle miles traveled
VOC	volatile organic compound

I. INTRODUCTION/BACKGROUND

The Visibility Improvement – State and Tribal Association of the Southeast (VISTAS) has contracted with E.H. Pechan & Associates, Inc. (Pechan) to prepare a 2002 mobile source emissions inventory. The purpose of this emissions inventory is to support the modeling and assessment of speciated particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers ($PM_{2.5}$). Through this contract, Pechan first prepared an inventory review document. This document summarized several regional and national emission inventory efforts and identified strengths and weaknesses associated with the use of these inventories in regional haze modeling. This document also summarized data submittals by State and local air agencies within the VISTAS region that could be used in the VISTAS 2002 mobile source emissions inventory.

Since that time, the State and local air agencies have updated their submittals for the mobile source sectors, including both onroad vehicles and nonroad engines. In July of 2003, Pechan delivered sets of inputs to the NONROAD model option files and MOBILE6.2 input files and vehicle miles traveled (VMT) data for each State and local agency to review. For the onroad sector, the MOBILE6.2 input files and VMT data represented Pechan's processing of the State and local inputs in a consistent manner for use in calculating the 2002 onroad emissions inventory. The MOBILE6.2 input files and VMT data included as much of the local data supplied by the State and local agencies as possible, with missing information filled in with appropriate default data. The data delivered by Pechan for the State and local agencies to review related to the nonroad sector was primarily in the form of temperature and fuel data that would be used as inputs to the NONROAD model. It should be noted that the nonroad sector inputs were completed first and did not include some of the later temperature and fuel updates that did get incorporated in the onroad data.

The State and local agencies were given a brief period to review, comment upon, and make updated submittals to the onroad and nonroad inputs that were delivered in July 2003. After receiving these comments and updated data, Pechan updated the appropriate MOBILE6.2 input files, VMT data, and nonroad inputs with the revised State and local data. Pechan then calculated 2002 onroad and nonroad emissions from these inputs. Pechan presented the preliminary results of these emission inventories at a VISTAS meeting on August 28, 2003. These draft August 2003 emission estimates, including inputs and methodology, were documented in a draft report circulated to VISTAS in October 2003. This October 2003 report also included documentation of draft 2002 refueling emissions from onroad and nonroad sources. The VISTAS States were asked to review this document, as well as the supporting files provided by Pechan, and provide comments or revisions by December 2003. Onroad and nonroad 2002 emissions for the VISTAS States have since been calculated based on the updates provided by the States. This report documents the inputs and methodologies used in the February 2004 version of the VISTAS 2002 onroad and nonroad mobile source emission inventories.

II. ONROAD METHODS AND DATA

A. 2002 VMT DEVELOPMENT

Table II-1 summarizes the type of VMT data submitted by each agency. Depending upon the data submitted by the individual State or agency, up to three different procedures were performed on the data. First, VMT data that were not provided at the annual level were converted from daily VMT to annual VMT. Second, VMT provided for years other than 2002 were grown from the base year provided. Finally, the VMT were allocated by vehicle type, if not already at that level of detail. The section discusses each of these procedures in more detail.

It should be noted that although the format and content of the VMT provided by the VISTAS State and Local agencies varied significantly from agency to agency, this draft 2002 VISTAS inventory is based at a minimum on county/roadway type specific VMT, as provided by the individual agencies. This is a significant improvement over the spatial allocation methods used in the U.S. Environmental Protection Agency's (EPA's) National Emission Inventory (NEI) for onroad vehicles.

1. Conversion to Annual VMT

For use in the emission calculations, Pechan's ultimate goal with the VMT data was to develop an annual 2002 VMT database by county, roadway type, and vehicle type. As indicated in Table II-1, the VMT data were submitted using three different time periods: annual, average annual day, and summer day. No temporal adjustments were applied to VMT data submitted as annual VMT. VMT data submitted as average annual day VMT were multiplied by 365 to convert from an average day to the annual time period. The Jefferson County, Kentucky VMT were submitted as summer day VMT. All annual VMT values were converted to units of millions of miles per year. Therefore, any VMT values submitted as miles were divided by a factor of 1,000,000 and VMT values submitted in units of 1,000 miles were divided by a factor of 1,000.

The Jefferson County, Kentucky VMT submittal included a single factor for converting the summer day VMT to average annual day VMT. Thus, the Jefferson County summer day VMT data were first multiplied by a factor of 0.97752 (the temporal conversion factor provided by Jefferson County) to obtain average annual day VMT. The VMT data were then multiplied by 365 to obtain the annual VMT.

Table II-1. VMT Data Provided by State/Local Agencies

State/Area	Time Period	2002 Actual VMT by County/Road Type/Vehicle Type	2002 Actual VMT by County/Road Type	2002 Projected VMT by County/Road Type	2002 VMT from TDM by County/Road Type/Vehicle Type	1999 Actual VMT by County/Road Type/Vehicle Type
Alabama	AAD		X			
Florida	AAD		X			
Georgia	AAD		X			
Kentucky	AAD			X		
Jefferson County, KY	SD				X	
Mississippi	ANN	X				
North Carolina	AAD		X			
South Carolina	ANN		X			
Tennessee	AAD		X			
Virginia	ANN					X
West Virginia	ANN	X				X
Time Period Codes: AAD=Average Annual Day, SD=Summer Day, ANN=Annual						

2. Projection to 2002

As indicated in Table II-1, the Virginia VMT submittal was for a base year of 1999 rather than 2002. Thus, these VMT data needed to be projected to 2002 before calculating emissions. For Virginia, growth factors were developed by roadway type for the period from 1999 to 2001 based on historical VMT data by roadway type from Table VM-2 "Functional System Travel" in DOT's *Highway Statistics* series (DOT, 1999 and 2001). The growth factors, presented in Table II-2, were calculated by dividing Virginia's 2001 VMT for each of the 12 roadway types from *Highway Statistics 2001* by the corresponding 1999 VMT from *Highway Statistics 1999*. For the period from 2001 to 2002, the growth factors were developed using data obtained from the U.S. Department of Transportation's Traffic Volume Trends report (DOT, 2002). This monthly publication provides a comparison of preliminary 2002 VMT estimates with comparable 2001 VMT. For several roadway types, these data are provided only at a national level. However, for the combined rural interstates and arterials, these data are presented by State. The resultant data, used to project the 2001 Virginia VMT to 2002, are shown in Table II-2. The 2001 to 2002 growth factors represent the 2002 VMT divided by the 2001 VMT, based on the data Virginia for the rural interstates and arterials and on the national data for the remaining roadway types. Once the growth factors were developed, the Virginia 1999 VMT data were first multiplied by the appropriate 1999 to 2001 growth factor and then by the appropriate 2001 to 2002 growth factor.

Table II-2. VMT Growth Factors Used for Virginia

Roadway Type	Roadway Type Portion of SCC	Virginia 1999 to 2001 VMT Growth Factor	Virginia 2001 to 2002 VMT Growth Factor
Rural Interstate	110	1.043	1.035
Rural Other Principal Arterial	130	1.050	1.035
Rural Major Arterial	150	1.130	1.035
Rural Major Collector	170	0.982	1.011
Rural Minor Collector	190	1.032	1.011
Rural Local	210	0.923	1.011
Urban Interstate	230	1.050	1.024
Urban Other Freeway & Expressway	250	0.984	1.011
Urban Other Principal Arterial	270	1.061	1.011
Urban Minor Arterial	290	0.991	1.011
Urban Collector	310	0.925	1.013
Urban Local	330	0.690	1.013

Sources: U.S. Department of Transportation, Federal Highway Administration, "Traffic Volume Trends, December 2002", (http://www.fhwa.dot.gov/ohim/tvtw/tvtpage.htm); *Highway Statistics 1999*, and *Highway Statistics 2001 (http://www.fhwa.dot.gov/policy/ohpi/hss/hsspubs.htm)*

3. Splitting VMT by Road Type

The final step in developing a consistent 2002 VMT data base was to allocate VMT from the county and roadway type level of detail to the county/roadway type/vehicle type level of detail. As shown in Table II-1, the Jefferson County, Kentucky; Mississippi; Virginia; and West Virginia VMT data supplied for these jurisdictions already included the vehicle type level of detail, so this final adjustment was not needed for these areas. For the remaining areas, some provided VMT mix by vehicle type fractions while others provided no information on the allocation of VMT by vehicle. In this latter case, default VMT fraction data from EPA's MOBILE6 model were used.

The States for which MOBILE6 default VMT mix data were used are: Alabama, Florida, Georgia, Kentucky (excluding Boone County, Campbell County, Kenton County, and Jefferson County), and South Carolina. It should be noted that Georgia initially provided VMT fractions based on Georgia's HPMS classification count data, but after review of ten years of these data determined that they are not reflecting the trend towards increasing travel by light trucks. Georgia therefore decided it was more conservative to assume MOBILE6 default VMT fractions.

a. Allocation of VMT to Vehicle Type using Default VMT Mix Data

To calculate 2002 VMT at the county/roadway type/vehicle type level using national default data, the VMT totals by county and roadway type need to be allocated among the 28 MOBILE6 vehicle types. This was done based on the distribution of the 2001 rural and urban VMT among the six Highway Performance Monitoring Systems (HPMS) vehicle types found in Table VM-1 ("Annual Vehicle Distance Traveled in Miles and Related Data - 1999 - by Highway Category and Vehicle Type") of the Federal Highway Administration's (FHWA's) *Highway Statistics*

2001 (http://www.fhwa.dot.gov/ohim/ hs01/index.htm) and a mapping of these HPMS vehicle categories to the 28 MOBILE6 vehicle types. This mapping of the MOBILE6 vehicle types to the HPMS vehicle types was developed by EPA's Office of Transportation and Air Quality (OTAQ) and is used in the development of the NEI. The data first needed to be expanded to the 28 vehicle type level of detail to obtain the proper cross reference between the HPMS and MOBILE6 vehicle types since the eight vehicle types used in the final VISTAS VMT data base cannot be directly mapped to the HPMS vehicle categories. First, the VMT totals for each of the six HPMS vehicle categories were calculated as a fraction of the total VMT. This calculation was performed separately for the rural VMT and the urban VMT. The resulting 2001 VMT fractions for rural VMT and urban VMT are shown in Table II-3. Note that 2002 VMT are not yet available at this level of detail. Using the default MOBILE6 VMT fractions for 2001 (since the HPMS data represents 2001), taken from a MOBILE6 output file for 2001, the MOBILE6 VMT fractions were renormalized among all MOBILE6 vehicle types mapped to a given HPMS vehicle category. This renormalization is shown in the final column of Table II-3.

Table II-3. Allocation of VMT from HPMS Vehicle Categories to MOBILE6 Vehicle Types for 2001

HPMS Vehicle Category	HPMS 2001 Rural VMT Fractions	HPMS 2001 Urban VMT Fractions	MOBILE6 Vehicle Category	MOBILE6 2001 VMT Fractions by HPMS Category
Passenger Cars	0.5454	0.6065	LDGV	0.9980
			LDDV	0.0020
Motorcycles	0.0039	0.0031	MC	1.0000
Other 2-Axle 4-Tire Vehicles	0.3368	0.3375	LDGT1	0.1565
			LDGT2	0.5211
			LDGT3	0.1585
			LDGT4	0.0729
			LDDT12	0.0005
			LDDT34	0.0032
			HDGV2B	0.0658
			HDDV2B	0.0216
Single-Unit 2-Axle 6-Tire or More Trucks	0.0332	0.0212	HDGV3	0.0376
			HDGV4	0.0206
			HDGV5	0.0436
			HDGV6	0.0934
			HDGV7	0.0437
			HDDV3	0.1023
			HDDV4	0.0867
			HDDV5	0.0380
			HDDV6	0.2138
			HDDV7	0.3205
Combination Trucks	0.0770	0.0300	HDGV8A	0.0001
			HDGV8B	0.0000
			HDDV8A	0.2191
			HDDV8B	0.7808
Buses	0.0037	0.0017	HDGB	0.1920
			HDDBT	0.3258
			HDDBS	0.4822
Total	1.0000	1.0000		

To calculate VMT by vehicle type, each VMT value representing a given county and road type was multiplied by the product of the HPMS VMT fraction (selected depending upon whether the road type represent VMT on rural or urban roads) and the corresponding MOBILE6 VMT fraction by HPMS category. This process resulted in 28 VMT values at the county/roadway type/vehicle type level of detail for each county/roadway type VMT value in the original VMT file.

As an example, Table II-3 shows that the HPMS Passenger Car vehicle category accounts for 54.54 percent of the total VMT on rural road types and that the MOBILE6 LDGV category accounts for 99.8 percent of the VMT in the HPMS Passenger Car category. Therefore, a VMT value representing rural interstates would be multiplied by 0.5454 times 0.9980 (0.5443), to obtain the VMT total on rural interstates from LDGVs. Once all county/roadway type VMT values were expanded to the corresponding set of values of VMT at the county/roadway type/28 MOBILE6 vehicle type level of detail, the VMT data base was then totaled at the eight vehicle type level of detail (LDGV, LDGT1, LDGT2, HDGV, LDDV, LDDT, HDDV, MC).

b. Allocation of VMT to Vehicle Type using State-Provided VMT Mix Data

Both North Carolina and Tennessee provided VMT mix data at the eight vehicle type level of detail. The Tennessee data was provided for ten different county groupings, with a VMT mix provided for six aggregated roadway type categories. North Carolina provided statewide VMT mix fractions for each of the 12 roadway types. Since the VMT mix data for these two States were already at the eight vehicle type level, the procedure for allocating VMT by vehicle type was simpler than the procedure described above using the default data. Each county/roadway type VMT value was matched to the corresponding VMT mix for that county and roadway type and then separately multiplied by each of the eight VMT mix fractions to create eight VMT values by county/roadway type/vehicle type that would sum to the original VMT value at the county/roadway type level of detail.

c. Allocation of VMT by Month

The resulting annual county-level, vehicle, and roadway type-specific VMT data were temporally allocated to months during the emission calculations. National Acid Precipitation Assessment Program (NAPAP) temporal allocation factors were used to apportion the VMT to the four seasons. Monthly VMT data were obtained using a ratio between the number of days in a month and the number of days in the corresponding season. These temporal factors are shown in Table II-4. Several States provided some level of information on temporal adjustment factors for their VMT. These data were not used in this draft version of the 2002 VISTAS emission inventory due to time constraints. However, any State or locally supplied temporal adjustment factors will be included in the final version of the 2002 VISTAS onroad emission inventory.

Table II-4. Default VMT Seasonal and Monthly Temporal Allocation Factors

Roadway Seasonal VMT Factors					
Vehicle Type	Roadway Type	Winter	Spring	Summer	Fall
LDV,LDT,MC	Rural	0.2160	0.2390	0.2890	0.2560
LDV,LDT,MC	Urban	0.2340	0.2550	0.2650	0.2450
HDV	All	0.2500	0.2500	0.2500	0.2500

Monthly VMT Factors													
Vehicle Type	Roadway Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
LDV,LDT,MC	Rural	0.0744	0.0672	0.0805	0.0779	0.0805	0.0942	0.0974	0.0974	0.0844	0.0872	0.0844	0.0744
LDV,LDT,MC	Urban	0.0806	0.0728	0.0859	0.0832	0.0859	0.0864	0.0893	0.0893	0.0808	0.0835	0.0808	0.0806
HDV	All	0.0861	0.0778	0.0842	0.0815	0.0842	0.0815	0.0842	0.0842	0.0842	0.0852	0.0824	0.0861

B. 2002 ONROAD EMISSION FACTOR DEVELOPMENT USING MOBILE6.2

The onroad emission factors used in the calculation of the VISTAS 2002 onroad emission inventory were generated using EPA's MOBILE6.2 emission factor model. In the development of the MOBILE6.2 input files, Pechan attempted to include as much of the relevant data supplied by the State and local agencies as possible, while at the same time, maintaining a generally similar overall structure to the MOBILE6.2 input files, such that the output emission factors could easily be matched to the appropriate VMT values. This section first discusses the overall general structure of the MOBILE6.2 input files. This is followed by details explaining how this general structure was adapted to include the State and local agency data and summaries of the types of data provided by each agency.

1. General MOBILE6.2 File Structure

Each MOBILE6.2 input file is divided into three sections: the header section, the run data section, and the scenario section. Information contained in the header section is primarily related to defining the output format and content desired by the user. For the processing of the VISTAS emission calculations, the database output format, aggregated to the daily level, was the desired output format. In addition, for proper modeling of the VOC emissions, it was desired to calculate the exhaust VOC emissions separately from the evaporative VOC emissions. However, within the constraints of MOBILE6.2 in the daily aggregated database output format, it is not possible to obtain evaporative and exhaust VOC emission factors broken out separately within each scenario. It is also not possible to obtain emission factors for both PM_{10} and $PM_{2.5}$ within a single MOBILE6.2 scenario. Therefore, two sets of MOBILE6.2 input files were created—one set to model VOC exhaust, NO_x, CO, SO_2, PM_{10}, and NH_3 emission factors and a second set to model VOC evaporative and $PM_{2.5}$ emission factors. Figure II-1 illustrates the header section of a sample VISTAS MOBILE6.2 input file used to generate the VOC exhaust, NO_x, CO, SO_2, PM_{10}, and NH_3 emission factors. Similarly, Figure II-2 illustrates the header section of a sample VISTAS MOBILE6.2 input file used to generate the VOC evaporative and $PM_{2.5}$ emission factors. The primary difference between these two header sections is in the selection of the emission types included, using the DATABASE EMISSIONS command and in the selection of the pollutants to be included in the output. In Figure II-1, having the first two flags set to "2" following the DATABASE EMISSIONS command indicates that the startup and running exhaust emission factor components will be included in the output emission factor table. In Figure II-2, the last six flags of the DATABASE EMISSIONS command line are set to "2" to obtain the evaporative emission factor components in the emission factor output file. In Figure II-2, the pollutants SO_2 and NH_3 are eliminated from the PARTICULATES command line, as the emission factors for these pollutants will be reported in the output file resulting from the file shown in Figure II-1.

Figure II-1. Header Section of MOBILE6.2 Input File Including VOC Exhaust and PM_{10} Emission Factors

```
MOBILE6 INPUT FILE :
> HEADER 01 0012002 - EXHAUST - PM 10.0

REPORT FILE        : Vistas02/Output02/V0100110.TXT REPLACE
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DAILY OUTPUT       :
DATABASE EMISSIONS : 2211 1111
PARTICULATES       : SO4 OCARBON ECARBON GASPM LEAD SO2 NH3 BRAKE TIRE
AGGREGATED OUTPUT  :
EMISSIONS TABLE    : Vistas02/TB1_02/V0100110.TB1 REPLACE
```

Figure II-2. Header Section of MOBILE6.2 Input File Including VOC Evaporative and $PM_{2.5}$ Emission Factors

```
MOBILE6 INPUT FILE :
> HEADER 01 0012002 - EVAPORATIVE - PM 2.50

REPORT FILE        : Vistas02/Output02/V0100125.TXT REPLACE
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DAILY OUTPUT       :
DATABASE EMISSIONS : 1122 2222
POLLUTANTS         : HC
PARTICULATES       : ECARBON SO4 OCARBON GASPM LEAD BRAKE TIRE
AGGREGATED OUTPUT  :
EMISSIONS TABLE    : Vistas02/TB1_02/V0100125.TB1 REPLACE
```

The next section of the MOBILE6 input files is the run data section. This section includes data that applies to all scenarios in the input file. Figure II-3 shows an example of this section for a county using default data. The only commands included in this example tell MOBILE6 that the HC emission factors should be expressed in terms of VOC and that refueling emission factors should be excluded from the output. It should be noted that refueling emissions were calculated using a separate set of input files, but were excluded from the onroad input files here since refueling emissions are included in the area source inventory rather than the onroad inventory. Chapter IV discusses the onroad refueling MOBILE6 input files and emission calculations. Comments in Figure II-3 indicate that this input file is using default registration distributions and diesel sales fractions. For any input files that represent counties for which registration distribution, diesel sales fractions, or trip length distributions have been provided or that have an inspection and maintenance (I/M) program, anti-tampering program (ATP), or low emission vehicle program in place in 2002, additional inputs are required in the run data section of the MOBILE6.2 input file. Figure II-4 shows an example of an input file including all of these data. Some of these data inputs are included directly in the MOBILE6.2 input file, while other data are contained in external text files that are named by the commands in the run data section. For questions regarding the specifics of any of the MOBILE6 input commands listed, the MOBILE6 User's Guide should be consulted.

Figure II-3. Run Data Section of a MOBILE6.2 Input File

```
RUN DATA           :
>

EXPRESS HC AS VOC  :
NO REFUELING       :

* MOBILE6 Default Registration Distributions Applied
* MOBILE6 Default Diesel Sales Fractions Applied
```

Figure II-4. Run Data Section of a MOBILE6.2 Input File with Significant Local Inputs

```
RUN DATA           :
>

EXPRESS HC AS VOC  :
NO REFUELING       :

REG DIST           : Vistas02\ExtFiles\R02_ARLI.RDT

* Diesel Sales Fractions Source File -
E:\TrendsM6_New\Vistas02\ExtFiles\D02_ARLI.DSF
DIESEL FRACTIONS   :
0.0012 0.0023 0.0026 0.0027 0.0029 0.0015 0.0008 0.0011 0.0001 0.0006
0.0013 0.0015 0.0006 0.0014 0.0006 0.0099 0.0087 0.0446 0.0685 0.0857
0.1922 0.1481 0.1132 0.0959 0.0126
0.0056 0.0221 0.0167 0.0235 0.0126 0.0119 0.0206 0.0136 0.0155 0.0127
0.0246 0.0206 0.0222 0.0184 0.0227 0.0115 0.0310 0.0568 0.0508 0.1211
0.1077 0.2126 0.0711 0.0286 0.0176
0.0056 0.0221 0.0167 0.0235 0.0126 0.0119 0.0206 0.0136 0.0155 0.0127
0.0246 0.0206 0.0222 0.0184 0.0227 0.0115 0.0310 0.0568 0.0508 0.1211
0.1077 0.2126 0.0711 0.0286 0.0176
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0115 0.0111 0.0145
0.0115 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124 0.0135 0.0169 0.0209
0.0256 0.0013 0.0006 0.0011 0.0001
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0115 0.0111 0.0145
0.0115 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124 0.0135 0.0169 0.0209
0.0256 0.0013 0.0006 0.0011 0.0001
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.2578 0.2515 0.3263
0.2784 0.2963 0.2384 0.2058 0.1756 0.1958 0.2726 0.2743 0.3004 0.2918
0.2859 0.0138 0.0000 0.0000 0.0000
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.7715 0.7910 0.8105
0.8068 0.8280 0.8477 0.7940 0.7488 0.7789 0.7842 0.6145 0.5139 0.5032
0.4277 0.0079 0.0000 0.0000 0.0001
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8473 0.8048 0.8331
0.7901 0.7316 0.7275 0.7158 0.5647 0.3178 0.2207 0.1968 0.1570 0.0738
0.0341 0.0414 0.0003 0.0000 0.0000
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4384 0.3670 0.4125
0.3462 0.2771 0.2730 0.2616 0.1543 0.0615 0.0383 0.0333 0.0255 0.0111
0.0049 0.0060 0.0000 0.0000 0.0000
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6078 0.5246 0.5767
```

```
0.5289 0.5788 0.5617 0.4537 0.4216 0.4734 0.4705 0.4525 0.4310 0.3569
0.3690 0.4413 0.3094 0.1679 0.1390
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8443 0.7943 0.8266
0.7972 0.8279 0.8177 0.7440 0.7184 0.7588 0.7567 0.7431 0.7261 0.6602
0.6717 0.7344 0.6107 0.4140 0.3610
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9989 0.9987 0.9989
0.9977 0.9984 0.9982 0.9979 0.9969 0.9978 0.9980 0.9979 0.9976 0.9969
0.9978 0.9982 0.9974 0.9965 0.9964
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.8857 0.8525 0.8795
0.9900 0.9105 0.8760 0.7710 0.7502 0.7345 0.6733 0.5155 0.3845 0.3238
0.3260 0.2639 0.0594 0.0460 0.0291


> ANTI-TAMP PROG     : E:\TrendsM6_New\Vistas02\ExtFiles\VA_ATP2002.ATP
ANTI-TAMP PROG     :
89 68 50 22222 21111111 1 12 098. 22112222

> Exhaust I/M - IDLE test program #1
I/M PROGRAM        : 1 1983 2050 2 TRC 2500/IDLE
I/M MODEL YEARS    : 1 1968 1980
I/M VEHICLES       : 1 22222 21111111 1
I/M STRINGENCY     : 1 35.0
I/M COMPLIANCE     : 1 98.0
I/M WAIVER RATES   : 1 2.0 2.0

> Exhaust I/M - ASM final program #2
I/M PROGRAM        : 2 1983 2050 2 TRC ASM 2525/5015 PHASE-IN
I/M MODEL YEARS    : 2 1981 2050
I/M VEHICLES       : 2 22222 11111111 1
I/M STRINGENCY     : 2 35.0
I/M COMPLIANCE     : 2 98.0
I/M WAIVER RATES   : 2 2.0 2.0
I/M EFFECTIVENESS  : 0.94 0.94 0.94

> Exhaust I/M - IDLE test program #1
I/M PROGRAM        : 3 1983 2050 2 TRC 2500/IDLE
I/M MODEL YEARS    : 3 1981 2050
I/M VEHICLES       : 3 11111 21111111 1
I/M STRINGENCY     : 3 35.0
I/M COMPLIANCE     : 3 98.0
I/M WAIVER RATES   : 3 2.0 2.0

> Evap I/M - Gas Cap test program #3
I/M PROGRAM        : 4 1998 2050 2 TRC GC
I/M MODEL YEARS    : 4 1973 2050
I/M VEHICLES       : 4 22222 21111111 1
I/M COMPLIANCE     : 4 98.0
I/M WAIVER RATES   : 4 2.0 2.0

94+ LDG IMP        : Vistas02\ExtFiles\NLEVNE.D

> WeekDay Trip Length Distribution
WE DA TRI LEN DI   : Vistas02\ExtFiles\WeekTLD2.wdt
```

The third and final section of the MOBILE6.2 input files contains the scenario data. For this VISTAS inventory, each speed and road type combination or speed distribution were modeled in twelve consecutive scenarios representing the temperature and fuel properties applicable in each month. Thus, if a State agency supplied an average speed/road type combination for each of the 12 HPMS road categories, the corresponding MOBILE6.2 input file would have 144 scenarios. The first scenario would represent January temperature and fuel conditions at the speed and MOBILE6 roadway type for the first speed/roadway type provided (typically rural interstates). This would be followed by the February scenario modeled for the same speed and roadway type, and so on through the twelfth scenario representing December conditions for the same speed and roadway type combination.

Figure II-5 illustrates a sample scenario from one of the VISTAS MOBILE6.2 input files. This is the first scenario in the file—therefore, it represents January temperature and fuel conditions. The month of a given scenario in the VISTAS MOBILE6.2 input files can be determined by the last two digits of the SCENARIO RECORD command line. In this case, the last two digits are "01" indicating January. It should be noted that the only options for the EVALUATION MONTH command are "1" indicating January or "7" indicating July. For the VISTAS input files, the EVALUATION MONTH was set to "1" for all months from January through June and to 7 for months from July through December. When this flag is set to "1", it indicates that MOBILE6 will use a January registration distribution. When the flag is set to "7", MOBILE6 ages the registration by a half year, applying a half year of fleet turnover to the distribution. The EVALUATION MONTH setting can also affect the reductions from reformulated gas programs. However, by including the SEASON command, as shown in Figure II-5, the EVALUATION MONTH flag setting will not affect reformulated gasoline reductions. With the SEASON flag set to "2", winter reformulated gasoline rules will be applied in areas with a reformulated gas program modeled (using the FUEL PROGRAM command). Summer reformulated gas rules and reductions will be applied when the SEASON flag is set to "1" if reformulated gas has been modeled. In all of the VISTAS input files, the SEASON flag was included for all areas, whether or not a reformulated gasoline program was modeled. This flag has no effect when the FUEL PROGRAM command is not used. The SEASON flag was set to "1" for the months of May through September and to "2" for the remaining months.

Figure II-5. Sample Scenario for a Typical MOBILE6.2 Input File

```
SCENARIO RECORD    : 010010215.0_M01
>FV FILE:      SCENARIO: 1
CALENDAR YEAR      : 2002
EVALUATION MONTH   : 1
MIN/MAX TEMPERATURE: 38.0 60.0
ALTITUDE           : 1
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV
SEASON             : 2
AVERAGE SPEED      : 15.0 Arterial
FUEL RVP           : 12.5
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 500.0
```

Local speed data were provided by the agencies in Georgia, Kentucky, North Carolina, Tennessee, and Virginia. A set of 12 monthly scenarios was developed for each speed input for these States, with one exception. The Northern Kentucky (Boone County, Campbell County, and Kenton County) and Jefferson County, Kentucky inputs were speed distribution files, rather than average speeds by individual roadway types (one for Northern Kentucky and one for Jefferson County, Kentucky). In this case, only 12 scenarios were modeled in total in the Jefferson County and Northern Kentucky input files, with the Jefferson County or Northern Kentucky speed distribution referenced in each scenario, respectively. No speed information was provided for Alabama, Florida, Mississippi, South Carolina, or West Virginia. The average speeds modeled in these files were the default speeds used in the NEI. These speeds are shown in Table II-5 and vary by both roadway type and vehicle category. It should be noted that several agencies provided speed information for ramps. Since the VMT data file is organized by SCC and no SCC currently exists for ramp VMT, the ramp speed information could not be used directly. In some cases, the fraction of VMT occurring on ramps was provided. In these cases, this information was combined with the freeway speeds, following the guidance in the MOBILE6 user's guide to determine the overall freeway speed including the ramp speed, at 34.6 mph (the assumed value for ramp speeds in MOBILE6), and the fraction of VMT occurring on the ramps.

Table II-5. Default Speeds Modeled by Road Type and Vehicle Type (mph)

	Speed (mph) and MOBILE6 Road Type		
HPMS Road Type	**Light Duty Vehicles**	**Light Duty Trucks**	**Heavy Duty Trucks**
Rural Interstate	60 Freeway	55 Freeway	40 Freeway
Rural Principal Arterial	45 Arterial	45 Arterial	35 Arterial
Rural Minor Arterial	40 Arterial	40 Arterial	30 Arterial
Rural Major Collector	35 Arterial	35 Arterial	25 Arterial
Rural Minor Collector	30 Arterial	30 Arterial	25 Arterial
Rural Local	30 Arterial	30 Arterial	25 Arterial
Urban Interstate	45 Freeway	45 Freeway	35 Freeway
Urban Other Freeway and Expressway	45 Freeway	45 Freeway	35 Freeway
Urban Principal Arterial	20 Arterial	20 Arterial	15 Arterial
Urban Minor Arterial	20 Arterial	20 Arterial	15 Arterial
Urban Collector	20 Arterial	20 Arterial	15 Arterial
Urban Local	Local	Local	Local

Another optional input included in the scenario section of the MOBILE6 input files is the VMT mix by 16 MOBILE6 vehicle categories. These vehicle categories are based on the 28 MOBILE6 vehicle categories, but with gasoline and diesel vehicles of the same weight class combined together. When no information was provided on VMT mix, the MOBILE6 defaults were used. Local VMT mix information provided by Tennessee, Virginia, and Jefferson County, Kentucky were included in the MOBILE6.2 input files. In some cases, the same VMT mix was applied to all scenarios. In other cases, the VMT mixes were specific to roadway type, so the VMT mix would vary according to the roadway type being represented in the scenario.

C. 2002 ONROAD EMISSION INVENTORY CALCULATIONS

Once the MOBILE6.2 input files were set up and run through the MOBILE6.2 model, onroad emissions were calculated by multiplying the monthly VMT for a given county, roadway type, and vehicle type by the emission factor modeled for the same month, county, vehicle type and roadway type. Because the MOBILE6.2 input files were set up to create output files in the form of database tables, the output is provided by each of the 28 MOBILE6 vehicle types. Thus, the emission factors first were aggregated to the eight vehicle categories included in the VMT files. This was done using the VMT Fraction data provided in each of the MOBILE6 output files. For each of the MOBILE6 vehicle types included in one of the eight vehicle types needed, the VMT fractions were renormalized within that category. These eight vehicle categories are sometimes referred to as the MOBILE5 vehicle categories. For example, the LDGT1 and LDGT2 MOBILE6 vehicle categories are both included in the MOBILE5 LDGT1 category. In this case, the MOBILE6 LDGT1 VMT fraction was divided by the sum of the MOBILE6 LDGT1 and LDGT2 VMT fractions. The same was done with the MOBILE6 LDGT2 VMT fraction, so that the renormalized MOBILE6 LDGT1 and LDGT2 VMT fractions should now sum to 1. Next, these normalized VMT fractions were multiplied by the corresponding MOBILE6 emission factor and all of these weighted emission factors for a given scenario, within a MOBILE5 vehicle category were summed to obtain the weighted emission factors at the MOBILE5 vehicle category level. The VMT fractions included in the MOBILE6 output files are affected by the registration distribution, diesel sales fractions, and VMT mixes supplied in the MOBILE6.2 input files. Areas that used the MOBILE6 defaults for each of these inputs should all have the same VMT fractions, although even in these cases, there are two sets of VMT fractions—one for the months from January through June and another for the months July through December. This occurs due to the aging of the registration distribution caused by the use of the EVALUATION MONTH flag, as discussed above. These emission factors, now at the MOBILE5 vehicle category level, were multiplied by the corresponding VMT values to obtain monthly emissions by county, roadway type, and vehicle category.

D. DATA PROVIDED BY STATE AND LOCAL AGENCIES

The sections above describe some of the data that was supplied by the VISTAS State and local agencies for use in the development of the 2002 onroad emission inventory. Tables II-6 through II-15 summarize the data supplied by each agency in a consistent fashion. These tables primarily list the data that were actually used in this analysis. This section provides additional information on the data supplied by these agencies as well discussing why some of the data supplied could not be used.

Table II-6. Summary of Onroad Data Provided by Alabama

Data Element	Data Supplied by Responsible Agency
VMT Data	2002 actual daily VMT by county/road type
MOBILE6 Input Files	
MOBILE5 Input Files	
VMT Mix Information	
Counties by Temperature Region	
Monthly Temperatures	Monthly 2002 temperatures by county
RVP Data	March-September RVP values
Speed Data	
Registration Data	
Fuel Information	
I/M Program Information	N/A
Other	

Table II-7. Summary of Onroad Data Provided by Florida

Data Element	Data Supplied by Responsible Agency
VMT Data	2002 actual daily VMT by county/road type
MOBILE6 Input Files	
MOBILE5 Input Files	
VMT Mix Information	
Counties by Temperature Region	Supplied counties in each of 3 temperature regions
Monthly Temperatures	
RVP Data	Summer RVP values provided
Speed Data	
Registration Data	
Fuel Information	
I/M Program Information	N/A
Other	

Table II-8. Summary of Onroad Data Provided by Georgia

Data Element	Data Supplied by Responsible Agency
VMT Data	2002 actual average annual daily VMT by county and functional classification prepared by Georgia DOT
MOBILE6 Input Files	Provided MOBILE6 sample input files
MOBILE5 Input Files	
VMT Mix Information	
Counties by Temperature Region	
Monthly Temperatures	
RVP Data	Provided summer RVP values
Speed Data	Provided 2002 statewide speeds by road type (speeds based on VMT-weighted average speeds, from a 2002 loaded highway network for the 13-county Atlanta area)
Registration Data	Provided one MOBILE6 registration distribution for 13-county Atlanta area and one MOBILE6 registration distribution for rest-of-state
Fuel Information	Provided information on Georgia gasoline program, applied to 25 counties
I/M Program Information	Provided I/M inputs for 13-county Atlanta area in MOBILE6 format
Other	Provided VMT temporal adjustment factors by month and day of week for each road type (not used in the 01/04 inventory)

Table II-9. Summary of Onroad Data Provided by Kentucky

Data Element	Data Supplied by Responsible Agency
VMT Data	2002 actual daily VMT by county/road type
MOBILE6 Input Files	Provided sample MOBILE6 input files for several counties
MOBILE5 Input Files	
VMT Mix Information	
Counties by Temperature Region	Provided temperature stations to be used for several counties
Monthly Temperatures	
RVP Data	Provided summer RVP for several counties
Speed Data	Provided average speed by road type for several county groupings
Registration Data	
Fuel Information	Verified counties in reformulated gasoline program
I/M Program Information	I/M program information provided
Other	
Jefferson County, Kentucky	
Data Element	**Data Supplied by Responsible Agency**
VMT Data	2002 summer day VMT from TDM by county/road type/vehicle type
MOBILE6 Input Files	Provided MOBILE6 input files representing the four different vehicle control combinations found in Jefferson County
MOBILE5 Input Files	
VMT Mix Information	Provided Jefferson County VMT mix in MOBILE6 format
Counties by Temperature Region	
Monthly Temperatures	Provided 2002 actual monthly temperature data for Louisville area
RVP Data	Provided summer and winter RVP values
Speed Data	Provided speed distribution file for Jefferson County
Registration Data	Provided registration distribution for Jefferson County in MOBILE6 format
Fuel Information	Reformulated gasoline modeled
I/M Program Information	I/M program information provided
Other	Provided absolute humidity data
Boone County, Campbell County, and Kenton County, Kentucky	
Data Element	**Data Supplied by Responsible Agency**
VMT Data	2002 actual daily VMT by county/road type
MOBILE6 Input Files	
MOBILE5 Input Files	Provided MOBILE5 input file for Northern Kentucky counties
VMT Mix Information	
Counties by Temperature Region	
Monthly Temperatures	
RVP Data	Provided summer and winter RVP values
Speed Data	Provided speed distribution file for Northern Kentucky
Registration Data	Provided registration distribution for Northern Kentucky in MOBILE6 format—LDGVs and LDGT1s only
Fuel Information	Reformulated gasoline modeled
I/M Program Information	I/M program information extracted from MOBILE5 input file
Other	Provided Northern Kentucky VMT distributions by facility type and by hour in MOBILE6 format

Table II-10. Summary of Onroad Data Provided by Mississippi

Data Element	Data Supplied by Responsible Agency
VMT Data	Provided 2002 actual annual VMT by county/road type/vehicle type
MOBILE6 Input Files	
MOBILE5 Input Files	
VMT Mix Information	
Counties by Temperature Region	
Monthly Temperatures	
RVP Data	Provided statewide RVP by season
Speed Data	
Registration Data	
Fuel Information	
I/M Program Information	N/A
Other	

Table II-11. Summary of Onroad Data Provided by North Carolina

Data Element	Data Supplied by Responsible Agency
VMT Data	2002 actual daily VMT by county/road type
MOBILE6 Input Files	
MOBILE5 Input Files	
VMT Mix Information	
Counties by Temperature Region	Indicated counties within each of several temperature regions in state
Monthly Temperatures	
RVP Data	
Speed Data	Provided average speed data by road type for several groups of counties and rest-of-state
Registration Data	Provided registration data for several groups of counties and rest-of-state based on 2001 data
Fuel Information	
I/M Program Information	Provided written description of I/M program
Other	

Table II-12. Summary of Onroad Data Provided by South Carolina

Data Element	Data Supplied by Responsible Agency
VMT Data	2002 actual annual VMT by county/road type
MOBILE6 Input Files	
MOBILE5 Input Files	
VMT Mix Information	
Counties by Temperature Region	Supplied counties in each of 7 temperature regions
Monthly Temperatures	
RVP Data	
Speed Data	
Registration Data	
Fuel Information	
I/M Program Information	N/A
Other	

Table II-13. Summary of Onroad Data Provided by Tennessee

Data Element	Data Supplied by Responsible Agency
VMT Data	2002 actual daily VMT by county/road type
MOBILE6 Input Files	Provided MOBILE6 input files for groups of counties covering state
MOBILE5 Input Files	
VMT Mix Information	Provided VMT mix fractions by road type
Counties by Temperature Region	
Monthly Temperatures	
RVP Data	Provided summer RVP information
Speed Data	Provided average speed data by road type for groups of counties
Registration Data	Provided registration data for most counties
Fuel Information	
I/M Program Information	Provided in MOBILE6 input files
Other	

Table II-14. Summary of Onroad Data Provided by Virginia

Data Element	Data Supplied by Responsible Agency
VMT Data	1999 actual annual VMT by county/road type/vehicle type
MOBILE6 Input Files	Provided MOBILE6 input files for representative counties
MOBILE5 Input Files	
VMT Mix Information	
Counties by Temperature Region	Provided listing of counties within each of several temperature regions
Monthly Temperatures	
RVP Data	Provided summer RVP data
Speed Data	Speed data provided for each VMT record
Registration Data	2002 county-level registration data provided for nonattainment counties
Fuel Information	Verified counties in reformulated gasoline program
I/M Program Information	I/M and ATP inputs provided in MOBILE6 formats; verified counties that implement I/M
Other	LEV progam modeled statewide; provided diesel sales fractions

Table II-15. Summary of Onroad Data Provided by West Virginia

Data Element	Data Supplied by Responsible Agency
VMT Data	2002 actual annual VMT by county/road type/vehicle type
MOBILE6 Input Files	Supplied several sample MOBILE6 input files
MOBILE5 Input Files	
VMT Mix Information	VMT data included vehicle type splits
Counties by Temperature Region	Supplied counties in each of 4 temperature regions
Monthly Temperatures	
RVP Data	Supplied summer RVP value statewide
Speed Data	Supplied speed data in MOBILE6 input files--speed data determined to be inappropriate for this analysis
Registration Data	
Fuel Information	
I/M Program Information	N/A
Other	

1. Temperature

The default average daily maximum and minimum temperature data for each month used in this analysis was obtained from the National Climatic Data Center. This temperature data was actual 2002 data. It should be noted that a number of agencies provided information on ozone season or summer temperatures. This information could not be used in this analysis, as the ozone season temperature data are based on several years of temperature data and do not represent the average daily minimum and maximum monthly temperatures that were needed for this analysis. Information was provided by Alabama, Kentucky, North Carolina, South Carolina, Virginia, and West Virginia related to monthly temperature. In some cases, this data divided the counties within the State into several temperature regions and listing a city that should be used for obtaining the temperature data. In these cases, a temperature station from the National Climatic Data Center database was selected from the desired city, and this corresponding temperature set was applied to the counties listed by the States. Several of the States provided their own full set of 2002 temperature data either Statewide or by county. These data were included in the analysis, replacing the default temperature data for those States.

2. I/M and ATP Programs

Several agencies provided I/M and ATP inputs in the form of MOBILE5 input files. Pechan converted these inputs to MOBILE6 inputs, following the guidance in the MOBILE6 user's guide. Agencies that provided the data in MOBILE5 format should review the MOBILE6 I/M and ATP inputs carefully to make sure that the conversions fully capture the actual programs as they were implemented in 2002. In addition, from information provided by North Carolina, Tennessee, and Jefferson County, Kentucky, the I/M and ATP programs should only be applied to a portion of the VMT in the corresponding counties. For the North Carolina and Tennessee I/M counties, duplicate MOBILE6.2 input files were created that eliminate the I/M and ATP programs. The VMT from these counties was divided according to the fraction of the VMT subject to I/M and the fraction of the VMT not subject to I/M. These fractions were provided by the corresponding agencies in North Carolina and Tennessee. The VMT data for each I/M county was then divided according to these VMT fractions to obtain one set of VMT for the portion of vehicles subject to I/M and another set for those not subject to I/M. The emission factors from the I/M files were multiplied by the portion of the VMT subject to I/M while the emission factors from the files without the I/M were multiplied by the remaining portion of the VMT. In Jefferson County, Kentucky, a similar procedure was followed. However, in this case, the county also has a significant portion of VMT from vehicles registered in Indiana that are not subject to I/M or that do not have reformulated gasoline. Thus, the Jefferson County VMT was divided into four subsets and four MOBILE6 input files were developed representing the four groups of vehicle types traveling in the county.

3. RVP and Fuel Programs

Default RVP by county and month were obtained from the data used in the 2002 NEI. The NEI fuel data are based on year 2000 fuel survey data for January and July, with data for intermediate months calculated by interpolation. RVP data for July were applied from May through September, the months when Phase II RVP regulations are in effect. For States that supplied

July, summer, or ozone season RVP values, these values were also applied from May through September. If winter RVP values were supplied, these values were applied directly in each of the remaining months. As mentioned above, reformulated gasoline programs were modeled where appropriate. Georgia provided additional fuel inputs to capture the RVP and sulfur content values of its low sulfur gasoline program.

III. NONROAD METHODS AND DATA

A. NONROAD MODEL CATEGORIES

Pechan used EPA's draft NONROAD2002a model to generate 2002 annual emissions for the majority of nonroad engines. To improve the accuracy of these model runs, we asked State/ Local/Tribal (S/L/T) contacts to provide seasonal or monthly gasoline Reid Vapor Pressure (RVP) and temperature; appropriate data on reformulated gasoline (RFG), oxygenated fuel and Stage II programs, and diesel fuel sulfur levels. In addition, to improve the activity data inputs, we asked whether S/L/T agencies had collected information on equipment populations or activity (e.g., hours of use or load factors) to use in place of default populations in the NONROAD model. No S/L/T agencies provided activity data to replace the model defaults.

Seasonal average RVP and average, maximum and minimum temperature values were calculated based on the county-level, monthly RVP and temperature data set prepared for onroad mobile sources. Information on RFG programs and oxygenated fuels programs obtained for the onroad mobile sector was also used. In July 2003, Pechan distributed the input values (RVP, percent O2, temperature, and Stage II control efficiency) to be used for the draft NONROAD model 2002 inventory for review and comment by the VISTAS S/L/T agencies. Pechan obtained comments from the S/L/T agencies listed in Table III-1.

Table III-1. Summary of Comments by S/L/T Agencies on NONROAD Model Input Values Distributed in July 2003

State	Comment
Alabama	Provided region specific data to replace the statewide default values for RVP and ambient temperature
Georgia	Changed oxygen weight percent to zero for all counties
Kentucky	No Stage II programs in Bullitt and Oldham Counties
Tennessee	Revised RVP value for Davidson County
Mississippi	Revised statewide RVP by season
Virginia	No Stage II program in Charles City County

Additional comments on the August 2003 NONROAD model temperature and RVP inputs were incorporated for consistency with data submitted for the onroad mobile modeling (e.g., North Carolina). In addition, the State of West Virginia provided revised geographic allocation files for certain nonroad categories to improve upon the NONROAD model's default county allocation.

Using the inputs shown in the file "VISTAS NONROAD County Inputs.xls," Pechan prepared seasonal option files for each of four seasons (winter, spring, summer, and autumn), and ran the

NONROAD model at the county level. Model default values were used for all other inputs, with the exception of diesel fuel sulfur. A value of 2,500 parts per million volume (ppmv) was used instead of the default 2,318 ppm, since the default represented a national average including California's lower diesel fuel sulfur level. Pechan summed the seasonal results, and then processed the model output to develop a county-level, SCC-level annual emissions inventory for all pollutants except NH_3.

The NH_3 emissions for NONROAD model categories were developed using the following procedures. OTAQ recently reviewed the basis of NH_3 data summarized in a report entitled, "A Study of the Potential Impact of Some Unregulated Motor Vehicle Emissions" (Harvey, 1983). In conducting this review, OTAQ performed an analysis of the available light-duty noncatalyst engine data to develop defensible gasoline nonroad emission factors on a mg/gallon basis (Harvey, 2003). For both gasoline noncatalyst and diesel engines, fuel based emission factors were developed from emission factors expressed on a gram/mile basis by accounting for the reported fuel economy of each tested engine. For gasoline non-catalyst engines, this resulted in a value of 115.8 mg/gallon, which is applied to county-level fuel consumption estimates for 2-stroke gasoline, 4-stroke gasoline and liquified petroleum gas (LPG) equipment. From the diesel engine test data, a value of 83.3 mg/gallon was derived, which is applied to diesel fuel consumption estimates. County-level fuel consumption for these engines, expressed in gallons, is an output from EPA's NONROAD model.

B. AIRCRAFT, COMMERCIAL MARINE VESSELS AND LOCOMOTIVES

For 2002 aircraft, commercial marine vessels (CMVs), and locomotives, Pechan used 1999 emission estimates developed for EPA's 1999 NEI Version 2 as base year estimates for the VISTAS region. These categories are not included in the NONROAD model, and are hereafter referred to as "other nonroad." Pechan then incorporated revised S/L/T estimates summarized in Table III-2, using the replacement procedures summarized in Tables III-3a through III-3d. Pechan tracked changes by labeling the default 1999 NEI records as Version 2 (V2) and the revised S/L/T records as Version 3 (V3). In cases where PM2.5 estimates were not provided, they were developed using the following category-specific fractions applied to the available PM_{10} emission estimates: 1) Aircraft: 0.69; 2) Locomotive: 0.90; and 3) CMV: 0.92 (EPA, 2002). Commercial marine adjustments are described in detail in the following section.

Table III-2. Summary of S/L/T Agency Data Incorporated into the Draft VISTAS 2002 Other Nonroad Inventory

State	Description of Inventory	Pollutants
Alabama	1999 Locomotive emissions for Pickens and Tuscaloosa counties	VOC, NO_x, and CO
Florida	2001 Aircraft, Locomotive and Commercial Marine Vessel emissions for Palm Beach County	VOC, NO_x, CO, PM10, and SO_x
Tennessee	1999 Aircraft and Locomotive emissions for Davidson County	VOC, NO_x, CO, SO_x, and primary PM_{10}
Virginia	1999 Statewide Inventory for Aircraft, Locomotive and Commercial Marine Vessels	VOC, NO_x, CO

Table III-3a. Replacement Procedures for 1999 Locomotive Emissions for Pickens and Tuscaloosa County, Alabama

STATE_ FIPS	COUNTY_ FIPS	SCC	Version	Notes	START_ DATE	END_ DATE	VOC	NOX	CO
01	107	2285002005	V3				7.73	179.7	22.81
01	107	2285002005	V2	Replace VOC, NOx, and CO emissions	19990101	19991231	1962.9	45643	5794.5
01	107	2285002010	V3				5.39	53.48	9.47
01	107	2285002010	V2	Replace VOC, NOx, and CO emissions	19990101	19991231	5.39	53.48	9.48
01	125	2285002005	V3				16.31	379.15	48.13
01	125	2285002005	V2	Replace VOC, NOx, and CO emissions	19990101	19991231	3384.9	78711.4	9992.6
01	125	2285002010	V3				9.29	92.15	16.33
01	125	2285002010	V2	Replace VOC, NOx, and CO emissions	19990101	19991231	9.29	92.15	16.33

Table III-3b. Replacement Procedures for 1999 Aircraft, Locomotive, and Commercial Marine Vessel Emissions for Palm Beach County, Florida

STATE_ FIPS	COUNTY_ FIPS	SCC	Version	Notes	START_ DATE	END_ DATE	VOC	NOX	CO	SO2	PM10-PRI	PM25-PRI
12	099	2275000000	V3	Apply a Growth Factor to 2001 state-supplied aircraft emissions to backcast to 1999 Estimate PM2.5-PRI off PM10-PRI	19990101	19991231	470.39	805.94	4,121.41	1.98	0.00	
12	099	2275001000	V2	Delete all records for this SCC	19990101	19991231	0.44	0.05	9.03	0	0.19	0.13
12	099	2275020000	V2	Delete all records for this SCC	19990101	19991231	79.1	275.5	330.6	26.34		
12	099	2275050000	V2	Delete all records for this SCC	19990101	19991231	13.93	2.37	437.43	0.36	8.62	5.95
12	099	2275060000	V2	Delete all records for this SCC	19990101	19991231	9.23	1.19	212.32	0.11	4.55	3.14
12	099	2280000000	V3	Apply a Growth Factor to 2001 state-supplied cmv emissions to backcast to 1999 Estimate PM2.5-PRI off PM10-PRI	19990101	19991231	10.42	115.60	0.97	9.94	33.91	
12	099	2280002100	V2	Delete all records for this SCC	19990101	19991231	25.5	815.4	107.51	36.95	34.3	31.55
12	099	2280002200	V2	Delete all records for this SCC	19990101	19991231	0.22	7.05	0.93	0.32	0.3	0.27
12	099	2280003100	V2	Delete all records for this SCC	19990101	19991231	6.8	217.5	28.63	115.6	9.48	8.73
12	099	2280003200	V2	Delete all records for this SCC	19990101	19991231	0.06	1.93	0.25	1.43	0.11	0.1
12	099	2285002000	V3	Apply a Growth Factor to 2001 state-supplied locomotive emissions to backcast to 1999 Estimate PM2.5-PRI off PM10-PRI	19990101	19991231	28.19	658.78	83.64	48.09	15.50	
12	099	2285002006	V2	Delete all records for this SCC	19990101	19991231	6.11	164.1	16.17	10.26	4.07	3.66
12	099	2285002008	V2	Delete all records for this SCC	19990101	19991231	0.45	12.15	1.2	0.76	0.3	0.27
12	099	2285002009	V2	Delete all records for this SCC	19990101	19991231	6.78	182.2	17.95	11.39	4.52	4.07
12	099	2285002010	V2	Delete all records for this SCC	19990101	19991231	3.75	64.36	6.77	3	1.64	1.47

[1] Palm Beach County provided emission estimates corresponding to 2001; as such, 2001 emission estimates were backcast to 1999 using growth factors presented in this report before incorporation.

Table III-3c. Replacement Procedures for 1999 Aircraft and Locomotive Emissions for Davidson County, Tennessee

STATE_ FIPS	COUNTY_ FIPS	SCC	Version	Notes	START_ DATE	END_ DATE	VOC	NOX	CO	SO2	PM10-PRI	PM25-PRI
47	037	2275000000	V3	Estimate PM2.5-PRI off PM10-PRI	19990101	19991231	232.125	634.35	1766	32.13	39.25	
47	037	2275001000	V2	Delete all records for this SCC	19990101	19991231	1.7	0.2	35	0.02	0.75	0.52
47	037	2275020000	V2	Delete all records for this SCC	19990101	19991231	187.45	649.92	782.93	62.34		
47	037	2275050000	V2	Delete all records for this SCC	19990101	19991231	4.72	0.8	148.3	0.12	2.92	2.02
47	037	2275060000	V2	Delete all records for this SCC	19990101	19991231	15.22	1.97	349.97	0.19	7.51	5.18
47	037	2285002000	V3	Estimate PM2.5-PRI off PM10-PRI	19990101	19991231	20.803	363.117	50.701	26.36	8.893	
47	037	2285002006	V2	Delete all records for this SCC	19990101	19991231	31.91	857.26	84.46	53.6	21.27	19.15
47	037	2285002010	V2	Delete all records for this SCC	19990101	19991231	19.6	336.23	35.39	15.68	8.54	7.69

Table III-3d. Replacement Procedures for 1999 Aircraft, Locomotive, and Commercial Marine Vessel Emissions for Sample Counties in Virginia

STATE_ FIPS	COUNTY_ FIPS	SCC	Version	Notes	START_ DATE	END_ DATE	VOC	NOX	CO	SO2	PM10-PRI	PM25-PRI
51	001	2275001000	V3		19990101	19991231	3.47	0.78	3.74			
51	001	2275001000	V2	Replace VOC, NOx, and CO emissions Keep SO2, PM10-PRI, and PM2.5-PRI emissions	19990101	19991231	0.31	0.04	6.38	0	0.14	0.09
51	013	2275020000	V3		19990101	19991231	145.821	992.23	1634.2			
51	013	2275020000	V2	Replace VOC, NOx, and CO emissions Keep SO2 emissions	19990101	19991231	271.17	940.36	1132.7	90.2		
51	001	2275050000	V3		19990101	19991231	1.25	0.21	39.34			
51	001	2275050000	V2	Replace VOC, NOx, and CO emissions Keep SO2, PM10-PRI, and PM2.5-PRI emissions	19990101	19991231	0.25	0.04	7.81	0.01	0.15	0.11
51	001	2275060000	V3		19990101	19991231	0.05	0.01	1.26			
51	001	2275060000	V2	Replace VOC, NOx, and CO emissions Keep SO2, PM10-PRI, and PM2.5-PRI emissions	19990101	19991231	1.47	0.19	33.8	0.02	0.72	0.5
51	670	2280002000	V3	Add SCC to the Inventory	19990101	19991231	3.3	18.16	6.94			
51	670	2280002100	V2	Sum up SO2, PM10-PRI, and PM2.5-PRI emissions for SCCs 2280002100 and 2280002200 and add to SCC 280002000. After that, delete all records for SCC 2280002100 and 2280002200	19990101	19991231	10.12	323.52	42.66	14.7	13.61	12.52
51	670	2280002200	V2	Sum up SO2, PM10-PRI, and PM2.5-PRI emissions for SCCs 2280002100 and 2280002200 and add to SCC 2280002000. After that, delete all records for SCC 2280002100 and 2280002200	19990101	19991231	0.17	5.39	0.71	0.24	0.23	0.21
51	670	2280003000	V3	Add SCC to the Inventory	19990101	19991231	0.14	1.64	0			
51	670	2280003100	V2	Sum up SO2, PM10-PRI, and PM2.5-PRI emissions for SCCs 2280003100 and 2280003200 and add to SCC 2280003000. After that, delete all records for SCC 2280003100 and 2280003200	19990101	19991231	2.7	86.31	11.36	45.9	3.76	3.46
51	670	2280003200	V2	Sum up SO2, PM10, and PM2.5 Emissions for SCCs 2280003100 and 2280003200 and add to SCC 2280003000. After that, delete all records for SCC 2280003100 and 2280003200	19990101	19991231	0.05	1.48	0.19	1.09	0.08	0.08
51	199	2283002000	V3		19990101	19991231	8.46	53.47	15.51			
51	199	2283002000	V2	Replace VOC, NOx, and CO emissions	19990101	19991231	7.43	47.26	13.63			
51	740	2285002005	V3	Add SCC to the Inventory	19990101	19991231	3.76	100.99	9.95			
51	740	2285002006	V2	Sum up SO2, PM10-PRI, and PM2.5-PRI emissions for SCCs 2285002006 and 2285002007 and add to SCC 285002005. After that, delete all records for SCC 2285002006 and 2285002007.[1]	19990101	19991231	0.7	18.77	1.85	1.17	0.47	0.42
51	740	2285002007	V2	Sum up SO2, PM10-PRI, and PM2.5-PRI emissions for SCCs 2285002006 and 2285002007 and add to SCC 285002005. After that, delete all records for SCC 2285002006 and 2285002007.[1]	19990101	19991231	0.08	2.26	0.22	0.14	0.06	0.05
51	036	2285002010	V3		19990101	19991231	0.59	10.13	1.06			
51	036	2285002010	V2	Replace VOC, NOx, and CO emissions Keep SO2, PM10-PRI, and PM2.5-PRI emissions	19990101	19991231	1.99	34.15	3.59	1.59	0.87	0.78

[1] Other counties may also have emissions for SCCs 2285002008 and 2285002009. In these cases, sum up SO2, PM10-PRI, and PM2.5-PRI emissions for SCCs 2285002006, 2285002007, 2285002008, and 2285002009 and add to SCC 2285002005. After that, delete all records for SCC 2285002006, 2285002007, 2285002008, and 2285002009.

2. CMV Improvements

This section describes procedures for improving the spatial distribution of CMV emission estimates for the VISTAS region. States that share borders with non-VISTAS States along the Mississippi and Ohio Rivers have expressed concern about the representativeness of port emission estimates at a county-level. Revising the county-level emissions estimates would allow more accurate modeling of emissions in the VISTAS States.

Ideally, CMV emission estimates would be developed using local activity data that account for vessel type, engine type and mode of operation (cruise, maneuvering, and hotelling). Creating this type of "bottom-up" emission inventory requires a large amount of effort. Therefore, Pechan utilized port-specific emission estimates developed for the 1999 NEI, distributed using a revised allocation methodology, which incorporates information on the number of port facilities in each county.

a. Current Allocation Method

The current 2002 VISTAS commercial marine inventory is based on EPA's 1999 NEI Version 2.0, projected to 2002 using appropriate growth factors. State-supplied data were incorporated by EPA or by Pechan for some VISTAS States for this category, including Alabama, Virginia, West Virginia, and Palm Beach County, Florida.

The 1999 NEI estimated emissions for these categories according to the following SCCs:

SCC	Descriptor 1	Descriptor 3	Descriptor 6	Descriptor 8
2280002100	Mobile Sources	Marine Vessels, Commercial	Diesel	Port emissions
2280002200	Mobile Sources	Marine Vessels, Commercial	Diesel	Underway emissions
2280003100	Mobile Sources	Marine Vessels, Commercial	Residual	Port emissions
2280003200	Mobile Sources	Marine Vessels, Commercial	Residual	Underway emissions

For the 1999 NEI, commercial marine diesel emissions were developed by obtaining 2000 emission estimates for all pollutants except SO_2 from OTAQ's marine diesel regulatory background documentation (*Draft Regulatory Impact Analysis - Control of Emissions from Compression-Ignition Marine Engines*). To estimate emissions for 1999, 2000 estimates were backcast using growth factors obtained from the draft RIA cited above. Steam-powered residual CMV emission estimates were developed by obtaining fuel usage data from OTAQ and applying fuel-based emission factors (EPA, 1989). A similar method was used for diesel SO_2 emissions. National diesel usage was estimated assuming a sulfur content of 0.25 percent and EPA emission factors (EPA, 2002).

National diesel emissions were disaggregated into port and underway emissions estimates based on the assumption that 75 percent of distillate fuel is consumed within the port, while the remaining fuel is consumed while underway, consistent with EPA guidance. National residual emissions were disaggregated into port and underway emissions estimates based on the assumption that 25 percent of residual fuel is consumed within the port, while the remaining fuel is consumed while underway (EPA, 1989).

To allocate to counties, port emissions were assigned to the 150 largest U.S. ports based on activity obtained from the U.S. Army Corps of Engineers (USACE). The percentage of total traffic for each port was calculated by dividing the port-level traffic by the total traffic. Emissions for each port were then assigned to a single county.

Underway emissions are assigned to counties based on a county's shipping lane traffic. The Bureau of Transportation Statistics' (BTS') *National Transportation Atlas Databases-1999* contains data on the thousand tons per mile traveled for each shipping lane link in the United States (BTS-CD26). Where navigable rivers form a county or State boundary, the shipping lane traffic is proportioned to individual counties based on the length of shoreline that is shared. For example, if two counties share a navigable river, and both counties have the same length of shoreline, the shipping traffic is split evenly between the two counties. Shipping lanes that are not within counties, for example in the ocean, are associated to States based on BTS assignments. These waterway weights are then evenly distributed among the counties within these States that have navigable waterways. All shipping activity is summed at the county-level and compared with national shipping activity to determine what portion of activity can be attributed to individual counties. These proportions were used in disaggregating the national CMV emission estimates to the county level.

b. Revised Port Allocation Method

Figures III-1 and III-2 present emission maps for CMV port and underway NO_x emissions created from the 1999 NEI Version 2.0 data. For underway emissions, Pechan believes that the allocation procedure results in a reasonable distribution of county-level emissions. However, the methodology to allocate port emissions results in all the emissions being assigned to a single county. For example, Cabell County in West Virginia is assigned all emissions for Huntington Port, but no emissions are allocated to Lawrence County in Ohio, the county on the opposite river bank.

Port areas encompass multiple States and counties and in some cases, multiple waterways. Therefore, the emissions allocation process must incorporate all counties in the vicinity of the port where activity is occurring. This is especially true for inland rivers where activity takes place on both riverbanks and for 10 river miles or more outside the port city. The revised methodology allocates port emissions based on a surrogate for port-related activity in each county, rather than using a single county to define the port.

Figure III-1. VISTAS Region and Surrounding States, *Underway NO_x Emissions*

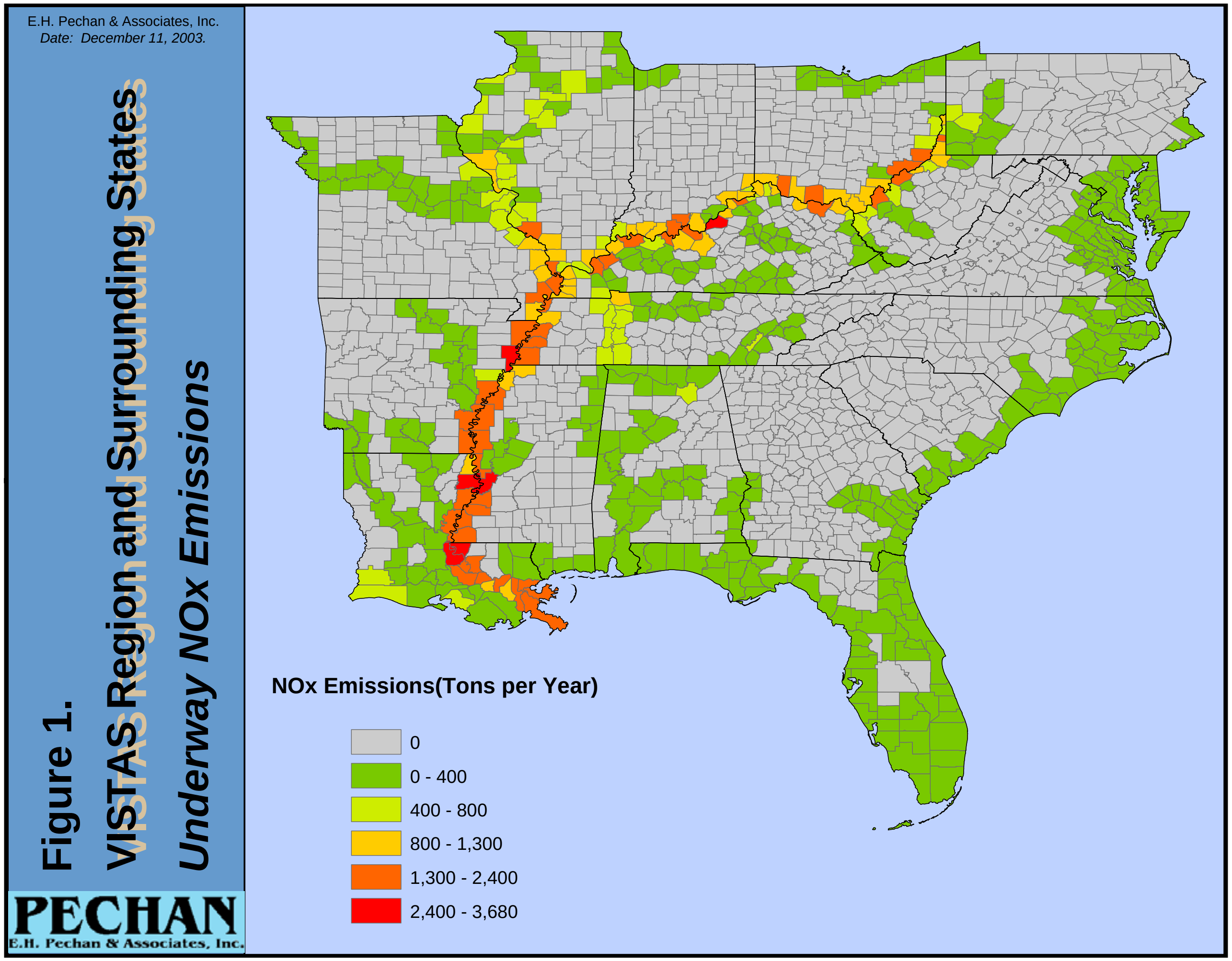
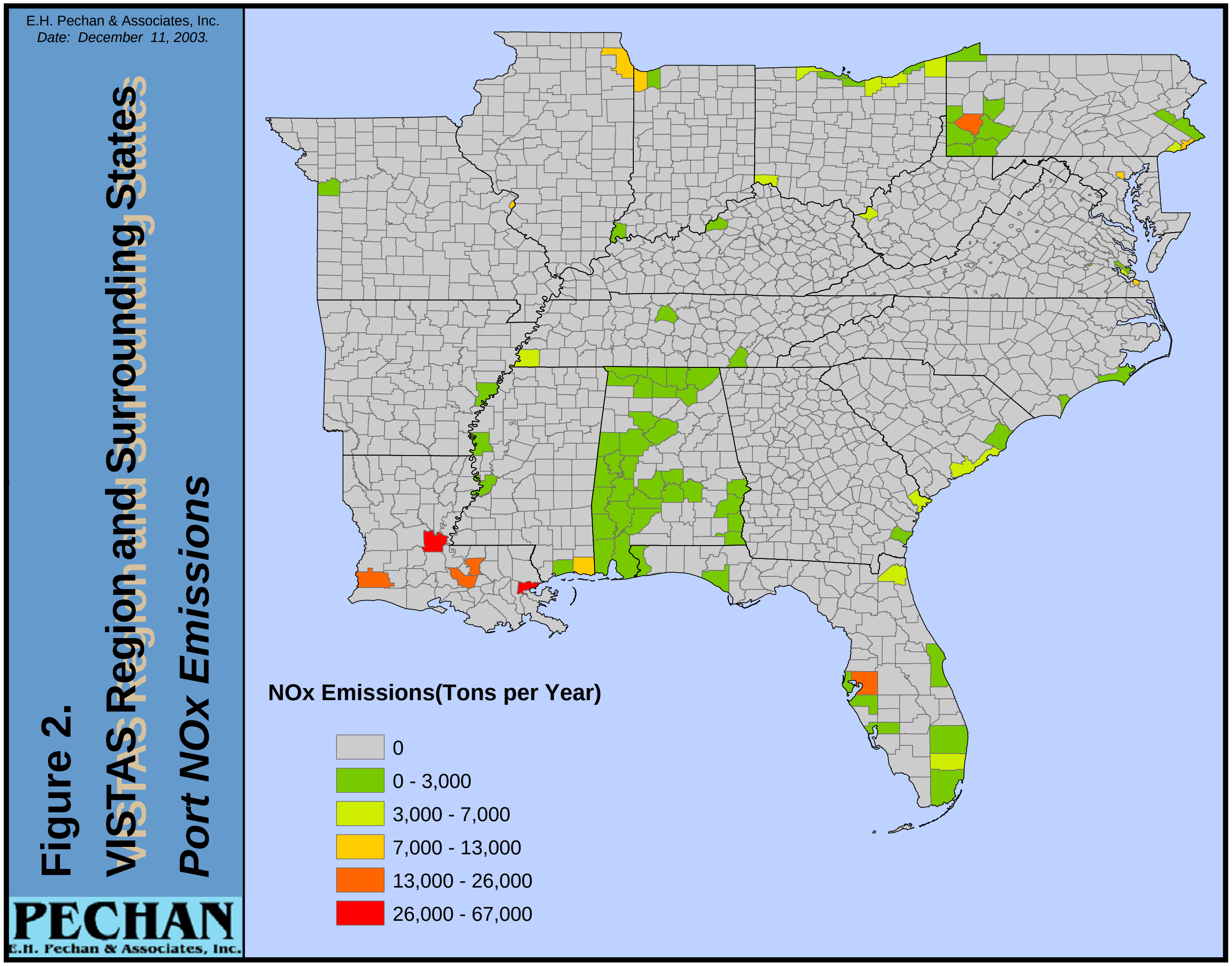


Figure III-2. VISTAS Region and Surrounding States, *Port NO_x Emissions*



The report, *Waterborne Commerce of the United States, Calendar Year 1999* (USACE, 2000), hereafter referred to as *Waterborne Commerce*, presents the cargo tonnage and number of vessel trips in major waterways of the United States. The report defines port areas, which USACE uses to develop the Top 150 Ports in the United States by amount of cargo tonnage. As discussed in the previous section, the 1999 NEI allocates all the port emissions to these 150 ports based on the cargo tonnage handled by the port.

Pechan uses this allocation of emissions to each port area as the starting point of its revised allocation process. Table III-4 presents the ports that are located in VISTAS and adjoining States, which are part of the Top 150 Ports.

Table III-4. Port Areas Located in VISTAS and Adjoining States

Port	State	Port	State
Mobile	AL	Pascagoula	MS
Guntersville	AL	Vicksburg	MS
Helena	AR	Biloxi	MS
Port Everglades	FL	Greenville	MS
Jacksonville	FL	Gulfport	MS
Miami	FL	Wilmington	NC
Port Canaveral	FL	Morehead City	NC
Palm Beach	FL	Cincinnati	OH
Panama City	FL	Pittsburgh	PA
Pensacola	FL	Charleston	SC
Tampa	FL	Georgetown	SC
Port Manatee	FL	Memphis	TN
Weedon Island	FL	Nashville	TN
Savannah	GA	Chattanooga	TN
Brunswick	GA	Norfolk Harbor	VA
Mount Vernon	IN	Newport News	VA
Louisville	KY	Hopewell	VA
New Orleans	LA	Huntington	WV
Baton Rouge	LA		

The next step was to develop a list of counties that make up the port area. Port area definitions were obtained from *Waterborne Commerce*. Table III-6 presents the port definitions for the VISTAS States and adjoining States. Using the port definitions by river mile, Pechan established which counties are included in each port area. In many cases, these port areas encompass multiple counties. For example, Pittsburgh is defined in *Waterborne Commerce* as:

> Ohio River from Pittsburgh, PA to mile 40 (Pennsylvania/Ohio State Line);
> Allegheny River from Pittsburgh, PA to mile 72 (to head of project);
> Monongahela River from Pittsburgh, PA to mile 91 (to head of project).

Therefore, the Port of Pittsburgh includes the following counties in Pennsylvania; Allegheny, Westmoreland, Armstrong, Washington, Fayette, Greene, Beaver. This process was repeated for all the port areas listed in Table III-4.

The next step in allocating emissions is to develop a surrogate for the amount of CMV activity in each county of the port area. Pechan assumed that the activity of vessels in each county is related to the number of port facilities operating in a given county. Port facilities include terminals, piers, wharves, and docks that are involved in all types of commercial activity and support services. Pechan obtained the number of port facilities in each county from *The Port Series Reports* (USACE, 2003). The USACE periodically surveys the commercial marine industry to obtain information on port facilities and publishes it in *The Port Series Reports*. The reports give the name, location, operations, and describe the physical and inter-modal characteristics of the facilities. The data includes the location of the facility by river mile, State, and county.

For each port area, Pechan calculated the ratio between the number of port facilities in each county to the total number of facilities in all counties that make up the port area. This ratio was used to allocate emissions for each port area to the county-level. Table III-5 presents the allocation ratios for each county in the port areas. Some port areas were still encompassed by one county using the definition of the port from *Waterborne Commerce*. However, a number of port areas include multiple counties. Note that New Orleans and Pittsburgh do not include any counties in VISTAS States.

Table III-5. List of VISTAS Ports and Ports of Adjoining States

Port	State	County	Ratio	Port	State	County	Ratio	Port	State	County	Ratio
Port Everglades	FL	Broward	1.0	Helena	AR	Phillips	0.7778	Chattanooga	TN	Hamilton	0.7692
Jacksonville	FL	Duval	1.0		MS	Coahoma	0.2222		TN	Marion	0.2308
Miami	FL	Miami-Dade	1.0	Charlotte	FL	Charlotte	0.7500	Norfolk	VA	Norfolk City	0.5568
Port Canaveral	FL	Brevard	1.0		FL	Lee	0.2500		VA	Chesapeake City	0.3068
Palm Beach	FL	Palm Beach	1.0	Mount Vernon	IN	Vanderburgh	0.3182		VA	Portsmouth	0.1364
Panama City	FL	Bay	1.0		IN	Posey	0.4773	Newport News	VA	Newport News	0.6500
Pensacola	FL	Escambia	1.0		KY	Henderson	0.2045		VA	Hampton	0.3500
Tampa	FL	Hillborough	1.0	Louisville	KY	Jefferson	0.6596	Hopewell	VA	Hopewell	0.5000
Port Manatee	FL	Manatee	1.0		IN	Clark	0.3404		VA	Charles City	0.5000
Weedon Island	FL	Pinellas	1.0	New Orleans	LA	St. Bernard	0.0858	Pittsburgh	PA	Allegheny	0.5206
Savannah	GA	Chatham	1.0		LA	Plaquemines	0.1231		PA	Westmoreland	0.0412
Brunswick	GA	Glynn	1.0		LA	Orleans	0.3284		PA	Armstrong	0.0309
Pascagoula	MS	Jackson	1.0		LA	Jefferson	0.4366		PA	Washington	0.1340
Vicksburg	MS	Warren	1.0		LA	St. Tammany	0.0224		PA	Fayette	0.0412
Biloxi	MS	Harrison	1.0		LA	Tangipahoa	0.0037		PA	Greene	0.0567
Greenville	MS	Washington	1.0	Wilmington	NC	New Hanover	0.8974		PA	Beaver	0.1753
Gulfport	MS	Harrison	1.0		NC	Brunswick	0.1026	Huntington	KY	Greenup	0.0795
Morehead City	NC	Carteret	1.0	Cincinnati	OH	Hamilton	0.7931		KY	Boyd	0.1023
Georgetown	SC	Georgetown	1.0		KY	Kenton	0.0862		OH	Gallia	0.1136
Nashville	TN	Davidson	1.0		KY	Boone	0.1207		OH	Lawrence	0.2273
Mobile	AL	Mobile	1.0	Charleston	SC	Charleston	0.7097		OH	Scioto	0.1364
Guntersville	AL	Marshall	1.0		SC	Berkeley	0.2903		WV	Wayne	0.1136
				Memphis	TN	Shelby	0.9123		WV	Cabell	0.0795
					AR	Crittenden	0.0877		WV	Mason	0.1477

Pechan was directed to perform the reallocation for all VISTAS ports. Figure III-3 presents the reallocation of port emissions in all States except Alabama. Alabama's CMV data were provided to EPA and already incorporated into the 1999 NEI Version 2, and Pechan did not have access to the default 1999 NEI estimates for this State and category. Since State data take precedence, the inventory prepared by Pechan reflects the incorporation of State data for those areas that developed independent CMV emission estimates, including Virginia and Palm Beach County, Florida. In addition, West Virginia provided their own county fractions to allocate emissions for the Port of Huntington, using District-level data from the Army Corps of Engineers on tonnage of freight shipped and received. West Virginia also requested that residual-fueled CMV activity/emissions be zeroed out for their State. States providing their own data are encouraged to review the allocations Pechan developed for their port areas, and to provide further comment or direction as needed.

Figure III-3. VISTAS Region and Surrounding States, *Revised Port Emissions of NO_X*

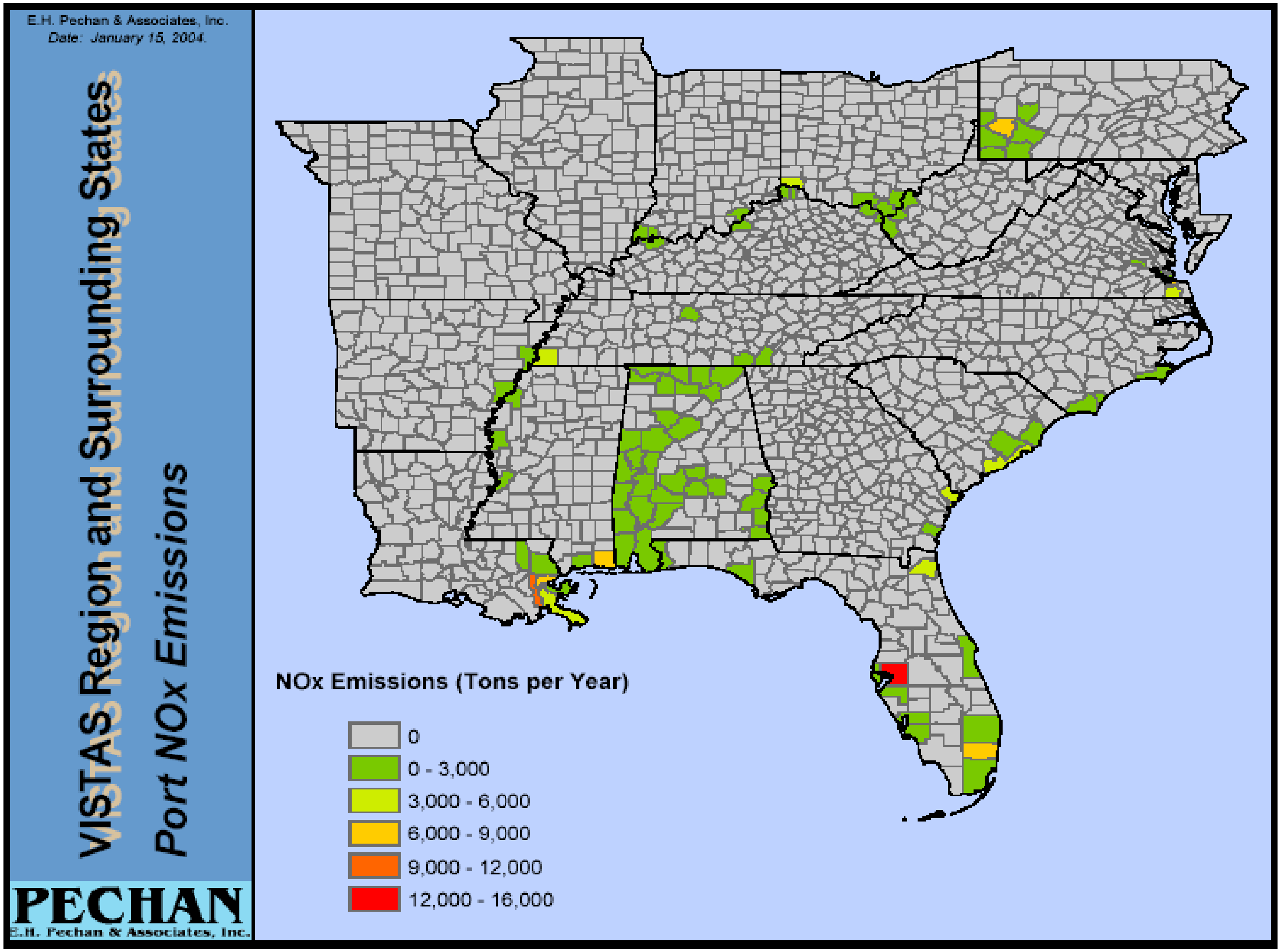


Table III-6. Definition of Port Areas Obtained from Waterborne Commerce (USACE, 2000)

VISTAS PORTS
MOBILE, AL Entrance. bay and river channels, and channels into Chickasaw and Three Mile Creeks; Branch Channels; Theodore Ship Channel.
GUNTERSVILLE, AL Both banks of the Tennessee River at mile 358 to mile 363.
JACKSONVILLE HARBOR, FL Atlantic Ocean to the Florida East Coast Railway Bridge at Jacksonville, 26.8 miles.
TAMPA, FL Gulf of Mexico to and including the channels of upper Tampa Harbor, 49.8 miles; Channel to Port Tampa and thence to Courtney Campbell Parkway, 17.5 miles; Natural channel leading from Port Tampa Channel toward St. Petersburg, 1.8 miles; Alafia River Channel, 3.6 miles; Hillsborough River to City Waterworks Dam, 10 miles; Channels in “Little Manatee River, Fl; Port Manatee, Fl Harbor.”
MIAMI HARBOR, FL Atlantic Ocean to inner end of turning basin at Miami, 6 miles; Meloy Channel and thence natural channels along the easterly side of Biscayne Bay to Bakers Haulover Inlet, FL, about 11 miles; channel from turning basin to mouth of Miami River, 1.1 miles; existing Florida East Coast Railway Channel, Fishermans Channel from mouth of Miami River to Government Cut, 3.8 miles; and the channels reported under “Miami River, FL.”
EVERGLADES HARBOR, COLLIER COUNTY, FL - No definition given
CANAVERAL HARBOR, FL Entrance Channel (Atlantic Ocean) to Barrier Beach inner channel and Turning Basins, thence a Barge canal through a lock in the perimeter dike and continuing to the Intracoastal Waterway, Jacksonville to Miami.
CHARLOTTE HARBOR, FL Gulf of Mexico to Municipal Terminal at Punta Gorda, about 29.5 miles; waterfront on Gasparilla Island from Port Boca Grande to Boca Grande, 4.5 miles; and Myakka River to El Jobean, 4 miles.
PALM BEACH HARBOR, FL Atlantic Ocean to Port of Palm Beach Terminals, 1.7 miles; Lake Worth from Riviera Bridge to Southern Boulevard Bridge at West Palm Beach, 7.5 miles; and “Palm Beach, FL side channel and basin.”
PORT MANATEE, FL 40 feet deep by 400 feet wide entrance channel and basin. The entrance channel extends approximately 3 miles in length from the turning basin to its intersection with Tampa Harbor main channel. Controlling Depth: 40 feet in entrance channel and turning basin.
PANAMA CITY HARBOR, FL Entrance channel, inside bay and Watson Bayou. Project Depth: Approach channel, 34 feet; across Lands End, 32 feet; Watson Bayou, 10 feet.

Table III-6. Definition of Port Areas Obtained from Waterborne Commerce (USACE, 2000)

PENSACOLA HARBOR, FL Entrance channel and entire harbor, including Bayou Chico. Project Depth: entrance, 35 feet; Inner Harbor, 33 feet; Bayou Chico, 15 and 14 feet.
WEEDON ISLAND, FL – no definition
BRUNSWICK HARBOR, GA From 32-foot contour in the ocean across the Barthrough St. Simon Sound, Brunswick River, and Turtle River to the upper end of the Allied Chemical Company's Wharf, formerly Atlantic Refining Company Wharf, 20.4 miles; from Brunswick River through East River, to the upper end of the project in Academy Creek, 2.7 miles; from St. Simon Sound through Back River to Mill Creek, the upper end of Back River improvement, 2.9 miles; from Back River through Terry Creek to the Glynn Canning Company's Wharf, 1.8 miles; a total distance of 27.8 miles.
SAVANNAH HARBOR, GA From the 40-foot contour in the ocean to the Continental Can Company Plant, 32.15 miles.
LOUISVILLE, KY Both banks of the Ohio River from mile 606 to mile 616 Controlling Depth: 9 feet. Project Depth: 9 feet at low water stages.
BILOXI HARBOR, MS Mississippi Sound, Biloxi Bay, Back Bay, and land cut to Gulfport Lake. Project Depth: East entrance channel, Mississippi Sound to Gulfport Lake, 12 feet: West entrance channel, Mississippi Sound to Biloxi Harbor, 10 feet; Ott Bayou, 12 feet.
GREENVILLE, MS From Mississippi River mile 537 AHP left descending bank in an easterly direction, an entrance channel, 8,000 feet long and 250 feet wide transitioning into the harbor and port area 10,000 feet long and 500 feet wide, then transitioning into Lake Ferguson, a channel 5,700 feet long and 250 feet wide.
GULFPORT HARBOR, MS Mississippi Sound Channel, Ship Island Pass Channel, and Small Craft Harbor about 4,300 feet long west of the anchorage basin. Project Depth: Mississippi Sound, 30 feet; Ship Island Pass, 32 feet; Small Craft Harbor, 8 feet.
PASCAGOULA HARBOR, MS Lower 4 miles of Dog River and lower 6.8 miles of Pascagoula River, Mississippi Sound, Bayou Casotte, and Horn Island Pass Channels.
VICKSBURG, MS From Mississippi River mile 437 AHP on left descending bank in a northerly direction, a channel 14,500 feet long by 150 feet wide in the Yazoo Diversion Canal, thence a dredged entrance channel 4,800 feet long and 150 feet wide, transitioning into a 300-foot wide dredged slack water harbor and turning basin 10,700 feet long.
MOREHEAD CITY HARBOR, NC Morehead City Harbor, NC.

Table III-6. Definition of Port Areas Obtained from Waterborne Commerce (USACE, 2000)

PORT OF WILMINGTON, NC (see also Wilmington Harbor NC for waterway data) Both banks of the Cape Fear River extending from a point about 18 miles below the foot of Castle St. in Wilmington to a point about 2 miles above the Railroad Bridge at Navassa, and both banks of Northeast (Cape Fear) River from its mouth to a point about 1.67 miles above the Hilton Railroad Bridge.
CHARLESTON HARBOR, SC (Including Ashley River, Cooper River, Shem Creek And Shipyard River, SC) Ocean to Goose Creek via Cooper River and Town Creek; to the Standard Wharf on Ashley River; to the Mount Pleasant Memorial Highway Bridge on Shem Creek; to the Airco Alloys Wharf on Shipyard River; Wando River to Cainhoy.
GEORGETOWN HARBOR, SC (Winyah Bay) Atlantic Ocean Entrance to Winyah Bay, SC, to and including turning basin in Sampit River at the City of Georgetown, SC.
MEMPHIS, TN Section Inlcuded: From mile 715.5 to mile 741.0 on Lower Mississippi River and includes Memphis Harbor (McKellar Lake) and Wolf River Harbor, Tennessee. Controlling Depth: 9 feet. Project Depth: 9 feet at low water stages.
PORT OF NASHVILLE, TN (included in traffic of Cumberland River, TN and KY) Both banks of Cumberland River, mile 182 to mile 194 Controlling Depth: 9 feet. Project Depth: 9 feet at low water stages.
CHATTANOOGA, TN Section Included: Both banks of the Tennessee River at mile 454 to 471. Controlling Depth: 9 feet. Project Depth: 9 feet at low water stages.
PORT OF RICHMOND, VA (Included in James River, VA Consolidated Report)
PORT OF NEWPORT NEWS, VA (Including Newport News Creek, VA) Lower east shore of James River from mouth to 1.8 miles, and portion of north shore of Hampton Roads covering approximately 15,000 linear feet of waterfront at Newport News; and Newport News Creek.
PORT OF HOPEWELL, VA (Included In James River VA Consolidated Report) South side of James River, from City Point, at mouth of Appomattox River, 2 miles downstream to the mouth of Baileys Creek. Controlling Depth: 25 feet at mean low water. Project Depth: 35 feet, maintained to 25 feet.
NORFOLK HARBOR, VA From 55-foot contour in Hampton Roads to Norfolk & Western (formerly Virginia) Railway Bridge Crossing Southern Branch of Elizabeth River, 14.78 miles; thence upstream in Southern Branch, 4.61 miles. In Eastern Branch, 2.54 miles upstream from the mouth of that branch; in Western Branch, 1.78 miles upstream from the mouth of that branch; and 0.73 miles in Scotts Creek.
HUNTINGTON, WV Both banks of the Ohio River from mile 303 to mile 317 Controlling Depth: 9 feet. Project Depth: 9 feet at low water stages.

Table III-6. Definition of Port Areas Obtained from Waterborne Commerce (USACE, 2000)

NON-VISTAS PORTS
HELENA, AR Mile 659 through mile 663 on the Lower Mississippi River. The project provides for maintenance of an off-river harbor with dimensions of 9 feet deep and 450 feet wide for a length of 3,200 feet.
MOUNT VERNON, IN Section Included: Right Bank of Ohio River from mile 151 to mile 154. Controlling Depth: 9 feet. Project Depth: 9 feet at low water stages.
CINCINNATI, OH Both banks of the Ohio River from mile 465 to mile 491. Controlling Depth: 9 feet. Project Depth: 9 feet at low water stages.
PORT OF PITTSBURGH, PA Ohio River from Pittsburgh, PA to mile 40 (Pennsylvania/Ohio State Line); Allegheny River from Pittsburgh, PA to mile 72(to head of project); Monongahela River from Pittsburgh, PA to mile 91(to head of project). Includes Aliquippa-Rochester, Pittsburgh, Clairton-Elizabeth. Controlling Depth: 9 feet. Project Depth: 9 feet.
PORT OF PLAQUEMINES, LA Both banks of Mississippi River from mile 0 A.H.P. through mile 81.2 A.H.P Controlling and Project Depths: 45 feet.
PORT OF BATON ROUGE, LA Both banks of Mississippi River from mile 168.5 A.H.P. through mile 253 A.H.P; including the Baton Rouge Barge Canal from a point on the east bank of the Mississippi River at mile 234.5 A.H.P., for a distance of 5 miles.
PORT OF NEW ORLEANS, LA Both banks of the Mississippi River from mile 81.2 A.H.P. through mile 114.9 A.H.P.; Innerharbor Navigation Canal, 5.5 miles; Mississippi River-Gulf Outlet from its junction with the Innerharbor Navigation Canal to Bayou Bienvenue, 7 miles; and Harvey Canal, 5.5 miles.
PORT OF SOUTH LOUISIANA (LA) Both banks of Mississippi River from mile 114.9 A.H.P. through mile 168.5 A.H.P. Controlling and Project Depths: 45 feet.

3. Projection Methods

Pechan then projected the revised 1999 inventory to 2002 using surrogate growth indicators. For the aircraft category, 1999 and 2002 approach operations by airport and aircraft type were compiled from the Federal Aviation Administration's Air Traffic Activity Data System (ATADS). The airport-level landing and takeoffs (LTOs) were assigned to counties and summed for the county. For counties with aircraft emissions without a county match in ATADS, State-average growth factors were calculated and applied. The county-level growth factors are not presented in this report, but could be provided to VISTAS S/L/Ts if requested.

For locomotives, projected emissions were developed in two steps as described below. For 1999 to 2001, State-level vessel bunkering and rail fuel consumption was obtained from the Energy Information Administration's (EIA's) *Fuel Oil and Kerosene Sales.* For 2001 to 2002, Pechan applied national growth factors developed from fuel consumption projections in EIA's *Annual Energy Outlook.* Table III-7a lists the growth factors for locomotives that were applied to the 1999 emissions to first develop 2001 emissions. Table III-7b lists the growth factors used to generate 2002 emissions. Locomotive emissions were not revised from the August 2003 draft VISTAS 2002 inventory.

Table III-7a. Growth Factors for Railroad Distillate Fuel Oil Use

FIPSST	State	Rail Distillate Fuel Oil Sales (Thousand Gallons)		Growth Factor (GF)
		1999	2001	
01	Alabama	42,137	55,777	**1.3**
12	Florida	127,269	107,084	**0.8**
13	Georgia	73,494	70,538	**1.0**
21	Kentucky	98,941	99,812	**1.0**
28	Mississippi	14,267	24,812	**1.7**
37	North Carolina	53,900	77,762	**1.4**
45	South Carolina	13,051	15,936	**1.2**
47	Tennessee	44,083	91,363	**2.1**
51	Virginia	32,202	61,154	**1.9**
54	West Virginia	9,160	8,787	**1.0**

Source: Department of Energy, Energy Information Administration Fuel Oil and Kerosene Sales 1999 & Fuel Oil and Kerosene Sales 2001 Table 23. Adjusted Sales for Transportation Use: Distillate Fuel Oil and Residual Fuel Oil (http://tonto.eia.doe.gov/FTPROOT/pertroleum/053599.pdf), (http://tonto.eia.doe.gov/FTPROOT/pertroleum/053501.pdf)

Table III-7b. 2002 National Rail Transportation Energy Use by Fuel Type (Trillion BTU)

	2001	2002	Growth Factor (GF)
Intercity Rail (Electric)	10.17	10.40	1.0226
Intercity Rail (Diesel)	16.60	16.88	1.0169
Transit Rail (Electric)	46.36	47.40	1.0224
INTERCITY/TRANSIT RAIL AVERAGE (SCC 2285002008)			**1.0206**
Commuter Rail (Electric)	16.13	16.49	1.0223
Commuter Rail (Diesel)	26.31	26.76	1.0171
COMMUTER RAIL AVERAGE (SCC 2285002009)			**1.0197**
Freight Rail (Distillate) (SCCs 2285002000, 2285002005, 2285002006, 2285002007, 2285002010)	512.81	492.32	**0.9600**

Source: Department of Energy, Energy Information Administration, Annual Energy Outlook 2003: Table 34. Transportation Sector Energy Use by Fuel Type Within a Mode (http://www.eia.doe.gov/oiaf/aeo/supplement/sup_tran.pdf)

Since the CMV emissions were revised for the 1999 base year, these emissions were projected using 2002 *Fuel Oil and Kerosene Sales* data, which became available in November 2003. Table III-8 lists the growth factors for CMVs that were applied to 1999 emissions to generate 2002 emissions. The same regional growth factor that accounts for an average regional growth rate was applied to CMV emissions for all VISTAS States. Because the State-level data represents sales and not use, and CMV activity spans State borders, a regional growth factor was deemed more appropriate. Pechan could make a similar adjustment for the locomotive growth factors, which are also based on fuel sales for 1999 to 2001, if requested by VISTAS.

Table III-8. Growth Factors for Commercial Marine Vessel Distillate and Residual Fuel Oil Use

FIPSST	State	Fuel Oil Sales (Thousand Gallons)		Growth Factor (GF)
		1999	2002	
DISTILLATE				
01	Alabama	67,455	73,400	**1.1**
12	Florida	139,809	143,577	**1.0**
13	Georgia	17,697	22,327	**1.3**
21	Kentucky	81,811	56,169	**0.7**
28	Mississippi	12,749	68,668	**5.4**
37	North Carolina	11,279	10,057	**0.9**
45	South Carolina	12,732	19,782	**1.6**
47	Tennessee	43,867	112,364	**2.6**
51	Virginia	29,444	28,235	**1.0**
54	West Virginia	54,560	46,981	**0.9**
Regional Distillate GF		**471,403**	**581,560**	**1.2**
RESIDUAL				
01	Alabama	46,093	93,487	**2.0**
12	Florida	404,228	460,600	**1.1**
13	Georgia	40,117	79,191	**2.0**
21	Kentucky[1]		69	**1.2**
28	Mississippi	48,644	54,031	**1.1**
37	North Carolina	6,989	35,210	**5.0**
45	South Carolina	20,056	22,758	**1.1**
47	Tennessee[1]		124	**1.2**
51	Virginia	60,090	36,445	**0.6**
54	West Virginia			**1.2**
Regional Residual GF		**626,217**	**781,915**	**1.2**

[1] For Kentucky, Tennessee and West Virginia, Pechan summed the 1999 and 2002 CMV residual fuel oil use to develop a total VISTAS State growth factor, which was then applied to the three States.
Source: Department of Energy, Energy Information Administration, Fuel Oil and Kerosene Sales 1999 & Fuel Oil and Kerosene Sales 2002, Table 23. Adjusted Sales for Transportation Use: Distillate Fuel Oil and Residual Fuel Oil.

IV. ONROAD REFUELING METHODS

Emissions were separately calculated from onroad refueling, also known as Stage II emissions. Since refueling is a category of evaporative rather than exhaust emissions, VOC is the only criteria pollutant of concern for this category. This chapter discusses the controls modeled for this emission category and the methods used to calculate these emissions. Refueling emissions for onroad sources were updated in February 2004 to account for the VMT updates provided by several States.

A. CONTROLS

Based on default information from the NEI as well as some information provided by VISTAS agencies, portions of five of the VISTAS States have onroad Stage II refueling controls in place. These States, along with the specific counties with onroad Stage II controls, are listed in Table IV-1. This table also shows information about the Stage II control program in each State including the year a Stage II program began, the number of years that the program was phased-in over, and the control efficiency of the program in reducing VOC emissions from Stage II refueling for the LDGV, LDGT, and HDGV vehicle categories. These are the inputs required for modeling a Stage II control program using MOBILE6. States with Stage II programs should review this information and provide any corrections for the next round of emissions modeling.

Table IV-1. Onroad Stage II Control Programs

State	Start Year	Phase-In Years	Control Efficiency	Counties
Florida	1993	2	95%	Broward, Miami-Dade, Palm Beach
Georgia	1992	3	81%	Cherokee, Clayton, Cobb, Coweta, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Henry, Paulding, Rockdale
Kentucky	1999	2	86%	Boone, Campbell, Kenton
Kentucky	1992	2	95%	Jefferson
Tennessee	1993	3	95%	Davidson, Rutherford, Sumner, Williamson, Wilson
Virginia	1993	2	95%	Counties: Arlington, Chesterfield, Fairfax, Hanover, Henrico, Loudoun, Prince William, Stafford Independent Cities: Alexandria, Colonial Heights, Fairfax, Falls Church, Hopewell, Manassas, Manassas Park, Richmond

B. METHODS

A simplified set of MOBILE6.2 input files was created to simulate the onroad refueling emission factors. These input files were simplified because several of the inputs used for calculating the onroad exhaust and evaporative emission factors do not affect the refueling emission factors. For example, the refueling emission factors are unaffected by vehicle speed or I/M program. Thus, for each group of counties in a State with the same fuel parameters, temperature parameters, fleet characteristics (registration distribution, diesel sales fractions), and Stage II control program parameters, a MOBILE6.2 input file was created to model the onroad refueling emission factors. As mentioned above, speed does not affect the refueling emission factors, so each input file contained only 12 scenarios—one for each month of the year. Within each scenario, the temperature and fuel parameters were varied, using the same temperature and fuel data modeled in the onroad exhaust and evaporative MOBILE6.2 input files. Other fleet characteristics, such as registration distributions and diesel sales fractions, were included in the input files where applicable. The inputs shown in Table IV-1 were included for the input files representing counties with Stage II control programs. The header section of the MOBILE6.2 input files was set up so that only refueling emission factors would be included in the tabular output file.

After the MOBILE6.2 input files were generated, they were run through the MOBILE6.2 model to obtain refueling VOC emission factors in the database table format. These emission factors are produced for the 28 MOBILE6 vehicle types. The emission factors were then weighted using the VMT fraction information included in the MOBILE6 output tables to obtain VOC refueling emission factors for the 8 vehicle types included in the VISTAS VMT database. The VMT fraction information contained in the MOBILE6 input files is based on the default MOBILE6 registration distributions, diesel sales fractions, and VMT fractions, or, when this information is provided in the input files, based on area-specific fleet parameters. A database of emission factors by month, county, and 8 vehicle types was then prepared. In calculating monthly onroad refueling emissions, the VISTAS annual VMT data were temporally allocated by month in the same manner as described in Chapter II for the onroad exhaust and evaporative emission calculations. These VMT were then multiplied by the corresponding monthly emission factor (in terms of grams per mile) to obtain refueling emissions from onroad vehicles. The monthly emissions for each county were then summed to obtain annual refueling emissions. Also, since refueling emissions are included in the area source inventory and are not distinguished by vehicle type, all refueling emissions from onroad vehicles were summed for each county in the VISTAS region. Summaries of the refueling emissions from onroad vehicles are presented in Chapter VI.

V. NONROAD REFUELING METHODS

The NONROAD model accounts for refueling emissions from nonroad equipment under two separate components, vapor displacement and spillage. Vapor displacement emissions result when new liquid fuel being added to a fuel tank displaces fuel vapors already present in the tank. Spillage emissions result when fuel is spilled during the refueling process.

Nonroad equipment may be fueled from a gasoline pump or a portable container. Refueling nonroad equipment from a portable container results in different emissions for both spillage and vapor displacement compared to refueling from a gasoline pump. In addition, the use of portable containers also results in extra refueling events. Both spillage and displacement emissions will also occur when the container is filled from a gasoline pump. However, due to lack of data, the NONROAD2002 model does not attempt to quantify this set of refueling emissions. As such, the NONROAD model refueling emissions associated with nonroad equipment being filled directly at the gasoline pumps will be used to represent the nonroad Stage II emission component. Stage II control factors listed in Table IV-1 were input in the county-specific NONROAD model option files. Once the model runs were performed, Pechan extracted the refueling and spillage emissions corresponding only to those engines (typically the larger horsepower engines) within each SCC assumed to be refueled at the pump. The list of SCC and horsepower ranges associated with pump versus container refueling is specified in the model since different emission rates are assumed for these two types of refueling.

Table V-1 presents draft annual Stage II VOC emission estimates by State. These emissions were combined with the onroad vehicle Stage II estimates described in Section IV of this report.

Table V-1. 2002 Draft Stage II Refueling Emissions by State

FIPSST	NAME	VOC Emissions, tpy
01	Alabama	167.25
12	Florida	842.60
13	Georgia	209.01
21	Kentucky	112.65
28	Mississippi	147.18
37	North Carolina	298.49
45	Tennessee	197.81
47	South Carolina	155.33
51	Virginia	174.70
54	West Virginia	39.33

VI. SUMMARY OF RESULTS

This chapter presents the emission results from the February 2004 draft version of the 2002 mobile source emissions inventory for the VISTAS region. These emissions result from the data and procedures described in the preceding chapters of this report.

A. ONROAD RESULTS

Table VI-1 summarizes the latest 2002 VISTAS onroad emissions inventory by State. This table also summarizes the total VMT for each State. Tables VI-2 and VI-3 are provided here for the purpose of comparing this inventory with another existing onroad inventory. The emissions shown in Table VI-2 are taken from Version 2 of EPA's 1999 NEI. Table VI-3 then shows the percentage change from the 1999 NEI to the 2002 draft VISTAS inventory. If the two inventories had been developed using comparable data, one would generally expect to see reductions in the onroad emissions from 1999 to 2002 due to fleet turnover resulting in the replacement of older, dirtier vehicles with vehicles meeting more stringent emission standards. However, this reduction in per-vehicle emissions also needs to overcome increases in VMT for the overall emissions to decrease. All of the VISTAS States show increases in VMT from 1999 to 2002, except North Carolina. This decrease in VMT needs to be further investigated by the State agency. States that were modeled with significant State or locally supplied inputs in the VISTAS modeling, such as Virginia and Georgia, would be expected to have more significant differences from the NEI data than States with no State-supplied information other than VMT. Some of the State inputs that cause significant deviations from the NEI estimates are registration distributions, VMT mixes by vehicle type, and speeds by road type. In addition, some of the pollutants are more affected by these inputs, while others (such as NH_3) are minimally affected by these inputs. The 2002 VISTAS onroad emissions will continue to undergo review. Any comments or questions on these emissions by the State or local agencies will be investigated as part of this review.

Table VI-1. 2002 VISTAS Onroad Emissions and VMT by State (February 2004 Version)

	2002 Annual Emissions (tons per year)							2002 Annual VMT
State	**VOC**	**NOx**	**CO**	**SO2**	**PM10**	**PM2.5**	**NH3**	**(million miles)**
Alabama	99,650	154,908	1,275,969	6,515	4,344	3,231	5,619	55,723
Florida	457,309	463,419	4,678,471	19,739	12,666	9,232	18,240	178,681
Georgia	215,035	311,125	2,601,785	11,487	8,038	5,942	10,612	106,785
Kentucky	79,110	164,231	1,196,211	5,718	4,083	3,048	5,103	51,020
Mississippi	68,508	107,047	845,990	4,354	3,152	2,399	3,603	36,278
North Carolina	147,977	278,265	2,116,829	9,953	6,374	4,741	7,868	80,166
South Carolina	92,491	136,569	1,192,894	5,647	3,825	2,867	4,719	47,074
Tennessee	126,959	255,090	1,785,136	8,115	5,445	4,059	6,855	68,316
Virginia	115,044	182,513	1,858,629	6,110	4,413	3,032	7,937	76,566
West Virginia	34,197	57,941	512,592	2,361	1,550	1,155	1,947	19,544
VISTAS Total	***1,436,279***	***2,111,108***	***18,064,506***	***79,999***	***53,890***	***39,705***	***72,504***	***720,153***

Table VI-2. 1999 NEI Version 2 Onroad Emissions and VMT by State

	1999 Annual Emissions (tons per year)							1999 Annual VMT
State	**VOC**	**NOx**	**CO**	**SO2**	**PM10**	**PM2.5**	**NH3**	**(million miles)**
Alabama	121,201	163,024	1,412,343	6,280	4,712	3,599	5,249	52,914
Florida	328,412	424,969	3,379,563	16,581	12,259	9,318	14,162	141,903
Georgia	207,562	313,568	2,526,592	12,028	9,263	7,139	9,787	98,859
Kentucky	97,286	162,160	1,225,414	6,006	4,772	3,715	4,703	47,816
Mississippi	74,579	126,344	830,477	4,478	3,908	3,106	3,406	34,955
North Carolina	187,346	285,380	2,252,671	10,829	8,462	6,552	8,663	87,759
South Carolina	98,010	153,346	1,207,336	5,616	4,515	3,527	4,330	44,146
Tennessee	138,629	211,133	1,697,778	7,876	6,108	4,716	6,392	64,570
Virginia	150,528	238,515	1,861,417	8,972	6,892	5,307	7,320	73,904
West Virginia	40,060	68,580	539,578	2,471	2,023	1,589	1,859	19,033
VISTAS Total	***1,443,613***	***2,147,019***	***16,933,170***	***81,137***	***62,913***	***48,567***	***65,871***	***665,859***

Table VI-3. Change in Onroad Emissions and VMT from 1999 NEI Version 2 to VISTAS 2002 Inventory (February 2004 Version)

	Change from 1999 NEI V2 to 2002 VISTAS Draft Inventory							
State	**VOC**	**NOx**	**CO**	**SO2**	**PM10**	**PM2.5**	**NH3**	**VMT**
Alabama	-18%	-5%	-10%	4%	-8%	-10%	7%	5%
Florida	39%	9%	38%	19%	3%	-1%	29%	26%
Georgia	4%	-1%	3%	-4%	-13%	-17%	8%	8%
Kentucky	-19%	1%	-2%	-5%	-14%	-18%	9%	7%
Mississippi	-8%	-15%	2%	-3%	-19%	-23%	6%	4%
North Carolina	-21%	-2%	-6%	-8%	-25%	-28%	-9%	-9%
South Carolina	-6%	-11%	-1%	1%	-15%	-19%	9%	7%
Tennessee	-8%	21%	5%	3%	-11%	-14%	7%	6%
Virginia	-24%	-23%	0%	-32%	-36%	-43%	8%	4%
West Virginia	-15%	-16%	-5%	-4%	-23%	-27%	5%	3%
VISTAS Total	-1%	-2%	7%	-1%	-14%	-18%	10%	8%

Table VI-4 presents the latest 2002 VISTAS onroad refueling emission estimates by State. These refueling emissions are NOT included in the emissions shown in Tables VI-1 through VI-3.

Table VI-4. 2002 VISTAS Annual Onroad Refueling Emissions

State	**2002 Annual Onroad VOC Refueling Emissions (tons per year)**
Alabama	8,408
Florida	28,367
Georgia	12,329
Kentucky	6,885
Mississippi	6,057
North Carolina	15,320
South Carolina	8,926
Tennessee	9,901
Virginia	8,657
West Virginia	3,383
VISTAS Total	***108,233***

B. NONROAD RESULTS

Table VI-5 provides a summary of draft 2002 nonroad sector annual emissions by State, including Stage II refueling emission estimates. Table VI-6 provides a summary of the draft 2002 NONROAD model emission estimates by State, and compares the values to 2001 NONROAD model NEI Version 2 estimates by showing the percent difference. A similar comparison is shown in Table VI-7 for other nonroad emission estimates compared to the 1999 NEI Version 2.

For the NONROAD model categories, SO_2, PM_{10}, $PM_{2.5}$, and NH_3 decrease consistently across all States. SO_2 emissions decrease due in part to a lower diesel fuel sulfur content input for the NONROAD model runs, which also contributes to decreases in particulate emissions. The decrease in NH_3 is due primarily to corrections made to compresses natural gas (CNG) engine NH_3 emissions, which involved zeroing out the estimates. The 1999 NEI erroneously applied emission factors on a grams per gallon basis to CNG fuel consumption. Although reported as uncompressed gallons in the NONROAD model, the CNG fuel consumption estimates represent a gaseous, not liquid, volume. Based on OTAQ's recommendations, CNG NH_3 emissions are now reported as zero. CO and NO_x show little change for all States, and changes in VOC vary by State and are dependent on the contribution of specific equipment categories (detail not shown).

For other nonroad categories, the increase in PM_{10} and $PM_{2.5}$ is due to the addition of commercial aircraft PM emissions. Commercial aircraft PM_{10} and $PM_{2.5}$ emissions were zero in the 1999 NEI; hence, the large percent increase. To gap fill this portion of the inventory, Pechan calculated and applied an average air taxi PM/NO_x emission ratio to commercial aircraft NO_x emissions. States with a higher proportion of commercial aircraft show significant PM increases (e.g., FL, TN, VA). In addition, NO_x emissions decrease due to new State data for other nonroad from AL and VA.

Table VI-5. Summary of Draft 2002 Nonroad Sector Annual Emissions by State, tons per year

FIPSST	STATE	VOC	NOX	CO	PM10-PRI	PM25-PRI	SO2	NH3
01	Alabama	46,788	64,367	373,634	5,504	4,895	7,529	32
12	Florida	211,006	153,396	1,765,539	61,426	45,849	17,453	109
13	Georgia	66,712	87,053	712,159	10,411	8,666	7,914	55
21	Kentucky	35,537	100,989	294,929	8,538	7,249	13,771	28
28	Mississippi	33,443	90,190	217,407	5,795	5,194	11,537	23
37	North Carolina	75,020	81,264	742,822	12,814	10,379	7,281	62
45	South Carolina	43,231	46,518	375,469	4,115	3,678	4,465	29
47	Tennessee	52,333	118,690	461,976	14,727	11,692	12,478	41
51	Virginia	61,655	69,668	614,958	21,580	16,497	11,068	44
54	West Virginia	15,497	36,613	120,029	2,293	2,034	2,388	10

Table VI-6. Summary of Draft 2002 NONROAD Model Emission Estimates by State

2002 DRAFT VISTAS NONROAD Model Inventory, tpy								
FIPSST	**STATE**	**VOC_ANN**	**NOX_ANN**	**CO_ANN**	**PM10_ANN**	**PM25_ANN**	**SO2_ANN**	**NH3_ANN**
01	Alabama	44,501.18	28,635.48	365,161.12	3,306.84	3,044.48	2,729.32	31.92
12	Florida	205,489.66	86,654.40	1,730,125.77	12,890.06	11,862.13	9,113.26	109.02
13	Georgia	65,054.02	51,452.93	705,292.75	5,493.33	5,057.34	5,025.11	54.97
21	Kentucky	32,836.91	28,253.72	283,488.53	3,152.29	2,901.82	2,777.69	28.00
28	Mississippi	31,097.14	23,549.89	207,824.23	2,761.65	2,542.05	2,375.53	23.37
37	North Carolina	73,610.93	58,667.62	734,496.85	6,095.96	5,613.11	5,442.35	62.06
45	South Carolina	41,652.41	26,212.76	366,737.16	3,028.92	2,788.66	2,461.79	29.29
47	Tennessee	48,626.66	39,833.95	446,461.43	4,240.53	3,904.21	3,810.11	41.22
51	Virginia	56,973.85	40,914.48	594,020.13	4,739.47	4,362.61	4,103.01	44.22
54	West Virginia	14,498.68	9,502.33	115,652.49	1,038.29	955.70	980.17	10.31
2001 NONROAD Model NEI Version 2, tpy								
FIPSST	**STATE**	**VOC_ANN**	**NOX_ANN**	**CO_ANN**	**PM10_ANN**	**PM25_ANN**	**SOX_ANN**	**NH3_ANN**
01	Alabama	43,602.83	28,786.95	360,439.36	3,422.60	3,150.91	3,110.79	581.69
12	Florida	188,868.96	86,835.32	1,713,539.62	13,243.04	12,186.78	10,456.05	1,305.25
13	Georgia	63,927.85	51,521.66	698,868.77	5,678.55	5,227.63	5,749.47	989.31
21	Kentucky	31,662.34	28,350.32	279,283.79	3,274.35	3,014.06	3,127.88	463.74
28	Mississippi	29,037.96	23,671.70	205,664.64	2,877.28	2,648.40	2,668.55	359.21
37	North Carolina	69,671.36	58,742.13	724,908.46	6,300.02	5,800.72	6,196.92	1,223.82
45	South Carolina	39,310.79	26,304.57	363,112.01	3,130.17	2,881.75	2,817.02	507.81
47	Tennessee	47,193.97	39,916.38	440,915.76	4,395.90	4,047.06	4,337.42	749.51
51	Virginia	55,459.80	41,082.63	585,850.58	4,887.90	4,499.09	4,677.52	627.60
54	West Virginia	13,912.53	9,568.82	113,766.38	1,076.32	990.67	1,113.21	179.75
Percent Difference								
FIPSST	**STATE**	**VOC_ANN**	**NOX_ANN**	**CO_ANN**	**PM10_ANN**	**PM25_ANN**	**SOX_ANN**	**NH3_ANN**
01	Alabama	2.06%	-0.53%	1.31%	-3.38%	-3.38%	-12.26%	-94.51%
12	Florida	8.80%	-0.21%	0.97%	-2.67%	-2.66%	-12.84%	-91.65%
13	Georgia	1.76%	-0.13%	0.92%	-3.26%	-3.26%	-12.60%	-94.44%
21	Kentucky	3.71%	-0.34%	1.51%	-3.73%	-3.72%	-11.20%	-93.96%
28	Mississippi	7.09%	-0.51%	1.05%	-4.02%	-4.02%	-10.98%	-93.50%
37	North Carolina	5.65%	-0.13%	1.32%	-3.24%	-3.23%	-12.18%	-94.93%
45	South Carolina	5.96%	-0.35%	1.00%	-3.23%	-3.23%	-12.61%	-94.23%
47	Tennessee	3.04%	-0.21%	1.26%	-3.53%	-3.53%	-12.16%	-94.50%
51	Virginia	2.73%	-0.41%	1.39%	-3.04%	-3.03%	-12.28%	-92.95%
54	West Virginia	4.21%	-0.69%	1.66%	-3.53%	-3.53%	-11.95%	-94.26%

Table VI-7. Summary of Draft 2002 Other Nonroad* Emission Estimates by State

FIPSST	STATE	VOC_ANN	NOX_ANN	CO_ANN	PM10_ANN	PM25_ANN	SO2_ANN
2002 DRAFT VISTAS Other Nonroad Inventory, tpy							
FIPSST	**STATE**	**VOC_ANN**	**NOX_ANN**	**CO_ANN**	**PM10_ANN**	**PM25_ANN**	**SO2_ANN**
01	Alabama	2,286.81	35,731.80	8,473.33	2,196.87	1,850.82	4,799.75
12	Florida	5,516.71	66,741.52	35,413.13	48,536.33	33,987.28	8,340.05
13	Georgia	1,657.99	35,599.76	6,865.94	4,917.40	3,609.14	2,889.06
21	Kentucky	2,699.92	72,735.57	11,440.23	5,385.61	4,346.83	10,992.91
28	Mississippi	2,345.96	66,640.48	9,582.89	3,033.69	2,652.14	9,161.66
37	North Carolina	1,409.01	22,596.53	8,325.56	6,718.49	4,766.12	1,838.68
45	South Carolina	1,578.34	20,304.80	8,732.26	1,086.01	889.24	2,002.78
47	Tennessee	3,706.17	78,855.60	15,514.17	10,486.01	7,787.92	8,667.84
51	Virginia	4,681.39	28,753.43	20,938.22	16,840.30	12,134.84	6,965.04
54	West Virginia	998.41	27,110.49	4,376.64	1,254.86	1,077.93	1,408.05
1999 Other Nonroad NEI Version 2, tpy							
FIPSST	**STATE**	**VOC_ANN**	**NOX_ANN**	**CO_ANN**	**PM10_ANN**	**PM25_ANN**	**SO2_ANN**
01	Alabama	7,309.83	152,338.93	25,075.50	1,315.93	1,176.15	3,854.54
12	Florida	3,945.18	56,197.72	25,350.10	2,110.74	1,881.95	6,878.28
13	Georgia	2,594.07	39,245.14	12,198.09	1,072.08	953.43	3,070.41
21	Kentucky	2,676.93	62,930.31	12,388.06	2,370.31	2,153.93	8,965.67
28	Mississippi	1,755.99	48,927.22	8,072.51	1,917.16	1,747.89	7,051.91
37	North Carolina	1,447.95	17,999.44	8,739.21	540.09	470.85	1,508.40
45	South Carolina	2,470.03	18,034.10	13,291.47	561.99	503.60	1,858.19
47	Tennessee	2,426.97	51,133.47	11,127.02	1,786.06	1,616.72	6,266.91
51	Virginia	2,682.78	51,592.64	13,083.30	1,632.38	1,462.82	4,769.97
54	West Virginia	1,133.03	30,991.75	4,858.71	1,151.55	1,048.38	4,097.15
Percent Difference							
FIPSST	**STATE**	**VOC_ANN**	**NOX_ANN**	**CO_ANN**	**PM10_ANN**	**PM25_ANN**	**SO2_ANN**
01	Alabama	-69%	-77%	-66%	67%	57%	25%
12	Florida	40%	19%	40%	2199%	1706%	21%
13	Georgia	-36%	-9%	-44%	359%	279%	-6%
21	Kentucky	1%	16%	-8%	127%	102%	23%
28	Mississippi	34%	36%	19%	58%	52%	30%
37	North Carolina	-3%	26%	-5%	1144%	912%	22%
45	South Carolina	-36%	13%	-34%	93%	77%	8%
47	Tennessee	53%	54%	39%	487%	382%	38%
51	Virginia	74%	-44%	60%	932%	730%	46%
54	West Virginia	-12%	-13%	-10%	9%	3%	-66%

*Includes emissions from aircraft, commercial marine and locomotive SCCs

VII. OBSERVATIONS AND RECOMMENDATIONS FOR IMPROVEMENT

This chapter lists several areas where the onroad and nonroad emission inventories could be improved. Some of these improvements require a long lead-time for the States and would not likely be available for the final 2002 VISTAS modeling, but could improve future State and regional inventory efforts.

A. ONROAD SECTOR IMPROVEMENTS

In the onroad sector, significant improvements have been made to the inventory due to the State and local agencies providing 2002 VMT data by county and roadway type. For this February 2004 version of the VISTAS onroad inventory, only the Virginia VMT were projected by Pechan. It is anticipated that this States will be able to provide 2002 VMT data for use in the next revision of the inventory.

Local registration distribution data were provided by fewer than half of the VISTAS States. In many cases, registration data can be obtained from State Departments of Motor Vehicles. States that do not already do so should request a download of the data summarizing registrations by model year and vehicle class from their appropriate motor vehicle agency. Although it is probably too late in many cases to obtain 2002 data, 2003 registration data could be used with some adjustments in developing the 2002 emission inventories. Registration data will become even more important as VISTAS prepares to project a 2018 onroad emission inventory, since the 2018 projections will be affected by the number of vehicles that are subject to the Tier 2 emission standards and the new heavy duty vehicle standards. The registration distributions directly determine the proportion of vehicles subject to these new emission standards.

A relatively small amount of data was obtained regarding the distribution of VMT by season or month. Many State Departments of Transportation collect data that could be used to better distribute VMT by season or month. States should check to see what is available. These distributions will affect the episodic modeling that will be conducted by VISTAS. Pechan is currently performing a VMT scoping study for VISTAS to determine what data are available for better allocating VMT and emissions by month, day, and hour. These temporal improvements are expected to be incorporated into the next update of the VISTAS onroad emission inventory.

Due to the direct relationship between the VMT mix by vehicle type and the overall emissions, States should investigate potential sources of information for this data to replace the default data used here in most States.

EPA is currently in the process of preparing guidance on estimating emissions from heavy duty vehicles during long-term idling (sometimes referred to as hotelling). While these emissions are theoretically included in the MOBILE6 HDDV emission factors, they are not currently accounted for in the appropriate locations. For example, these emissions would typically occur at rest stops, trucking centers, and warehouse and distribution centers. With the current modeling, these emissions are spread over all counties, based on the VMT traveled by HDDVs in each county. If significant sources of truck idling emissions occur in or near Class I areas, the current modeling may be underestimating the effect of these emissions. If States are able to obtain data on the locations and utilization of truck rest stops, some of this emissions effect could be more appropriately accounted for in future versions of VISTAS modeling.

B. NONROAD SECTOR IMPROVEMENTS

NH_3 emissions for aircraft, commercial marine and locomotives are still reported as zero. As a result of recent communications with OTAQ, Pechan would suggest applying the updated nonroad diesel NH_3 emission factors used for the NONROAD model categories to activity data for commercial marine vessels and locomotives. To develop ammonia from commercial marine vessels and locomotives, Pechan would need to obtain or compile the county-level fuel consumption estimates used as the basis for 1999 emissions for these categories to use as the activity data for calculating updated NH_3 emissions. The presence of State or local data in the 1999 NEI does not allow for this to be determined easily by backing out the reported emission factors, and in some cases (e.g., diesel commercial marine), actual emissions (instead of activity) were obtained at a national level and allocated to counties (EPA, 2002). Alternatively, Pechan could use county level fuel consumption estimates developed for these categories for 2000 or 2001. These activity data were used by Pechan to estimate dioxin/furan emission estimates for the 2000 and 2001 NEI. Pechan could normalize the 2000 or 2001 county distribution to national level fuel consumption estimates for 1999. Due to the characteristics of aircraft jet and piston engines, Pechan does not recommend estimating aircraft NH_3 emissions using the available NH_3 emission factors.

VIII. REFERENCES

EPA, 1989: “Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources.” U.S. Environmental Protection Agency, Office of Mobile Sources and Office of Air Quality Planning and Standards, EPA 450/4-81-026d (Revised). July 1989.

EPA, 2002. “Documentation for Aircraft, Commercial Marine Vessel, Locomotive, and Other Nonroad Components of the National Emissions Inventory,” prepared by Eastern Research Group, Morrisville, NC for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. September 30, 2002.

Harvey, 1983. Craig Harvey, et al. “A Study of the Potential Impact of Some Unregulated Motor Vehicle Emissions.,” SAE Paper 830987. June 1983.

Harvey, 2003. C. Harvey, U.S. Environmental Protection Agency, Office of Transportation and Air Quality, e-mail entitled “NH3 Emission Updates,” sent to K. Thesing, E.H. Pechan & Associates, Inc. June 30, 2003.

USACE, 2000: *Waterborne Commerce of the United States, Calendar Year 1999,* IWR-WCUS-99-2 U.S. Army Corps of Engineers. 2000.

USACE, 2003: U.S. Waterways Data, Port and Waterway Facilities, [Data file]. Accessed from U.S. Army Corps of Engineers, http://www.iwr.usace.army.mil/ndc/data/datapwd.htm on December 12, 2003.