United States
Environmental Protection
Agency

Air and Radiation

EPA420-R-05-013
December 2005

User's Guide for the Final NONROAD2005 Model

EPA420-R-05-013
December 2005

User's Guide for the Final NONROAD2005 Model

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Prepared with assistance from
Cimulus, Inc.
and
ENVIRON International Corp.

NOTICE

This technical report does not necessarily represent final EPA decisions or positions. It is intended to present technical analysis of issues using data that are currently available. The purpose in the release of such reports is to facilitate the exchange of technical information and to inform the public of technical developments which may form the basis for a final EPA decision, position, or regulatory action.

TABLE OF CONTENTS

Page

FIGURES

Chapter 1 *Introduction*

Air pollution in the United States results from the emission of a wide variety of manmade and natural pollutants such as volatile organic compounds (VOC) , nitrogen oxides (NO_X), air toxics, and particulate matter (PM). Under the Clean Air Act, the U.S. Environmental Protection Agency (EPA) is given specific responsibilities to reduce the emissions of pollutants from a range of sources in order to provide clean and healthy air in the United States.

Generally speaking, the EPA classifies anthropogenic (manmade) emissions into three broad categories, mobile, stationary (point), and area sources. Mobile source emissions are further disaggregated into on-road (e.g., cars, trucks, and motorcycles) and nonroad emission categories. Because of the significant contribution of nonroad emission sources to the total mobile source emission inventory, it has become critical over the past several years for the EPA to provide state and local pollution control agencies with the ability to easily create and project accurate, reproducible inventories of nonroad emissions to satisfy the specific requirements of the Clean Air Act Amendments of 1990.

Nonroad emissions result from the use of fuel in a diverse collection of vehicles and equipment, including vehicles and equipment in the following categories:

- recreational vehicles, such as all-terrain vehicles and off-road motorcycles;
- logging equipment, such as chain saws;
- agricultural equipment, such as tractors;
- construction equipment, such as graders and back hoes;
- industrial equipment, such as fork lifts and sweepers;
- residential and commercial lawn and garden equipment, such as leaf and snow blowers;
- recreational and commercial marine vessels, such as power boats and oil tankers;
- locomotive equipment, such as train engines; and
- aircraft, such as jets and prop planes.

With the exception of aircraft, all categories of nonroad vehicles and equipment were unregulated by the EPA prior to the mid-1990s.

In a report issued by the EPA in 1991[1], the agency reported that nonroad vehicles and equipment were a significant source of VOC, NO_x , and PM emissions. The report showed that in some

[1]EPA, *Nonroad Engine and Vehicle Emission Study*, EPA-21A-2001, November 1991.

areas of the country, nonroad emissions contributed to as much as a third of the total mobile source NO_x and VOC inventory and over two-thirds of the mobile source PM inventory.

To assist states and local regulatory agencies in the creation of accurate nonroad emission inventories, the EPA has developed a nonroad emissions model which covers all areas of the nation. This document describes the 2002 limited release version of the model.

OVERVIEW OF THE EPA NONROAD EMISSIONS MODEL

Equipment Types

This version of the nonroad emissions model predicts emissions for all nonroad equipment categories listed above with the exception of commercial marine, locomotive, and aircraft emissions. The model includes more than 80 basic and 260 specific types of nonroad equipment, and further stratifies equipment types by horsepower rating. Fuel types include gasoline, diesel, compressed natural gas (CNG), and liquefied petroleum gas (LPG).

Pollutants Reported

The NONROAD model estimates emissions for six exhaust pollutants: hydrocarbons (HC), NO_X, carbon monoxide (CO), carbon dioxide (CO_2), sulfur oxides (SO_X), and PM. The user selects among five different types for reporting HC — as total hydrocarbons (THC), total organic gases (TOG), non-methane organic gases (NMOG), non-methane hydrocarbons (NMHC), or volatile organic compounds (VOC). Particulate matter can be reported as PM of 10μ or less (PM_{10}) or PM of 2.5μ or less ($PM_{2.5}$). The model also estimates emissions of non-exhaust HC for several modes — diurnal, refueling spillage, vapor displacement, hot soak, running loss, tank permeation, hose permeation, and crankcase emissions. All emissions are reported as short tons (i.e., 2000 lbs).

Geographic and Temporal Coverage

In each run of the model, the user selects what geographic area(s) are to be included. At the broadest level, the model estimates national total emissions. More commonly users will specify emissions by state, or for one or more counties within a state. At the most detailed level, the user can estimate sub-county emissions; however, this is an advanced feature and the user must supply sub-county input data. Thus the model is capable of estimating emissions for nonattainment areas which may consist of multiple counties or sub-counties in one or more states.

The NONROAD model can estimate current year emissions for the specified geographic area as well as project future year emissions and backcast past year emissions for calendar years 1970 through 2050. In estimating future year projections and in backcasting, the model includes growth and scrappage rates for equipment in addition to a variety of control program options. The model can calculate emissions for a variety of time periods — an entire year, one of four seasons, or any particular month. Emissions for the period selected are estimated either for the total period or for a typical day (weekday or weekend) in that period.

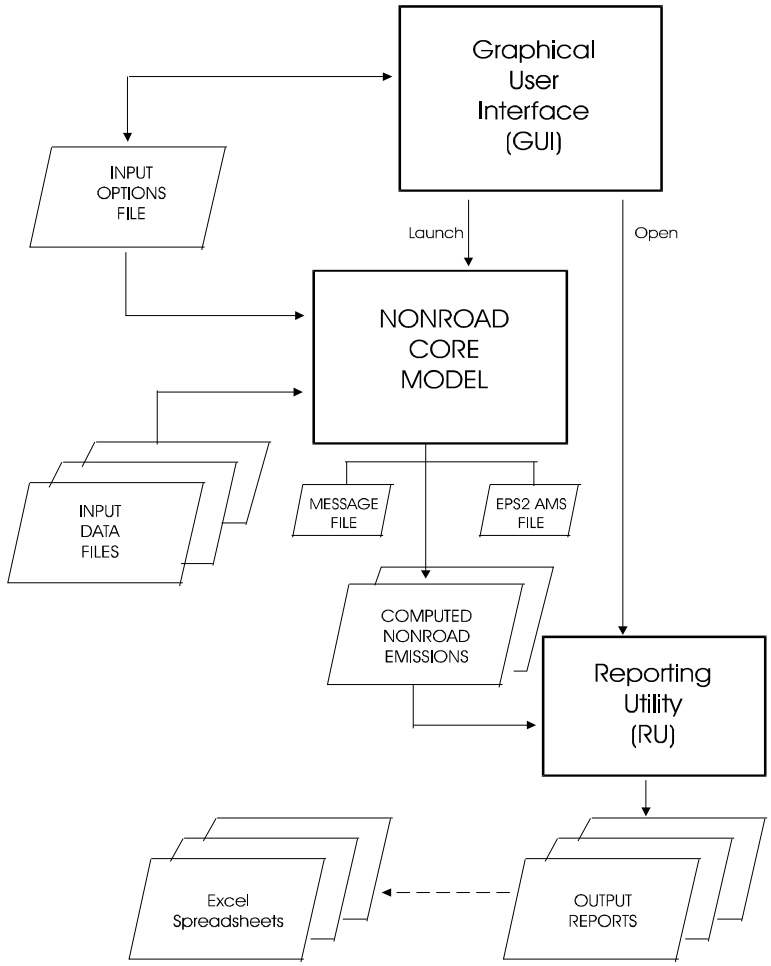
Model Components

As shown in Figure 1-1, the NONROAD model consists of three separate components: a graphical user interface written in Visual Basic, the core model written in Fortran, and a reporting utility written in Microsoft ACCESS.

The primary purpose of the user interface is to provide the user with an easy method to specify the options for a model run. With simple Windows-type screens and pull-down menus, the user can quickly set up, execute, and view a modeling scenario. Once the model options are specified, the user can then run the Fortran core model from within the interface, and then can move directly to the reporting utility to view and summarize the modeling results.

The core model of NONROAD, written in Fortran, contains all of the algorithms used by the model for calculating emissions estimates. The core model can be operated as a stand-alone application; however, as a stand-alone application it requires some basic knowledge of the DOS operating system. Also, note that while the user interface runs the core model for one specified set of conditions, and there is no built-in capability to run multiple scenarios in a single model run. However, multiple runs can be performed by creating and running a batch file in DOS or in a DOS window in a Windows environment.

The reporting utility, written using Microsoft's ACCESS database software, is used to create standardized reports using output data generated in the core model. Like the graphical user interface, the reporting utility is a fully operational Windows program, with pull-down menus, designed as a separate module in order to take advantage of the many reporting and formatting options available when using a database application. Although the reporting utility is written in ACCESS, it is a stand-alone application, and you do not need to know how to use ACCESS to generate reports.



GUI: Visual Basic program used to easily modify core model input options file, launch the core model, and open the reporting utility.

Core Model: Fortran program which computes nonroad emissions. Reads numerous data files and writes ASCII output files.

RU: Microsoft ACCESS program with pull down menus to allow easy reporting of core model results.

Figure 1-1: NONROAD model flowchart.

The reporting utility provides the user with the following standard reports:

- Emission Totals by County
- Emission Totals by County and Fuel Type
- Emission Totals by Equipment Type
- Emission Totals by HP (Horsepower)
- Emission Totals by HP and Source Classification
- Emission Totals by HP and Equipment Type
- Emission Totals by SCC (source category code)
- Emission Totals by Source Classification
- Population and Fuel Consumption by HP and Source Classification
- Population and Fuel Consumption by SCC

For most reports, emissions can be reported for either all counties or for a single, user-specified county and for all fuels or for a single user-specified fuel type. Reports that include emissions estimates by equipment types or by SCC are separated by major source classification (e.g., agricultural, lawn and garden), with subtotals provided for each classification. For those reports, equipment type descriptions are also included (e.g., "2-wheel tractors", "pavers", etc.). Where appropriate, reports also include a grand total by pollutant.

In addition to generating and viewing standardized reports from single model runs, the reporting utility provides the user the ability to compare the results of two separate model runs. The current version of the reporting utility has standardized reports for comparing two model runs by

- Emission Totals by HP and Source Classification,
- Emission Totals by SCC,
- Emission Totals by Source Classification,
- Emission Totals by County,
- Emission Totals by HP,
- Emission Totals by Equipment Type,
- Emission Totals by HP and SCC,
- Population and Fuel Consumption by SCC,

For the emission totals comparisons, the report displays the results of the two model runs, and the absolute and percent difference between the two model runs. For the population and fuel comparisons, the report displays only the results of the two model runs side by side. The comparison reports are useful, for example, to compare emissions from present and future year projections, or to compare emissions with two different future year control programs.

Finally, the reporting utility provides the user with the following emission factor reports:

- Grams per Operating Hour by SCC

- Grams per Operating Hour by HP and SCC
- Grams per Day by SCC
- Grams per Day by HP and SCC
- Grams per HP-Hour by SCC
- Grams per HP-Hour by HP and SCC

Both the reports that include emission factor estimates by SCC and by HP and SCC are separated by fuel type, major source classification, and SCC. The reports that include estimates by HP and SCC display one more level of separation, breaking the information down to the horsepower category level. The emission factor reports do not provide subtotals or grand totals for each group of estimates. The HP-Hour reports are only provided for exhaust and crankcase pollutants.

Model Inputs

The NONROAD model estimates emissions for each specific type of nonroad equipment by multiplying the following input data estimates:

- Equipment population for base year (or base year population grown to a future year), distributed by age, power, fuel type, and application;

- Average load factor expressed as average fraction of available power ;

- Available power in horsepower;

- Activity in hours of use per year; and

- Emission factor with deterioration and/or new standards.

The emissions are then temporally and geographically allocated using appropriate allocation factors.

There are several input files that provide necessary information to calculate and allocate emissions estimates. These input files correspond to the basic data needed to provide the calculations: emission factors, base year equipment population, activity, load factor, average lifetime, scrappage function, growth estimates, and geographic and temporal allocation. Default values are provided for all input files. The user can replace the default data files when better information becomes available, either from EPA for national defaults or from local sources for locality-specific data. The input files are also modifiable to test control strategies.

Output Options

Output from the core model is an ASCII file, which can be imported directly into the reporting utility by simply specifying the file name. The reporting utility can then be used to generate the standardized reports; users with ACCESS can generate their own reports or query the emissions estimates and other output from the model. The ASCII file can also easily be imported into an Excel or Lotus spreadsheet for those users who prefer spreadsheet applications, or wish to generate graphs of model output. In addition, the reporting utility has a feature that allows users to easily output an Excel file of data in a tabulated report; Excel can then be used to graph the tabled results.

Lastly, the user also has the option to generate an Emission Pre-Processor System 2 (EPS-2) input file. EPS-2 is a program, available on EPA's Web site or bulletin board, that can take the county-level output from the NONROAD core model and create gridded emissions files ready for input to the Urban Airshed Model (UAM), a photochemical grid model.

TECHNICAL DOCUMENTATION

Technical documentation of the default model inputs may be found at the EPA's Office of Transportation and Air Quality (OTAQ) web site for nonroad modeling:

http://www.epa.gov/otaq/nonrdmdl.htm

If you obtained the model from a CD-ROM rather than downloading it from the web site, the technical documents are included on the CD-ROM.

As of the release date for this version of the model, the following technical documents are available:

- Temperature Corrections for Nonroad Exhaust Emissions (NR-001c)
- Conversion Factors for Hydrocarbon Emission Components (NR-002c)
- Exhaust Emission Effects of Fuel Sulfur and Oxygen on Gasoline Nonroad Engines (NR-003c)
- Seasonal and Monthly Activity Allocation Fractions for Nonroad Engine Emissions Modeling (NR-004c)
- Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling (NR-005c)
- Nonroad Engine Population Estimates (NR-006d)
- Calculation of Age Distributions in the Nonroad Model — Growth and Scrappage (NR-007c)

- Nonroad Engine Growth Estimates (NR-008c)
- Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling — Compression-Ignition (NR-009c)
- Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling — Spark-Ignition (NR-010e)
- Spark-Ignition Engine Emission Deterioration Factors for the Draft NONROAD2004 Emissions Model (NR-011b)
- Nonroad Evaporative Emission Rates (NR-012c)
- Refueling Emissions for Nonroad Engine Modeling (NR-013b)
- Geographic Allocation of Nonroad Engine Population Data to the State and County Level (NR-014d)
- Weekday and Weekend Day Temporal Allocation of Activity in the Draft NONROAD2004 Model (NR-015a)

Any additional technical documents will be posted on the web site when they are completed. Also currently available on the web site are numerous review documents, papers, and presentation materials.

For answers to specific questions on the NONROAD model and model inputs, or to make comments or suggestions, email the nonroad inventory model team at:

nonroad@epa.gov

FUTURE MODEL UPDATES

The EPA NONROAD modeling team is very interested in receiving comments on this version of the model and suggestions for future model revisions and enhancements. E-mail your comments and suggestions to the team at nonroad@epa.gov

All updates to the model will be announced on and available from the OTAQ nonroad modeling web site.

TO STAY INFORMED

For the latest news on the NONROAD inventory model, subscribe to EPA-MOBILENEWS. EPA will use this listserver as the primary means of communication on the NONROAD model to distribute technical memos for review, to answer commonly asked questions, and to announce future model updates. The list is also used for EPA's other mobile source inventory models, so if you use the MOBILE series of models, you may already be a subscriber.

To subscribe to the EPA-MOBILENEWS listserver, send a blank email to:

join-EPA-MOBILENEWS@lists.epa.gov

Your email address will then be added to the list of subscribers and a confirmation message will be sent to your email address. Whenever EPA posts a message to the listserver, a copy of that message will be sent to all subscribers. You can remove yourself from the list by sending a blank email to:

leave-EPA-MOBILENEWS@lists.epa.gov

CONVENTIONS USED IN THE USER'S GUIDE

The following conventions are used in this User's Guide:

- "Click" when used in reference to commands means to carry out the command by clicking it with the left button on the mouse or using keyboard equivalents -- for example, the **Enter** key used in place of the **Enter** command.

- "Enter OK" means to click the **OK** button with the mouse or press the **Enter** key to carry out the action.

- A dialog radio-button option is enabled when its button contains a black dot. The absence of a black dot means the option is disabled.

- Key strokes are printed in bold and bracketed. For example **<R>** means to press the R key on the keyboard.

- Carrying out commands or procedures with keys frequently involves pressing two or more keys together. For example, **<Alt-F>** means to hold down the **Alt** key while simultaneously pressing **F**.

- "Arrow keys" or "Cursor keys" are collective terms for the Up, Down, Left, and Right arrow keys.

- A selection from a Windows menu bar is illustrated by **bold type** and the full name of the pull-down menu. For example, **Reports** from the Reporting Utility menu bar. To demonstrate the selection of an item in a pull-down menu both the main menu selection and the submenu selection are in bold type connected with a "➤". For example, **Reports**

➤ **Emission Totals by SCC**, indicates you should pull-down the Reports submenu and select the Emission Totals by SCC report.

- Files names are italicized. For example, the default option file provided with the NONROAD model is *template.opt*.

Both the Graphical User Interface and the Reporting Utility are standard Windows applications. They use pull-down menus, dialog boxes, and message boxes. This document assumes that an individual setting up and running the NONROAD model has experience in a Windows environment. If you find yourself bogged down in either the graphical user interface or the reporting utility perhaps you would benefit from one of the many books available that discuss in great detail the Windows environment.

A very brief summary of pull-down menus follows using the example **Reports ➤ Emission Totals by SCC** from the Reporting Utility:

You can activate the Reports submenu using the mouse or with keyboard strokes. With the mouse, you move the mouse pointer over Reports and click with the left mouse button. This displays the reports submenu list. To select an item from the pull-down list click on the item with the left mouse button. You can also click on the Reports menu and then drag the mouse to the item of interest (Emission Totals by SCC) while holding down the left mouse button. When you release the button the item is selected.

Alternatively, using the keyboard you can activate the Reports submenu by typing **<Alt-R>**, where R is the underlined character of the menu selection (usually the first character of the word if there are no conflicts). You can also use the arrow keys to move to a different menu selection or within the submenu list. To select a pull-down menu option type the underlined letter in the item name. For the above example, <**S**> will select the Emissions Totals by SCC report.

ORGANIZATION OF THE USER'S GUIDE

To assist you in the set-up and operation of the nonroad emissions model, this document guides you in the process of installing the model, provides information on system requirements to operate the model, and provides detailed information on each component of the model. In addition, a chapter is provided to assist you on more advanced topics.

Note: For reference, each chapter begins with a "Quick Start" section that summarizes the steps explained in the chapter. The chapters then continue with a more detailed guide to the model. As the detailed descriptions include some important notes on the proper use of the model, we recommend that you read the chapters completely before using the model for any official purposes.

The user's guide is organized in the following manner:

Chapter 2 - Getting Started: This chapter provides information on model hardware and software requirements. In addition, instructions are provided on installing the model on the your computer.

Chapter 3 - Graphical User Interface: This chapter discusses the graphical user interface in detail, and how to specify and change model inputs for most model runs.

Chapter 4 - The Core Model: This chapter describes how to edit options using a text editor and how to run the core model. Step by step examples are provided.

Chapter 5 - Reporting Utility: This chapter describes the reporting utility and provides you with information on how to import data from a model run and generate standardized reports.

Chapter 6 - Advanced Topics - This chapter provides detailed information to assist more advanced users of the model. This detailed information includes:

- a description of the core model inputs;
- a description of required and optional input file packets;
- how to incorporate local data by editing input tables;
- how to perform additional model runs by editing input tables;
- a description of core model output options, such as the generation of EPS-2 input files and the creation of spreadsheet files; and
- how to model more advanced scenarios.

Chapter 7 - Trouble Shooting - This chapter describes possible solutions to troubles you may have running the model.

Several appendices are included that document FIPS and SCC codes used by the NONROAD model and provide examples of reporting utility standardized reports.

Chapter 2 *Getting Started*

In this chapter of the User's Guide, the following topics are discussed:

- the minimum system requirements for installing and running the model; and
- the steps involved in installing the NONROAD model on your computer.

Note: Please see the README file for installation instructions. The latest version of the model may not have the setup.exe installation utility described below, in which case you must carefully follow the step-by-step installation instructions referred to in the README file.

QUICK START

The process of installing the NONROAD model on your computer may be quite simple using the installation utility provided, which works for Windows 98, 2000, NT, and XP. It is named *setup.exe*, and it is included on the NONROAD CD-ROM or can be downloaded from the nonroad modeling web site. In addition, the CD includes electronic copies of this NONROAD User's Guide, all currently available technical reports, and the source code for the FORTRAN core model.

In brief, the steps involved in installing and setting up the NONROAD model are as follows (in this example drive D is used for the CD drive and you should substitute the appropriate letter for the CD drive on your system):

1. Insert the NONROAD CD-ROM in drive D.

   Windows 95, 98, 2000, NT, XP: **Start ➤ Run** and then type *d:\setup.exe*

2. The NONROAD model installation program will prompt you for information as required during the installation process. Once you have supplied the necessary information, the program will install the NONROAD model on your computer. When the process is complete, a message box will appear indicating that the installation was completed successfully.

SYSTEM REQUIREMENTS FOR RUNNING THE NONROAD MODEL

The following are the minimum system requirements for running the NONROAD model:

- **Processor** 486
- **RAM** 8 megabytes
- **Drive** CD-ROM (or access by network)
- **Operating System** Windows 98, NT, or XP (core model only needs DOS)
- **Mouse**

It is recommended that you have at least 200 megabytes of free disk space for installation and operation of the NONROAD model. Besides the files to be installed, disk space will also be needed for the output files generated when running the model. The installed files consist of approximately 20 megabytes for the core model and data files, 4 megabytes for the graphical user interface, 10 megabytes for the reporting utility and multi-year postprocessors, and for users without Microsoft Access 2000 or later already installed, the stand-alone Microsoft Access runtime package is installed for the Reporting Utility, requiring an additional 50-100 megabytes.

INSTALLING THE NONROAD MODEL

To install the NONROAD model, follow these steps:

1. Insert the NONROAD CD-ROM in drive D (substitute the appropriate letter for the CD drive on your system).

2. Begin the installation procedure.

   Windows 98, 2000, NT, XP: Specify **Start ➤ Run** and enter *d:\setup.exe*. Specify **OK**.

3. During the installation process, a number of dialog screens will appear that request information from you to assist in installing and setting up the program. Once you have provided all required information, the installation program will set-up a directory on your computer and copy the necessary files to that directory.

4. The installation program will create a program group on your computer called Nonroad. This program group will contain an icon for each component of the model -- the graphical user interface, the core model, and the reporting utility. For information on the operation of each of these components, see Chapter 3 (graphical user interface), Chapter 4 (core model), and Chapter 5 (reporting utility).

Attaching the Reporting Utility Databases

When the NONROAD model is installed, a subdirectory called Reports is created. Within this subdirectory are two databases, *Nrdata.mdb* and *Reports.mdb*, required to run the reporting utility. To operate the reporting utility, *Reports.mdb* must "know" the path of *NRdata.mdb* in order to properly connect to it. This connection is done automatically the first time the Reporting Utility is opened.

If the Reporting Utility cannot find *Nrdata.mdb* (for example, the file was moved to another directory) then a message is displayed. You must attach the tables in order to successfully generate reports. Refer to the section in Chapter 5 titled Attaching the Reporting Utility Databases.

REINSTALLING THE NONROAD MODEL

The NONROAD model can be completely reinstalled on your computer by following the normal steps outlined above. During reinstallation, the program will search for a current installation of the program. If any current NONROAD files are found, the program will ask you whether you want to overwrite the files. Indicate **Yes** or **No**.

Chapter 3 Graphical User Interface

In this chapter of the user's guide, the following topics are discussed after the Quick Start description:

- a general description of the graphical user interface,
- moving around in the user interface,
- creating an option file and specifying model parameters,
- running and viewing a model scenario, and
- some advanced options.

QUICK START

The process of setting up an option file that contains a scenario that you are interested in modeling, and running and viewing the modeling results, is quite simple with the graphical user interface. Each of the steps involved is discussed in detail in this chapter. In summary, the steps involved in setting up, running, and viewing a modeling scenario are as follows:

1. Start the Graphical User Interface using the icon created when the EPA NONROAD Emissions Model was installed on your computer. (For more information, see General Description below.)

2. Define the parameters that you are interested in modeling. When you first run the interface, the modeling parameters are contained in the default option file *TEMPLATE.OPT* which is automatically read by the interface. Select **Scenario** on the main menu. A submenu will appear that contains the various options that you can specify. These options include the title of your model run, fuel specifications, the period of time and geographical region over which you want to estimate emissions, and the source categories that you want to model. (For more information, see the section below on Creating an Option File.)

3. Save the modified option file, **File ➤ Save** (or **Save As**). (For more information, see the section below on Creating an Option File.) If you do not save the option file with the name you want, it will be saved automatically with its currren tname when you choose **Model ➤ Run** in the next step.

4. Submit your option file to the core model to run, **Model ➤ Run**. Once the run has been completed, a message will appear in a DOS screen notifying you that the run was successful. (For more information, see the section below on Running and Viewing a Modeling Scenario.)

5. To view the results of this model run, specify **Model ➤ Reports**. This will move you to the reporting utility. (For more information, see the section below on Running and Viewing a Modeling Scenario.)

6. Exit the interface when you are finished with **File ➤ Exit**. (For more information, see the section below Exiting the Graphical User Interface.)

GENERAL DESCRIPTION

The NONROAD user interface provides you with an easy method for designing the nonroad emissions simulations that you are interested in modeling. In addition, the interface provides you with an easy means for accessing the reporting utility to view the results of your modeling run. With simple Windows-type screens and pull-down menus, you can quickly set up, execute, and view a modeling scenario without any computer programming experience.

When the NONROAD emissions model is installed on your computer, an icon for each component of the model is created. While this allows you to access each component of the model individually, through the interface you can operate most of the functions of the EPA NONROAD Emissions Model -- from the creation of a scenario, to the running of the core model, to the development of reports -- without exiting one program and executing another.

Note: In this chapter of the user's guide, information is provided to assist you in setting up an emissions scenario to model using the default data provided in the model. If you are interested in modifying the data files to reflect alternatives to the default data, please see Chapter 6 on Advanced Topics.

MOVING AROUND IN THE GRAPHICAL USER INTERFACE

Figure 3-1: Graphical User Interface icon.

Begin the Graphical User Interface denoted by the icon displayed in Figure 3-1. If your computer operates with Windows 95 or above, the icon can be found in a program group called **Nonroad Model** accessed from the **Start** menu. If you are operating with Windows 3.1, the icon can be found through Program Manager.

When launched, the main menu screen of the interface appears (Figure 3-2). The title bar of the screen displays the NONROAD name followed by the currently opened option file in parentheses. The default is *template.opt*. Below the title bar is the main menu bar, followed by the EPA banner, and the model run title, message file name, and output file name which are extracted from the opened option file.

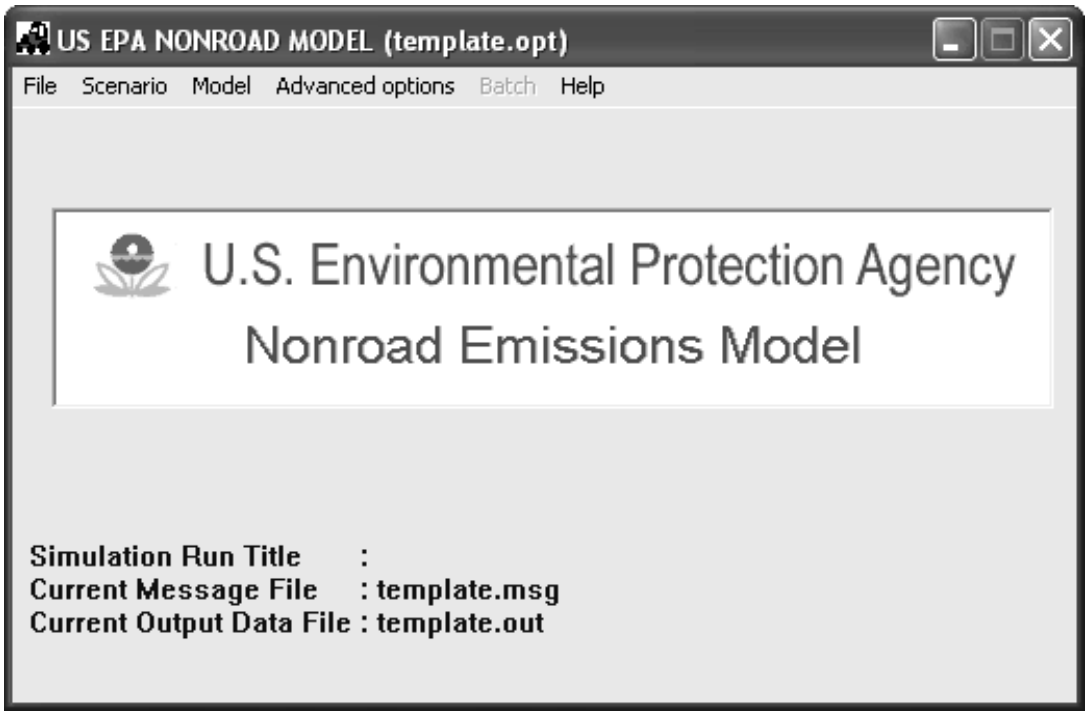


Figure 3-2: Initial graphical user interface screen

From this screen you can access submenus that make up the graphical interface module, as listed at the top of the window in the menu bar:

- **File** - open an existing option file, save a modified option file with the old or a new name, or exit the interface.

- **Scenario** - define the various parameters that you want in your modeling run.
- **Model** - run the core model and access the reporting utility.
- **Advanced Options** - select your own data files to replace the default files provided with the model and to specify optional output.
- **Batch** - this option is unavailable. Multiple runs must be done manually.
- **Help -** general information is provided on the version and status of the model.

Once a main menu item is selected, a list of submenu items will be displayed. The following shows the list of submenu items for each of the main menu choices:

File	Open Save Save As Exit
Scenario	Options Period Region Sources
Model	Run Reports
Advanced Options	Geographical Allocation Temporal Allocation Growth Equip. Population Phase In Emission Factors Deterioration Factors Activity U.S. Counties FIPS Optional Output
Help	Help About Current

In most instances, after selecting a submenu item a form is displayed for user inputs or selections. When an input error occurs, an appropriate message (dialog box) is displayed. If a dialog box appears, specify **OK**, make the corrections needed and continue.

CREATING AN OPTION FILE

The first step involved in operating the EPA NONROAD Emissions Model is to setup an option file which defines the parameters that you are interested in modeling. Once this file has been set up, it can be submitted directly to the core model from the interface, and then following the model run the estimated emissions output can be imported into the reporting utility and standard reports generated.

An option file (**.opt*) contains all of the parameters that specify your modeling run. This file is opened, read, and updated from the interface. To more easily explain the process of setting up an option file, the following example is provided:

> *You have been given an assignment to estimate the total emissions from all lawn and garden equipment in Travis County (Austin), Texas. You are interested in estimating these emissions for the summertime of 1998*.

Throughout this chapter, we will refer to the above example.

Opening and Naming an Option File

When you first run the interface, the default option file *TEMPLATE.OPT* is automatically opened and the file name is displayed on the title bar of the main screen. Also displayed in the main menu screen is the run title, the message file name, and the output file name extracted from the currently opened option file. You can modify the default option file to define a modeling scenario of interest. Alternatively, if you want to use or modify a different option file (**.opt*) that you have previously created, follow these steps:

1. From the Main Menu, select **File ➤ Open**.

2. An open file dialog box appears that requests you to select a new option file. Specify the option file you are interested in using. This loads the option file into the interface and updates the main screen.

Before beginning to modify the scenario options in the option file, you should save the option file with a different name to prevent yourself from accidentally overwriting data in a previously created option file or in *TEMPLATE.OPT*. To do this, select **File ➤ Save As** and indicate the new file name. For our example, you would specify the file *TRAVIS.OPT*. The main menu

screen title bar is updated with the new file name. In addition, when you specify a new file name the message file and output file names are set to the same name as the specified option file with the file name extensions *.msg* and *.out* respectively. For our example, you see the files *TRAVIS.MSG* and *TRAVIS.OUT*.

Note: The name of the option file must be no longer than eight characters as a result of DOS conventions. It is recommended that the extension *.OPT* be used for all option files.

If the message file specified in the opened option file exists then the button "View Message File" will appear in the middle of the main menu window. Click on this button to open Windows Notepad and review the indicated message file.

Defining a Report Title

The interface allows you to easily title your model run. This title will be used on any reports you might generate for this particular scenario.

To provide a descriptive title for your model run, follow these steps:

1. From the main menu select **Scenario ➤ Options**.

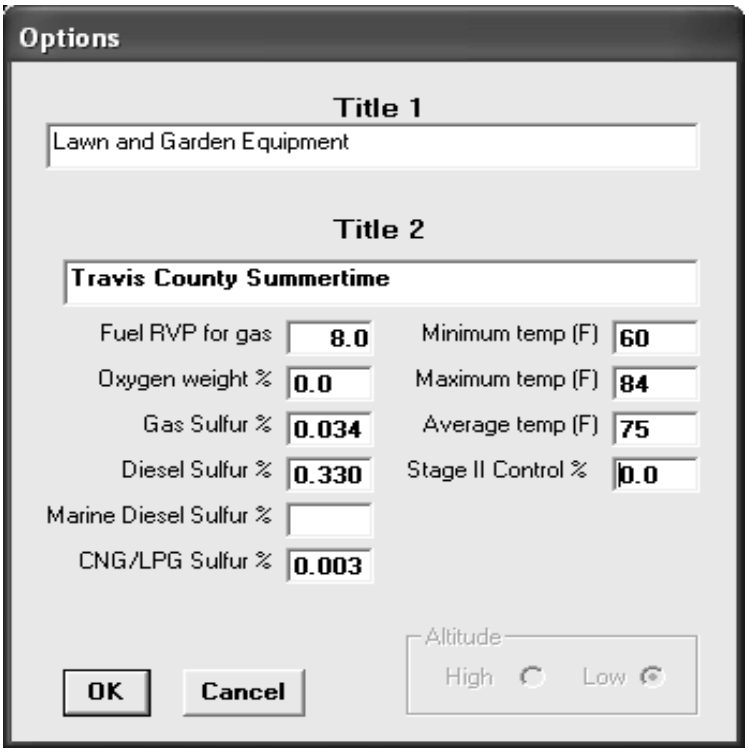


Figure 3-3: Options screen

2. Update the Options screen (Figure 3-3). When the Options screen first appears, it will contain the title and any options previously defined for this option file. Specify a descriptive title for your scenario in the field below Title 1. If you want to add a subtitle, you can do so in the field below Title 2.

Note: The two title lines of your modeling run must be no longer than 80 characters each. In addition, the titles should not include single or double quotation marks (i.e., " or '), or periods.

3. Specify **Done** or **OK** to return to the main menu.

Defining Fuel Specifications, Ambient Temperatures, and Stage II Control Effectiveness

Nonroad emissions result from the combustion, evaporation, and spillage of fuel in equipment and vehicles designed primarily for off-road use. The emissions that come from nonroad equipment and vehicles are dependent, in part, on the composition of the fuel used. Similarly, the ambient temperature will also affect the emissions from nonroad sources. Finally, implemented controls act to decrease emissions. As a result, it is important to define the composition of the fuel, the ambient temperature for the period of time that you are interested in modeling, and the effectiveness of any existing controls.

The minimum temperature that you define for your modeling scenario is the average low for the time period selected. For example, when modeling a typical summer day, the minimum temperature should be the average low temperature in Fahrenheit for the summer season. Moreover, when modeling an entire year, the minimum temperature should be the average daily low for the year and not the lowest temperature ever recorded. Other modeling parameters, such as RVP, sulfur, and oxygen content, depend on local fuel characteristics. Data for an area should be available from the state or local air agency.

Stage II controls are designed to reduce emissions during refueling due to vapor displacement. They are generally mounted on the pumps at gasoline stations. With regards to nonroad equipment, their benefits only apply to equipment that are refueled directly via the pumps (rather than with portable containers). Where present, the effectiveness of this control is also affected by the design of the filler opening of the equipment.

Note: EPA currently has no data on the effectiveness of Stage II for nonroad equipment. The value should be left at 0% unless local data exist on which a value can be based.

To specify fuel characteristics, temperature, and Stage II control effectiveness, follow these steps:

1. From the main menu select **Scenario ➤ Options**.

2. Modify the required parameters. For our example, indicate the gasoline specifications and ambient temperatures that will be in effect in Travis County during the summer of 1998. Next, identify whether the modeling region is at high or low altitude[1]. High should be specified where the average altitude is greater than 5000 feet; this is consistent with the MOBILE program.

3. Specify **Done** or **OK** to return to the main menu.

The acceptable range of values for each of the fuel specification and ambient temperature options are as follows:

Parameter	Minimum	Maximum
Fuel RVP (ps*i*)	6	16
Oxygen (wt.%)	0	5
Fuel Sulfur (wt %)	0	0.5
Temperature (F)	-40	120
Stage II control effectiveness (%)	0	100

Note: The percent effectiveness value must be followed by a decimal point.

Defining the Modeling Period

The modeling period is simply the period of time for which you want to estimate emissions. To define the modeling period, follow these steps:

1. From the main menu select **Scenario ➤ Period**.

[1] Altitude adjustment is not in this version of the model. Hence, this selection is currently disabled in the user interface.

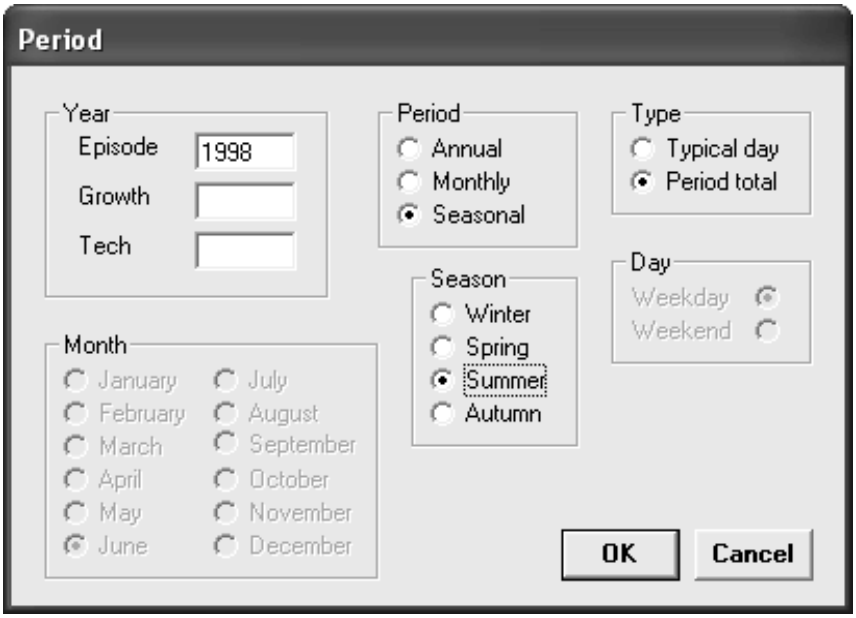


Figure 3-4: Period screen

2. Indicate the modeling period of interest in the displayed screen (Figure 3-4).

   The interface makes it easy to define the modeling period through a series of select buttons. The following options are available to you:

   - **Episode Year** - You can define any year between 1970 and 2050 that you are interested in modeling.

   - **Growth Year** - You can define any year between 1970 and 2050 to forecast or backcast engine populations. If this is left blank, the Episode Year will be used.

   - **Tech Year** - You can define any year between 1970 and 2050 as the maximum technology year. If this is left blank, the Episode Year will be used. Note that if a year is entered, it cannot be greater than the Episode Year.

   - **Period** - You can define the modeling period as annual, monthly, or seasonal.

- **Month** - If you select the modeling period to be monthly, the list of months will become active and you can select the appropriate month of the year.

- **Season** - If you select the modeling period to be seasonal, the list of seasons will become active and you can select the appropriate season of the year. Seasons are defined as follows in the model:

Winter:	Jan/Feb/Dec
Spring:	Mar/Apr/May
Summer:	Jun/Jul/Aug
Autumn:	Sep/Oct/Nov

- **Type** - For any period that you select, you can estimate the emissions as the total for a 24-hour period (typical day) within the period or for the total period.

- **Day** - If you select the type to be a typical day, days will become active and you can select a weekday or weekend day.

Note: While the model allows you to define any model year from 1970 to 2050, it actually forecasts and backcasts based on data from 1990-2002. For this reason, its estimates become less accurate as you move further into the past or the future.

Since we are interested in estimating the total emissions during the summertime of 1998 in our example, specify **Seasonal** (under Period), **Summer** (under Season), **Period Total** (under Type), and type in 1998 in the year field.

3. Specify **Done** or **OK** to return to the main menu.

Defining the Modeling Region

The interface makes it relatively easy to define the geographical region -- from one county to multiple counties to an entire state or the nation -- that you are interested in modeling. To do this, follow these steps:

1. Specify **Scenario ➤ Region**. The Region screen will appear (Figure 3-5).

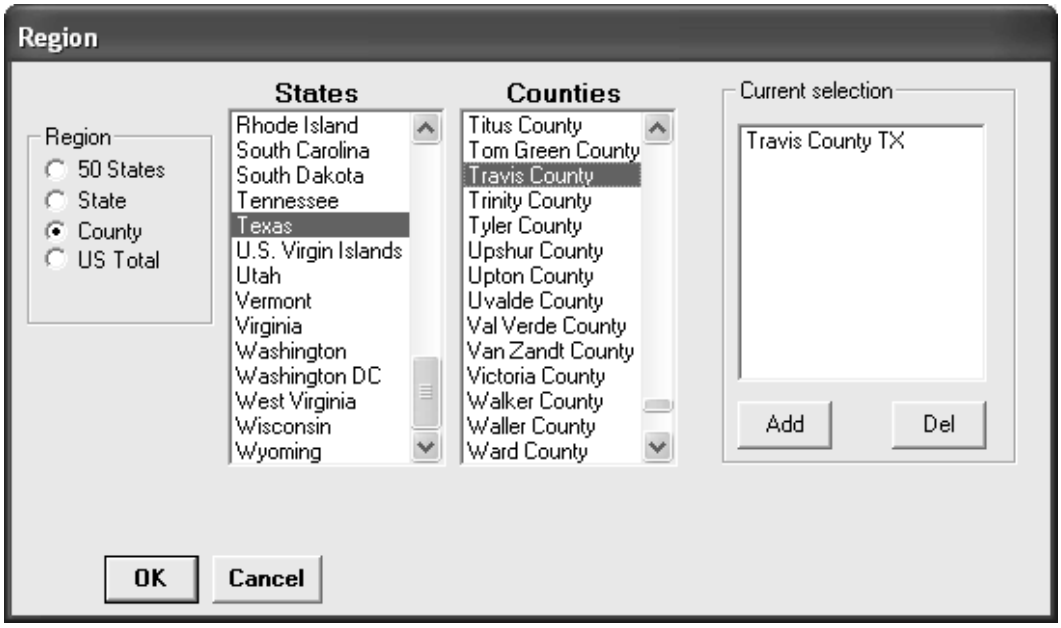


Figure 3-5: Region screen.

2. The first step in defining the modeling region is to remove any regions that have been specified in a previous scenario that are not applicable to the current scenario. To do this, highlight the regions in the Current selection list and click on **Del**.

3. Specify a region. Several options are available, the methods for selecting them are as follows:

   - **50 States** - This option selects all 50 states, you will obtain the state totals for all 50 states individually. When selected, the "Current selection" list is cleared, as no individual states or counties need be specified.

Tip:	Since selecting 50 States as a region clears the current selection list this is a quick and easy way to delete all previously specified states or counties before starting a new region definition.

   - **State** - This option allows you to select any one, or multiple, of the 50 states. When a state is selected, the model will compute total emissions for the entire state, but will not allocate emissions among counties in the state. Specify **State** (under region), scroll through the list of states or type the first letter to jump in the

list. Once found, highlight the state and then **Add**. The state will appear in the current selection field.

- **County** - This option allows you to select one or more counties. To select an individual county, specify County (under region) and highlight the state of interest. When you highlight the state a list of counties for that state will be displayed. Move through the list of counties until you find the one that you want, highlight the county, and then **Add**. The county name and state abbreviation are written to the Current selection list.

  To specify all counties within a state, indicate County (under region), highlight the state of interest, and then **Add**. The Current selection list will display the state name (e.g., Michigan) with "All of ..." (e.g., "All of Michigan"). The core model will compute emission estimates for every county, individually, in the named state.

Note: To create a modeling region that is larger than a single state or county, continue to add new regions to the list of currently selected regions by repeating the process for selecting states or counties. For example, if a metropolitan area covered four counties, simply select the first county and then each additional county one at a time.

- **US Total** - This option allows you to estimate national total emissions, no state detail is generated. When selected, the "Current selection" list is cleared, as no individual states or counties need be specified.

Note: The NONROAD model also allows you to define a sub-county region. However, this option requires that you provide a significant amount of data beyond that furnished with the model. For information on how to input this additional data, please see Chapter 6, Advanced Topics.

For our example scenario, indicate **County** (under Region), highlight Texas from the list of states, highlight Travis from the list of counties, and **Add**.

5. Specify **Done** or **OK** to return to the main menu.

Defining Source Categories

The EPA NONROAD Emissions Model allows you to estimate emissions from many different types of equipment and vehicles. Each source category in the NONROAD model is uniquely

identified with a source classification code (SCC), which is a ten-digit number. The first two digits, 22, represent mobile sources. For most categories, the next two digits represent the engine or fuel type (60, 65, 67, 68, and 70, represent 2-stroke gasoline, 4-stroke gasoline, LPG, CNG, and diesel respectively). The next three digits represent the segment type (for example, recreational or construction). And the last three digits represent the specific kind of equipment (for example, golf carts or snowmobiles). Refer to Appendix B for a complete list of NONROAD SCCs.

When selecting source categories to process in a NONROAD simulation you can specify 'global' source category codes instead of each individual SCC. For example, instead of listing all lawn and garden equipment types individually, when you specify **Add segment** the SCCs are listed with the last three digits (equipment type) as zero. It is implied that all equipment types within that segment will be processed.

To define the source categories that you want to model, follow these steps:

1. From the main menu specify **Scenario ➤ Sources**. The Sources screen will appear (Figure 3-6).

The following options are available:

- **Active** - Choose either 'Selected sources' to specify a subset of sources to model or 'All Sources' which will model all SCCs with valid equipment population data. If 'All Sources' is selected then the ability to select specific SCCs is removed (i.e. the Add buttons become deactivated).

- **Fuel** - Choose between 'All Fuels', 'Diesel', or 'SI' (spark ignition engines).

- **Segment** - Choose one of the segments listed.

- **List of selected sources** - Each selected SCC and a brief description is displayed in the lower portion of the window.

- **Add Segment** - The 'global' SCCs which represent the specified segment and fuel type will be added to the list of selected SCCs.

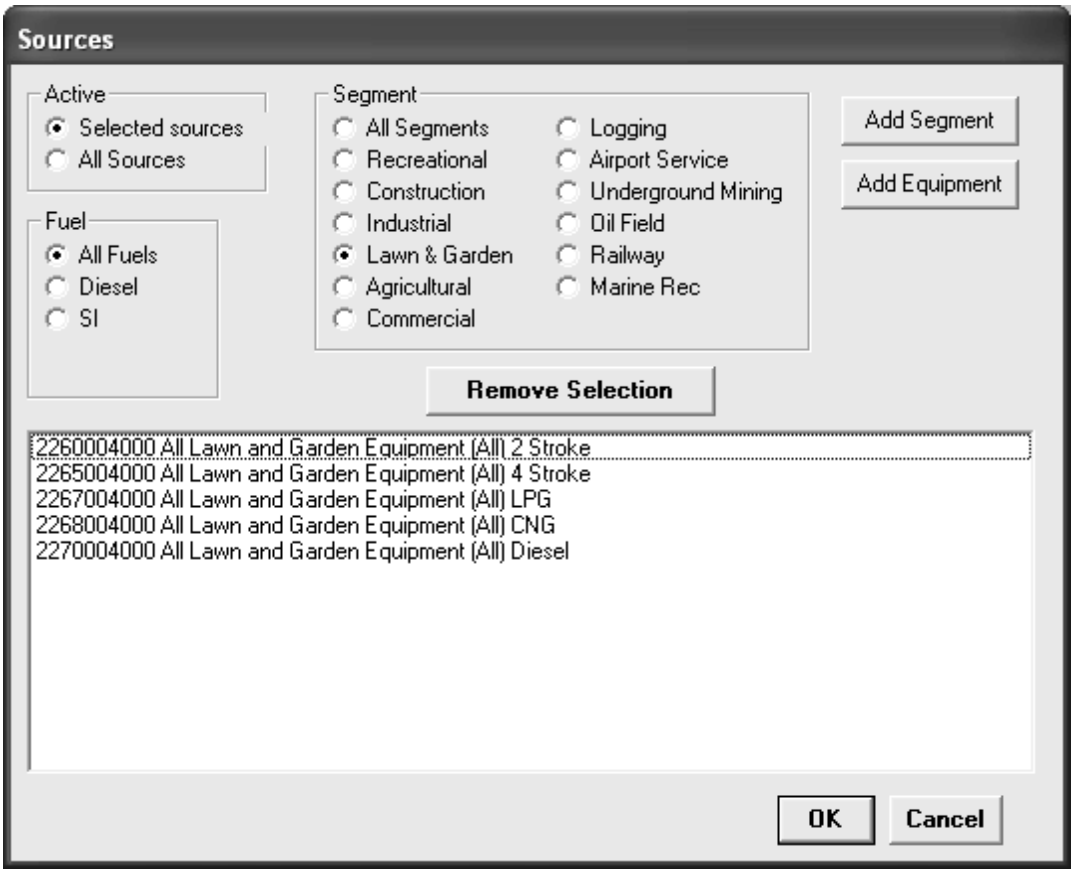


Figure 3-6: Sources screen

- **Add Equipment** - The individual SCCs which represent every type of equipment within a segment will be added to the list of selected SCCs. This allows you to select a subset of equipment types within a segment, by then removing the individual equipment types that you do not want.

- **OK** - Return to the main menu.

- **Remove Selection** - This will remove any highlighted SCCs from the list of selected sources.

2. Similar to defining a region, you must first remove any source segments or equipment that you do not want to model. Highlight the segments and/or equipment in the list of selected sources and specify **Remove Selection**. Multiple sources may be highlighted

by using the **<Shift>** or **<Control>** keys. The **<Delete**> key may also be used to remove the highlighted sources from the list of selected sources.

3. Select the fuel type. For our example scenario we are interested in all lawn and garden equipment so we will specify **All fuels**.

4. Select the segment type. For our example, we are interested in all lawn and garden equipment and select **Lawn & Garden**.

5. Specify **Add Segment** to add a list of 'global' SCCs for the specified segment/fuel to the current list of selected sources. Alternatively, if you are interested in specific equipment within a source segment then **Add Equipment**. Every type of equipment that falls under the specified segment/fuel type will appear in the list of selected sources. Highlight any equipment that you do not want to model, and remove them from the selection list (see 2 above).

Note: If you are interested in estimating emissions from more than one segment or fuel type, add the first segment/fuel type and then continue adding segment/fuel types as desired.

6. When you have finished defining sources, specify **OK** to return to the main menu.

Saving an Option File

Once you have created an option file by defining all of the parameters that you want, you should save this file. To do this, follow these steps:

1. From the main menu **File ➤ Save**.

Note: The option file is saved automatically when you specify **Model ➤ Run**, but it is good practice to save it manually using **File ➤ Save as...** to be sure the version you want is saved with your desired filename.

RUNNING AND VIEWING A MODELING SCENARIO

Once you have set up an option file, the interface allows you to easily submit the option file to the core model to run. Similarly, the interface allows you to access the reporting utility to view the results of your run and prepare printed reports.

To submit an option file to the core model, follow these steps:

1. From the Main Menu, specify **File ➤Open**.

2. Specify the option file you want to model in the open file dialog box. This loads the option file into the interface and the file name is displayed on the main menu title bar. If the option file is already loaded, you can skip steps 1 and 2.

3. From the main menu, specify **Model ➤ Run** (Figure 3-7).

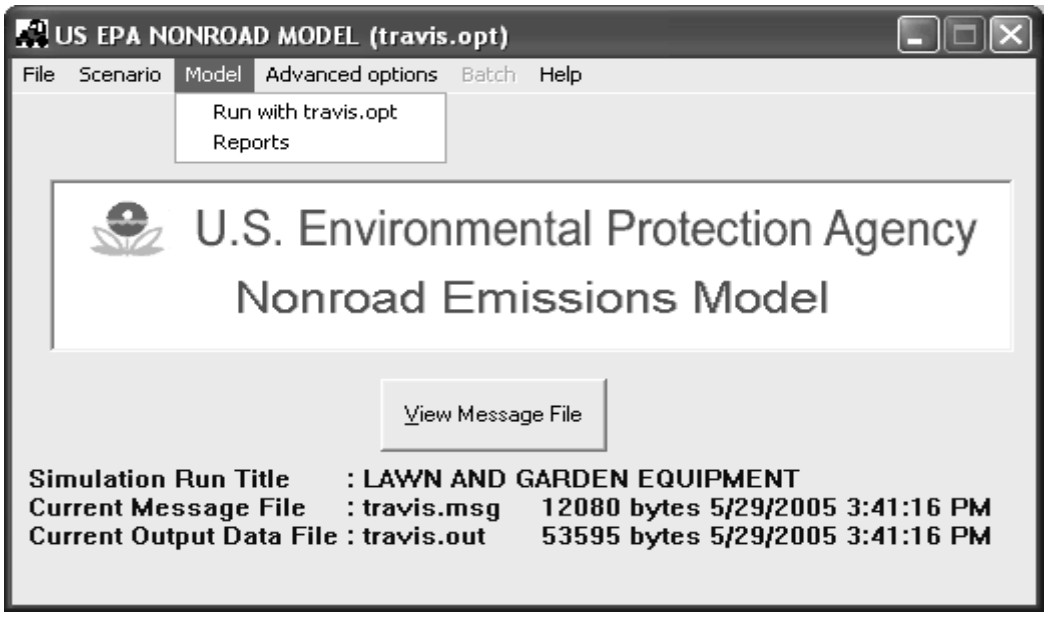


Figure 3-7: Model submenu screen

4. A DOS window will appear. After the run has been completed, a message will appear notifying you that the run was successful.

   If the DOS window disappears after the core model completes and you wish to view the DOS screen, then you need to change the default 'close on exit' in your Windows application. In Windows 95 or above, right click on the *nonroad.exe* file name, select Properties, select the Program tab, and disable the 'Close on exit' box. You will then need to manually close the DOS window when the core model completes.

5. To return to the interface, press <**Enter**>.

6. It is important to review the output message file produced by the core model. In addition to any warning or error messages that are generated during execution, the message file will indicate all of the parameters specified in the option file and all of the input files used in processing. These should be reviewed in order to verify that the simulation performed was what you intended. Specify **View Message File** from the main menu in order to open Windows Notepad and examine the message file.

7. If you are interested in modeling several scenarios prior to viewing and printing a report, repeat the above steps for each of your option files. Be sure to use a different option filename for each scenario, or else the later model runs will overwrite the output files from the previous runs.

Note: The core model runs in DOS under a Windows environment which allows you to multitask activities while the model is running. However, multitasking may lengthen the amount of time it takes for the model to run, depending on the capability of your computer (speed and memory). If this is a problem, you should consider closing all other applications prior to running the model.

To access the reporting utility, follow these steps:

1. From the main menu, specify **Model ➤ Reports**. Refer to Chapter 5 for a complete description of the Reporting Utility.

ADVANCED OPTIONS

The Advanced Options menu allows you to specify your own data files to replace the default files provided with the NONROAD model and to specify certain alternate output file formats. Each submenu selection allows you to specify a different file to use. In some cases, more than one file may be applicable to a selection.

An optional output available from the core model, via the graphic interface, is the Emissions Processor System (EPS) AMS format. This output is generated only if a filename is provided for that format. Another optional output available only from the reporting utility is the NEI Input Format (NIF), which can be used to generate inputs for EPA's National Emissions Inventory (NEI). NIF output is covered in Chapter 5.

Depending on your desired modeling region you may need to change the default Geographic Allocation and Equipment Population file names. These files are provided by state to reduce the size of the files.

EXAMPLE OF CHANGING GEOGRAPHIC ALLOCATION

The Geographic Allocation selection allows you to identify the allocation look-up table (the default is "*allocate.xrf*") and allocation data files that you want to use. The allocation look-up table is an assignment of equipment type to an allocation indicator (e.g., construction equipment assigned to employees in the construction industry). The allocation files contain the actual estimates of indicator values (e.g., the actual number of employees in the construction industry by county and year).

To change the look-up table or allocation data files, follow these steps:

1. From the main menu, select **Advanced options ➤Geographic Allocation**. The Geographic Allocation screen is displayed (Figure 3-8).

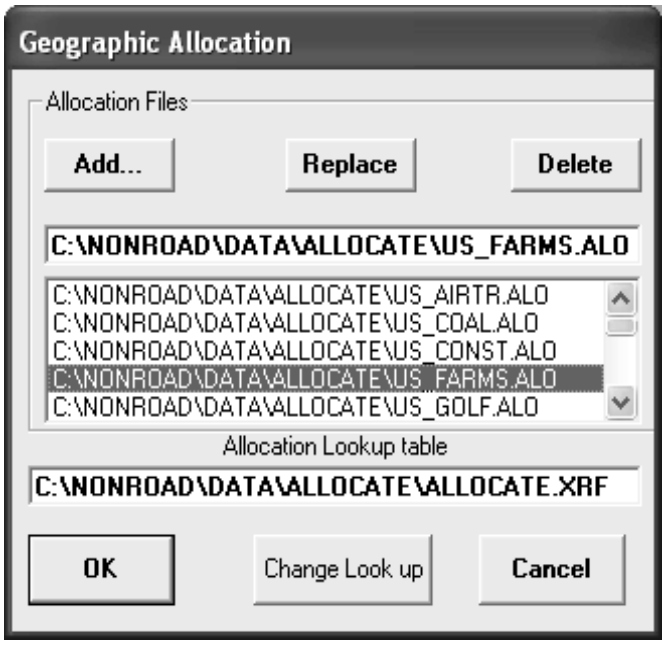


Figure 3-8: Geographic Allocation screen

2. The first step in defining the geographic allocation data files is to remove any previous data files. Highlight the current files and Delete one at a time.

3. Click Add to specify a new list of allocation files. An open file dialog box appears that requests you to select a new allocation file. Locate the directory where the allocation files are saved (when installed: \nonroad\data\allocate) and specify the data file that you want. Repeat this until all necessary files have been added.

4. To change a specific allocation file, select that file from the list. Then enter the path and name of the new file in the text box directly above the list. Click **Replace**.

Note: The specification of modeling region under the Scenario menu automatically selects the appropriate default allocation and population data files. Thus any changes made to these via the Advanced Options menu will be un-done if you access the **Scenario ➤ Region** screen.

5. Specify **Change Look up** to change the allocation look-up table. Again, an open file dialog box appears that requests you to select a new allocation file (this time with the extension *.xrf*). Locate the directory where the allocation files are saved and specify the data file that you want.

6. Specify **Done** or **OK** to return to the main menu.

EXITING THE GRAPHICAL USER INTERFACE

To exit the interface, follow these steps:

1. From the main menu, specify **File ➤ Exit**.

Chapter 4 *Core Model*

In this chapter of the user's guide, the following topics are discussed:

- a general description of the core model,
- the process of modifying an option file and
- running the core model.

QUICK START

The process of modifying an option file and running the core model using data provided in the NONROAD model is straightforward. In summary, the steps involved in running the core model with existing data are as follows:

1. Modify the core model input option file. To modify an option file, either use the graphical user interface as discussed in Chapter 3 or a text editor, such as Microsoft's Notepad or WordPad, to access the **.opt* file that you are interested in changing. Alternatively, you can edit the file through DOS. (For more information, see the section below on Creating an Option File.)

2. Once you have an option file defining the scenario that you are interested in modeling, you can run the scenario from the graphical user interface as discussed in Chapter 3, or from DOS by typing "*nonroad (the name of your option file).opt*" from the nonroad directory. (For more information, see the section below on Running the Core Model.)

3. After the model has finished, a message will appear in a DOS window notifying you of the successful completion of the run or of any errors that have occurred.

GENERAL DESCRIPTION

The core NONROAD model contains all of the algorithms used by the model for calculating emissions estimates. The model includes standard data files and tables that allow you to easily estimate the emissions from a wide variety of nonroad equipment and vehicles for any region of the country. The information used by the core model for estimating emissions, including user-specified options, data files, and data tables, are input through an option file.

The core model can be operated as a stand-alone application; however, as a stand-alone application it requires some basic knowledge of the DOS operating system. In addition, in order to create/modify an input option file you must be familiar with the use of a text editor. If you prefer you can easily modify the input option file and access the core model from the GUI (Graphical User Interface), which is described in detail in Chapter 3.

When the NONROAD model is installed on your computer, a directory for the model is created. The standard installation creates the NONROAD directory on the c drive; i.e. c:\Nonroad. The core model is executed with the file *NONROAD.EXE*.

Note: In this chapter of the user's guide, information is provided to assist you in setting up an emissions scenario and running the model using the default data provided in the model. If you are interested in modifying the data files to reflect alternatives to the default data, please see Chapter 6 on Advanced Topics.

For more technical information on the core model, please refer to the technical support documents, or the core model source code.

CREATING AN OPTION FILE

Before running the core model, you must define the scenario you are interested in modeling by creating an option file. All model input files and scenario specific parameters are specified in the input option file. The information contained in each option file is separated into "packets" based on common information. For example, all data items related to the period of time for which you are interested in estimating emissions is grouped in a single packet, as are data files related to the population of equipment for a modeling region. You can quickly set up an option file specifying the parameters that are applicable to your modeling scenario using default data.

You can view and modify an option file using a text editor such as Microsoft's Notepad or WordPad or by using the DOS command *edit*. When viewing an option file through a text editor, the keyword that identifies a packet is surrounded by forward slashes ("/") and can appear in upper case, lower case, or mixed case. For example, the packet identifier for all of the data files

related to the population of equipment is /POP FILES/. To designate the end, or terminator, of a packet, the keyword END is used, also surrounded by forward slashes (i.e., /END/).

One convenient aspect resulting from the use of a packet input structure is that packets can appear in any order in an option file. Furthermore, any type of notes or descriptions that aid in describing the packet can be placed between the individual packets. When executed, the core model searches for packet identifiers and reads the data between the identifier and the packet terminator. All other lines in the file are ignored. The file *TEMPLATE.OPT* is provided with the NONROAD model and contains a complete description of the packet parameters and formats.

In a fashion similar to that followed in Chapter 3, the following example is provided to more easily explain the process of creating and setting up an option file:

> *You have been given an assignment to estimate the total emissions from all lawn and garden equipment in Travis County (Austin), Texas. You are interested in estimating these emissions for the summertime of 1998.*

This example will be referred to throughout this chapter.

To create an option file using a text editor, follow these steps:

1. Start the text editor of your choice. Notepad and WordPad are possibilities.
   Note: The use of a word processor such as WordPerfect or Microsoft Word is not recommended unless you are experienced in dealing with ASCII files in those applications.

2. Open the option file of interest.
   Note: If this is the first option file that you are creating, use *TEMPLATE.OPT*. The *template.opt* file, installed with the model, is initially located in the \nonroad directory. If you have previously created an option file, you can select any **.opt* file for modification.

3. Save the opened option file with a new name in order to prevent the accidental loss of data resulting from overwriting an existing file. For our example, save the *template.opt* file as *travis.opt.* Figure 4-1 shows a portion of the file *template.opt*.

```
This is the options file for the NONROAD program.
The data is sperated into "packets" bases on common
information.  Each packet is specified by an
identifier and a terminator. Any notes or descriptions
can be placed between the data packets.

-----------------------------------------------------

                  PERIOD PACKET

This is the packet that defines the period for
which emissions are to be estimated.  The order of the
records matter.  The selection of certain parameters
will cause some of the record that follow to be ignored.
The order of the records is as follows:

1  - Char 10  - Period type for this simulation.
                 Valid responses are: ANNUAL, SEASONAL, and MONTHLY
2  - Char 10  - Type of inventory produced.
                 Valid responses are: TYPICAL DAY and PERIOD TOTAL
3  - Integer  - year of episode (4 digit year)
4  - Char 10  - Season of year
                 Valid responses are: WINTER, SPRING, SUMMER, and AUTUMN
5  - Char 10  - Month of episode (use complete name of month)
6  - Char 10  - Type of day
                 Valid responses are: WEEKDAY and WEEKEND
7  - Integer  - Year of growth calculation (4 digit year)
8  - Integer  - Year of technology selection (4 digit year)
                 Valid responses are: (blank) or 4 digit year (must not be
                 greater than Year of episode)

-----------------------------------------------------
/PERIOD/
Period type        : Annual
Summation type     : Period Total
Year of episode    : 1996
Season of year     :
Month of year      :
Weekday or weekend :
Year of growth calc:
Year of tech sel   :
/END/
```

Figure 4-1: Portion of the *TEMPLATE.OPT* file.

4. Modify the option file. For our modeling example, we want to modify *travis.opt* by specifying the parameters required to estimate summertime emissions in 1998 from lawn and garden engines in Travis County, Texas.

For a simple modeling run, using the data provided with the model, five packets of information will most frequently be modified. These five packets are the /RUNFILES/, /OPTIONS/, /PERIOD/, /REGION/, and /SOURCE CATEGORY/ packets which are described in the

following sections. In addition, the /POP FILES/ and /ALLOC FILES/ packets will be modified if the region is changed to another state.

Modifying /RUNFILES/

In the /RUNFILES/ packet, some of the data files read by the model are defined. The first 20 characters of each line contains the keyword(s) which identify the kind of file specified. For our simple example, we are only interested in changing the name of the message file and the output data file. In Figure 4-2, the message and output data files have been changed (*travis.**).

```
 This is the packet that lists the names of output files
 and some of the input data files read by the model.  If
 a drive:\path\ is not given, the location of the
 NONROAD.EXE file itself is assumed.  You will probably
 want to change the names of the Output and Message files
 to match that of the OPTion file, e.g., MICH-97.OPT,
 MICH-97.OUT, MICH-97.MSG, and if used MICH-97.AMS.
-----------------------------------------------------
/RUNFILES/
ALLOC XREF          :c:\nonroad\data\allocate\allocate.xrf
ACTIVITY            :c:\nonroad\data\activity\activity.dat
EXH TECHNOLOGY      :c:\nonroad\data\tech\tech-exh.dat
EVP TECHNOLOGY      :c:\nonroad\data\tech\tech-evp.dat
SEASONALITY         :c:\nonroad\data\season\season.dat
REGIONS             :c:\nonroad\data\season\season.dat
MESSAGE             :c:\nonroad\outputs\travis.msg
OUTPUT DATA         :c:\nonroad\outputs\travis.out
EPS2 AMS            :
US COUNTIES FIPS    :c:\nonroad\data\allocate\fips.dat
RETROFIT            :
/END/
```

Figure 4-2: *TRAVIS.OPT* /RUNFILES/ packet (A).

Note: The core model creates two output files. The first is a message file (**.msg*) that can be read with a text editor or through DOS and identifies relevant information on the model run such as time and date of the run, files processed, and any error or warnings which occurred during the run. The second is a data file (**.out*) that can be opened and viewed in the reporting utility. It is important to choose new names for any output files, unless you want to overwrite prior outputs of the same name.

In addition, the core model can optionally create two by-model-year data files. See the /MODELYEAR OUT/ section below for more information.

To do this, follow these steps:

1. Locate the /RUNFILES/ packet in *travis.opt*.

2. Move to the *"Message file"*. Type in the name that you want to call the new message file (in our example *travis.msg*).

3. Move to the *"Output data file"*. Type in the name that you want to call the new output file (in our example, *travis.out*).

Modifying /MODELYEAR OUT/

The core model can create two additional output files, defined in the optional /MODELYEAR OUT/ packet. These files further break down the data in the standard output file, by model year and technology type. The by-model-year data is separated into two files, one for exhaust emissions and one for evaporative emissions. One or both files or the entire packet may be omitted from the option file. If included, the packet appears as follows, where the first 20 characters of each line contains the keywords which identify the kind of file specified.

```
/MODELYEAR OUT/
EXHAUST BMY OUT    :c:\nonroad\outputs\travis.bmx
EVAP BMY OUT       :c:\nonroad\outputs\travis.bmv
/END/
```

Figure 4-3: *TRAVIS.OPT* /RUNFILES/ packet (B).

To modify the /MODELYEAR OUT/ packet, follow these steps:

1. Locate the /MODELYEAR OUT/ packet.

2 Move to the *"Exhaust bmy out file"*. Type in the name that you want to call the new exhaust by-model-year file (in our example *travis.bmx*).

3. Move to the *"Evap bmy out file"*. Type in the name that you want to call the new evaporative by-model-year file (in our example *travis.bmv*).

Modifying /OPTIONS/

The options packet, /OPTIONS/, defines some of the parameters that make episode-specific emission factor adjustments. These options include fuel specifications that will be in effect during the modeling period and ambient temperatures that are typical during the same period. In addition, you can define the title that describes your modeling scenario and which will appear on your model reports.

The order of the records is fixed. The order is as follows:

1 - Char 80: First title on reports
2 - Char 80: Second title on reports
3 - Real 10: Fuel RVP of gasoline for this simulation
4 - Real 10: Oxygen weight percent of gasoline for simulation
5 - Real 10: Weight percent sulfur for gasoline
6 - Real 10: Weight percent sulfur for diesel
7 - Real 10: Weight percent sulfur for marine diesel
8 - Real 10: Weight percent sulfur for LPG/CNG
9 - Real 10: Minimum daily temperature (deg. F)
10 - Real 10: Maximum daily temperature (deg. F)
11 - Real 10: Representative average daily temperature (deg. F)
12 - Char 10: **UNUSED.** Flag to determine if region is high altitude (LOW or HIGH)

The acceptable range of values for each of the fuel specification and ambient temperature options are as follows:

Fuel RVP	6 to 16	
Oxygen (wt.%)	0 to 5	
Fuel Sulfur (%)	0 to 0.5	
Temperature (°F)	-40 to 120	
Altitude*	Low or High	(Specify high where average altitude > 5000 ft)

*High altitude adjustments are not included in this version of the model.

The minimum temperature that you define for your modeling scenario is the average low for the time period selected. For example, when modeling a typical summer day, the minimum temperature should be the average low temperature in Fahrenheit for the summer season. Moreover, when modeling an entire year, the minimum temperature should be the average daily low for the year and not the lowest temperature ever recorded. Other modeling parameters, such as RVP, sulfur, and oxygen content, depend on local fuel characteristics. Data for an area should be available from the state or local air agency.

> Note: If a daily temperature and RVP input data file is specified in the /DAILY FILES/ packet, then the RVP and temperature inputs in the /OPTIONS/ packet are ignored. See Chapter 6, Advanced Topics, for more information on the /DAILY FILES/ packet.

To modify the options packet, follow these steps:

1. Locate the /OPTIONS/ packet.

2. Locate **Title 1**. Type in a description of your scenario. If you are interested in adding a subtitle, type that on the line **Title 2**. If you do not want a title to appear on your report, leave these fields blank.

3. For the remaining information in the /OPTIONS/ packet, change any existing information that is relevant for your run. Figure 4-4 shows the /OPTIONS/ packet with modifications for our model example.

```
-----------------------------------------------------
1  -  Char 80  - First title on reports
2  -  Char 80  - Second title on reports
3  -  Real 10  - Fuel RVP of gasoline for this simulation
4  -  Real 10  - Oxygen weight percent of gasoline for simulation
5  -  Real 10  - Percent sulfur for gasoline
6  -  Real 10  - Percent sulfur for diesel
7  -  Real 10  - Percent sulfur for LPG/CNG
8  -  Real 10  - Minimum daily temperature (deg. F)
9  -  Real 10  - maximum daily temperature (deg. F)
10 -  Real 10  - Representative average daily temperature (deg. F)
11 -  Char 10  - Flag to determine if region is high altitude
                      Valid responses are: HIGH and LOW
12 -  Char 10  - Flag to determine if RFG adjustments are made
                      Valid responses are: YES and NO
-----------------------------------------------------
/OPTIONS/
Title 1            : Lawn and Garden Equipment
Title 2            : Travis County, Summertime 1998
Fuel RVP for gas   : 9.0
Oxygen Weight %    : 0.0
Gas sulfur %       : 0.034
Diesel sulfur %    : 0.33
Marine Dsl sulf %  : 0.33
CNG/LPG sulfur %   : 0.003
Minimum temper. (F): 60
Maximum temper. (F): 84
Average temper. (F): 75
Altitude of region : LOW
/END/
```

Figure 4-4: Modified /OPTIONS/ packet.

Modifying /PERIOD/

The packet /PERIOD/ defines the period of time for which emissions are to be estimated. The valid responses for the /PERIOD/ packet are as follows:

Period type	Annual, seasonal, or monthly
Summation Type	Typical day or period total
Year of Episode	A four-digit year between 1970 and 2050
Season of year	Winter, spring, summer, autumn
Month of year	Complete month name
Weekday or Weekend	Weekday or Weekend
Year of Growth Calc	A four-digit year between 1970 and 2050 (may be left blank)
Year of Tech Sel	A four-digit year between 1970 and 2050 (may be left blank. If a year is entered, it must not be greater than the Episode year)

The season is ignored if the period type is not seasonal. Similarly, the month is ignored if the period type is not monthly. Also, weekday/weekend is ignored if summation type is period total.

To modify the /PERIOD/ packet, follow these steps:

1. Locate the /PERIOD/ packet.

2. Modify the information that is appropriate for your scenario. Figure 4-5 shows the /PERIOD/ packet with the changes required for our example.

```
1  - Char 10  - Period type for this simulation.
                Valid responses are: ANNUAL, SEASONAL, and MONTHLY
2  - Char 10  - Type of inventory produced.
                Valid responses are: TYPICAL DAY and PERIOD TOTAL
3  - Integer  - Year of episode (4 digit year)
4  - Char 10  - Season of year
                Valid responses are: WINTER, SPRING, SUMMER, and AUTUMN
5  - Char 10  - Month of episode (use complete name of month)
6  - Char 10  - Type of day
                Valid responses are: WEEKDAY and WEEKEND
7  - Integer  - Year of growth calculation (4 digit year)
8  - Integer  - Year of technology selection (4 digit year)
                Valid responses are: (blank) or 4 digit year (must not be
                greater than Year of episode)
-------------------------------------------------
/PERIOD/
Period type        : seasonal
Summation type     : Period Total
```

```
Year of episode    : 1998
Season of year     : Summer
Month of year      :
Weekday or weekend :
Year of growth calc:
Year of tech sel   :
/END/
```

Figure 4-5: Modified /PERIOD/ packet.

Modifying /REGION/

The packet /REGION/ defines the geographic region that you are interested in modeling. In the NONROAD model, regions are defined by using two types of parameters. The first specifies the type of region. The acceptable responses for the region level are US TOTAL, 50 STATE, STATE, COUNTY, and SUBCOUNTY. The second type of parameter identifies the region codes or FIPS codes to be modeled. You can specify a global FIPS code to indicate an entire group of counties or states. For example, by entering "06000" as the FIPS code, you are specifying all of the counties in the State of California. Similarly a FIPS code of "00000" indicates all states in the United States. Examples of some FIPS codes used in the model are listed in Appendix A. Beginning with NONROAD2005 the full set of FIPS codes used by the model exists as an input data file (*fips.dat*) in the DATA\ALLOCATE folder.

The following table shows how the model's definition of the modeling region depends on the combination of the level and FIPS code(s) specified:

Level	FIPS Code
US TOTAL	The "FIPS code" is ignored and national estimates are calculated. This run is substantially faster than 50 STATE since no state detail or allocation is required.
50 STATE	The "FIPS code" is ignored and state-level estimates are calculated for all 50 states, Washington D.C., Puerto Rico, and the U.S. Virgin Islands.
STATE	If a list of specific state FIPS codes is supplied [e.g., 06000 (for California) and 48000 (for Texas)], state-wide emissions for the defined states are produced.
COUNTY	If the global code for a state is specified (e.g., 06000), county-level estimates are calculated for all counties within the state. If a list of specific county FIPS codes is supplied, county-level estimates for just those counties will be produced.

SUBCOUNTY	To estimate subcounty emissions, the codes must be a combination of a single county FIPS code and a subcounty code. For example, if you were interested in modeling the Northwest portion of Washtenaw County in Michigan, you would combine the FIPS code for the county (26161) with a subcounty code (NW) to form the code 26161NW. Estimates for the sub-county level will be calculated. If this option is specified, appropriate data for subcounty resolution must also be supplied in the data files. Refer to the section on Modifying Inputs for Subcounty Runs in Chapter 6.

To modify the /REGION/ packet, follow these steps:

1. Locate the /REGION/ packet.

2. Remove, add, or change any existing information that is not relevant for your scenario. For our example, the FIPS code for Travis County, Texas is 48453 (48 designates the State of Texas; 453 is the code for Travis County). Figure 4-6 shows the /REGION/ packet with the changes required for our example.

```
US TOTAL   -  Nothing needs to be specified.  The FIPS
              code 00000 is used automatically.

50STATE    -  Nothing needs to be specified.  The FIPS
              code 00000 is used automatically.

STATE      -  state FIPS codes

COUNTY     -  state or county FIPS codes.  State FIPS
              code means include all counties in the
              state.

SUBCOUNTY  -  county FIPS code and subregion code.
-----------------------------------------------------
/REGION/
Region Level       :COUNTY
                   :48453
/END/
-----------------------------------------------------
```

Figure 4-6: Modified /REGION/ packet.

Modifying /SOURCE CATEGORY/

The packet /SOURCE CATEGORY/ tells the model which source classification codes (SCCs) are to be processed. This is an optional packet. If the /SOURCE CATEGORY/ packet is omitted, all SCCs are processed. If you would like to model only a subset of equipment types then include the packet and your preferred list of SCCs. Running the model with only the desired equipment types can reduce model run time and help focus reports on data of particular interest.

> **Tip**: Some packets in the core model, such as /SOURCE CATEGORY/, are optional and can be removed from processing by simply removing the initial slash "/" character, or by placing any non-blank character in the first column of the line containing the packet identifier. For example, if you wanted to "comment out" the /SOURCE CATEGORY/ packet, the first column of the packet could look like this: ,/SOURCE CATEGORY/ with the comma (,) as the non-blank character.

Each source category in the NONROAD model is uniquely identified with a source category code (SCC), which is a ten-digit number. The first two digits, 22, represent mobile sources. For most categories, the next two digits represent the engine or fuel type (60, 65, 67, 68, and 70, represent 2-stroke gasoline, 4-stroke gasoline, LPG, CNG, and diesel respectively). The next three digits represent the segment type (for example, recreational or construction). And the last three digits represent the specific kind of equipment (for example, golf carts or snowmobiles). For our example, the SCCs for lawn and garden equipment are 22xx004000, where xx = 60, 65, 67, 68, and 70, '004' signifies lawn and garden, and '000' indicates all types of equipment in the lawn and garden category. The SCC 2265000000 refers to all 4-stroke gasoline sources. Refer to Appendix B for a complete list of NONROAD SCCs.

To modify the /SOURCE CATEGORY/ packet, follow these steps.

1. Locate the /SOURCE CATEGORY/ packet.

2. Remove or change any existing information that is not relevant for your scenario (Figure 4-7).

```
                  SOURCE CATEGORY PACKET

This packet is used to tell the model which source
categories are to be processed.  It is optional.
If used, only those source categories list will
appear in the output data file.  If the packet is
not found, the model will process all source
categories in the population files.
-----------------------------------------------------
/SOURCE CATEGORY/
                    :2260004010
                    :2265004010
                    :2267004010
                    :2268004010
                    :2270004010
/END/
```

Figure 4-7: Modified /SOURCE CATEGORY/ packet.

Modifying the /POP FILES/ and /ALLOC FILES/ Packet

In the NONROAD model, there are several packets found in an option file that list the names of files that contain data used by the model to estimate emissions. To make these data files more manageable, some of the data is separated into files by state. In most cases, these files do not require any modifications if you are running the model with the default data provided.

When you modify the /REGION/ packet, specifying a different or additional state to model, then two types of data files may be affected by this modification. These two types of files are the population data files and the allocation data files, which are located in the /POP FILES/ packet and the /ALLOC FILES/ packet, respectively. The /POP FILES/ packet defines the equipment population files read by the model. You can identify any number of files for a run; typically each file represents one state. The /ALLOC FILES/ packet defines the spatial allocation files read by the model. These files contain the surrogate indicators typically used to allocate from the state-level to county-level. These files are separated by state and by type of allocation indicator.

Whenever you create an option file for a region outside of the originally defined area, you must change the state identification code of the population and allocation data files to the new state, or U.S. total.

To modify the /POP FILES/ packet, follow these steps.

1. Locate the /POP FILES/ packet .

2. Check to see that the population data files contain the name of the state that you are interested in modeling. If not, modify the name of the population file to identify the state you want. For our example, the population file should be changed to the file for the state of Texas, "*C:\NONROAD\DATA\POP\TX.POP*", as shown in Figure 4-8. (Since we are only interested in a county in one state in our example, only the population file for that state is required. If you were interested in multiple states, the population files for each state would be required.)

Note: Population data files are named using the two character state abbreviation.

```
-------------------------------------------------
This is the packet that defines the equipment population
files read by the model.
-------------------------------------------------
/POP FILES/
                    :c:\nonroad\data\pop\tx.pop
/END/
```

Figure 4-8: Modified /POP FILES/ packet.

To modify the /ALLOC FILES/ packet, follow these steps:

1. Locate the /ALLOC FILES/ packet.

2. As you can see in Figure 4-9, in addition to being separated by state, the allocation data files are further stratified by a series of allocation factors. Once you locate /ALLOC FILES/, check to see that the allocation data files contain the two-character abbreviation of the state that you are interested in modeling. If not, modify the name of the allocation data files to identify the state you want. For our example, the files containing the allocation data should be changed to identify the state of Texas.

```
-----------------------------------------------------
This is the packet that defines the spatial
allocation files read by the model.
-----------------------------------------------------
/ALLOC FILES/
RV Park employees  :c:\nonroad\data\allocate\tx_rvprk.alo
Golf Course estab. :c:\nonroad\data\allocate\tx_golf.alo
Air Transportation :c:\nonroad\data\allocate\tx_airtr.alo
Contruction value  :c:\nonroad\data\allocate\tx_const.alo
Havested cropland  :c:\nonroad\data\allocate\tx_farms.alo
Wholesale establis.:c:\nonroad\data\allocate\tx_holsl.alo
Family housing     :c:\nonroad\data\allocate\tx_house.alo
Logging empl.      :c:\nonroad\data\allocate\tx_loggn.alo
Landscape empl.    :c:\nonroad\data\allocate\tx_lscap.alo
Manufacturing empl.:c:\nonroad\data\allocate\tx_mnfg.alo
Oil & gas employees:c:\nonroad\data\allocate\tx_oil.alo
Census population  :c:\nonroad\data\allocate\tx_pop.alo
Resid. snowblower  :c:\nonroad\data\allocate\tx_sbr.alo
Comm. snowblower   :c:\nonroad\data\allocate\tx_sbc.alo
Snowmobile         :c:\nonroad\data\allocate\tx_snowm.alo
Outboard water     :c:\nonroad\data\allocate\tx_wob.alo
Inboard water      :c:\nonroad\data\allocate\tx_wib.alo
Coal mining empl.  :c:\nonroad\data\allocate\tx_coal.alo
Locomotive NOx     :c:\nonroad\data\allocate\tx_rail.alo
/END/
```

Figure 4-9: Modified /ALLOC FILES/ packet.

To modify the /STAGE II/ packet, follow these steps:

1. Locate the /STAGE II / packet.

2. Once you locate /STAGE II/, check to see that the percentage reduction in refueling emissions under Stage II control reflects that of the area you are interested in modeling. If the area does not have Stage II control at the fuel pump, the effectiveness should be zero. Otherwise, enter a control effectiveness between 0.0 and 100.0 percent.

Note: A decimal point must be used after the percent effectiveness.

Note: EPA currently has no data on the effectiveness of Stage II for nonroad equipment. The value should be left at 0.0% unless local data exist on which a value can be based.

Saving an Option File

After you have completed the modification of an option file to reflect the scenario that you are interested in modeling, save the file and exit the text editor.

RUNNING THE CORE MODEL

After you have created an option file that defines the scenarios you are interested in modeling, the process of running the core model is quite simple. In Chapter 3, the steps necessary to run the core model through the graphical user interface were described. In this chapter, the steps required to run the core model through a DOS window are described.

To run the core model through a DOS window, follow these steps:

1. Open a DOS window.

2. Change to the Nonroad directory.

3. Type "*nonroad* (*the name of your option file).opt*" to run the core model. For example, if you were interested in running the example option file *travis.opt*, type "*nonroad travis.opt*".

4. The model will now run with your option file. The first step that the model goes through is an initialization. During this step, the core model is reading in the option and data files and checking to ensure that all data files required to complete the run are available. After the model has initialized, it will begin the process of calculating emissions estimates based on the parameters that you set. A line on the screen will inform you of the progress of your run. When the run has finished, a message will appear indicating that the run was successfully completed (Figure 4-10).

Note: Most of the errors that may occur during the running of a scenario will occur during the initialization stage. If an error occurs, a message will appear on the screen notifying you of the error. Make the appropriate correction and rerun the model.

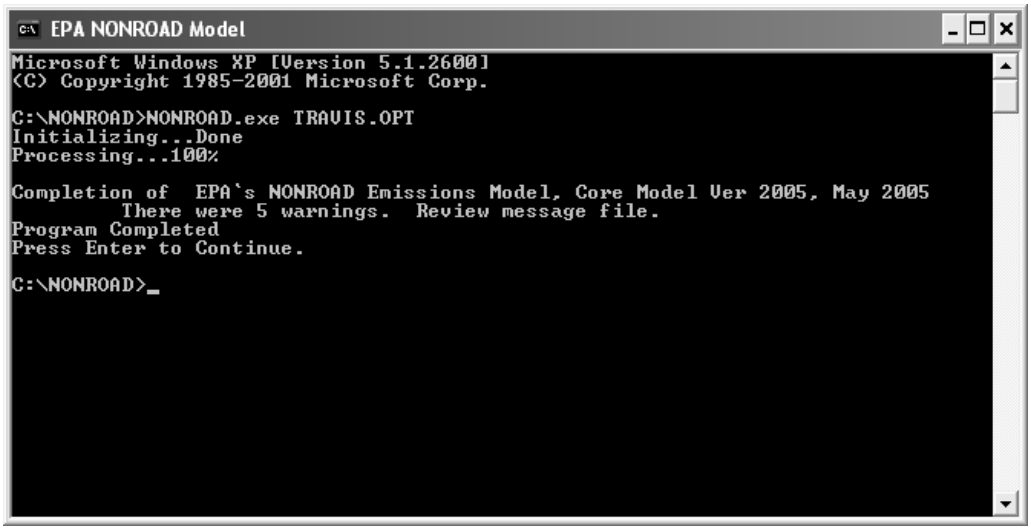


Figure 4-10: DOS window showing successful model run.

5. Review the mesage file associated with this run. Either type *"edit outputs\(the name of your file).msg"* or you can open the message file through a Windows text editor.

Error Stop Feature

When an error occurs in the core model, an informative message is displayed in the window and written to the output message file, and the program stops. In addition to error checking, a number of conditions are checked that will produce a warning message. Warning messages are meant to inform you that a condition exists which you may want to review and correct. An example is "WARNING: Monthly seasonality factors do not add to 1. Renormalizing..." If you have included new seasonality data and thought it should sum to one, then this message would indicate either a data format problem or a typo. There are conditions which could produce many warning messages and still run to completion. In order to avoid this situation, the model will stop if 50 of the same kind of warning message is generated.

Chapter 5 Reporting Utility

In this chapter of the user's guide, the following topics are discussed:

- a general description of the NONROAD model Reporting Utility,
- how to import core model outputs,
- the different report types,
- how to generate and view reports, and
- how to compact databases, and how to repair corrupted databases.

QUICK START

Each step involved in the creation of NONROAD model reports is explained in this chapter. However, to quickly create reports and view core model output data, follow these simple steps.

1. Start the reporting utility from the Reports icon created when the NONROAD model was installed on your computer, or by selecting **Model ➤ Reports** from the graphical user interface main menu. (For more information, see General Description below.)

2. Import the core model output file that you are interested in viewing by selecting **Data ➤ Import Data** from the main menu of the reporting utility. (For more information, see Importing Core Model Output below.)

3. Select the report type. From the main menu select **Reports ➤ "report name"**. Once you have selected the report that you want, specify the report options. (For more information, see Report Types and Generating Reports below.)

4. You can print the displayed report by selecting **File ➤ Print**. (For more information, see Viewing a Report in Print Preview below.)

GENERAL DESCRIPTION

The reporting utility is used to create standardized reports using output data generated in the core model. Like the graphical user interface, the reporting utility is a fully operational Windows program designed as a separate module in order to take advantage of the many reporting and formatting options available when using a database application. Although the reporting utility is written in Microsoft Access database software, **you do not need to know how to use Access to generate reports**. Microsoft Access 2000 allows users operating Windows 3.1 and Windows 95 and above to run the reporting module. If you do not have Access 2000 (i.e., if you do not have any version of Access installed on your computer or you are using a higher version of Access, such as XP or 2003, for other database applications), the reporting utility will operate as a standalone application.

Warning: If you are using a version of Access that is higher than 2000, such as XP or 2003, **do not convert** the reporting utility from Access 2000 to the higher version. The two versions may be significantly different and may require major rewriting of the reporting utility modules. If you want to use a version of Access that is higher than 2000 on the NONROAD reporting utility tables then make a copy of *nrdata.mdb* and convert/import the copied database into the higher version of Access. This will preserve the reporting utility integrity and allow you the power to create custom reports.

When the NONROAD model is installed on your computer, an icon for the reporting utility is created. To start the reporting utility, double click on the reporting utility icon. Alternatively, selecting **Model ➤ Reports** while running the graphical user interface will also start the reporting utility.

THE REPORTING UTILITY MENUS

Figure 5-1 shows the initial screen when the reporting utility is executed. From this screen you can access the pull down menus that make up the reporting utility.

- **File** - setup and preview a window for printing, print a window, and exit the database.
- **Reports** - select a standard report for viewing emission inventory, equipment population, or fuel consumption data.
- **Compare** - select a report for comparing the results of two separate modeling runs.

- **Emission Factors** - select a report for viewing gram/hp-hr or gram/hour data.
- **Data** - import data, remove a simulation from the database, and re-attach files.

Figure 5-1: Initial report utility screen.

Once a main menu item is selected, a list of submenu items will be displayed. The following shows the list of submenu items for each of the main menu choices:

File
- Print Setup...
- Print Preview
- Print...
- Exit

Reports
- Emissions Totals by County
- Emissions Totals by County and Fuel Type
- Emissions Totals by Equipment Type
- Emissions Totals by Horsepower
- Emissions Totals by HP and Source Classification
- Emissions Totals by HP and Equipment Type
- Emissions Totals by SCC

	Emissions Totals by Source Classification
	Population and Fuel Consumption by HP and Source Classification
	Population and Fuel Consumption by SCC
Compare	Compare Two Model Runs by HP and Source Classification
	Compare Two Model Runs by Pop and Fuel
	Compare Two Model Runs by SCC
	Compare Two Model Runs by Source Classification
	Compare Two Model Runs by County
	Compare Two Model Runs by Horsepower
	Compare Two Model Runs by Equipment Type
	Compare Two Model Runs by HP and SCC
Emission Factors	Grams per Operating Hour by SCC
	Grams per Operating Hour by HP and SCC
	Grams per Day by SCC
	Grams per Day by HP and SCC
	Grams per HP-Hour by SCC
	Grams per HP-Hour by HP and SCC
Data	Import Data
	Remove Run
	Re-Attach Tables
	Export NIF File

Each submenu item opens a window where you must provide additional information. When an input error occurs, an appropriate message (dialog box) is displayed. Make the corrections needed, and continue.

IMPORT, DELETE, RE-ATTACH, AND EXPORT NIF

The reporting utility has been designed to run cohesively with the graphical user interface and the core model to simplify the use of the NONROAD model; if you operate the model with the default inputs provided, the process of running a simulation and generating reports is straightforward.

Importing Core Model Output

In order to generate model summary reports, the reporting utility must import the output from the core model. As discussed in Chapters 3 and 4, the core model output file (**.out*) will have the name you assigned to it.

Follow these steps to import a core model output data file:

1. From the Main Menu, select **Data ➤ Import Data**.

2. Specify the core model output file in the open file dialog box.

3. A screen will appear requesting you to enter the new database table name (Figure 5-2). Type in the appropriate name of the database table. The database table name that you enter is the name that the reporting utility will recognize for all further processing of the data.

Tip: The reporting utility allows you to name the database table using up to 30 characters. The name you give the database table can be the same as the output data file (but without the .extension since a period is not a valid table name character in Access, nor is the apostrophe). However, because the core model was developed in Fortran, the name of the output file without extension is no longer than eight characters as a result of DOS conventions. Thus, to help in differentiating one core model run from others, it is recommended that a more descriptive name be used.

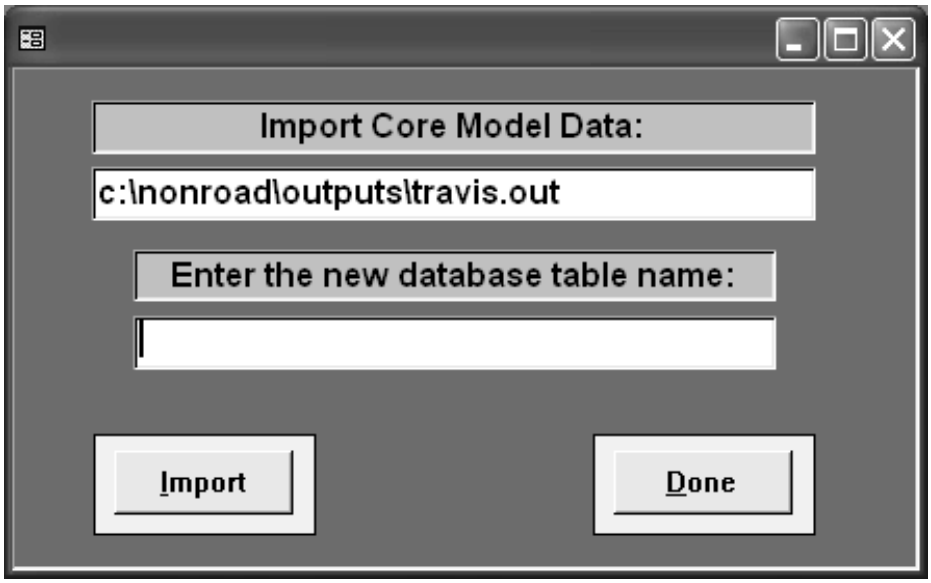


Figure 5-2: Import core model data screen.

4. After you have entered a name, **Import** the data. The bottom of the window will display a line indicating the percent completion of the import. This process may take several minutes or longer depending on the size of the database that you are

processing and the speed of your computer. When the import is complete, a message box will appear indicating that the process is done. Enter **OK**.

Note: If you enter a name that is invalid (e.g., contains punctuation marks or has already been used), a message will appear notifying you of the problem and return you to the table name field. If this happens, simply rename the table and **Import** again.

5. Following the data import and message screen you will be requested to specify another core model output file in the open file dialog box (Step 2). You can repeat steps 2 - 4 and continue to import core model output files. When you are finished importing files select **Cancel** in the open file dialogue box to return to the main menu.

Removing a Run

When an imported database table is no longer of use it can be deleted. This should only be done with the reporting utility submenu option Remove Run. In addition to deleting the table, the reporting utility removes records from tables it uses for processing.

Warning: Simulation tables should never be deleted in the NRdata database except through **Data ➤ Remove Run** in the reporting utility.

Follow these steps to delete an imported database table:

1. From the Main Menu, select **Data ➤ Remove Run**.

2. A screen appears allowing you to indicate which table you want to delete. Select the table name from the available list or type the table name in the field. When you type the table name it will automatically be expanded to match a name in the list.

3. Specify **Remove**. When the table has been successfully deleted a message box will appear indicating that the process is done. Enter **OK**.

4. Repeat steps 2 and 3 until all database tables you want to delete have been removed. Until you return to the main menu, the list of table names may show "#Deleted" for those tables which you have deleted.

5. Specify **Done**. The message, "Access 2000 and later will automatically compact NRdata.mdb upon exiting the Reporting Utility when simulations have been removed." is displayed. Enter **OK**.

Attaching the Reporting Utility Databases

When the NONROAD model is installed, a subdirectory called Reports is created. Within this subdirectory are two databases required to run the reporting utility. These databases and the information contained in each are as follows:

- *NRdata.mdb* - This database contains the example data supplied with the model and any core model output data you import.

- *Reports.mdb* - This database contains the reporting utility code and requisite data tables (such as the SCC table and FIPs county code).

Warning: The NRdata and Reports databases are essential to run the reporting utility. In addition, there are two tables in the NRdata database called Table Headers and Table Counties that also are essential to the operation of the reporting utility. These databases and tables should never be deleted.

To operate the reporting utility, *Reports.mdb* must have the path of *NRdata.mdb* in order to properly connect to it. The first time the reporting utility is started a screen will be displayed with the message "Attaching Tables...". When the Nrdata tables have been successfully attached to the Reports database a message box will appear indicating that the operation is complete.

If you move the database tables to a new directory you will have to connect *Nrdata.mdb to the Reports database.* Follow these steps:

1. Select **Data ➤ Re-Attach Tables**.

2. If the databases reside in the same subdirectory as the reporting utility, a message box will appear indicating that tables were successfully attached. Enter **OK**. If *NRdata.mdb* resides in a different directory than *Reports.mdb*, an open file dialog box will appear. Locate the directory where the *NRdata.mdb* database resides. When *NRdata.mdb* is attached, a message box will appear indicating that the operation is done.

Exporting a NIF Database

In addition to providing various reports to allow analysis of run data, the reporting utility also makes available the ability to export National Emission Inventory Input Format (NIF) data. NIF is the format most widely used by state and local agencies to transfer data to the EPA's National Emission Inventory (NEI).

Follow these steps to export a NIF database from one of the run tables:

1. From the Main Menu, select **Data ➤ Export NIF File**.

2. Specify the simulation table in the screen that appears (Figure 5-3), after clicking on the down arrow. This will be the table name that was entered when the simulation run was imported.

Figure 5-3: Select simulation screen.

3. A screen will appear requesting you to enter supplementary information (Figure 5-4). Enter the contact information, period specification, and comments. Some of the information is mandatory, and the screen will prompt for any missing information.

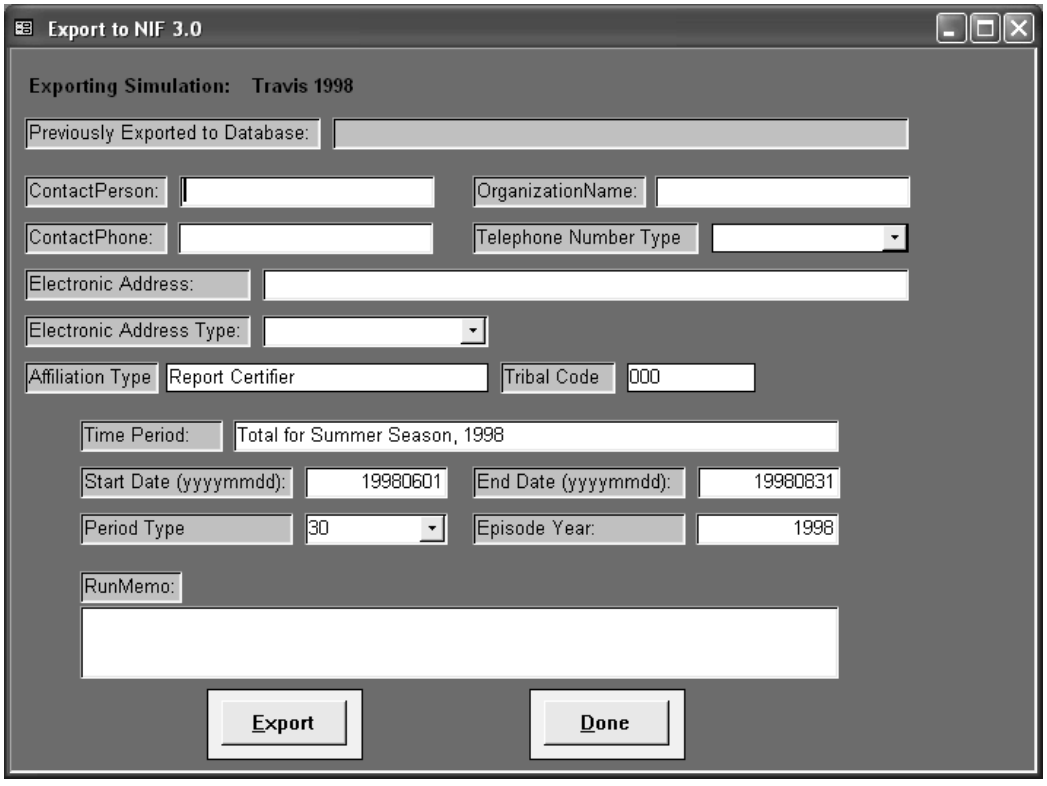


Figure 5-4: Supplementary information screen.

4. After you have entered the supplementary information, Export the data. Specify the output NIF database in the save file dialog. The database name must end in *".mdb"* and must not exist yet.

STANDARD REPORT TYPES

The reporting utility provides you with a set of standard reports. With the exception of the first report listed below, Emissions Totals by County, each of the reports displays the report data total for either all states or counties, or for a single user-specified state or county. In addition, each of the emissions reports displays emissions for either every fuel type or for a single, user-specified fuel type. A summary of each of these reports is as follows:

Emissions Totals by County - This report lists emissions by pollutant and county.

Emission Totals by County and Fuel Type - This report lists emissions by pollutant, fuel type, and county.

Note: If the output file generated in the core model contains data for multiple counties in a state, the *Emission Totals by County* and *Emission Totals by County and Fuel Type* reports will be reported for all of these counties. If you want a separate report for each county, then the core model must be run for each individual county. Once the core model has been run, you must import the output files and run the *Emission Totals by County* or *Emission Totals by County and Fuel Type* report using each 'county' database table.

Emission Totals by Equipment Type - This report lists emissions by pollutant for each equipment type. It is separated by major source classification (e.g., agricultural, lawn & garden, etc.) with subtotals provided for each classification. Equipment type descriptions are also included (e.g., "2-wheel tractors", "asphalt pavers", etc.). The report includes a grand total by pollutant.

Emissions Totals by Horsepower - This report lists emissions by pollutant and horsepower ranges. The report includes totals across all horsepower ratings by pollutant.

Emissions Totals by HP and Source Classification - This report lists emissions by pollutant for each Source Classification segment and horsepower range. The report is separated by major equipment classification and subtotals are provided. The report includes a grand total by pollutant.

Emission Totals by HP and Equipment Type - This report lists emissions by pollutant for each equipment type and horsepower range. It is separated by major source segment

(e.g., agricultural, lawn & garden, etc.) with subtotals provided for each segment. Equipment type descriptions are also included (e.g., "2-wheel tractors", "asphalt pavers", etc.), as are the horsepower ranges within the equipment type. The report includes a grand total by pollutant.

Emissions Totals by SCC - This report lists emissions by pollutant for each SCC code. The report is separated by major equipment classification and subtotals are provided. In addition to the SCC code, the equipment description and engine type is provided. The report includes a grand total by pollutant.

Emissions Totals by Source Classification - This report just lists emissions by pollutant for each major equipment segment (e.g., agricultural, lawn & garden, etc.). The report includes a grand total by pollutant.

Population and Fuel Consumption by HP and Source Classification - This report lists equipment population and fuel consumption for each fuel type, major source segment (e.g., agricultural, lawn & garden, etc.), and horsepower range. The report is separated by fuel type and major equipment segment, and subtotals are provided. The report includes a grand total of population.

Population and Fuel Consumption by SCC - This report lists equipment population and fuel consumption for each SCC code. The report is separated by fuel type and major equipment classification, and subtotals are provided. In addition to the SCC code, the equipment description and engine type are provided. The report includes a grand total of population.

Note: CNG is a gaseous fuel, and its fuel consumption is reported in gallons at standard temperature and pressure. This can be misleading if this very large number is viewed together with the fuel consumption of the other (liquid) fuels.

USER SPECIFICATIONS

To provide flexibility in designing a report, the reporting utility offers several report options. When you select a report type, a window appears requesting specific inputs and your choice of display options. Figure 5-5, used by most of the different report types, sets all of the report options available. The other window used to set report options contains a subset of these options.

Note: Because there are different types of hydrocarbon and particulate matter emissions, the reporting utility is designed to allow you to identify the type of reporting units that you want. For hydrocarbon emissions, the core model calculates and outputs these emissions as THC (total hydrocarbon). The reporting utility has the capability to report hydrocarbons as THC, TOG (total organic gas), NMOG (non-methane organic gas), NMHC (non-methane hydrocarbon), or VOC (volatile organic compounds). THC is converted to the other designations by applying appropriate factors.

For particulate matter, the core model calculates and outputs these emissions as PM_{10}. The reporting utility allows you to report particulates as PM_{10} (particulate size of 10 microns or less), or $PM_{2.5}$ (particulate size of 2.5 microns or less). PM_{10} is converted to $PM_{2.5}$ by applying an appropriate factor.

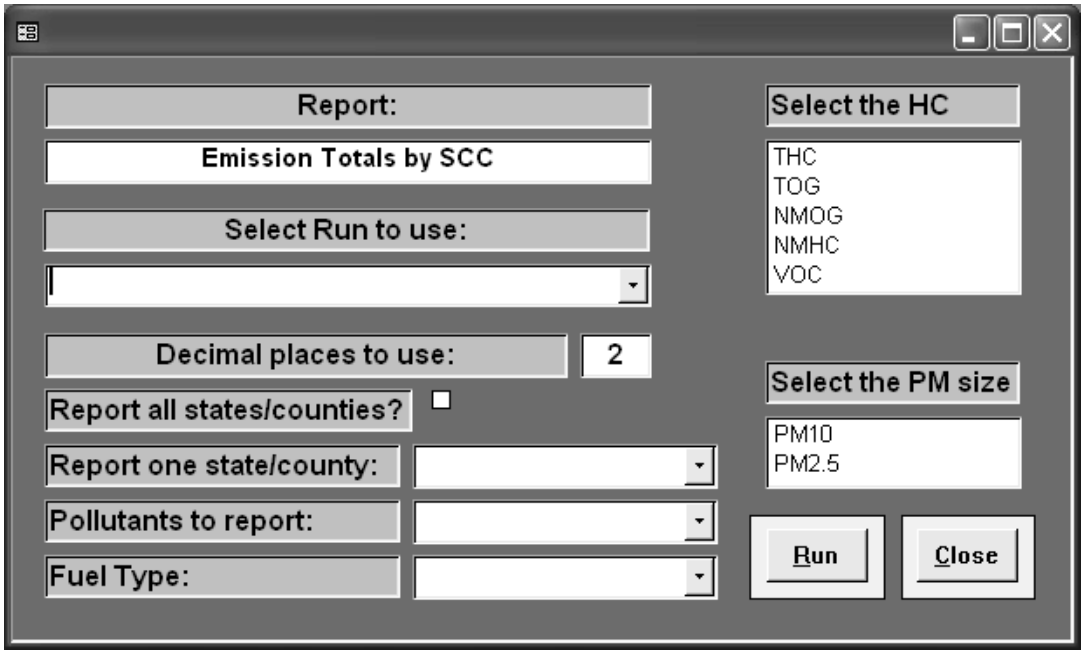


Figure 5-5: User specified report options screen

A brief description of the report options is provided in the table below.

User-Specified Report Option	Description
Database table to use	Enter the table name that you want to use for the report (this is the name you gave the database table when you imported the file into the reporting utility as described previously in Importing Core Model Output). Select the table name from the available drop-down list or type the table name in the field. When you type the table name it will automatically be expanded to match a name in the list.
Decimal places to use	The default is two decimal places for most reports. You can specify a number between 0 and 5.
Report all states/counties?	If you want to report emissions for all states or counties included in the core model output file, click in this field to specify yes. If you select all, the next report option (Report one state/county) is removed from the window.
Report one state/county	Select a state or county from the drop-down list or type the name of the state/county directly into the field. When you type the state/county name it will automatically be expanded to match a name in the list.
Pollutants to report	The "pollutants to report" option allows you to select a grouping of pollutants to report. Designate the group of pollutants to report from the list of pollutant choices and descriptions. Depending on your selection, the "Select the HC" field and/or the "Select the PM size" field may be removed from the window. For example, by choosing all PM, it is no longer necessary to specify a hydrocarbon type or a particulate matter size.
Fuel Type	This option allows you to report all fuels or to specify a single fuel to report. The options are All fuels, CNG, Diesel, Gasoline, and LPG. All equipment types which have lumped fuels (HP $\leq$ 25) are reported as gasoline.
Select the HC	When you select a group of pollutants that include hydrocarbon emissions, you need to specify the

	hydrocarbon species that you want to report. Select the hydrocarbon to report (i.e, THC, TOG, NMOG, NMHC, VOC).
Select the PM	When you select a group of pollutants that include particulate emissions (with the exception of All PM) , you need to specify the particulate size cutoff that you want to report. Select the size of particulates to report (i.e., PM_{10}, or $PM_{2.5}$).

Note: Total hydrocarbons is also reported when reporting non-exhaust hydrocarbon emissions. This occurs for the pollutant groups: All Pollutants, Non-Exhaust, and All HC.

If a single fuel is reported, other than diesel, it is important to remember that all sources with HP $\leq$ 25 have been lumped into one category and will be reported as gasoline.

GENERATING REPORTS

Note: All emissions are reported as short tons (i.e., 2000 lbs).

Once you have imported the necessary output files from the core model, reports can easily be generated with the reporting utility. When a report is generated, a window opens and the report is displayed in a Print Preview window.

Running a Report

To run a report, follow these steps:

1. From the Main Menu, select **Reports ➤ "Report Name"**

2. Enter the report options. A message box is displayed when an error is detected informing you of the problem encountered. Make the necessary changes and continue.

3. After all required options have been specified, select **Run**. If a required field is left blank or an incorrect entry has been made, a message box will be displayed. You must correct the detected error and attempt to **Run** again. Once the report has been generated, it will appear in a window.

4. To return to the main menu without running the report select **Cancel**.

Tip: User specified report options will remain in the window until closed (Cancel). If you want to run more than one report which uses the same options window then leave the report options window open and select another report from the **Reports** submenu. The report title will be changed in the options window. Specify **RUN**. The same options (database table, decimal places, pollutants, etc.) will be used for the report. This can save you a lot of selecting/specifying report options.

Viewing a Report in Print Preview

For easier viewing maximize the report window. As you move the cursor across the report, it changes from an arrow icon to a magnifying glass icon. To alternately zoom in or out of the report, click the mouse while the cursor is on the report.

To view a specific portion of the report:

1. Locate the desired section of the report in Zoom Out mode.

2. Zoom In to the area of interest for detailed viewing.

3. To page up or down through a multipage report, press **<PgUp>** or **<PgDn>** while in the Zoom Out mode. In either the Zoom In or Zoom Out modes, clicking on the arrows in the lower left corner of the report window or typing the page number at the bottom of the Print Preview window and pressing **<Enter>** will also move you to the desired page.

To provide a consistent look for all reports, the report title area for each standard report in the reporting utility is similar in design (Figure 5-6). The first two lines identify the report name and attributes which include the user-specified fuel type, report units, and the state/county specification. Following these lines are the user title lines which come from the core model output file (originally from the OPTions file). The next line, also coming from the core model output file, designates the period of emissions estimates. The final line of the report title area indicates the date and time that the core model run was generated and the date that the report was created.

Emission Totals by SCC and Pollutant

All Fuels	**Tons/Season**	**Travis County**
Lawn and Garden Equipment		
Travis County Summertime (Travis 1998)		
Total for Summer Season, 1998		
Date of Model Run: May 29 16:37:19: 2005		Today's Date: 5/29/2005

Figure 5-6: Report title area.

The Reporting Utility menu bar has only one option, **File**, when viewing a report. A displayed report can be printed by selecting **File ➤ Print**. By selecting **File ➤ Print Setup** you can also modify the print setup to adjust the margins, the page orientation, and the printer selection This may be necessary if you have pagination problems printing a report (primarily due to different printer font sizes).

Note: The abbreviation NA (not available) is printed in a report for entries of missing data. If a column of data contains one or more NA entries, then the subtotals and totals for that column will also be listed as NA.

Also, only sources with nonzero emissions are shown in a report. For example, if the core model output file was generated for only lawn and garden source categories, then only lawn and garden SCC codes with nonzero emissions for at least one pollutant will be reported.

Warning: If the format of the value to be displayed in a report column exceeds the column width then the value will be wrapped to the following line. For example,

123,456.789 might be written as 123,456.7
89

This should only occur when you have specified more than the default number of decimal places to display. You can avoid this problem by specifying fewer decimal places to display and rerunning the report.

Appendix C contains examples of all standard reports for a core model run of Washtenaw County, Michigan emissions.

Exporting to Excel

An option to export the line item report data to an Excel spreadsheet is available by selecting **File ➤ Export to Excel**. When selected, a dialogue box is opened to specify the Excel output file name. After the name is specified it is displayed in a window where you can select **Export Report** to create the file. When completed a message is displayed.

The spreadsheet file will contain the line item information from the report with appropriate column headings. It will not contain subtotals, grand totals, or report title information. The spreadsheet will have columns for all species and modes even though for example, you selected to report only exhaust particulate matter. In addition, there are fields labeled "Missing species" which are used by the reporting utility for totaling purposes. The numerous additional columns can be deleted in Excel if you do not want or need them.

COMPARING MODEL RUNS

In addition to allowing you to generate and view reports from single model runs, the reporting utility provides you with the ability to compare the results of two separate model runs. When you select **Compare** from the reporting utility main menu the comparison reports include:

- Compare Two Model Runs by HP and Source Classification
- Compare Two Model Runs by Pop and Fuel
- Compare Two Model Runs by SCC
- Compare Two Model Runs by Source Classification
- Compare Two Model Runs by County
- Compare Two Model Runs by Horsepower
- Compare Two Model Runs by Equipment Type
- Compare Two Model Runs by HP and SCC

When comparing two runs, the report only shows the records that the two runs have in common. For example, it you select a report that lists information by SCC, only that information pertaining to SCCs that the two model runs have in common will be shown in the comparison report. Similarly, if you are interested in comparing two model runs by horsepower and source classification, you will get horsepower ranges within source classifications that the two runs have

in common. If there are no common records between the two runs, you will get a message that there is nothing to report.

In order to reasonably compare values between two model runs the simulations must contain the same units. Since emissions are always output as short tons the period type must be the same between the two simulations. For example, a tons/year simulation compared to a tons/season will cause an informative message to be displayed and request you to select different tables to compare.

For the comparison reports by HP and Source Classification, SCC, Source Classification, County, Horsepower, Equipment Type, and HP and SCC, the report displays the results of model run 1, model run 2, the difference between model run 2 and model run 1, and the percent difference for a single user-specified pollutant. For the Pop and Fuel comparison report, the report displays only the results of model run 1 and model run 2 side by side.

To compare the results of two separate model runs, follow these steps:

1. From the Main Menu, select **Compare ➤ "Report Name"**

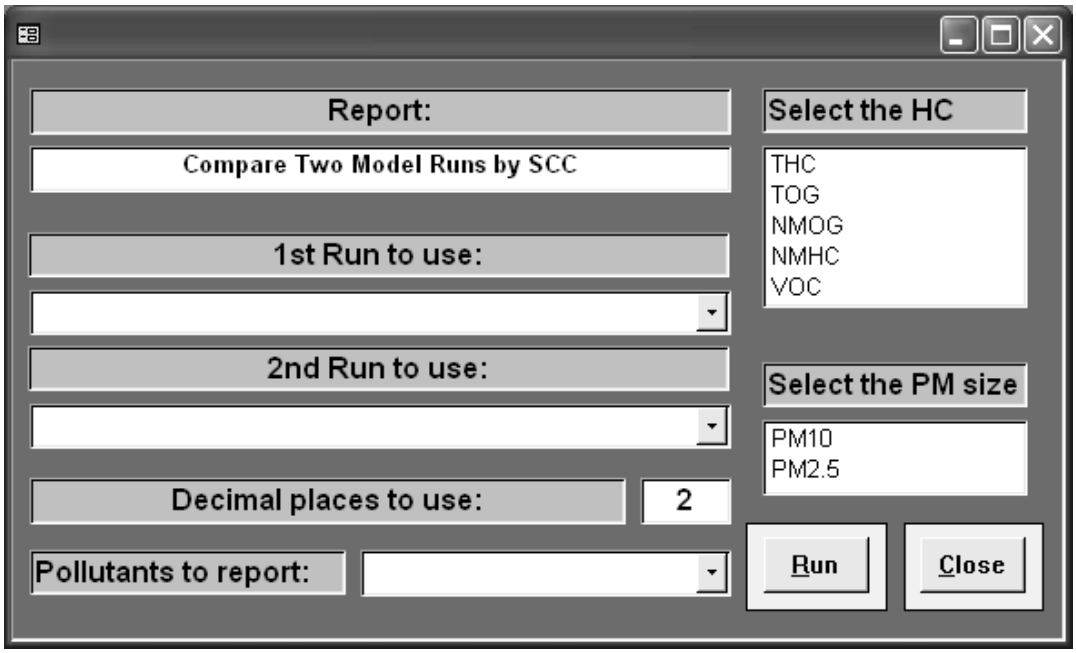


Figure 5-7: Report options for comparing two model runs.

2. Enter the report options. For the comparison reports *Compare Two Model Runs by HP and Source Classification, Compare Two Model Runs by SCC, Compare Two*

Model Runs by Source Classification, *Compare Two Model Runs by County*, *Compare Two Model Runs by Horsepower*, *Compare Two Model Runs by Equipment Type*, and *Compare Two Model Runs by HP and SCC*, the report options are shown in Figure 5-7. For the comparison report *Compare Two Model Runs by Pop and Fuel*, the report options are shown in Figure 5-8. A message box is displayed when an error is detected informing you of the problem encountered. Make the necessary changes and continue.

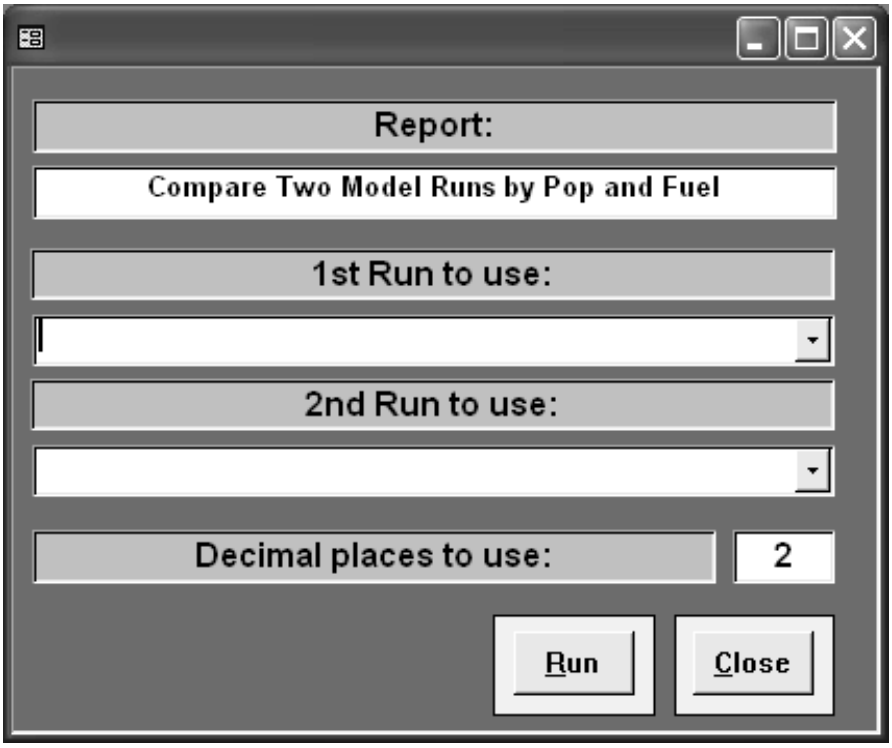


Figure 5-8: Report options for comparing two model runs by population and fuel.

3. After all required options have been specified, select **Run**. If a required field is left blank or an incorrect entry has been made, a message box will be displayed. You must correct the detected error and attempt to **Run** again. Once the report has been generated, it will appear in a window.

4. To return to the main menu without running the comparison, select **Cancel.**

Refer to the previous section on Viewing a Report in Print Preview for a discussion of viewing and printing the generated report. Examples of all comparison reports are provided in Appendix D.

EMISSION FACTOR REPORT TYPES

In addition to the standard and comparison reports, the reporting utility provides you with a set of emission factor reports. Each of the reports displays emission factor data for all fuels for all states or counties in the simulation run table. Reports in g/hr or g/day report on all exhaust and evaporative pollutants, whereas reports in g/hp-hr only report on exhaust pollutants. There are no subtotals or grand totals in the emission factor reports. A summary of each of these reports follows:

Note: If the output file generated in the core model contains data for multiple counties in a state the emission factor reports will be reported for all of these counties. If you want a separate emission factor report for each county, then the core model must be run for each individual county. Once the core model has been run, you must import the output files and run the emission factor report using each *'county'* database table.

Grams per Operating Hour by SCC - This report lists emission factors in g/hr for each SCC code. The report is separated by fuel type and major equipment classification. In addition to the SCC code, the equipment description and engine type are provided.

Grams per Operating Hour by HP and SCC - This report lists emission factors in g/hr for each SCC code and horsepower category. The report is separated by fuel type, major equipment classification, SCC, and HP. In addition to the SCC code, the equipment description and engine type are provided.

Note: Even though most diurnal, hot soak, permeation, and refueling emissions occur when the engine is not running, the Grams per Operating Hour report calculates these emissions by dividing the total tons of emissions by total operating hours.

Grams per Day by SCC - This report lists emission factors in g/day for each SCC code. The report is separated by fuel type and major equipment classification. In addition to the SCC code, the equipment description and engine type are provided.

Grams per Day by HP and SCC - This report lists emission factors in g/day for each SCC code and horsepower category. The report is separated by fuel type, major equipment classification, SCC, and HP. In addition to the SCC code, the equipment description and engine type are provided.

Grams per HP-Hour by SCC - This report lists emission factors in g/hp-hr for each SCC code. The report is separated by fuel type and major equipment classification. In addition to the SCC code, the equipment description and engine type are provided.

Grams per HP-Hour by HP and SCC - This report lists emission factors in g/hp-hr for each SCC code and horsepower category. The report is separated by fuel type, major equipment classification, SCC, and HP. In addition to the SCC code, the equipment description and engine type are provided.

To run an emission factor report, follow these steps:

1. From the Main Menu, select **Emission Factors ➤ Report Name**.

2. Enter the report options. All emission factor reports have the same options, as shown in figure 5.9. These options are a subset of the options described in the "USER SPECIFICATIONS" section above. A message box is displayed when an error is detected informing you of the problem encountered. Make the necessary changes and continue.

3. After all required options have been specified, select **Run**. Once the report has been generated, it will appear in a window.

4. To return to the main menu without running the emission factor report, select **Cancel**.

Refer to the previous section on Viewing a Report in Print Preview for a discussion of viewing and printing the generated report. Examples of all emission factor reports are provided in Appendix E.

COMPACTING DATABASES

If a database contains many large tables, it may slow the operation of the reporting utility and take up substantial space on the hard drive. This is particularly true if you remove large simulations. Prior versions of NONROAD included a separate utility to compact the database after removing simulations, but in NONROAD2005 this compacting function occurs automatically.

Chapter 6 Advanced Topics

In this chapter of the user's guide the following topics are discussed:

- a description of how data are grouped for use in estimating emissions,
- a description of the option file packets,
- a description of all input data files,
- information on how to incorporate local data by editing data files, and
- steps involved in running multiple model runs in a batch file.

INTRODUCTION

The NONROAD model includes default data files and report tables that allow you to easily estimate the emissions from a wide variety of nonroad equipment and vehicles for any region of the country. As discussed in Chapters 3 and 4, you can quickly set up an option file specifying the parameters that are applicable to your modeling scenario using default data.

The NONROAD model was also designed, however, to provide you with the flexibility to create emissions estimates based on locally specific data that may be available to you. For example, you may have developed more up-to-date information for equipment populations in a particular region than the default data available in the model. Similarly, you might want to estimate the emissions for a particular category of nonroad equipment at a subcounty regional level. The steps involved in modifying the default data input files and tables are provided in this chapter of the User's Guide. In addition, an example is provided for modifying inputs for subcounty runs.

While editing input files lets you adapt the model to specific local conditions, it also lets you change the model in ways that lead to invalid results. In particular, the interdependency between some inputs means that changes can affect outputs in surprising ways. The NONROAD model is designed to warn you about the most obvious input errors, but avoiding more subtle, but serious, errors requires understanding how the core model works.

You must be certain that any added data records are uniquely identified. Results will be unpredictable if there are multiple records with matching key fields that have different data values. For example, the file that contains monthly adjustment factors used to calculate the fraction of annual activity in a given month is identified by a regional and a SCC code. If you

add a record to this file with the same regional and SCC code as an existing record, with differences in the monthly distributions, then the output may not be what you intend. Searches are performed differently depending on the data file and processing routine. Do not assume that the first record matching the key fields will be used. Some searches stop at the first match, others find the last match, and still others sort the data before searching and the order of input data records is no longer significant.

Note: The notes in this chapter offer guidance, but EPA's technical support documents provide more detail. A list of the NONROAD technical support documents can be found in the Technical Documentation section of Chapter 1. If you have questions, e-mail EPA nonroad modeling staff at nonroad@epa.gov

Warning: While editing input files lets you adapt the model to specific local conditions, there is the possibility of changing the model in ways that lead to invalid results. An understanding of data relationships is recommended before changes are made to the data files.

HOW DATA ARE GROUPED IN THE NONROAD MODEL

As discussed briefly in Chapter 4, information used by the NONROAD model for estimating emissions, including user-specified options and data files are input into the core model through an option file. The information contained in each option file is separated into "packets" based on common information. For example, all data files related to the population of equipment for a modeling region is grouped in a single packet, as is information related to the period of time for which you are interested in estimating emissions.

When viewing an option file through a text editor, the keyword that identifies a packet is surrounded by forward slashes ("/") and can appear in upper case, lower case, or mixed case. For example, the packet identifier for all of the data files related to the population of equipment is /POP FILES/. To designate the end, or terminator, of a packet, the keyword END is used, also surrounded by forward slashes (i.e., /END/). The /RUNFILES/, /POP FILES/, and /GROWTH FILES/ packets in an option file can be seen in Figure 6-1.

```
-----------------------------------------------------
 This is the packet that lists the names of output files
 and some of the input data files read by the model.
-----------------------------------------------------
/RUNFILES/
ALLOC XREF         : c:\nonroad\data\allocate\allocate.xrf
ACTIVITY           : c:\nonroad\data\activity\activity.dat
EXH TECHNOLOGY     : c:\nonroad\data\tech\tech-exh.dat
EVP TECHNOLOGY     : c:\nonroad\data\tech\tech-evp.dat
SEASONALITY        : c:\nonroad\data\season\season.dat
REGIONS            : c:\nonroad\data\season\season.dat
MESSAGE            : c:\nonroad\outputs\travis.msg
OUTPUT DATA        : c:\nonroad\outputs\travis.out
EPS2 AMS           : c:\nonroad\outputs\travis.ams
US COUNTIES FIPS   : c:\nonroad\data\allocate\fips.dat
/END/
-----------------------------------------------------
This is the packet that defines the equipment population
files read by the model.
-----------------------------------------------------
/POP FILES/
                  :c:\nonroad\data\pop\tx.pop
/END/
-----------------------------------------------------
This is the packet that defines the growth files
read by the model.
-----------------------------------------------------
/GROWTH FILES/
National defaults  :c:\nonroad\data\growth\nation.grw
/END/
```

Figure 6-1: Option file showing packet identifiers and terminators.

The following packets make up the NONROAD model option file:

Packet Identifier	Required	Description
/PERIOD/	Yes	Period of time to model
/OPTIONS/	Yes	Run title, fuel specs, temperatures
/REGION/	Yes	Region to model
/RUNFILES/	Yes	A set of input and output file names
/SOURCE CATEGORY/	No	Source categories to process
/POP FILES/	Yes	Equipment population file names
/GROWTH FILES/	Yes	Projection/backcast data file names
/ALLOC FILES/	Yes	Spatial allocation file names
/EMFAC FILES/	Yes	Emission factors file names
/DETERIORATE FILES/	No	Deterioration factors file names
/MODEL YEAR OUT/	No	By-model-year output file names

Packet Identifier	Required	Description
/PERIOD/	Yes	Period of time to model
/PM BASE SULFUR/	No	Diesel sulfur content corresponding to base emission factors
/STAGE II/	No	Percent reduction due to Stage II control
/DAILY FILES/	No	Daily temperature and fuel RVP file name

If a packet is required by the core model to estimate emissions and is not found during a run then an error message will appear and the program will stop. Each line within an option file packet begins with a 20 character label. In most cases, the core model does not read these first 20 characters as they exist simply for the purpose of identifying the information provided. For example, the line in the /OPTIONS/ packet that indicates minimum temperature ignores the 'Minimum temper. (F):' label. A few packets use these first 20 characters to specify a keyword which identifies the type of data file. For example, the /RUNFILES/ packet identifies the output message file with the keyword 'Message'.

One convenient aspect resulting from the use of a packet input structure is that packets can appear in any order in an option file. Furthermore, any type of notes or descriptions that aid in describing the packet can be placed between the individual packets. When executed, the core model searches for packet identifiers and reads the data between the identifier and the packet terminator. All other lines in the file are ignored. The file, template.opt, provided with the NONROAD model contains a complete description of each packet including format requirements.

INPUT DATA PACKETS AND DATA FILES

As indicated above, all data input packets with the exception of that containing source category data and deterioration factor files are required for the model to estimate emissions from nonroad sources. In many of these packets, data are supplied in a series of input data files. In other packets, information relevant to any scenario you are interested in modeling is supplied through user-specified options.

Note: To assist in better understanding the format of information in data files, it is suggested that you open each data file through a text editor as you read the information in this chapter. The data files are in a subdirectory called Data under the Nonroad directory. Each of the data files provided with the NONROAD model follows the 'packet' structure of the input option file. All files contain descriptive information including format specifications.

Review of Previously Described Packets

Some of the NONROAD model input packets from the options file have already been discussed in Chapters 3 and 4. They are briefly reviewed here for completeness. Please refer to the previous chapters for a more complete discussion of the /OPTIONS/, /REGIONS/, /PERIOD/, and /SOURCE CATEGORY/ packets.

The /OPTIONS/ packet defines several of the user-specified options that make up a modeling scenario. /OPTIONS/ include descriptive titles, fuel specifications that will be in effect during the modeling period, and typical ambient temperatures for the period. The order of the records in this packet are fixed.

The period packet, identified as /PERIOD/, defines the period of time that you are interested in modeling. The order of the records in this packet are fixed. Furthermore, the selection of certain parameters will cause some of the records in /PERIOD/ to be ignored.

The /REGION/ packet, defines the region that you are interested in modeling. Regions are defined using two types of parameters. The first specifies the type of region and the second the region codes to be included.

The source category packet, identified as /SOURCE CATEGORY/, is used to identify which source categories are to be processed. This is an optional packet; if you do not specify a list of SCC codes, the model will calculate emissions estimates based on all equipment in the population files.

Runfiles Packet

The runfiles packet, identified as /RUNFILES/, defines input data file types required by the model and output files created (see previously referenced Figure 6-1). These data file types contain information that is universal to all regions and emissions species. Each file type is identified by a keyword(s) which appears in columns 1 to 20 of the /RUNFILES/ packet. The names for these file types may appear in any order within the packet but each must be preceded by a valid keyword.

Keywords	Input	Output	Required	Description
ACTIVITY	✓		✓	Defines equipment use per year
ALLOC XREF	✓		✓	Allocation indicator lookup table
REGIONS	✓		✓	Geographic region definitions
SEASONALITY	✓		✓	Temporal adjustment data

Keywords	Input	Output	Required	Description
EXH TECHNOLOGY	✓		✓	Exhaust & crankcase technology distributions
EVP TECHNOLOGY	✓		✓	Evaporative technology distributions
MESSAGE		✓	✓	Output message file
OUTPUT DATA		✓	✓	Emission estimates (for RU)
EPS2 AMS		✓		Emission estimates (EPS2 format)
US COUNTIES FIPS	✓			County list with FIPS codes

Each of the input data files contained in the /RUNFILES/ packet, along with their format, are described below.

ACTIVITY

The file identified by the keyword ACTIVITY, contains the activity data for the core model. *Activity.dat* is the data file provided with the NONROAD model and these default values are described in the EPA documentation report NR-005c. The activity is defined as how often a piece of equipment is used in a year. This file also contains other information about the equipment, such as average load factor. Global SCC codes can be used to indicate entire groups of equipment types. A sample of the text of the activity file shown is shown below to illustrate the look of the input file.

```
.............
.............
----------------------------------------         Region       HPmn HPmx LFac NoUse    Units  Hours/Yr  AgeAdj
/ACTIVITY/
2260002006 2-Stroke Tampers/Rammers                             0 9999 0.55        Hrs/Yr        160  DEFAULT
2260002009 2-Stroke Plate Compactors                            0 9999 0.55        Hrs/Yr        166  DEFAULT
.............
.............
```

The load factor ("LFac") and annual usage ("Hours/Yr") are both directly used to calculate the exhaust emissions.

In addition to providing the input data by SCC, they can be specified by region and power level. The default NONROAD files use the same estimates for all regions and power levels.

If alternative data exists, it can be used either by modifying the entire file or including separate estimates in the same file as the default national estimates using the Region Code, which is a code defined in the temporal allocation file ("season.dat").

The activity can be a function of the power level for a given piece of equipment. For instance, a survey method produced alternative annual activity ("Hours/Yr") for large (>25 hp) diesel construction equipment for Houston, so the alternative activity can be used along with the default information for the smaller equipment as shown in the example below.

```
.............
.............
----------------------------------------        Region     HPmn HPmx LFac NoUse    Units  Hours/Yr  AgeAdj
/ACTIVITY/
2270002003 Diesel Pavers                                       0 9999 0.59        Hrs/Yr        821  DEFAULT
2270002003 Diesel Pavers                        SW             0   25 0.59        Hrs/Yr        821  DEFAULT
2270002003 Diesel Pavers                        SW            25 9999 0.59        Hrs/Yr        719  DEFAULT
.............
.............
```

The exhaust emissions estimates are directly related to the load factor and activity (hours/year), so a change in those inputs will proportionately affect the emissions calculated. Also, because the load factor and activity (hours/year) are used to determine the life of the equipment in years, the age distribution is affected by modifying these estimates. For instance, if activity and load factor are reduced, then the equipment will be expected to last longer in years, so the age distribution shifts to older equipment.

The format for this data is as follows:

Packet Identifier: /ACTIVITY/

Column		Description
Line:	1 - 10	Equipment code (SCC)
	12 - 51	Equipment description (not used)
	52 - 56	Region code (refer to description of REGIONS section below)
	57 - 76	(not used. was technology type)
	77 - 81	Minimum horsepower
	82 - 86	Maximum horsepower
	87 - 91	Load factor
	92 - 96	(not used)
	97 - 106	Activity level units (Hrs/Yr)
	107 - 116	Activity level
	117 - 126	Identifier for age adjustment curve (DEFAULT=no adjustment)

Warning: The EPA does not recommend changing the activity files. This is because the activity, equipment population, load factor, and average life are all linked and changes can have surprising results. For details, see EPA's technical documents or talk to EPA nonroad modeling staff.

ALLOC XREF

The file identified by the keyword ALLOC XREF is the allocation indicator lookup table used by the core model. *Allocate.xrf* is the data file provided with the NONROAD

model. These data are used to allocate equipment type populations from one regional level to another. For each SCC in the file, the code is cross referenced to a list of indicator codes and their associated coefficients. The model will retrieve the indicator data identified by the indicator codes and calculate a linear combination. Global SCC codes can be used to indicate entire groups of equipment types.

To calculate the allocation factors, the model first calculates a linear combination of allocation indicator values. The linear combinations are defined in this file. For instance, if an SCC were discovered to be a function of two codes, then the indicator could be a combination of the two codes (e.g., RVP and POP) as shown below for a given county, and the calculation would be as follows. (This is a hypothetical example only and not an accurate reflection of in-use allocation.)

*Indicator = 0.6 * (County RVP)/(State RVP) + 0.4 * (County POP)/(State POP)*

*County equipment population = Indicator * State equipment population*

In the example below, the allocate cross reference file was modified for recreational vehicle use to reproduce the hypothetical example above.

Current Version

```
..........
..........
/ALLOC XREF/
2260001000  1.0
2260001000 RVP
..........
..........
```

Sample Alteration (this is not an accurate reflection of the allocation)

```
..........
..........
/ALLOC XREF/
2260001000  0.6      0.4
2260001000  RVP      POP
..........
..........
```

The indicator codes are arbitrary. The codes in this file are:

AIR	Number of employees in air transportation
MIN	Underground coal production tons
CON	Dollars spent on construction adjusted for the relative geographic costs of construction materials
FRM	Harvested cropland
GC	Number of golf courses and country clubs
COM	Number of wholesale establishments
HOU	Number of single and double (duplex) family homes
LOG	Number of employees in logging
LSC	Number of employees in landscaping services
MFG	Number of employees in manufacturing
OIL	Number of employees in oil & gas extraction, and drilling oil & gas wells
POP	Human population
RVP	Number of recreational vehicle parks and campgrounds
SBC	Relative number of commercial snowblowers
SBR	Relative number of residential snowblowers
SNM	Snowmobiles: State-level registration, snowfall and inverse human population for county level
WIB	Recreational marine state fuel consumption, county water surface area - Inboard
WOB	Recreational marine state fuel consumption, county water surface area - Outboard
RR	Locomotive NOx - allocates rail maintenance equipment

The format for this data is as follows:

Packet Identifier: /ALLOC XREF/

Column	Description
Line 1: 1 - 10	Equipment code (SCC)
11 - 20	Coefficient for indicator 1
21 - 30	Coefficient for indicator 2
31 - 40	Coefficient for indicator 3
Line 2: 1 - 10	Equipment code (must match the code in Line 1)
11 - 20	Indicator code of indicator 1
21 - 30	Indicator code of indicator 2
31 - 40	Indicator code of indicator 3

Note: If you add additional indicator codes and factors to the *allocate.xrf* file, you must also add corresponding data files. For example, if you add forest land as an allocation factor for recreational vehicles, you must provide the model with data files on forest land per county. Refer to the section Allocation Files Packet. Furthermore, the input option file must list the appropriate data file names.

REGIONS

The file identified by the keyword REGIONS, defines the states/counties in each geographic region. *Season.dat* is the data file provided with the NONROAD model. The region packet within the season file associates the region definition with the FIPS code for a State or County as shown in the example below. New regions can be defined here, but inputs for the monthly allocation (described below) must be described for any new region defined here.

```
.........
.........
/REGIONS/
SW            Southwest                          48000 Texas
US            National                           00000 Nation
.........
.........
```

Identification by the region code is arbitrary (SE for Southeast or SW for Southwest) but the FIPS code must be a valid state or county FIPS code. If a state code is supplied, all counties in that state are included in the indicated region, unless overridden by a county-specific record.

Warning: Changing the region does not change altitude or temperatures, but it does change which activity factor is applied and the allocation of activity throughout the year. If you define a new region, you must add the new region to the *season.dat* file; and if applying a region specific activity, you must also add it to the *activity.dat* file.

The format for this data is as follows:

Packet Identifier: /REGIONS/

Column		Description
Line:	1 - 5	User-defined region code
	6 - 45	Region description (not used)
	46 - 50	State or county FIPS code
	51 - 70	State or county name (not used)

SEASONALITY

The file identified by the keyword SEASONALITY, contains the seasonality (temporal adjustment data) used by the core model. *Season.dat* is the data file provided with the NONROAD model. Two specific types of information are contained in this file, each identified by a different packet keyword, other than the /REGIONS/ packet that may also be in this file.

The first, identified by the packet identifier /MONTHLY/, provides the monthly adjustment factors used by the model to calculate the fraction of annual activity occurring in the given month. When modeling a season, the factors from each month spanned by the period are summed by the model. Seasons are defined as follows in the model:

Winter: Jan/Feb/Dec
Spring: Mar/Apr/May
Summer: Jun/Jul/Aug
Autumn: Sept/Oct/Nov

The second packet, identified as /DAILY/, provides the day-of-the-week adjustments. The first of the two values on each line of this packet is the fraction of weekly activity in a typical (average) weekday day. This represents activity occurring on any single day, Monday - Friday. The second Daily value is the fraction of weekly activity occurring on a typical single weekend day – Saturday or Sunday.

If no monthly or daily data for an equipment type is found in *season.dat*, a warning message is written to the output message file and the model default values will be used for temporal allocation. The default values represent an equal distribution of temporal activity throughout each month of the year. If you change the monthly allocations, you should check to make sure the allocations sum to one. Likewise, the weekend and weekday allocations should sum to one for an entire week (i.e. $1 = 5 \times$ weekday fraction + $2 \times$ weekend day fraction).

The format for the monthly data is as follows:

Packet Identifier: /MONTHLY/

Column		Description
Line:	1 - 5	Subregion code (blank = match all)
	7 - 16	SCC code (global codes are acceptable)
	18 - 51	Equipment description (not used)
	52 - 61	Fraction of annual activity in January
	62 - 71	Fraction of annual activity in February
	72 - 81	Fraction of annual activity in March
	82 - 91	Fraction of annual activity in April
	92 - 101	Fraction of annual activity in May
	102 - 111	Fraction of annual activity in June
	112 - 121	Fraction of annual activity in July
	122 - 131	Fraction of annual activity in August
	132 - 141	Fraction of annual activity in September
	142 - 151	Fraction of annual activity in October
	152 - 161	Fraction of annual activity in November
	162 - 171	Fraction of annual activity in December

The format for the day-of-the-week data is as follows:

Packet Identifier: /DAILY/

Column		Description
Line:	1 - 5	Subregion code (blank = match all)
	7 - 16	SCC code (global codes are acceptable)
	18 - 51	Equipment description (not used)
	52 - 61	Fraction of weekly activity in typical weekday day
	62 - 71	Fraction of weekly activity in typical weekend day

EXH TECHNOLOGY

The file identified by the keywords EXH TECHNOLOGY, defines the exhaust technology type distributions for the core model. *Tech-exh.dat* is the default exhaust technology data file provided with the NONROAD model. The technology types are specified by SCC and horsepower range. Global SCC codes can be used to indicate entire groups of equipment types. Each data record in these files is separated into two lines. The first line has the identification information and a list of up to 15 technology types which make up the specified equipment population. The second line identifies the year and the fraction of that year's sales in each technology type. Multiple second lines

may be provided if data is available for different model years as shown in the example below. From the "*tech-exh.dat*" input file (up to 15 tech types may be defined).

```
   SCCodes      HPminHPmax   Tech1    Tech2    Tech3    Tech4 (more>)
Year                 Fract    Fract    Fract    Fract
/TECH FRAC/
.........
.........
   2270000000    750 9999   Base     T0       T1       T2
1900                1.000    0.000    0.000    0.000
1988                0.000    1.000    0.000    0.000
2000                0.000    0.000    1.000    0.000
2006                0.000    0.000    0.200    0.800
2007                0.000    0.000    0.100    0.900
2013                0.000    0.000    0.000    1.000
.........
.........
```

The fractions of sales by technology type for each year should sum to 1. If the sum differs from 1.0 by more than +/- 0.002 then the fractions are normalized and a warning message is generated and displayed. The model will use the distribution beginning with the specified model year, until a new distribution is provided.

The NONROAD model uses the tech types primarily to determine phase-in of emissions standards. The tech type defines which zero-hour (brand new) exhaust emission factor (derived from the emission factor files described below) and deterioration rate are used by the model when processing each model year of each equipment type. In the example above, diesel engines (SCC 227000000) of power levels between 750 and 9999 horsepower can potentially be one of 4 tech types (Base, T0, T1, T2). Older engines (starting with the 1900 model year) were exclusively the 'Base' tech type while new engines were produced with tech type 'T0' beginning with the 1988 model year. The first emission standard, Tier 1 (tech type 'T1') for all diesel equipment types began with the 2000 model year. However, the Tier 2 standard is phased-in starting with the 2006 model year where only 80% (0.800 entry) of the new engines are expected to be Tier 2 (tech type 'T2') with the remainder still Tier 1.

The tech types in NONROAD have meanings that relate to the type of engine and which emission standard applies to that engine. Other tech types may appear in the default input files but have zero entries, so are not currently used. The representative tech types are as follows:

Descriptions for representative tech types.

Tech Type	Description
G2H3	Gasoline 2-stroke handheld Class 3
G2H31	Gasoline 2-stroke handheld Class 3 meeting Phase 1 Standards
G2H3C1	Gasoline 2-stroke handheld Class 3 meeting Phase 1 Standards with a catalyst
G2H32	Gasoline 2-stroke handheld Class 3 meeting Phase 2 Standards
G2H3C2	Gasoline 2-stroke handheld Class 3 meeting Phase 2 Standards with a catalyst
G2H4	Gasoline 2-stroke handheld Class 4
G2H41	Gasoline 2-stroke handheld Class 4 meeting Phase 1 Standards
G2H4C1	Gasoline 2-stroke handheld Class 4 meeting Phase 1 Standards with a catalyst
G4H41	Gasoline 4-stroke handheld Class 4 meeting Phase 1 Standards
G2H42	Gasoline 2-stroke handheld Class 4 meeting Phase 2 Standards
G2H4C2	Gasoline 2-stroke handheld Class 4 meeting Phase 2 Standards with a catalyst
G4H42	Gasoline 4-stroke handheld Class 4 meeting Phase 2 Standards
G2H5	Gasoline 2-stroke handheld Class 5
G2H51	Gasoline 2-stroke handheld Class 5 meeting Phase 1 Standards
G2H5C1	Gasoline 2-stroke handheld Class 5 meeting Phase 1 Standards with a catalyst
G2H52	Gasoline 2-stroke handheld Class 5 meeting Phase 2 Standards
G2H5C2	Gasoline 2-stroke handheld Class 5 meeting Phase 2 Standards with a catalyst
G2N1	Gasoline 2-stroke nonhandheld Class 1
G4N1S	Gasoline 4-stroke nonhandheld Class 1 side-valve carburetor
G4N1O	Gasoline 4-stroke nonhandheld Class 1 overhead-valve carburetor
G2N1	Gasoline 2-stroke nonhandheld Class 1
G4N1S1	Gasoline 4-stroke nonhandheld Class 1 side-valve carburetor meeting Phase 1 Standards
G4N1O1	Gasoline 4-stroke nonhandheld Class 1 overhead-valve carburetor meeting Phase 1 Standards
G4N1SC1	Gasoline 4-stroke nonhandheld Class 1 side-valve carburetor meeting Phase 1 Standards with a catalyst
G4N1S2	Gasoline 4-stroke nonhandheld Class 1 side-valve carburetor meeting Phase 2 Standards
G4N1O2	Gasoline 4-stroke nonhandheld Class 1 overhead-valve carburetor meeting Phase 2 Standards
G2N2	Gasoline 2-stroke nonhandheld Class 2
G4N2S	Gasoline 4-stroke nonhandheld Class 2 side-valve carburetor
G4N2O	Gasoline 4-stroke nonhandheld Class 2 overhead-valve carburetor
G4N2S1	Gasoline 4-stroke nonhandheld Class 2 side-valve carburetor meeting Phase 1 Standards
G4N2O1	Gasoline 4-stroke nonhandheld Class 2 overhead-valve carburetor meeting Phase 1 Standards
G4N2S2	Gasoline 4-stroke nonhandheld Class 2 side-valve carburetor meeting Phase 2 Standards
G4N2O2	Gasoline 4-stroke nonhandheld Class 2 overhead-valve carburetor meeting Phase 2 Standards
G2GT25	Gasoline 2-stroke greater than 25 horsepower
G4GT25	Gasoline 4-stroke greater than 25 horsepower
G4GT251	Gasoline 4-stroke greater than 25 horsepower meeting Tier 1 Standards
G4GT252	Gasoline 4-stroke greater than 25 horsepower meeting Tier 2 Standards
R12S	Gasoline Recreational 2-stroke
** R12SP*	*Gasoline Recreational 2-stroke ("P" = Pump Fueled, unused as a separate tech type)*
R12S1	Gasoline Recreational 2-stroke meeting Tier 1 Standards
R12S1P	Gasoline Recreational 2-stroke meeting Tier 1 Standards ("P" = Pump Fueled, unused as a separate tech type)
R12S2	Gasoline Recreational 2-stroke meeting Tier 2 Standards
** R12S2P*	*Gasoline Recreational 2-stroke meeting Tier 2 Standards ("P" = Pump Fueled, unused as a separate tech type)*
R14S	Gasoline Recreational 4-stroke
** R14SP*	*Gasoline Recreational 4-stroke ("P" = Pump Fueled, unused as a separate tech type)*
R14S1	Gasoline Recreational 4-stroke meeting Tier 1 Standards

Tech Type	Description
** R14S1P*	*Gasoline Recreational 4-stroke meeting Tier 1 Standards ("P" = Pump Fueled, unused as a separate tech type)*
R14S2	Gasoline Recreational 4-stroke meeting Tier 2 Standards
** R14S2P*	*Gasoline Recreational 4-stroke meeting Tier 2 Standards ("P" = Pump Fueled, unused as a separate tech type)*
** R14S2C*	*Gasoline Recreational 4-stroke meeting Tier 2 Standards ("C" = Catalyst, unused as a separate tech type)*
** R14S2CP*	*Gasoline Recreational 4-stroke meeting Tier 2 Standards ("C" = Catalyst, "P" = Pump Fueled, unused as a separate tech type)*
LGT25	LPG greater than 25 horsepower
LGT251	LPG greater than 25 horsepower meeting Tier 1 Standards
LGT252	LPG greater than 25 horsepower meeting Tier 2 Standards
NGT25	CNG greater than 25 horsepower
NGT251	CNG greater than 25 horsepower meeting Tier 1 Standards
NGT252	CNG greater than 25 horsepower meeting Tier 2 Standards
Base	Early (pre-1988) uncontrolled diesel engines
T0	Late model (1988+) uncontrolled diesel engines
T1	Diesel engine meeting Tier 1 Standards
T2	Diesel engine meeting Tier 2 Standards
T3	Diesel land-based engine meeting Tier 3 Standards
T3B	Diesel land-based engine meeting Tier 3 Standards for 75-100 hp engines
T4A	Diesel land-based engine meeting transitional Tier 4 Standards for engines under 50 hp
T4B	Diesel land-based engine meeting transitional Tier 4 Standards for engines under 25 hp
T4	Diesel land-based engine meeting full Tier 4 PM Standards
** T4N1*	*Unused*
T4N	Diesel land-based engine meeting full Tier 4 PM & NOx Standards
T2M	Diesel recreational marine engine meeting "Tier 2" Standards for over 50 hp engines
MO2C	2-stroke gasoline Outboard Carbureted
MO2I	2-stroke gasoline Outboard with Indirect injection
MO2D	2-stroke gasoline Outboard with Direct injection
MO4C	4-stroke gasoline Outboard Carbureted
MO4I	4-stroke gasoline Outboard with Indirect injection
MO4D	4-stroke gasoline Outboard with Direct injection
MP2C	2-stroke gasoline Personal Watercraft Carbureted
MP2I	2-stroke gasoline Personal Watercraft with Indirect injection
MP2D	2-stroke gasoline Personal Watercraft with Direct injection
MP4C	4-stroke gasoline Personal Watercraft Carbureted
MP4I	4-stroke gasoline Personal Watercraft with Indirect injection
MP4D	4-stroke gasoline Personal Watercraft with Direct injection
MS4C	4-stroke gasoline Sterndrive/Inboard Carbureted
MS4D	4-stroke gasoline Sterndrive/Inboard with Direct Injection

* These technology types are not currently used in NONROAD, but exist in various input files for certain diagnostic/developmental tests that have been done.

New tech types may be defined for any SCC as long as the emission factors and deterioration rates are also provided for those new tech types. In many cases above, EPA has estimated what tech type of engines will be used for future year standards so the tech type descriptions and relative sales fractions may change as manufacturers introduce engines meeting the emission standards.

Note: Proposed regulations are estimated to reduce the number of 2-stroke engines sold in the future in favor of 4-stroke engines. Therefore, spark ignition engines **less than or equal to 25** horsepower are lumped into one SCC category, eliminating the SCC distinction between 2- and 4-stroke gasoline, LPG, and CNG engines.

The format for the data in this file is as follows:

Packet Identifier: /TECH FRAC/

Column		Description
Line 1:	6 - 15	SCC code (globals can be used)
	21 - 25	Minimum horsepower range
	26 - 30	Maximum horsepower range
	35 - ?	List of tech type codes (each in field of 10 characters)
Line 2 +:	1 - 5	Model Year
	35 - ?	Fractions of each tech type (each in field of 10 characters)

Warning: The technology type data are generally used with the emission factor data to model changes in control strategies. While users may wish to change the technology type data to experiment with various phase-in strategies, they should use the default values for official submittals to EPA.

EVP TECHNOLOGY

The file identified by the keywords EVAP TECHNOLOGY, defines the evaporative technology type distributions for the core model. *Tech-evp.dat* is the evaporative technology data file provided with the NONROAD model. The technology types are specified by SCC and horsepower range. Global SCC codes can be used to indicate entire groups of equipment types. The data in these files is separated into two lines. The first line has the identification information and a list of up to 15 technology types which make up the specified equipment population. The second line identifies the year and the fraction of population in each technology type. Multiple second lines may be provided if data is available for different years as shown in the example below. From the "*tech-evp.dat*" input file (up to 15 tech types may be defined).

```
     SCCodes         HPminHPmax    Tech1      Tech2      Tech3      Tech4 (more>)
Year                               Fract      Fract      Fract      Fract
/TECH FRAC/
..........
..........
     2260000000         25 9999    E00000000 E00010000 E10010010
1900                               1.000      0.000      0.000
2004                               0.000      1.000      0.000
2007                               0.000      0.000      1.000
..........
..........
```

The fractions of sales by technology type for each model year should sum to 1. If the sum differs from 1.0 by more than +/- 0.002 then the fractions are normalized and a warning message is generated and displayed. The model will use the distribution beginning with the specified model year, until a new distribution is provided.

The NONROAD model uses the tech types primarily to determine phase-in of emissions standards. The tech type defines which zero-hour (brand new) evaporative emission factor (derived from the emission factor files described below) and which evaporative deterioration rate are used by the model when processing each model year of each equipment type. In the example above, 2-stroke gasoline engines (SCC 2260000000), except rail and marine, of power levels between 25 and 9999 horsepower can potentially be one of 3 tech types (E00000000, E00010000, E10010010). Older engines (starting with the 1900 model year) were exclusively the 'E00000000' tech type while new engines were produced with tech type 'E00010000' beginning with the 2004 model year, and type 'E10010010' beginning with the 2007 model year.

Evaporative tech type codes are different than exhaust tech type codes. Each digit in the evaporative tech type code represents a different species of emission, and the value of the digit represents the control level for that species within the tech type.

Key to Tech Group

Char/Digit	Description
E	Evap Tech Group
1	Diurnal
2	Tank Permeation
3	Hose Permeation (applies to non-rec-marine hose and 3 rec-marine hoses)
4	Hot Soak
5	Refueling Vapor Displacement
6	Refueling Spillage
7	Running Loss
8	(unused)

```
 12345678
E00000000
```

Key to Tech Group Values

Value	Description
0	Base
1	Control Level 1
2	Control Level 2
...	...
N	Control Level N (maximum 9)

New tech types may be defined for any SCC as long as the emission factors and deterioration rates are also provided for those new tech types. In many cases above, EPA has estimated how much of each evaporative tech type will be used for future year standards, so the tech type descriptions and relative sales fractions may change as manufacturers introduce engines meeting the emission standards.

The format for the data in this file is as follows:

Packet Identifier: /EVAP TECH FRAC/

Column		Description
Line 1:	6 - 15	SCC code (globals can be used)
	21 - 25	Minimum horsepower range
	26 - 30	Maximum horsepower range
	35 - ?	List of tech type codes (each in field of 10 characters)
Line 2 +:	1 - 5	Model Year
	35 - ?	Fractions of each tech type (each in field of 10 characters)

US COUNTIES FIPS

The file entered here (default is *fips.dat*) contains a list of counties available to the model, including the five digit FIPS code, an optional start year, an optional end year, and the county name. Start and end years are only for counties that either come into existence (e.g., by splitting one county into two separate counties) or cease to exist (e.g., an urban area that had been treated separately from its surrounding county, changing its municipal designation to be treated as part of that county.

The format for the data in this file is as follows:

Packet Identifier: /FIPS/

Column	Description
1 - 5	FIPS code (all individual 5-digit county codes)
6	(blank, unused)
7 - 10	Start year (4-digit. Blank means all past years)
11	(blank, unused)
12 - 15	End year (4-digit. Blank means all future years)
16	(blank, unused)
17 - 66	County name

Population Files Packet

The population files packet, identified as /POP FILES/, lists all of the files containing equipment population data. The data in these files ultimately determines which equipment types will be processed in the core model. If population estimates for a given equipment type are included in any of these files, and you do not exclude the equipment from processing by user-specified options (i.e., with the /SOURCE CATEGORY/ packet in the option file), the model will use all of these population estimates to calculate emissions. The entire equipment population file will be processed and estimated emissions written to the output data file, unless you specify a subset of equipment types.

For convenience and ease of data management, the population data have been disaggregated into separate files by state and a file for national totals. The /POP FILES/ packet in an option file was shown earlier in Figure 6-1.

The **.pop* files, one for each state, contain the equipment population estimates for the NONROAD model. The "*" refers to the two character state abbreviation (*us* for the national total file). These data drive the rest of the model in terms of which equipment types will be processed. If multiple years of population are provided, the model uses the closest year which comes before the episode year. The model's growth function is used to grow this base year equipment population to the episode year. Population estimates for an entire state may be allocated to county level (refer to the Allocation Files Packet section below). The sum of all county equipment populations within a state is equal to the state population value.

The input data are defined by the region ("FIPS" defining State or County) and year in which the estimates are valid ("Year"), SCC, and by power level grouping ("HPmin" and "Hpmax"). Subregion codes ("SUBR")can be used to provide inputs for partial counties.

The horsepower range (HP) is lower bound exclusive and upper bound inclusive. For example, a range identified by a minimum HP of 3 and a maximum HP of 6 is the range $3 < HP \leq 6$. The acceptable ranges are:

0 to 1	25 to 40	300 to 600
1 to 3	40 to 50	600 to 750
3 to 6	50 to 75	750 to 1000
6 to 11	75 to 100	1000 to 1200
11 to 16	100 to 175	1200 to 2000
16 to 25	175 to 300	2000 to 3000
		Greater than 3000

The average of the horsepower range is used frequently in NONROAD model calculations. The option to specify a single weighted average horsepower is provided in the population file format. If the weighted average horsepower field is blank then the midpoint is computed from the specified range.

Note: To account for the shift that has been occurring from 2-stroke to 4-stroke spark ignition engines, while maintaining a single growth rate for a given type of equipment, spark ignition engines have been grouped into single SCCs with 2-stroke, 4-stroke, CNG and LPG engines in separate technology groups. Therefore, some SCCs are missing from the population file while others have the combined populations for all spark ignition engines.

When modifying the equipment populations with local information, usually available is the total population of the equipment type, or populations within a power range. The NONROAD model needs the equipment population distributed by power level, so the revised information must be mapped into each power level range. The most widely used method for this mapping procedure is to distribute the revised population according to the default national distribution by power level range.

EPA has designed an Excel spreadsheet that allows manipulation of the population files allowing the user to save a text file that can be used in NONROAD. With the Excel file, a column of data can replace the default data more easily than using a text editor. This file makes the redistribution method described above straight-forward.

The population file also provides the median life estimates ("Life") and directs the model to the type of scrappage function ("ScrapFlag") to determine the age distribution for each SCC and power level grouping. The scrappage function is defined in the growth file (named "Nation.grw").

A change in the "Life" estimate will proportionally affect the median life in years. If the median life in years is known, then the life in hours at full load needs to be modified and can be calculated using the equation below.

*Median Life (hours at full load) = Median life (years) * (A * LF)*

where

LF	*= Load Factor (fraction of available power) (from Activity File)*
A	*= Activity (hrs/yr) (from Activity File)*
Median Life	*= Median life in hours at full load (from Population File)*

The median life in years is not the same value as the average age of equipment in use. The median life is the typical age when the engine is scrapped, while the average age of equipment in-use depends upon the historic sales and the rate of scrappage. Typically the average age of equipment in-use is lower than the median life of the equipment.

The format for this data is as follows:

Packet Identifier: /POPULATION/

Column	Description
1 - 5	FIPS code
7 - 11	Subregion code (used for subcounty estimates)
13 - 16	Year of population estimates
18 - 27	SCC code (no globals accepted)
29 - 68	Equipment description (ignored)
70 - 74	Minimum horsepower (lower bound of single range; ranges must match those internal to the model)
76 - 80	Maximum horsepower (upper bound of single range)
82 - 86	Weighted average horsepower (optional)
88 - 92	Median expected life (in hours of use at full load)
93 - 102	Flag for scrappage distribution curve (DEFAULT = standard curve)
106 - 122	Population estimate

Warning: EPA does not recommend changing the equipment population files without making other corresponding input changes. This is because the activity, equipment population, load factor, and average life are all linked, and incomplete changes can lead to inconsistent results. For details, see EPA's technical documents or talk to EPA nonroad modeling staff.

Growth Files Packet

The growth files packet, identified as /GROWTH FILES/, lists the names of all of the files containing future year projection or backcasting data (see previously referenced Figure 6-1). The growth data provided with the NONROAD model is in a single file called "*nation.grw*" and is separated into data packets. Similar to population files, growth data can be placed in separate files, such as by state or county, to simplify data management.

The packets that make up the growth files are:

Packet Identifier	Required	Description
/INDICATORS/	✓	Cross reference between SCC and growth indicator code.
/GROWTH/	✓	Growth values by FIPS, indicator code, and year.
/SCRAPPAGE/	✓	Default scrappage curve used for model year distribution calculations.
/ALTERNATE SCRAPPAGE/		Alternate scrappage curve.

Note: For more information concerning how NONROAD handles growth and scrappage, consult Technical Reports NR-007b and NR-008c.

The /INDICATORS/ packet, provides a cross reference of equipment code (SCC) to growth indicator. The indicator code is an arbitrary code that can identify an actual predicted value such as human population or employment. The indicator codes may be defined by SCC (or SCC grouping following the hierarchy), power level range, and technology type. However the default values in the model only define codes applicable to all power and technology types for each general category (construction, lawn and garden, etc.) as described in EPA's NONROAD documentation report NR-008c. Below is a sample of lines from the /INDICATORS/ packet.

```
.........
.........
FIPS  Ind  SCCodes    HPminHPmax Tech       Description (not used)
/INDICATORS/
00000 010  2267008000     0 9999 ALL        LPG Airport Service Equipment
00000 010  2268008000     0 9999 ALL        CNG Airport Service Equipment
00000 011  2270008000     0 9999 ALL        Diesel Airport Service Equipment
.........
.........
```

The indicator codes found in the *nation.grw* file are:

010 -- Airport Service - Total	063 -- Light Commercial - LPG
011 -- Airport Service - Diesel	064 -- Light Commercial - CNG
012 -- Airport Service - Gasoline	070 -- Logging - Total
013 -- Airport Service - LPG	071 -- Logging - Diesel
014 -- Airport Service - CNG	072 -- Logging - Gasoline
020 -- Construction- Total	073 -- Logging - LPG
021 -- Construction - Diesel	074 -- Logging - CNG
022 -- Construction - Gasoline	080 -- Railway - Total
023 -- Construction - LPG	081 -- Railway - Diesel
024 -- Construction - CNG	082 -- Railway - Gasoline
030 -- Farm - Total	083 -- Railway - LPG
031 -- Farm - Diesel	084 -- Railway - CNG
032 -- Farm - Gasoline	090 -- Recreational - Total
033 -- Farm - LPG	091 -- Recreational - Diesel
034 -- Farm - CNG	092 -- Recreational - Gasoline
040 -- Industrial - Total	093 -- Recreational - LPG
041 -- Industrial - Diesel	094 -- Recreational - CNG
042 -- Industrial - Gasoline	095 -- Recreational - 2sATV
043 -- Industrial - LPG	096 -- Recreational - 4sATV
044 -- Industrial - CNG	097 -- Recreational - Offroad MC
050 -- Lawn & Garden -Total	098 -- Recreational - Snowmobile
051 -- Lawn & Garden - Diesel	099 -- Rec Marine - PWC (backcast to ~zero in 1970; =092 for 1996 and after)
052 -- Lawn & Garden - Gasoline	100 -- Oil Field - Total
053 -- Lawn & Garden - LPG	101 -- Oil Field - Diesel
054 -- Lawn & Garden - CNG	102 -- Oil Field - Gasoline
060 -- Light Commercial - Total	103 -- Oil Field - LPG
061 -- Light Commercial - Diesel	104 -- Oil Field - CNG
062 -- Light Commercial - Gasoline	

The format for this data is as follows:

Packet Identifier: /INDICATOR/

Column	Description
1 - 5	State/county code (FIPS)
7 - 10	Indicator code (arbitrary alphanumeric code)
12 - 21	Equipment code (SCC)
23 - 27	Minimum HP of range
28 - 32	Maximum HP of range
34 - 43	Technology type

The /GROWTH/ packet contains the estimated values used to compute growth factors for each of the indicator codes. The /GROWTH/ data packet specifies an estimated value by state/county code (FIPS), a growth indicator code, and year. The model will use the estimated values from the year(s) closest to the base year (the year of the input equipment population estimate) and the year(s) closest to the projection year (the specified growth year), interpolating as needed. It then calculates an annual growth factor based on the increase in the estimated values. The growth may be defined by State or County through the FIPS code. At least two years need to be provided to indicate a growth rate, but more may be included to provide for a variable rate over certain periods as shown in the example below.

```
.........
.........
FIPS SUBR  Year Code          Indicator Value
/GROWTH/
00000      1996  010                     1000
00000      1996  011                     1000
.........
.........
00000      2000  010                     1240
00000      2000  011                     1277
.........
.........
00000      2005  010                     1553
00000      2005  011                     1622
.........
.........
```

The data is easily modified by editing the text file. The growth rate is determined from the ratio of indicator values in one year compared to another, so the choice of value for the base year (1000 in the example above) is not restricted (except for zero). The indicator may be actual estimates (e.g. number of employees) or any other kind of indicator as long as it is understood that future years will be compared with the base year, so the units for the indicator must be consistent.

The resulting annual growth rate is applied to base year populations to obtain future-year predictions (or prior year backcasting) of equipment populations. Global FIPS codes can be used to provide estimated values for an entire state or even the entire country. The model will use the most refined data; county-specific where it is available.

Caution: County-level growth inputs (if provided) are only used by the model when a specific county is specified in the OPTions file. If a statewide county-level run is done, then the statewide growth will be applied for every county, regardless of the county specific growth inputs.

The format for this data is as follows:

Packet Identifier: /GROWTH/

Column	Description
1 - 5	State/county code (FIPS)
6 - 10	Subregion code (blank = applies to all subregions
11 - 15	Year of estimate (4-digit year)
17 - 20	Indicator code (arbitrary alphanumeric code)
26 - 45	Estimated value

An additional packet that must appear in the growth files is the /SCRAPPAGE/ packet. This packet contains the definition of the default scrappage curve used for the model year distribution calculations. All equipment types in which the scrappage flag in the population file is set to DEFAULT will use this scrappage curve. The scrappage curve is the percentage of equipment scrapped as a function of the fraction of useful life consumed. For example, the default scrappage curve has 9 percent of equipment scrapped when the equipment has reached 45 percent of its median expected life.

The format for this data is as follows:

Packet Identifier: /SCRAPPAGE/

Column	Description
1 - 10	Fraction of median expected life already consumed
11 - 20	Percentage of equipment scrapped

An optional packet of the growth data file is the /ALTERNATE SCRAPPAGE/ packet. This optional packet can be used to define scrappage curves that are used in place of the default scrappage curve for selected equipment types. To apply the /ALTERNATE SCRAPPAGE/ curve to an equipment type, you must first modify the records of the population file for the

selected equipment type by changing the scrappage flag from DEFAULT to some user-defined name. The name can be any alpha-numeric string up to 10 characters in length (e.g., "chain saw" or "motorcycle"). The next step is the creation of the /ALTERNATE SCRAPPAGE/ packet. The packet is similar to the /SCRAPPAGE/ packet in form, but allows for multiple columns for defining up to 10 alternate scrappage curves for various equipment groups. The first field is the fraction of useful life consumed. The remaining columns, one for each alternate scrappage curve, contain the percentage of units scrapped. Another significant difference between this packet and the /SCRAPPAGE/ curve is that the first record is used to identify the name of the scrappage curves. These names must match the name used to replace the DEFAULT value of the scrappage flag in the population files. An example of an alternate scrappage curve is provided in *nation.grw*. These data are not referenced in the NONROAD model population files, but simply provided as an example of an alternate scrappage curve.

The format for this data is as follows:

Packet Identifier: /ALTERNATE SCRAPPAGE/

	Column	Description
Line 1:	1 - 10	not used
	11 - 20	Name used to identify scrappage curve 1
	21 - 30	Name used to identify scrappage curve 2
	x1 - x0	up to 10 curves
Line 2+:	1 - 10	Fraction of median expected life already consumed
	11 - 20	Percentage of equipment scrapped in scrappage curve 1
	21 - 30	Percentage of equipment scrapped in scrappage curve 2
	x1 - x0	up to 10 curves

Allocation Files Packet

A list of spatial allocation files used by the core model is contained in the packet identified as /ALLOC FILES/. Specifically, the data in this packet is used to allocate from state-level equipment populations to county-level equipment populations. It could also be used to allocate national-level equipment populations to state-level. Alternatively, you can include additional data to allocate from county-level to subcounty-level (an example of subcounty allocation follows the description of the allocation file data format).

As seen in Figure 6-2, the /ALLOC FILES/ packet contains numerous data files; one for each of the indicators found in the *allocate.xrf* file. Similar to the population files found in the /POP FILES/ packet, the spatial allocation data files have been segregated into separate files by state and by indicator type for convenience and ease of data management. The first 20 characters of each line are ignored and contain a description of the file. These files contain surrogate

indicators used by the model for allocating equipment populations from a larger region type to a smaller region type (e.g., national-level to state-level or state-level to county-level).

Values for each indicator code are supplied both for the state total and for each county to facilitate the calculation of allocation fractions for the state equipment population. Below is a sample of the indicator values for one of the codes.

```
..........
..........
Column Format
1-3    Indicator code
6-10   FIPS code (can be global FIPS codes e.g. 06000 = all of CA)
11-15  Subregion code (blank means is entire nation, state or county)
16-20  Year of estimate or prediction
21-40  Indicator value
41+    optional description (unused)
------------------------------------------------------------------------------
/INDICATORS/
CON  48000      2003            45936058     TX
CON  48001      2003               37311     Anderson
CON  48003      2003               16290     Andrews
..........
..........
```

```
-----------------------------------------------------
This is the packet that defines the spatial
allocation files read by the model.
-----------------------------------------------------
/ALLOC FILES/
Air trans. empl.   :c:\nonroad\data\allocate\tx_airtr.alo
Undergrnd coal prod:c:\nonroad\data\allocate\tx_coal.alo
Construction cost  :c:\nonroad\data\allocate\tx_const.alo
Harvested acres    :c:\nonroad\data\allocate\tx_farms.alo
Golf course estab. :c:\nonroad\data\allocate\tx_golf.alo
Wholesale estab.   :c:\nonroad\data\allocate\tx_holsl.alo
Family housing     :c:\nonroad\data\allocate\tx_house.alo
Logging employees  :c:\nonroad\data\allocate\tx_loggn.alo
Landscaping empl.  :c:\nonroad\data\allocate\tx_lscap.alo
Manufacturing empl.:c:\nonroad\data\allocate\tx_mnfg.alo
Oil & gas employees:c:\nonroad\data\allocate\tx_oil.alo
Census population  :c:\nonroad\data\allocate\tx_pop.alo
RV Park establish. :c:\nonroad\data\allocate\tx_rvprk.alo
Snowblowers comm.  :c:\nonroad\data\allocate\tx_sbc.alo
Snowblowers res.   :c:\nonroad\data\allocate\tx_sbr.alo
Snowmobiles        :c:\nonroad\data\allocate\tx_snowm.alo
Rec marine inboard :c:\nonroad\data\allocate\tx_wib.alo
Rec marine outboard:c:\nonroad\data\allocate\tx_wob.alo
Locomotive NOx     :c:\nonroad\data\allocate\tx_rail.alo
/END/
```

Figure 6-2: /ALLOC FILES/ packet.

The files provided with the NONROAD model are:

Filename	Indicator Description
**_airtr.alo*	Number of employees in air transportation
**_coal.alo*	Underground coal production tons
**_const.alo*	Dollars spent on construction adjusted for the relative geographic costs of construction materials
**_farms.alo*	Harvested cropland
**_golf.alo*	Number of golf courses and country clubs
**_holsl.alo*	Number of wholesale establishments
**_house.alo*	Number of single and double (duplex) family homes
**_loggn.alo*	Number of employees in logging
**_lscap.alo*	Number of employees in landscaping services
**_mnfg.alo*	Number of employees in manufacturing
**_oil.alo*	Number of employees in oil & gas extraction, and drilling oil & gas wells
**_pop.alo*	Human population
**_rvprk.alo*	Number of recreational vehicle parks and campgrounds
**_sbc.alo*	Relative number of commercial snowblowers
**_sbr.alo*	Relative number of residential snowblowers
**_snowm.alo*	Snowmobiles: State-level registration, snowfall and inverse human population for county level
**_wib.alo*	Recreational marine state fuel consumption, county water surface area - Inboard
**_wob.alo*	Recreational marine state fuel consumption, county water surface area - Outboard
**_rail.alo*	Locomotive NOx - to allocate rail maintenance equipment

* Represents the two character state name abbreviation.

The format for these data is as follows:

Packet Identifier: /INDICATORS/

Column	Description
1 - 3	Indicator code
6 - 10	FIPS code (can be global FIPS codes e.g. 06000 = all of CA)
11 - 15	Subregion code (blank means entire nation, state, or county)
16 - 20	Year of estimate or prediction
21 - 40	Indicator value
41 - 45	Blank (unused)
46 +	Optional description (unused)

Modifying Inputs for Subcounty Runs

The NONROAD model has the capability of estimating emissions at a subcounty level provided that data for the subcounty level is supplied. To demonstrate how you can modify model inputs to estimate emissions at a subcounty level, we will again use the example found in Chapters 3 and 4 with the following revision:

> *You have been given an assignment to estimate the total emissions from residential lawn mowers with a horsepower range of 1 to 6 in the city of Austin, Texas for summertime, 1998.*

In simple terms, the methodology that the model will use to calculate emissions from lawn mowers with a horsepower range of 1 to 6 in Austin will be to first determine the number of lawn mowers (1 to 6 HP range) in Travis County (where Austin resides) based on an allocation indicator from the state-level to the county-level, and then in the Austin metropolitan area based on an allocation indicator from the county-level to the subregion-level. The allocation indicator that will be used for this example will be housing. Once the number of lawn mowers in Travis County has been supplied (either through a separate model run or locally available data), the model will then estimate the emissions from these sources in Austin (based on the ratio of the allocation indicator value from county-level to subregion-level).

To modify the input files for this scenario, follow these steps:

1. Create a subregion code for the county which, together with the state/county code in which the subcounty is contained, will be used to identify the data applied to the subcounty. Since the Austin metropolitan area is within Travis County, Texas, a region code could be identified as '48453Austn' where 48453 is the FIPS code for Travis County, Texas and 'Austn' is the subregion identifier for the Austin metropolitan area. The subregion identifier can only be up to five characters in length.

2. Estimate county-level equipment populations for each equipment type of interest. The most straightforward method for determining this estimate is to have the NONROAD model produce a county-level estimate using state-to-county allocation. For our example, the model would be run with the regional inputs set to

   Region level : COUNTY
   FIPS code : 48453

   and the /SOURCE CATEGORY/ packet modified to include Lawn and Garden residential lawn mowers.

res 2-stk mowers	:2260004010
res 4-stk mowers	:2265004010
res LPG mowers	:2267004010
res CNG mowers	:2268004010
res diesel mowers	:2270004010

3. Once the core model run is completed, use the reporting utility to generate a *Population and Fuel Consumption by HP and Source Classification* report. This will provide an estimate of the population of residential lawn mowers in Travis County. Next, you must enter the county-level population data into the population files using the FIPS code for the county where your subregion is located. For our example, the population file for the state of Texas (*nonroad\data\pop\TX.pop*) would be modified as shown in Figure 6-3 where:

   - 48000 is the FIPS code for the state of Texas;
   - 48453 is the FIPS code for Travis County;
   - 1996 is the year of population estimates;
   - 2265004010 is the SCC for 2-stroke residential lawn mowers (all engine types have been lumped into this SCC);
   - 1 and 3, and 3 and 6 are the minimum and maximum horsepower ranges, respectively;
   - 47.9 is the expected (median) life in number of hours at full load;
   - DEFAULT is the flag for scrappage distribution curve with default representing the standard curve; and
   - 1737 ($1<HP \leq 3$) and 86314 ($3<HP \leq 6$) represent the population estimates.
   - 2.55 and 4.1 are the average HP in the respective range (if blank model uses midpoint)

48000	1996 ...	1	3	2.55	47.9	DEFAULT	45442.8
48000	1996 ...	3	6	4.1	47.9	DEFAULT	2258444.9
48453	1996 ...	1	3	2.55	47.9	DEFAULT	1737.0
48453	1996 ...	3	6	4.1	47.9	DEFAULT	86314.0
48000	1996 ...	6	11	6.24	400	DEFAULT	744.6
48000	1996 ...	1	3	2.55	268	DEFAULT	2165.3
48000	1996 ...	3	6	4.1	268	DEFAULT	107612.6
48000	1996 ...	6	11	6.24	400	DEFAULT	35.5

Figure 6-3: Modified *TX.pop* file with population estimates for 2-stroke residential lawn mowers in Travis County (the SCC description, represented with three dots, has been removed from the display for readability).

With the exception of the FIPS code and the population estimate fields, the additional population county-level records will be identical to the corresponding state-level population records.

Note: The county-level equipment populations can be defined in a file other than the *(state name).pop* file. However, you must make sure that the name of this new file is listed in the /POP FILES/ packet of the options file.

4. For each of the allocation indicators that are used, you must next estimate the value of the indicator within the subcounty of interest. This value should be added to the appropriate allocation file, using the county FIPS code and the subregion code as the identifier.

   For our example, the allocation indicator that we will use is housing of the Austin metropolitan area which is estimated to be 112,970. To reflect this for our modeling scenario, the /INDICATOR/ packet of the housing allocation file for the state of Texas (*nonroad\data\allocate\TX_house.alo*) would be modified as shown in Figure 6-4.

```
HOU  48449       1997      7780   Titus County
HOU  48451       1997     30811   Tom Green County
HOU  48453       1997    191462   Travis County
HOU  48453Austn  1997    112970   Austin Metropolitan Area
HOU  48455       1997      4961   Trinity County
HOU  48457       1997      8420   Tyler County
HOU  48459       1997     10931   Upshur County
HOU  48461       1997      1470   Upton County
HOU  48463       1997      8261   Uvalde County
```

Figure 6-4: Modified *TX_house.alo* file showing housing of Austin.

5. Next, you must modify the /REGION/ packet of the options file to indicate a subcounty run. Specify Subcounty for the region level and include the list of partial counties by listing their FIPS code/subregion code pair. Figure 6-5 shows the /REGION/ packet modified for our example.

```
The remaining records define the regions to be included.
The type of data which must be specified depends on the
region level.

US TOTAL   -  Nothing needs to be specified.  The FIPS
              code 00000 is used automatically.

50STATE    -  Nothing needs to be specified.  The FIPS
              code 00000 is used automatically.

STATE      -  state FIPS codes

COUNTY     -  state or county FIPS codes.  State FIPS
              code means include all counties in the
              state.

SUBCOUNTY  -  county FIPS code and subregion code.
-----------------------------------------------------
/REGION/
Region Level       :SUBCOUNTY
                   :48453Austn
/END/
-----------------------------------------------
```

Figure 6-5: Modified /REGION/ packet showing subcounty region.

Note: Before running your subcounty modeling scenario, make sure that the /POP FILES/ and /ALLOC FILES/ packets of the option file lists the file names of the data files containing the newly created subcounty data.

6. Once you have completed steps 1 through 5 described above, create an options file incorporating the modified packets that reflect the subregion data, save the file under an appropriate name, and run the modeling scenario.

Emission Factors Files Packet

Simply put, emission factors are the rate at which emissions are produced for a particular process. In the NONROAD model, the names of the emission factors files for a variety of species and engine operating modes are contained in the packet identified as /EMFAC FILES/. Similar to the /RUNFILES/ packet, each filename must be preceded by a keyword. The keyword identifies the species or operating mode that is contained in the associated data file.

Note: The EPA does not expect users to have local data on emission factors. If you know of a study on emission factors that was not incorporated into the model inputs, please e-mail the nonroad modeling team at nonroad@epa.gov

The valid species/modes (keywords) are as follow:

BSFC	HOT SOAKS
THC EXHAUST	RUNINGLOSS
CO EXHAUST	TANK PERM
NOX EXHAUST	NON-RM HOSE PERM
PM EXHAUST	RM FILL NECK PERM
SPILLAGE	RM SUPPLY/RETURN
DIURNAL	RM VENT PERM
CRANKCASE	

Note: SO_X and CO_2 emissions are computed as a function of the BSFC factors and adjusted exhaust hydrocarbons, therefore there is no emission factor file for these species. Vapor displacement is computed as a function of fuel volume used, temperature, RVP, and refueling mode (pump vs. container) so no emission factor file is required. Similarly, fuel spillage is computed as a function of fuel volume used, tank size, and refueling mode.

As seen in Figure 6-6, these species/modes are contained in separate data files. The file names can appear in any order in the packet and are identified by the keyword(s). If a species/mode is not included in an option file, all data for that species/mode will be reported as missing. For example, if there is no data file for PM emission factors, the PM field of the output data file will contain all missing values. The exception is BSFC which is a required file.

```
-----------------------------------------------------
This is the packet that defines the emission factor
files read by the model.
-----------------------------------------------------
/EMFAC FILES/
BSFC               :c:\nonroad\data\emsfac\bsfc.emf
THC EXHAUST        :c:\nonroad\data\emsfac\exhthc.emf
CO EXHAUST         :c:\nonroad\data\emsfac\exhco.emf
NOX EXHAUST        :c:\nonroad\data\emsfac\exhnox.emf
PM EXHAUST         :c:\nonroad\data\emsfac\exhpm.emf
SPILLAGE           :c:\nonroad\data\emsfac\spillage.emf
DIURNAL            :c:\nonroad\data\emsfac\evdiu.emf
CRANKCASE          :c:\nonroad\data\emsfac\crank.emf
HOT SOAKS          :c:\nonroad\data\emsfac\evhotsk.emf
RUNNING LOSS       :c:\nonroad\data\emsfac\evrunls.emf
TANK PERM          :c:\nonroad\data\emsfac\evtank.emf
NON-RM HOSE PERM   :c:\nonroad\data\emsfac\evhose.emf
RM FILL NECK PERM  :c:\nonroad\data\emsfac\evneck.emf
RM SUPPLY/RETURN   :c:\nonroad\data\emsfac\evsupret.emf
RM VENT PERM       :c:\nonroad\data\emsfac\evvent.emf
/END/
```

Figure 6-6: /EMFAC FILES/ packet.

The spillage data file does not contain emission factors. It simply indicates if a source is a gasoline pump or a portable container and provides the inputs for tank and hose materials and dimensions. The equations for computing spillage and vapor displacement emissions differ for portable containers and gasoline pumps. Therefore, if the spillage file is not included in the option file then both spillage and vapor displacement emissions will be reported as missing.

Data Files in the /EMFAC FILES/ Packet

Data files provided with the NONROAD model include:

Filename	Description
Bsfc.emf	Brake specific fuel consumption factors
Crank.emf	Emission factors data for crankcase emissions
Evdiu.emf	Emission factors data for diurnal emissions
Evhose.emf	Emission factors data for non-metal hose permeation THC for non-rec-marine equipment
Evhotsk.emf	Emission factors data for hot soak emissions
Evneck.emf	Emission factors data for non-metal fill neck hose permeation THC for rec-marine equipment
Evrunls.emf	Emission factors data for running loss emissions
Evsupret.emf	Emission factors data for non-metal supply/return hose permeation THC for rec-marine equipment

Filename	Description
Evtank.emf	Emission factors data for tank permeation THC
Evvent.emf	Emission factors data for non-metal vent hose permeation THC for rec-marine equipment
Exhco.emf	Emission factors data for exhaust CO emissions
Exhnox.emf	Emission factors data for exhaust NOx emissions
Exhpm.emf	Emission factors data for exhaust PM emissions
Exhthc.emf	Emission factors data for exhaust THC emissions
Spillage.emf	Pump or container specification and tank sizes for gasoline equipment types

The emission factors files provide the NONROAD model the zero-hour (brand new) engine exhaust emissions rates and adjustments used to determine evaporative emissions. The emission factors used in the model are described in EPA's NONROAD documentation reports NR-009c for diesel and NR-010d for spark-ignition engines.

The exhaust emission factors files are adjusted for in-use emission rates within the NONROAD model using the information provided by the deterioration input files. The emission factors are defined by SCC, power level range, and tech type. The tech types must correspond to those provided in the tech type files so that the sales fractions of the equipment are matched to an emission factor.

Emission factor input file example (up to 10 tech types);

```
.........
.........
     2200000000     HpminHpmax     techtyT1  techtyT2  techtyT3  techtyp4  g/hp-hr   NOx
1900                               37.7      0         37.7      999.99
/EMSFAC/
.........
.........
     2270002003       750 9999     Base      T0        T1        T2        g/hp-hr   NOx
1900                               10.058    8.296     5.568     3.936
.........
.........
```

The units of the emission factor and the type of pollutant modeled must be specified. All exhaust emission factors currently are given in units of grams per horsepower-hour (g/hp-hr), but there is an option to use grams per hour (g/hr) or grams per gallon (g/gallon) and the activity rates in the activity file must be altered to match these units. The pollutants addressed by the exhaust emission factor files may be THC, CO, NOx, or PM, and the file labeled *BSFC.emf* provides the fuel consumption factors. (For the fuel consumption file no option is available for the units and must be in units of pounds per horsepower-hour.) Crankcase emission factor inputs are just multipliers that the model applies to the corresponding THC exhaust emissions.

Note: An exception to the default input units is made for offroad motorcycles and ATVs. Instead of g/hp-hr these emission factors are actually grams per mile, even though they are listed as g/hp-hr. Corresponding deviations occur in the activity inputs (miles per year instead of hours per year); load factor is set at 1.0 instead of an actual load factor; and in the population file inputs the "Hp" is set at 1.0, and the median life is actually miles instead of hours at full load.

In calculating emissions using these files, the model will use the emission factor for the closest year that is less than or equal to the current model year. The actual emission factors could have been given specifically for the year in which they are valid, but EPA has chosen to incorporate the phase-in of emission standards through the use of the tech types rather than in the emission factor file because it is easier to incorporate phase-in and different deterioration rates using tech types for new emission standards. In the example above, while the emission factor for Tier 2 diesel pavers is valid starting in the year 1900, the fraction of Tier 2 engines is nonzero only when the technology type file shows the phase-in of this standard beginning with the 2006 model year.

The diurnal emission factor input file supplies the NONROAD model with emission factor multipliers. The core model contains coding to calculate uncontrolled diurnal vapor generation based on input temperature swings (daily maximum minus minimum) and tank sizes. The emission factor multipliers in the diurnal input file adjust those internally calcualted values to account for thngs such as diffusion (vapor loss through an orifice at constant temperature), decreased tank temperature swings in boat tanks due to water temperatures, and any emission controls. Further details can be found in NONROAD technical report NR-012c, "Nonroad Evaporateve Emission Rates." The pollutant for diurnal emissions is, of course, THC but it still must be specified.

```
.............
.............
     2200000000     HPmn HPmx     techtyp1  techtyp2...  Units   Pollutant
/EMSFAC/
     2260000000          0   25    ALL       Mult       THC
1900                             1.46
     2260000000         25 9999    ALL       Mult       THC
1900                             1.46
.............
.............
```

The format for the data in the BSFC and the emission factors files is as follows:

Packet Identifier: /EMSFAC/

Column		Description
Line 1:	6 - 15	SCC code (globals can be used)
	21 - 25	Beginning of horsepower range
	26 - 30	End of horsepower range
	35 - 44	Technology type 1
	x5 - x4	Technology type 2 ... (repeating field)
	x5 - x4	Units options: g/hr of equipment use g/hp-hr of equipment use g/gallon of fuel use g/tank per day per gallon of tank volume g/day per calendar day mult
	x5 - x4	Pollutant
Line 2:	1 - 5	Year
	35 - 44	Emission factors for technology type 1
	x5 - x4	Emission factors for technology type 2 ... (repeating)

Note: The units field is ignored in the BSFC file; the units are lbs of fuel/hp-hr. The units field is 'MULT' in the crankcase and diurnal files where the emission factor is treated as a multiplier.

The format for the data in the spillage data file is as follows:

Packet Identifier: /EMSFAC/

Column		Description
Line 1:	1 - 10	SCC code (globals can be used)
	12 - 51	Equipment name
	54 - 62	Fill method (PUMP or CONTAINER)
	64 - 67	Range indicator code (HP or TANK)
	69 - 73	Beginning of horsepower range or tank volume range
	74 - 78	End of horsepower range or tank volume range (HP ranges must match those internal to model)
	79 - 88	Evaporative technology type
	90 - 99	Units (GALLONS or GAL/HP)

103 - 112	Tank size estimate (either gallons or gal/hp)
113 - 120	Fraction of tank filled with fuel (for diurnal calcs)
121 - 130	Tank metal fraction
131 - 140	Non-rec-marine hose length (meters)
141 - 150	Non-rec-marine hose diameter (meters)
151 - 160	Non-rec-marine hose metal fraction
161 - 170	Rec-marine fill neck hose length (meters)
171 - 180	Rec-marine fill neck hose diameter (meters)
181 - 190	Rec-marine supply/return hose length (meters)
191 - 200	Rec-marine supply/return hose diameter (meters)
201 - 210	Rec-marine vent hose length (meters)
211 - 220	Rec-marine vent hose diameter (meters)
221 - 230	Hot soak starts per hour of operation
231 - 240	Diurnal all non-rec marine/rec-marine portable plastic (get 0.78 factor)
241 - 250	Diurnal rec-marine installed plastic tank on trailer (get 50% temperature swing reduction)
251 - 260	Diurnal rec-marine installed plastic tank in water (get 80% temperature swing reduction)
261 - 270	Diurnal rec-marine installed metal tank on trailer (get 50% temperature swing reduction)
271 - 280	Diurnal rec-marine installed metal tank in water (get 80% temperature swing reduction)

Deterioration Factors Files Packet

Generally speaking, as a piece of equipment or vehicle ages over time, the rate at which pollutants are emitted increases. The data in the deterioration input files are used to adjust the emission factors for in-use deterioration, and the data used in the default files is discussed in EPA's NONROAD documentation reports NR-009c and NR-011b. The names of the files which contain the deterioration factors used by the core model to estimate this increase in emissions are contained in a packet identified as /DETERIORATE FILES/ (Figure 6-7). Similar to the /EMFAC FILES/ packet, each filename must be preceded by a keyword. The valid species/modes are the same as for the /EMFAC FILES/, with the exception that BSFC, CRANKCASE, and SPILLAGE are not recognized.

```
-----------------------------------------------------
This is the packet that defines the deterioration factors
files read by the model.
-----------------------------------------------------
/DETERIORATE FILES/
THC EXHAUST         :c:\nonroad\data\detfac\exhthc.det
CO EXHAUST          :c:\nonroad\data\detfac\exhco.det
NOX EXHAUST         :c:\nonroad\data\detfac\exhnox.det
PM EXHAUST          :c:\nonroad\data\detfac\exhpm.det
DIURNAL             :c:\nonroad\data\detfac\evdiu.det
HOT SOAKS           :c:\nonroad\data\detfac\evhotsk.det
RUNNING LOSS        :c:\nonroad\data\detfac\evrunls.det
TANK PERM           :c:\nonroad\data\detfac\evtank.det
NON-RM HOSE PERM    :c:\nonroad\data\detfac\evhose.det
RM FILL NECK PERM   :c:\nonroad\data\detfac\evneck.det
RM SUPPLY/RETURN    :c:\nonroad\data\detfac\evsupret.det
RM VENT PERM        :c:\nonroad\data\detfac\evvent.det
/END/
```

Figure 6-7: /DETERIORATION FILES/ packet.

Note: The EPA does not expect users to have local data on deterioration factors. If you know of a study on deterioration factors that was not incorporated into the model inputs, please e-mail the nonroad modeling team at nonroad@epa.gov

Data Files in the /DETERIORATE FILES/ Packet

The deterioration factors are specified by technology type. An "ALL" in the technology type field indicates that the deterioration factors apply to all technology types. The values are actually the coefficients of the deterioration equation

$$DF = 1 + A \times \text{engine age}^{b},$$

where A and b are provided in the file. The input file also provides a cap on the deterioration, to prevent further deterioration past a certain relative age. A sample of the look and estimates in a deterioration file is shown in the example below.

```
.........
.........
Tech Type               A coeff   b coeff   Age Cap Pollutant
/DETFAC/
.........
.........
Base                      0.024       1.0       1.0       NOx
T0                        0.024       1.0       1.0       NOx
T1                        0.024       1.0       1.0       NOx
T2                        0.009       1.0       1.0       NOx
T3                        0.008       1.0       1.0       NOx
.........
.........
```

Data provided with the NONROAD model include:

Filename	Description
Evdiu.det	Deterioration factors data for diurnal emissions
Evhose.det	Deterioration factors data for hose permeation for non-rec-marine equipment
Evhotsk.det	Deterioration factors data for hot soak emissions
Evneck.det	Deterioration factors data for fill neck hose permeation for rec-marine equipment
Evrunls.det	Deterioration factors data for running loss emissions
Evsupret.det	Deterioration factors data for supply/return hose permeation for rec-marine equipment
Evtank.det	Deterioration factors data for tank permeation
Evvent.det	Deterioration factors data for vent hose permeation for rec-marine equipment
Exhco.det	Deterioration factors data for exhaust CO emissions
Exhnox.det	Deterioration factors data for exhaust NOx emissions
Exhpm.det	Deterioration factors data for exhaust PM emissions
Exhthc.det	Deterioration factors data for exhaust THC emissions

The format for the data in deterioration factors files is as follows:

Packet Identifier: /DETFAC/

Column	Description
1 - 10	Technology type
21 - 30	A coefficient of equation
31 - 40	b coefficient of equation
41 - 50	Emission Cap (in median life units)
51 - 60	Pollutant

PM Base Sulfur Packet

The /PM BASE SULFUR/ packet contains diesel sulfur weight percents corresponding to the input diesel PM emission factors for each diesel technology type. The default is 0.3300 (3300 ppm), but Tier 2 and later diesel emission factors are based on lower sulfur fuel. These values are used by the model to adjust the calculated diesel PM emissions for in-use sulfur levels that differ from these base sulfur levels. For the details of this adjustment refer to technical report NR-009c, "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling -- Compression-Ignition." As with the emission factor inputs, EPA does not expect users to have local data, and users are not expected to change anything in this packet.

The format for this data is as follows:

Packet Identifier: /PM BASE SULFUR/

Column	Description
1 - 10	Diesel technology type
11 - 20	Base sulfur wt percent; or '1.0' means no-adjustment
21 - 30	Sulfate conversion rate

The default values contained in this packet are as follows:

```
/PM BASE SULFUR/
T2      0.2000   0.02247
T3      0.2000   0.02247
T3B     0.0500   0.02247
T4A     0.0500   0.02247
T4B     0.0015   0.02247
T4      0.0015   0.30
T4N     0.0015   0.30
/END/
```

EDITING INPUT DATA PACKETS AND FILES

For an advanced user of the NONROAD model, the process of incorporating locally-derived data into the core model is relatively straightforward. To make changes to the data files, simply use a text editor such as Microsoft's Notepad or WordPad, or the Edit command in DOS, to access the data file. If a display font option is available, be sure to choose a mono-spaced font such as courier to show the data in the proper columns. Once you have accessed the data file that you want to change, type the revised data in the appropriate field. Once complete, save the modified file under a new name to prevent the overwriting of default data.

Note: When the NONROAD model is initially installed, all data files are in a subdirectory called Data in the Nonroad directory.

There are two methods for indicating that you want to use new data files in an option file. The first is through the Advanced Options menu in the graphical user interface which is described in Chapter 3. The second is by modifying the appropriate packets in the option file through a text editor.

MAKING MULTIPLE MODEL RUNS

Through a text editor or DOS, you can create a batch file that allows you to run the core model with many different scenarios. This capability provides you with the flexibility of setting up and running these scenarios when you have available computer time, such as in the evening. Figure 6-8 shows the batch file *milg.bat* (for Michigan lawn and garden run).

```
nonroad milg95.opt
nonroad milg96.opt
nonroad milg97.opt
nonroad milg98.opt
```

Figure 6-8: Batch file *milg.bat.*

A batch file can be easily created with a text editor. Open a text editor and simply type *"nonroad (option file).opt"* on consecutive lines for each of the option files you want to run. Save the batch file and close the editor. It is recommended that you name the file with a relevant name and the extension .bat.

To run a batch file in DOS, type "*(name of your batch file).bat*". From Windows 95 or above, drag the mouse to the menu bar and **Start ➤ Run**. Type the name of your batch file in the dialog box and specify **OK**.

CALCULATION OF NONROAD RETROFIT INVENTORIES & BENEFITS

The recommended method to model the effects of nonroad engine retrofits is to use the National Mobile Inventory Model (NMIM), since it can properly model a fleet specific retrofit program where the exact number and model year of engines is known. However, some limited retrofit modeling capability is now also available within NONROAD itself. This documentation refers only to retrofit modeling within NONROAD.

There are two types of retrofit program calculations that are possible: (A) normal NONROAD county or state fleetwide inventories, in which a specified fraction of certain categories of engines (SCC and Hp range) are retrofitted, or (B) fleet specific inventories in which a specific number of engines of a known fleet (SCC and Hp) are retrofitted. The specification of engine categories in both cases includes SCC, Hp range, and optionally the Technology Type. For the latter fleet specific calculation, NMIM should be used rather than NONROAD, since NONROAD does not allow you to specify the model year; in this case NONROAD will simply assign the same age distribution as in the fleetwide example. So if there is just one engine of a given SCC and Hp in the fleet, its emissions would be calculated as if a small fraction of that engine's emissions came from many different model years.

Retrofit Inputs

The user must create a retrofit input file containing the desired retrofit information. This is a plain text file that includes the following parameters for each subset of engines being retrofitted and each pollutant affected. These parameters must be entered in the columns specified – there are no tabs or commas as delimiters. These data lines are preceded by a single line containing the retrofit packet identifier "/RETROFIT/" (without quotes) and the line following the last data line is the "/END/" end-of-packet identifier. Anything in the file outside of this packet is ignored, and can be used for comments if desired.

The format of the data lines is as follows:

Column	Type	Description
1 - 4	integer	Retrofit Year start (first calendar year when retrofits are done)
5		Blank
6 - 9	integer	Retrofit Year end (last calendar year when retrofits are done)
10		Blank
11 - 14	integer	Model Year start (first model year that is receiving retrofit)
15		Blank
16 - 19	integer	Model Year end (last model year that is receiving retrofit)

20		Blank
21 - 30	character	SCC Code
31		Blank
32 - 41	character	Exhaust Technology Type (e.g., Base, T0, T1, T2, T2M or ALL)
42		Blank
43 - 47	real	Minimum HP (min < Hp <= max)
48 - 52	real	Maximum HP (min < Hp <= max)
31		Blank
54 - 71	real	Annual Fleetwide Retrofit Fraction (0.0 - 1.0), or for fleet-specific case the actual Number Retrofitted (greater than 1.0)
72		Blank
73 - 78	real	Retrofit Effectiveness. Range = 0.0 - 1.0 (zero is no benefit)
79		Blank
80 - 89	character	Exhaust Pollutant affected by retrofit (HC, CO, NOx, or PM)
90		Blank
91 - 95	integer	Retrofit identifier (use same arbitrary number for different pollutants being affected by same retrofit)
96+		Optional description of the retrofit technology. Not read into model.

The Technology Type does not need to be entered, but is available in case a user knows which tech type within a mixed (phase-in) model year is appropriate for the retrofit. By default (i.e., if the field is left blank, or if "ALL" is entered) NONROAD will apply the retrofit effects to the entire model year inventory for that SCC, Hp bin, and model year (sum of all tech types for that model year).

The retrofit data file can include equipment that is not included in the SCCs being modeled. Any such retrofit specifications are simply ignored, since there is no equipment in the modeling run to apply the retrofits to.

Example NONROAD Retrofit Data File

```
RYst RYen MYst MYen SCC        TechType    HPmn HPmx AnnualRetroFracOrN Effect Pollutant  RetID
---- ---- ---- ---- ---------- ---------- ---------- ------------------ ------ ---------- -----
/RETROFIT/
2008 2009 1996 1997 2270002000 ALL           50  300               0.05   0.50 PM             1
2008 2008 1991 1996 2270002069 T1           175  600               0.06   0.15 NOx            1
2006 2007 1996 1997 2270000000 ALL           25   75               0.05   0.80 PM             2
2008 2008 1996 1997 2270000000 ALL           25   75               0.08   0.90 PM             3
/END/
```

This example is provided to only to help clarify the retrofit input format. For guidance on actual program input development, the user should consult the EPA document "Guidance for Quantifying and Using Emission Reductions from Mobile Source Retrofit Projects in State Implementation Plans and Transportation and General Conformity."

Chapter 7 *Trouble Shooting*

The NONROAD model does extensive validation of input data. Data initialization includes checking that each required input packet exists in the input option file and that the specified data values are within acceptable ranges. If the model detects unreasonable data, an error message is written and the program terminates. Specified data files must exist and include the necessary data elements. The messages written by the model are generally sufficient in determining where a problem exists.

MESSAGE FILE

The output message file should be reviewed after each model run. An example of an output message file is shown in Figure 7-1.

This file includes the NONROAD model title and version number, date and time of execution, and a summary of each packet in the input option file. In addition, warning messages may be seen informing you of possible problems. Consider the message, "WARNING: Cannot find /DETERIORATE FILES/ packet of the options file. Factors for all species will be set to 1.0 (no deterioration)." You may determine that this is acceptable to you for your application. However, you may also want to review your data to determine if you can provide additional information.

In general, warning messages allow the model to make generalizations and provide a default action if a data item is not found; this includes skipping some records. It is important to note that although default action can occur it is meant to be the exception. Therefore, if the model issues the same warning message more than 50 times it will terminate processing. This ensures that lengthy runs will not process invalid data.

```
  EPA`s NONROAD Emissions Model, Core Model Ver 2005, Nov 2005     Nov 29
15:40:56: 2005

                  *** Output Files ***

         Output data file    :c:\nonroad\outputs\travis.out
         Exhaust By-Model-Yea:OUTPUTS/TEST.BMX
         Evap By-Model-Year f:OUTPUTS/TEST.BMV

                  *** Input Files ***

         Options file        :C:\NONROAD\TRAVIS.OPT
         Allocation XREF file:data/allocate/allocate.xrf
         Activity file       :data/activity/activity.dat
         State/Regions file  :data/season/season.dat
         Seasonality file    :data/season/season.dat
         Exh Tech fractions  :data/tech/tech-exh.dat
         Evap Tech fractions :data/tech/tech-evp.dat
         US Counties FIPS    :data/allocate/fips.dat
         Retrofit file       :

                  *** Population Files ***

                           :c:\nonroad\data\pop\tx.pop

                  *** Daily Files ***

         Daily Temp/RVP file :DATA/DAILY/DAYTMPRV.DAT

 WARNING:  Cannot find TANK PERM filename in /EMFAC FILES/ packet of options file.
           All factors for this species will be set to missing.

 WARNING:  Cannot find NON-RM HOSE PERM filename in /EMFAC FILES/ packet of
options file.
           All factors for this species will be set to missing.

 WARNING:  Cannot find RM FILL NECK PERM filename in /EMFAC FILES/ packet of
options file.
           All factors for this species will be set to missing.

 WARNING:  Cannot find RM SUPPLY/RETURN filename in /EMFAC FILES/ packet of
options file.
           All factors for this species will be set to missing.

 WARNING:  Cannot find RM VENT PERM filename in /EMFAC FILES/ packet of options
file.
           All factors for this species will be set to missing.

                  *** Emission Factors Files ***

         BSFC file           :data/emsfac/bsfc.emf
         THC EXHAUST file    :data/emsfac/exhthc.emf
         CO EXHAUST file     :data/emsfac/exhco.emf
         NOX EXHAUST file    :data/emsfac/exhnox.emf
         CO2 EXHAUST file    : Not Supplied.
         SO2 EXHAUST file    : Not Supplied.
```

```
PM EXHAUST file     :data/emsfac/exhpm.emf
CRANKCASE file      :data/emsfac/crank.emf
DIURNAL file        :data/emsfac/evdiu.emf
TANK PERM file      : Not Supplied.
NON-RM HOSE PERM fil: Not Supplied.
RM FILL NECK PERM fi: Not Supplied.
RM SUPPLY/RETURN fil: Not Supplied.
RM VENT PERM file   : Not Supplied.
HOT SOAKS file      : Not Supplied.
DISPLACEMENT file   : Not Supplied.
SPILLAGE file       :data/emsfac/spillage.emf
RUNINGLOSS file     : Not Supplied.

          *** Deterioration Factors Files ***

THC EXHAUST file    :data/detfac/exhthc.det
CO EXHAUST file     :data/detfac/exhco.det
NOX EXHAUST file    :data/detfac/exhnox.det
CO2 EXHAUST file    : Not Supplied.
SO2 EXHAUST file    : Not Supplied.
PM EXHAUST file     :data/detfac/exhpm.det
CRANKCASE file      : Not Supplied.
DIURNAL file        :data/detfac/evdiu.det
TANK PERM file      : Not Supplied.
NON-RM HOSE PERM fil: Not Supplied.
RM FILL NECK PERM fi: Not Supplied.
RM SUPPLY/RETURN fil: Not Supplied.
RM VENT PERM file   : Not Supplied.
HOT SOAKS file      : Not Supplied.
DISPLACEMENT file   : Not Supplied.
SPILLAGE file       : Not Supplied.
RUNINGLOSS file     : Not Supplied.


          *** Spatial Allocation Files ***

                    :c:\nonroad\data\allocate\tx_airtr.alo
                    :c:\nonroad\data\allocate\tx_coal.alo
                    :c:\nonroad\data\allocate\tx_const.alo
                    :c:\nonroad\data\allocate\tx_farms.alo
                    :c:\nonroad\data\allocate\tx_golf.alo
                    :c:\nonroad\data\allocate\tx_holsl.alo
                    :c:\nonroad\data\allocate\tx_house.alo
                    :c:\nonroad\data\allocate\tx_loggn.alo
                    :c:\nonroad\data\allocate\tx_lscap.alo
                    :c:\nonroad\data\allocate\tx_mnfg.alo
                    :c:\nonroad\data\allocate\tx_oil.alo
                    :c:\nonroad\data\allocate\tx_pop.alo
                    :c:\nonroad\data\allocate\tx_rvprk.alo
                    :c:\nonroad\data\allocate\tx_sbc.alo
                    :c:\nonroad\data\allocate\tx_sbr.alo
                    :c:\nonroad\data\allocate\tx_snowm.alo
                    :c:\nonroad\data\allocate\tx_wib.alo
                    :c:\nonroad\data\allocate\tx_wob.alo
                    :c:\nonroad\data\allocate\tx_rail.alo
```

```
            *** Growth Indicator Files ***

                      :DATA/GROWTH/nation.grw

            *** Scenario Specific Parameters ***

First Title line    :Lawn and Garden Equipment
Second Title line   :Travis County Summertime
Fuel RVP (psi)      :  8.00
Fuel Oxygen weight %:  0.00
Gasoline Sulfur %   :  0.0340
Diesel Sulfur %     :  0.3300
Marine Diesel Sulfur:  0.3300
LPG/CNG Sulfur %    :  0.0030
Minimum Temperature : 60.00
Maximum Temperature : 84.00
Average Ambient Temp: 75.00
Altitude of region  :LOW
Stage II Control %  :  0.00

            *** Period Parameters ***

Year of Inventory   :1998
Inventory for       :SEASONAL period
Emissions summed for:PERIOD TOTAL
Season              :SUMMER
Year of Growth Calc :1998
Year of Tech Sel    :1998

            *** Region of Interest ***

Region level        : County-level estimates
Counties of Interest
                    :48453 - Travis County, Texas

            *** Equipment Types ***

SCC codes Selected
                    :2260004010
                    :2260004011
                    :2260004015
                    :2260004016
                    :2260004020
                    :2260004021
                    :2260004025
                    :2260004026
                    :2260004030
                    :2260004031
                    :2260004035
                    :2260004036
                    :2260004040
                    :2260004041
                    :2260004045
                    :2260004046
                    :2260004050
```

```
:2260004051
:2260004055
:2260004056
:2260004060
:2260004061
:2260004065
:2260004066
:2260004071
:2260004075
:2260004076
:2265004010
:2265004011
:2265004015
:2265004016
:2265004020
:2265004021
:2265004025
:2265004026
:2265004030
:2265004031
:2265004035
:2265004036
:2265004040
:2265004041
:2265004045
:2265004046
:2265004050
:2265004051
:2265004055
:2265004056
:2265004060
:2265004061
:2265004065
:2265004066
:2265004071
:2265004075
:2265004076
:2267004010
:2267004011
:2267004015
:2267004016
:2267004020
:2267004021
:2267004025
:2267004026
:2267004030
:2267004031
:2267004035
:2267004036
:2267004040
:2267004041
:2267004045
:2267004046
:2267004050
:2267004051
```

```
:2267004055
:2267004056
:2267004060
:2267004061
:2267004065
:2267004066
:2267004071
:2267004075
:2267004076
:2268004010
:2268004011
:2268004015
:2268004016
:2268004020
:2268004021
:2268004025
:2268004026
:2268004030
:2268004031
:2268004035
:2268004036
:2268004040
:2268004041
:2268004045
:2268004046
:2268004050
:2268004051
:2268004055
:2268004056
:2268004060
:2268004061
:2268004065
:2268004066
:2268004071
:2268004075
:2268004076
:2270004010
:2270004011
:2270004015
:2270004016
:2270004020
:2270004021
:2270004025
:2270004026
:2270004030
:2270004031
:2270004035
:2270004036
:2270004040
:2270004041
:2270004045
:2270004046
:2270004050
:2270004051
:2270004055
```

```
                            :2270004056
                            :2270004060
                            :2270004061
                            :2270004065
                            :2270004066
                            :2270004071
                            :2270004075
                            :2270004076

 **** Number of Population Records Found ****

                  48000 Texas                                    :  158
```

Figure 7-1: Output message file.

DATA FILE RELATIONSHIPS

One of the difficulties a novice user may have is understanding the relationships between different input files. The following is an example of possible problems as a result of providing some new data but not enough.

Allocation Files

The allocation cross reference file defines for each source category the allocation indicator and a corresponding coefficient to be used to allocate equipment population. If you have local data on the use of snowmobiles in your modeling domain, you can specify a new indicator code and then provide the allocation data for the new code. For example, adding 2260001020, recreational snowmobiles, with an indicator code of SNO to the allocation cross reference file means you must provide an allocation file for the SNO indicator.

In addition, you must remember to update the options file to reference the new files and data which you have created. The packet /ALLOC FILES/ must include the new allocation filename for the SNO indicator data. And if you made changes to a copy of the cross reference file you must be sure to specify the new cross reference file name in the /RUNFILES/ packet of the options file (perhaps *alloupd.xrf*).

Population Data

The equipment population data can contain records of any or mixed region levels and the model will use the most detailed provided. If you want to estimate county total emissions, then you can either provide state level equipment populations **and** state-to-county allocation data or you can provide county equipment populations. If equipment population is provided at the level for which emissions are being reported then, no allocation is needed. Only when equipment

populations are provided at a coarser level of detail than the level you are estimating will allocation data be required.

In addition to defining equipment populations and corresponding allocation data you must also include the data file names in the /POP FILES/ and /ALLOC FILES/ packets of the input option file.

APPENDIX A

EXAMPLES OF FIPS CODES

Refer to data file *fips.dat*, included with the NONROAD model, in the data\allocate directory for a complete list of FIPS codes.

State Name	FIPS	COUNTY
	00000	United States Total
Alabama	01000	The State of Alabama
Alabama	01001	Autauga County
Alabama	01003	Baldwin County
Alabama	01005	Barbour County
Alabama	01007	Bibb County
Alabama	01009	Blount County
Alabama	01011	Bullock County
Alabama	01013	Butler County
Alabama	01015	Calhoun County
Alabama	01017	Chambers County
Alabama	01019	Cherokee County
Alabama	01021	Chilton County
Alabama	01023	Choctaw County
Alabama	01025	Clarke County
Alabama	01027	Clay County
Alabama	01029	Cleburne County
Alabama	01031	Coffee County
Alabama	01033	Colbert County
Alabama	01035	Conecuh County
Alabama	01037	Coosa County
Alabama	01039	Covington County
Alabama	01041	Crenshaw County
Alabama	01043	Cullman County
Alabama	01045	Dale County
Alabama	01047	Dallas County
Alabama	01049	De Kalb County
Alabama	01051	Elmore County
Alabama	01053	Escambia County
Alabama	01055	Etowah County
Alabama	01057	Fayette County
Alabama	01059	Franklin County
Alabama	01061	Geneva County
Alabama	01063	Greene County
Alabama	01065	Hale County
Alabama	01067	Henry County
Alabama	01069	Houston County
Alabama	01071	Jackson County
Alabama	01073	Jefferson County
Alabama	01075	Lamar County
Alabama	01077	Lauderdale County
Alabama	01079	Lawrence County
Alabama	01081	Lee County
Alabama	01083	Limestone County
Alabama	01085	Lowndes County
Alabama	01087	Macon County
Alabama	01089	Madison County
Alabama	01091	Marengo County

Alabama	01093	Marion County
Alabama	01095	Marshall County
Alabama	01097	Mobile County
Alabama	01099	Monroe County
Alabama	01101	Montgomery County
Alabama	01103	Morgan County
Alabama	01105	Perry County
Alabama	01107	Pickens County
Alabama	01109	Pike County
Alabama	01111	Randolph County
Alabama	01113	Russell County
Alabama	01115	St Clair County
Alabama	01117	Shelby County
Alabama	01119	Sumter County
Alabama	01121	Talladega County
Alabama	01123	Tallapoosa County
Alabama	01125	Tuscaloosa County
Alabama	01127	Walker County
Alabama	01129	Washington County
Alabama	01131	Wilcox County
Alabama	01133	Winston County
Alaska	02000	The State of Alaska
Alaska	02013	Aleutians East Borough
Alaska	02016	Aleutians West Census Area
Alaska	02020	Anchorage Borough
Alaska	02050	Bethel Census Area
Alaska	02060	Bristol Bay Borough
Alaska	02068	Denali Borough
Alaska	02070	Dillingham Census Area
Alaska	02090	Fairbanks North Star Borough
Alaska	02100	Haines Borough
Alaska	02110	Juneau Borough
Alaska	02122	Kenai Peninsula Borough
Alaska	02130	Ketchikan Gateway Borough
Alaska	02150	Kodiak Island Borough
Alaska	02164	Lake and Peninsula Borough
Alaska	02170	Matanuska-Susitna Borough
Alaska	02180	Nome Census Area
Alaska	02185	North Slope Borough
Alaska	02188	Northwest Arctic Borough
Alaska	02201	Prince of Wales-Outer Ketchikan Census Area
Alaska	02220	Sitka Borough
Alaska	02232	Skagway-Yakutat-Angoon Census Area
Alaska	02240	Southeast Fairbanks Census Area
Alaska	02261	Valdez-Cordova Census Area

APPENDIX B

SOURCE CLASSIFICATION CODES (SCC) AND DEFINITIONS

SOURCE CATEGORY CODE USE AND DEFINITIONS

This appendix provides a description of the Source Category Codes (SCC) used in the NONROAD model. The NONROAD model uses SCCs to define the application and engine types. The model uses a hierarchy with the SCC in that a general SCC may define information for all more detailed SCC values. For example, input data using SCC code 2265000000 applies to all SCCs beginning with 2265xxxxxx unless input data are entered for a more detailed SCC; e.g., 2265001000 will overwrite the general information for that SCC or group of SCCs. Likewise, 2265001000 applies to all Recreational equipment (2265001010, 226501020, 226501030, 226501050, and 226501060) unless specific data are provided for those SCCs. Use of these hierarchical SCC's allows model input data to be simplified if information is the same for similar equipment types.

The codes used in the NONROAD model are listed in Tables B-1 through B-20. These table provide additional explanation of each of these codes, and also the average, minimum, and maximum power levels for each equipment type. The equipment descriptions are derived from the earlier NEVES (EPA, 1991) report on emissions from nonroad engines, with additional groups defined in EPA's NONROAD documentation report NR-006c (found at http://www.epa.gov/otaq/nonrdmdl.htm).

SCCs are defines by EPA, and States and other NONROAD users are discouraged from adding their own equipment types to avoid confusion between different State uses. To define additional SCCs in the NONROAD model, the core model must be recompiled with the additional SCCs included in the code using a Lahey FORTRAN compiler with a "Make" utility and the "Make" file included in the source code. It is HIGHLY recommended that States not alter the source code; if additional applications are required, then a cooperative effort should be pursued with EPA staff to add them to the model.

Table B-1. Recreational vehicles equipment types and descriptions. (xx refers to '60' for 2-stroke gasoline, '65' for 4-stroke gasoline, '70' for diesel, '67' for LPG, 68 for CNG).

SCC	Equipment Type	Definition
22xx001020	Snowmobiles	Self-explanatory
22xx001030	ATV/Off-road motorcycles	All terrain vehicles (ATV) are four or three wheeled off-road bikes combined with two wheeled off-road motorcycles
22xx001050	Golf Carts	Self-explanatory
22xx001060	Specialty Vehicles	Any number of off-road vehicles not otherwise classified including utility and personnel carriers, ice maintenance (aka Zamboni), snow groomers, and other various vehicles

Table B-2. Construction equipment types and descriptions. (xx refers to '60' for 2-stroke gasoline, '65' for 4-stroke gasoline, '70' for diesel, '67' for LPG, 68 for CNG).

SCC	Equipment Type	Definition
22xx002003	Pavers	Large and small (such as for curbs) primarily self-propelled pavers
22xx002006	Tampers/ Rammers	Small 'handheld,' walk-behind, or single person sized equipment for compaction such as for sidewalk or other small area compaction
22xx002009	Plate Compactors	Similar to tamper/rammers with a larger vibrating plate instead of a ram
22xx002015	Rollers	Rollers include smooth and knobby (such as used in landfills and called "compactors" not to be confused with smaller Plate Compacters) self-propelled rollers
22xx002018	Scrapers	Special equipment type that is an off-highway tractor with a mid-frame bucket that lowers to scrape loose material (dirt) into the bucket to carry to another part of the job site to dump; sometimes converted to a water-wagon
22xx002021	Paving Equipment	Various equipment types used to smooth and distributing paving material including vibrators and finishers to support the work of the pavers
22xx002024	Surfacing Equipment	Other various equipment used to supplement paving activity including paving material mixers, surface profilers (road reclaiming chippers), and seal coating

SCC	Equipment Type	Definition
		equipment not used to distribute paving material as with paving equipment
22xx002027	Signal Boards	Includes both highway boards and light plants used for nighttime lighting
22xx002030	Trenchers	Large and small trenchers typically using a rotating front mounted rotating 'blade' to pull material from trench and distribute it to the side.
22xx002033	Bore/Drill Rigs	Self-explanatory drills or boring rigs of all types that are skid mounted, trailer mounted, or self-propelled; not to be confused with highway trucks with drill attachments running off the highway engine, though truck mounted nonroad engines\equipment exist
22xx002036	Excavators	Single purpose wheeled or tracked excavators (backhoe) distinct of multipurpose tractor/backhoe/loaders
22xx002039	Concrete/ Industrial Saws	Handheld and large engine powered saws for stone cutting.
22xx002042	Cement & Mortar Mixers	Small mixers used for small batch mixing
22xx002045	Cranes	Self-propelled typically cable hoists; not to be confused with highway trucks with crane attachments running off the highway engine, though truck mounted nonroad engines\equipment exist
22xx002048	Graders	Called road or motor graders often used to prepare a site, especially a road, for paving. A blade is mid-frame mounted with equipment having a long wheel base
22xx002051	Off-highway Trucks	Large off-highway dump trucks not certified for highway use
22xx002054	Crushing/Proc. Equipment	Various crushing and screening equipment for bulk material
22xx002057	Rough Terrain Forklifts	Rough terrain forklifts (RTF) can be confused with typical forklifts but have larger knobby off-road wheels and can be confused with rubber tire loaders but are specifically designed for handling palettes. RTFs include telescoping lift trucks called telescopic handlers often used in building construction.
22xx002060	Rubber Tire Loaders	Bucket loaders or front-end loaders with a front mounted bucket for scooping though other attachments can be used instead of a bucket

SCC	Equipment Type	Definition
22xx002066	Tractors/ Loaders/ Backhoes	Common and ubiquitous multipurpose equipment type that is most often referred to as a "backhoe" but include the combined functions of loading and a backhoe in one unit. Agricultural tractors with alternative attachments may used for similar purposes
22xx002069	Crawler Tractors/ Dozers	Tracked (not wheeled) loaders and dozers
22xx002072	Skid Steer Loaders	Smaller (able to be 'skid' mounted to transport to job site) loaders which may have alternative attachments than a bucket for loading
22xx002075	Off-Highway Tractors	Large tractors used to primarily drag large buckets or other equipment around a job or mine site, and agricultural tractors have been used for the same purpose
22xx002078	Dumpers/ Tenders	Small loaders and other trucks for confined space and light loads typically used for small building projects and are typically walk-behind equipment.
22xx002081	Other Construction Equipment	Miscellaneous category for equipment not categorized above; only example of this type supplied by PSR are tensioners which are large winches used in construction

Table B-3. Industrial equipment types and descriptions. (xx refers to '60' for 2-stroke gasoline, '65' for 4-stroke gasoline, '70' for diesel, '67' for LPG, 68 for CNG).

SCC	Equipment Type	Definition
22xx003010	Aerial Lifts	Various (telescoping, articulated, scissors, and other) lift equipment for personnel also called man lifts not to be confused with highway trucks with crane attachments running off the highway engine, though truck mounted nonroad engines\equipment exist to provide lifts for buckets
22xx003020	Forklifts	Small wheeled forklifts used for warehouses and other general purposes
22xx003030	Sweepers/ Scrubbers	Off-road primarily self-propelled sweeping and scrubbing vehicles
22xx003040	Other General Industrial Equipment	Miscellaneous category with examples such as sandblasters, large vacuum\spraying\other nonroad trucks, paint sprayers, general purpose spreaders, and winches.
22xx003050	Other Material Handling Equipment	Conveyers and other bulk material handling equipment
22xx003060	Refrigeration	Self contained engine compressors for refrigeration such as used on refrigeration trucks
22xx003070	Terminal Tractors	Single driver (typically no passenger seat) off-road trucks used primarily for moving highway trailers around paved areas such as at container ports and other intermodal facilities (rarely used for moving aircraft around airports); also called yard spotters, hostlers, and hustlers.

Table B-4. Lawn and garden equipment types and descriptions. (xx refers to '60' for 2-stroke gasoline, '65' for 4-stroke gasoline, '70' for diesel, '67' for LPG, 68 for CNG).

SCC	Equipment Type	Definition
22xx004010	Lawn mowers (Residential)	Walk behind mowers owned by residences
22xx004011	Lawn mowers (Commercial)	Walk behind mowers owned by commercial landscaping and horticultural services companies as well as facility\parks\other maintenance departments.
22xx004015	Rotary Tillers < 6 HP (Residential)	Smaller walk-behind rotary tillers for residential gardens
22xx004016	Rotary Tillers < 6 HP (Commercial)	Smaller walk-behind rotary tillers for residential gardens owned by facility\ parks\other maintenance departments or landscaping professionals
22xx004020	Chain Saws < 6 HP (Residential)	Self explanatory but smaller than those used for forestry
22xx004021	Chain Saws < 6 HP (Commercial)	Self explanatory but smaller and owned by facility\parks\other maintenance departments or landscaping professionals
22xx004025	Trimmers/Edgers/Brush Cutters (Residential)	Small handheld or nonhandheld power equipment for general purpose cutting including equipment types such as string trimmers (aka Weedwackers) as well as other engine powered types
22xx004026	Trimmers/Edgers/Brush Cutters (Commercial)	Same as above but owned by facility\parks\other maintenance departments or landscaping professionals
22xx004030	Leafblowers/Vacuums (Residential)	Self explanatory
22xx004031	Leafblowers/Vacuums (Commercial)	Self explanatory owned by facility\parks\other maintenance departments or landscaping professionals
22xx004035	Snowblowers (Residential)	Self explanatory
22xx004036	Snowblowers (Commercial)	Self explanatory owned by facility\parks\other maintenance departments or landscaping professionals
22xx004040	Rear Engine Riding Mowers (Residential)	As described and designed for residential lawn mowing

SCC	Equipment Type	Definition
22xx004041	Rear Engine Riding Mowers (Commercial)	As described and designed for lighter duty mowing than front mowers owned by facility\parks\other maintenance departments or landscaping professionals
22xx004046	Front Mowers	Heavier duty and more versatile mowers than rear engine mowers with mower attached on the front of the vehicle
22xx004051	Shredders < 6 HP	Lighter-duty equipment (than chippers\stump grinders) with internal blades to reduce small diameter wood to small pieces
22xx004055	Lawn & Garden Tractors (Residential)	Small tractors used for mowing but able to perform tasks other than mowing and owned by residences
22xx004056	Lawn & Garden Tractors (Commercial)	Small tractors used for mowing but able to perform tasks other than mowing and owned by facility\parks\other maintenance departments or landscaping professionals
22xx004066	Chippers/Stump Grinders	Internal or external bladed equipment to grind and chip various, but primarily woody biomass, materials. Heavier duty than shredders. May include road chippers, stone grinders, and other non-lawn and garden equipment types
22xx004071	Commercial Turf Equipment	Various turf equipment designed for professional use and include applications, such as aerators, dethatchers, sod cutters, hydro-seeders, turf utility vehicles, and specific golf course equipment including greens mowers and sand trap groomers
22xx004075	Other Lawn & Garden Equipment (Residential)	Any other lawn and garden maintenance equipment not otherwise classified and include such equipment types as augers, sickle-bar mowers, and wood splitters owned by residences
22xx004076	Other Lawn & Garden Equipment (Commercial)	Any other lawn and garden maintenance equipment not otherwise classified and include such equipment types as augers, sickle-bar mowers, and wood splitters owned by facility\parks\other maintenance departments or landscaping professionals

Table B-5. Agricultural equipment types and descriptions. (xx refers to '60' for 2-stroke gasoline, '65' for 4-stroke gasoline, '70' for diesel, '67' for LPG, 68 for CNG).

SCC	Equipment Type	Definition
22xx005010	2-Wheel Tractors	Walk-behind 2-wheeled tractors for use in edible produce or other intensive farming
22xx005015	Agricultural Tractors	Large and small agricultural tractors, most prevalent farm equipment type
22xx005020	Combines	Self-propelled combined harvesting and cleaning equipment
22xx005025	Balers	Equipment that bales from loose or windrowed hay or other forage mowed crop
22xx005030	Agricultural Mowers	Equipment for mowing not intended for later baling or harvesting
22xx005035	Sprayers	Small (backpack) and large (self-propelled) powered equipment designed specifically for spraying
22xx005040	Tillers > 6 HP	Primarily small tillers similar to those used in lawn and garden applications intended to be used in edible produce or other intensive farming
22xx005045	Swathers	Equipment designed to cut crops for later baling or harvesting including windrowers
22xx005055	Other Agricultural Equipment	Other various cultivation equipment types and include harvesters or other special cultivating equipment
22xx005060	Irrigation Sets	Agricultural pumps and pivot wheel irrigation equipment to distribute water to fields or livestock.

Table B-6. Commercial equipment types and descriptions. (xx refers to '60' for 2-stroke gasoline, '65' for 4-stroke gasoline, '70' for diesel, '67' for LPG, 68 for CNG).

SCC	Equipment Type	Definition
22xx006005	Generator Set	Trailer or skid mounted self contained engine\electric generator designed to supply electrical power at a job site
22xx006010	Pumps	Trailer or skid mounted engine powered liquid pumps
22xx006015	Air Compressors	Trailer or skid mounted engine powered engine powered air compressors to generate high pressure air for pneumatic tools or other needs for pressurized air
22xx006020	Gas Compressors	Engine compressors for commercial gas, most likely to pressurize CNG from natural gas lines or boost pressure in those lines. May be similar to area or stationary source engine compressors.
22xx006025	Welders	Engine powered arc welding support equipment not unlike a generator
22xx006030	Pressure Washers	Engine powered pumps specifically for pressure washers
22xx006035	Hydro Power Units	Power engines designed to specifically supply hydraulic power;

Table B-7. Logging equipment types and descriptions. (xx refers to '60' for 2-stroke gasoline, '65' for 4-stroke gasoline, '70' for diesel, '67' for LPG, 68 for CNG).

SCC	Equipment Type	Definition
22xx007005	Chain Saws > 6 hp	Larger thinning and harvesting chainsaws for commercial forestry
22xx007010	Shredders > 6 hp	Larger shredders to reduce slash to smaller pieces; it is distinguished from a chipper by not producing uniform size pieces.
22xx007015	Fellers/Bunchers/ Skidders	Various harvesting equipment for forestry. Fellers typically appear to be excavators or loaders with grappling clamps and rotating saw attachments; a buncher typically loads whole logs for transport; a skidder is typically a low equipment type not unlike a loader with a chain winch to pull logs ('skid') to a location for a buncher or log loader.

Table B-8. GSE/underground mining/oil field equipment types and descriptions. (xx refers to '60' for 2-stroke gasoline, '65' for 4-stroke gasoline, '70' for diesel, '67' for LPG, 68 for CNG).

SCC	Equipment Type	Definition
22xx008005	Airport Support Equipment	All types of airport support equipment; EPA may expand this to more and varied types of equipment but only one SCC exists to date
22xx009010	Other Underground Mining Equipment	Mining equipment similar to other construction and mining equipment but specially designed for low profile and confined space conditions
22xx010010	Other Oil Field Equipment	Various oil field equipment including fracturing rigs, large mechanical drilling engines, seismograph rigs, and trailer or skid-mounted oil field pumps

Table B-9. Recreational marine equipment types and descriptions. (xx refers to '60' for 2-stroke gasoline, '65' for 4-stroke gasoline, '70' for diesel, '67' for LPG, 68 for CNG).

SCC	Equipment Type	Definition
2282005010	Gasoline Outboards	Standard outboard engines easily removed and replaced if needed
2282005015	Personal Watercraft	Engines used to provide power to jet-powered small boats and riding watercraft (aka JetSki)
2282010005	Gasoline Inboards	Primarily 4-stroke engines mounted as an integral part of the vessel
2282020005	Diesel Inboards	Diesel engines mounted as an integral part of the vessel
2282020010	Diesel Outboards	Rare, but nonzero diesel powered outboard engines.
2282020025	Diesel Sailboat Auxiliary	Not used because auxiliary integrally mounted propulsion power primarily for larger sailboats or outboard motors are included as inboards or outboards

Table B-10. Railway maintenance equipment types and descriptions. (xx refers to '60' for 2-stroke gasoline, '65' for 4-stroke gasoline, '70' for diesel, '67' for LPG, 68 for CNG).

SCC	Equipment Type	Definition
2285002015	Diesel Railway Maintenance	Equipment types specifically design for repair, maintenance, and construction of rail lines including ballast handlers, rail/tie handlers, and rail straightening equipment
2285003015	2-stroke Railway Maintenance	
2285004015	4-stroke Railway Maintenance	
2285006015	LPG Railway Maintenance	

APPENDIX C

EXAMPLES OF STANDARD REPORTS

Reports for Travis County, Texas 1998 nonroad emissions are printed in the following order. Note that only the first two pages are printed for the longer reports.

1. Emission Totals by County
2. Emission Totals by County and Fuel Type
3. Emission Totals by Equipment Type
4. Emission Totals by Horsepower
5. Emission Totals by HP and Source Classification
6. Emission Totals by HP and Equipment Type
7. Emission Totals by SCC
8. Emission Totals by Source Classification
9. Population and Fuel Consumption by HP and Source Classification
10. Population and Fuel Consumption by SCC

Emission Totals by County and Pollutant

All Fuels **Tons/Season**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

FIPS	County	Exhaust THC	Exhaust NOx	Exhaust CO	Exhaust PM10	Exhaust SO2	Exhaust CO2	Crankcase THC	Diurnal THC
48453	Travis County	1,096.13	147.00	17,646.23	35.75	14.22	35,478.46	19.74	8.10
Totals:		**1,096.13**	**147.00**	**17,646.23**	**35.75**	**14.22**	**35,478.46**	**19.74**	**8.10**

Core Model Ver 2005, May 2005 *page 1 of 2*

Emission Totals by County and Pollutant

All Fuels **Tons/Season**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

FIPS	County	Vapor Displacement THC	Spillage THC	Hot Soak THC	Running Loss THC	Tank Permeation THC	Hose Permeation THC	Total THC
48453	Travis County	15.19	84.40	0.00	0.00	0.00	0.00	1,223.56
Totals:		**15.19**	**84.40**	**0.00**	**0.00**	**0.00**	**0.00**	**1,223.56**

NONROAD Core Model Ver 2005, May 2005 *page 2 of 2*

Emission Totals by County, Fuel Type, and Pollutant

All Fuels **Tons/Season**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

FIPS	County / Fuel Type	Exhaust THC	Exhaust NOx	Exhaust CO	Exhaust PM10	Exhaust SO2	Exhaust CO2	Crankcase THC	Diurnal THC
48453	**TRAVIS COUNTY**								
	Diesel	8.34	52.24	30.08	6.21	7.74	3,827.82	0.17	0.00
	Gasoline	1,086.99	90.88	17,600.44	29.52	6.48	31,434.06	19.31	8.10
	LPG	0.80	3.88	15.72	0.02	0.00	216.58	0.26	0.00
48453	**Travis County Totals:**	**1,096.13**	**147.00**	**17,646.23**	**35.75**	**14.22**	**35,478.46**	**19.74**	**8.10**
Grand Totals:		**1,096.13**	**147.00**	**17,646.23**	**35.75**	**14.22**	**35,478.46**	**19.74**	**8.10**

Core Model Ver 2005, May 2005 *page 1 of 2*

Emission Totals by County, Fuel Type, and Pollutant

All Fuels **Tons/Season**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

FIPS	County / Fuel Type	Vapor Displacement THC	Spillage THC	Hot Soak THC	Running Loss THC	Tank Permeation THC	Hose Permeation THC	Total THC
48453	**TRAVIS COUNTY**							
	Diesel	0.00	0.00	0.00	0.00	0.00	0.00	8.51
	Gasoline	15.19	84.40	0.00	0.00	0.00	0.00	1,213.98
	LPG	0.00	0.00	0.00	0.00	0.00	0.00	1.07
48453	**Travis County Totals:**	**15.19**	**84.40**	**0.00**	**0.00**	**0.00**	**0.00**	**1,223.56**
Grand Totals:		**15.19**	**84.40**	**0.00**	**0.00**	**0.00**	**0.00**	**1,223.56**

NONROAD Core Model Ver 2005, May 2005 *page 2 of 2*

Emission Totals by Equipment Type and Pollutant

All Fuels **Tons/Season** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Source Classification	Equipment Description	Exhaust TOG	Exhaust NOx	Exhaust CO	Exhaust PM10	Exhaust SO2	Exhaust CO2	Crankcase TOG	Diurnal TOG
LAWN AND GARDEN EQUIPMENT (COM)									
	Chain Saws < 6 HP	135.24	1.31	351.98	7.79	0.13	637.78	0.00	0.01
	Chippers/Stump Grinders	11.09	34.57	306.25	2.96	4.04	2,779.23	1.16	0.06
	Commercial Turf Equipment	179.00	43.05	6,598.33	2.00	2.82	11,681.57	5.58	0.99
	Front Mowers	8.53	18.74	191.90	2.48	2.84	1,693.88	0.32	0.08
	Lawn & Garden Tractors	50.30	14.96	2,178.34	0.97	1.35	4,039.18	1.26	0.17
	Lawn mowers	88.02	5.07	1,190.16	0.77	0.41	2,006.26	1.13	0.12
	Leafblowers/Vacuums	178.77	10.39	1,537.30	6.99	0.60	2,924.92	1.47	0.14
	Other Lawn & Garden Eqp.	13.26	0.87	193.61	0.20	0.11	380.70	0.50	0.47
	Rear Engine Riding Mowers	3.44	0.79	161.05	0.03	0.06	272.22	0.08	0.02
	Rotary Tillers < 6 HP	83.45	2.23	664.63	1.50	0.26	1,260.83	1.98	0.03
	Shredders < 6 HP	7.70	0.24	71.04	0.11	0.03	138.56	0.25	0.02
	Snowblowers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Trimmers/Edgers/Brush Cutter	161.26	0.66	403.58	6.32	0.15	729.31	0.03	0.07
Lawn and Garden Equipment (Com) Totals:		**920.06**	**132.89**	**13,848.16**	**32.11**	**12.79**	**28,544.45**	**13.76**	**2.21**
LAWN AND GARDEN EQUIPMENT (RES)									
	Chain Saws < 6 HP	18.95	0.05	46.12	0.63	0.01	73.71	0.00	0.03
	Lawn & Garden Tractors	58.93	10.00	2,506.72	0.42	0.91	4,419.80	2.88	3.12
	Lawn mowers	68.40	2.57	749.79	0.45	0.32	1,558.97	3.20	1.25

Core Model Ver 2005, May 2005 *page 1 of 4*

Emission Totals by Equipment Type and Pollutant

All Fuels **Tons/Season** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Source Classification	Equipment Description	Vapor Displacement TOG	Spillage TOG	Hot Soak TOG	Running Loss TOG	Tank Permeation TOG	Hose Permeation TOG	Total TOG
LAWN AND GARDEN EQUIPMENT (COM)								
	Chain Saws < 6 HP	0.46	14.66	0.00	0.00	0.00	0.00	150.38
	Chippers/Stump Grinders	0.28	0.11	0.00	0.00	0.00	0.00	12.71
	Commercial Turf Equipment	5.23	4.40	0.00	0.00	0.00	0.00	195.20
	Front Mowers	0.15	0.26	0.00	0.00	0.00	0.00	9.34
	Lawn & Garden Tractors	1.70	2.85	0.00	0.00	0.00	0.00	56.29
	Lawn mowers	0.99	10.82	0.00	0.00	0.00	0.00	101.07
	Leafblowers/Vacuums	1.51	9.44	0.00	0.00	0.00	0.00	191.33
	Other Lawn & Garden Eqp.	0.18	0.24	0.00	0.00	0.00	0.00	14.65
	Rear Engine Riding Mowers	0.12	0.22	0.00	0.00	0.00	0.00	3.89
	Rotary Tillers < 6 HP	0.66	9.61	0.00	0.00	0.00	0.00	95.73
	Shredders < 6 HP	0.07	0.99	0.00	0.00	0.00	0.00	9.03
	Snowblowers	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Trimmers/Edgers/Brush Cutter	0.53	11.63	0.00	0.00	0.00	0.00	173.53
Lawn and Garden Equipment (Com) Totals:		**11.88**	**65.25**	**0.00**	**0.00**	**0.00**	**0.00**	**1,013.15**
LAWN AND GARDEN EQUIPMENT (RES)								
	Chain Saws < 6 HP	0.06	2.97	0.00	0.00	0.00	0.00	22.00
	Lawn & Garden Tractors	2.00	3.36	0.00	0.00	0.00	0.00	70.30
	Lawn mowers	0.77	8.41	0.00	0.00	0.00	0.00	82.02

NONROAD Core Model Ver 2005, May 2005 *page 2 of 4*

Source Classification	Equipment Description	Exhaust TOG	Exhaust NOx	Exhaust CO	Exhaust PM10	Exhaust SO2	Exhaust CO2	Crankcase TOG	Diurnal TOG
	Leafblowers/Vacuums	23.75	0.09	64.20	0.77	0.02	105.57	0.03	0.49
	Other Lawn & Garden Eqp.	5.47	0.27	79.88	0.07	0.03	150.79	0.20	0.20
	Rear Engine Riding Mowers	4.13	0.76	186.34	0.03	0.07	327.44	0.20	0.43
	Rotary Tillers < 6 HP	7.91	0.24	72.58	0.08	0.03	151.87	0.31	0.10
	Snowblowers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Trimmers/Edgers/Brush Cutter	36.46	0.12	92.44	1.19	0.03	145.86	0.02	0.27
Lawn and Garden Equipment (Res) Totals:		**223.99**	**14.11**	**3,798.07**	**3.64**	**1.43**	**6,934.01**	**6.85**	**5.89**
Grand Totals:		**1,144.05**	**147.00**	**17,646.23**	**35.75**	**14.22**	**35,478.46**	**20.61**	**8.10**

Source Classification	Equipment Description	Vapor Displacement TOG	Spillage TOG	Hot Soak TOG	Running Loss TOG	Tank Permeation TOG	Hose Permeation TOG	Total TOG
	Leafblowers/Vacuums	0.08	0.48	0.00	0.00	0.00	0.00	24.84
	Other Lawn & Garden Eqp.	0.07	0.10	0.00	0.00	0.00	0.00	6.04
	Rear Engine Riding Mowers	0.15	0.26	0.00	0.00	0.00	0.00	5.17
	Rotary Tillers < 6 HP	0.08	1.12	0.00	0.00	0.00	0.00	9.52
	Snowblowers	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Trimmers/Edgers/Brush Cutter	0.11	2.45	0.00	0.00	0.00	0.00	39.31
Lawn and Garden Equipment (Res) Totals:		**3.32**	**19.15**	**0.00**	**0.00**	**0.00**	**0.00**	**259.20**
Grand Totals:		**15.19**	**84.40**	**0.00**	**0.00**	**0.00**	**0.00**	**1,272.35**

NONROAD Core Model Ver 2005, May 2005 *page 4 of 4*

Emission Totals by Horsepower and Pollutant

All Fuels **Tons/Season** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Horsepower	Exhaust NMHC	Crankcase NMHC	Diurnal NMHC	Vapor Displacement NMHC	Spillage NMHC
0 < HP <= 1	9.29	0.01	0.14	0.03	0.51
1 < HP <= 3	340.95	0.17	0.93	1.16	22.52
3 < HP <= 6	444.27	7.42	1.96	4.14	44.91
6 < HP <= 11	36.56	0.91	0.90	1.48	5.55
11 < HP <= 16	98.79	3.14	2.68	4.03	6.22
16 < HP <= 25	87.46	2.26	1.39	3.58	3.26
25 < HP <= 40	7.99	2.20	0.07	0.47	0.25
40 < HP <= 50	0.55	0.01	0.00	0.00	0.00
50 < HP <= 75	3.11	0.83	0.02	0.15	0.41
75 < HP <= 100	1.32	0.03	0.00	0.00	0.00
100 < HP <= 175	2.85	0.79	0.01	0.16	0.77
175 < HP <= 300	0.44	0.01	0.00	0.00	0.00
300 < HP <= 600	0.66	0.01	0.00	0.00	0.00
600 < HP <= 750	0.24	0.00	0.00	0.00	0.00
750 < HP <= 1000	0.06	0.00	0.00	0.00	0.00
1000 < HP <= 1200	0.07	0.00	0.00	0.00	0.00
Totals:	**1,034.62**	**17.79**	**8.10**	**15.19**	**84.40**

Core Model Ver 2005, May 2005 *page 1 of 2*

Emission Totals by Horsepower and Pollutant

All Fuels **Tons/Season** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Horsepower	Hot Soak NMHC	Running Loss NMHC	Tank Permeation NMHC	Hose Permeation NMHC	Total NMHC
0 < HP <= 1	0.00	0.00	0.00	0.00	9.97
1 < HP <= 3	0.00	0.00	0.00	0.00	365.72
3 < HP <= 6	0.00	0.00	0.00	0.00	502.70
6 < HP <= 11	0.00	0.00	0.00	0.00	45.40
11 < HP <= 16	0.00	0.00	0.00	0.00	114.86
16 < HP <= 25	0.00	0.00	0.00	0.00	97.95
25 < HP <= 40	0.00	0.00	0.00	0.00	10.97
40 < HP <= 50	0.00	0.00	0.00	0.00	0.56
50 < HP <= 75	0.00	0.00	0.00	0.00	4.52
75 < HP <= 100	0.00	0.00	0.00	0.00	1.34
100 < HP <= 175	0.00	0.00	0.00	0.00	4.58
175 < HP <= 300	0.00	0.00	0.00	0.00	0.45
300 < HP <= 600	0.00	0.00	0.00	0.00	0.68
600 < HP <= 750	0.00	0.00	0.00	0.00	0.25
750 < HP <= 1000	0.00	0.00	0.00	0.00	0.06
1000 < HP <= 1200	0.00	0.00	0.00	0.00	0.07
Totals:	**0.00**	**0.00**	**0.00**	**0.00**	**1,160.09**

Core Model Ver 2005, May 2005 *page 2 of 2*

Emission Totals by Horsepower, Source Classification, and Pollutant

All Fuels **Tons/Season** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Source Classification	Horsepower	Exhaust NMHC	Crankcase NMHC	Diurnal NMHC	Vapor Displacement NMHC	Spillage NMHC
LAWN AND GARDEN EQUIPMENT (COM)						
	0 < HP <= 1	1.11	0.00	0.02	0.00	0.04
	1 < HP <= 3	271.62	0.11	0.22	0.93	17.02
	3 < HP <= 6	376.71	4.26	0.55	3.26	35.38
	6 < HP <= 11	31.85	0.68	0.37	1.29	5.24
	11 < HP <= 16	63.26	1.40	0.37	2.62	3.76
	16 < HP <= 25	72.57	1.53	0.59	2.99	2.37
	25 < HP <= 40	7.99	2.20	0.07	0.47	0.25
	40 < HP <= 50	0.55	0.01	0.00	0.00	0.00
	50 < HP <= 75	3.11	0.83	0.02	0.15	0.41
	75 < HP <= 100	1.32	0.03	0.00	0.00	0.00
	100 < HP <= 175	2.85	0.79	0.01	0.16	0.77
	175 < HP <= 300	0.44	0.01	0.00	0.00	0.00
	300 < HP <= 600	0.66	0.01	0.00	0.00	0.00
	600 < HP <= 750	0.24	0.00	0.00	0.00	0.00
	750 < HP <= 1000	0.06	0.00	0.00	0.00	0.00
	1000 < HP <= 1200	0.07	0.00	0.00	0.00	0.00
Lawn and Garden Equipment (Com) Totals:		**834.41**	**11.88**	**2.21**	**11.88**	**65.25**

Core Model Ver 2005, May 2005 *page 1 of 4*

Emission Totals by Horsepower, Source Classification, and Pollutant

All Fuels **Tons/Season** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Source Classification	Horsepower	Hot Soak NMHC	Running Loss NMHC	Tank Permeation NMHC	Hose Permeation NMHC	Total NMHC
LAWN AND GARDEN EQUIPMENT (COM)						
	0 < HP <= 1	0.00	0.00	0.00	0.00	1.18
	1 < HP <= 3	0.00	0.00	0.00	0.00	289.90
	3 < HP <= 6	0.00	0.00	0.00	0.00	420.16
	6 < HP <= 11	0.00	0.00	0.00	0.00	39.44
	11 < HP <= 16	0.00	0.00	0.00	0.00	71.41
	16 < HP <= 25	0.00	0.00	0.00	0.00	80.06
	25 < HP <= 40	0.00	0.00	0.00	0.00	10.97
	40 < HP <= 50	0.00	0.00	0.00	0.00	0.56
	50 < HP <= 75	0.00	0.00	0.00	0.00	4.52
	75 < HP <= 100	0.00	0.00	0.00	0.00	1.34
	100 < HP <= 175	0.00	0.00	0.00	0.00	4.58
	175 < HP <= 300	0.00	0.00	0.00	0.00	0.45
	300 < HP <= 600	0.00	0.00	0.00	0.00	0.68
	600 < HP <= 750	0.00	0.00	0.00	0.00	0.25
	750 < HP <= 1000	0.00	0.00	0.00	0.00	0.06
	1000 < HP <= 1200	0.00	0.00	0.00	0.00	0.07
Lawn and Garden Equipment (Com) Totals:		**0.00**	**0.00**	**0.00**	**0.00**	**925.62**

Core Model Ver 2005, May 2005 *page 2 of 4*

Source Classification	Horsepower	Exhaust NMHC	Crankcase NMHC	Diurnal NMHC	Vapor Displacement NMHC	Spillage NMHC
LAWN AND GARDEN EQUIPMENT (RES)						
	0 < HP <= 1	8.18	0.00	0.12	0.02	0.47
	1 < HP <= 3	69.33	0.05	0.71	0.23	5.50
	3 < HP <= 6	67.57	3.15	1.42	0.88	9.53
	6 < HP <= 11	4.71	0.24	0.52	0.19	0.31
	11 < HP <= 16	35.54	1.74	2.31	1.41	2.46
	16 < HP <= 25	14.89	0.73	0.81	0.59	0.88
Lawn and Garden Equipment (Res) Totals:		**200.20**	**5.91**	**5.89**	**3.32**	**19.15**
Grand Totals:		**1,034.62**	**17.79**	**8.10**	**15.19**	**84.40**

Source Classification	Horsepower	Hot Soak NMHC	Running Loss NMHC	Tank Permeation NMHC	Hose Permeation NMHC	Total NMHC
LAWN AND GARDEN EQUIPMENT (RES)						
	0 < HP <= 1	0.00	0.00	0.00	0.00	8.79
	1 < HP <= 3	0.00	0.00	0.00	0.00	75.83
	3 < HP <= 6	0.00	0.00	0.00	0.00	82.54
	6 < HP <= 11	0.00	0.00	0.00	0.00	5.96
	11 < HP <= 16	0.00	0.00	0.00	0.00	43.46
	16 < HP <= 25	0.00	0.00	0.00	0.00	17.89
Lawn and Garden Equipment (Res) Totals:		**0.00**	**0.00**	**0.00**	**0.00**	**234.47**
Grand Totals:		**0.00**	**0.00**	**0.00**	**0.00**	**1,160.09**

Emission Totals by Horsepower, Equipment Type, and Pollutant

All Fuels **Tons/Season** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Source Classification	Horsepower	Exhaust NMHC	Crankcase NMHC	Diurnal NMHC	Vapor Displacement NMHC	Spillage NMHC
LAWN AND GARDEN EQUIPMENT (COM)						
Chain Saws < 6 HP						
	1 < HP <= 3	24.31	0.00	0.00	0.08	4.09
	3 < HP <= 6	104.07	0.00	0.01	0.38	10.57
Chippers/Stump Grinders						
	3 < HP <= 6	0.00	0.00	0.00	0.00	0.00
	6 < HP <= 11	0.18	0.00	0.00	0.01	0.01
	11 < HP <= 16	1.18	0.00	0.01	0.04	0.04
	16 < HP <= 25	2.82	0.14	0.03	0.11	0.05
	25 < HP <= 40	0.21	0.07	0.00	0.01	0.00
	40 < HP <= 50	0.06	0.00	0.00	0.00	0.00
	50 < HP <= 75	1.68	0.50	0.02	0.08	0.01
	75 < HP <= 100	1.05	0.02	0.00	0.00	0.00
	100 < HP <= 175	1.08	0.24	0.01	0.04	0.00
	175 < HP <= 300	0.44	0.01	0.00	0.00	0.00
	300 < HP <= 600	0.66	0.01	0.00	0.00	0.00
	600 < HP <= 750	0.24	0.00	0.00	0.00	0.00
	750 < HP <= 1000	0.06	0.00	0.00	0.00	0.00
	1000 < HP <= 1200	0.07	0.00	0.00	0.00	0.00
Commercial Turf Equipment						

Core Model Ver 2005, May 2005 *page 1 of 12*

Emission Totals by Horsepower, Equipment Type, and Pollutant

All Fuels **Tons/Season** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Source Classification / Horsepower	Hot Soak NMHC	Running Loss NMHC	Tank Permeation NMHC	Hose Permeation NMHC	Total NMHC
LAWN AND GARDEN EQUIPMENT (COM)					
Chain Saws < 6 HP					
1 < HP <= 3	0.00	0.00	0.00	0.00	28.48
3 < HP <= 6	0.00	0.00	0.00	0.00	115.03
Chippers/Stump Grinders					
3 < HP <= 6	0.00	0.00	0.00	0.00	0.00
6 < HP <= 11	0.00	0.00	0.00	0.00	0.20
11 < HP <= 16	0.00	0.00	0.00	0.00	1.28
16 < HP <= 25	0.00	0.00	0.00	0.00	3.15
25 < HP <= 40	0.00	0.00	0.00	0.00	0.29
40 < HP <= 50	0.00	0.00	0.00	0.00	0.06
50 < HP <= 75	0.00	0.00	0.00	0.00	2.28
75 < HP <= 100	0.00	0.00	0.00	0.00	1.07
100 < HP <= 175	0.00	0.00	0.00	0.00	1.36
175 < HP <= 300	0.00	0.00	0.00	0.00	0.45
300 < HP <= 600	0.00	0.00	0.00	0.00	0.68
600 < HP <= 750	0.00	0.00	0.00	0.00	0.25
750 < HP <= 1000	0.00	0.00	0.00	0.00	0.06
1000 < HP <= 1200	0.00	0.00	0.00	0.00	0.07
Commercial Turf Equipment					

Core Model Ver 2005, May 2005 *page 2 of 12*

Emission Totals by SCC and Pollutant

All Fuels **Tons/Season** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

SCC	Equipment Description	Engine Type	Exhaust PM10	Exhaust PM2.5
LAWN AND GARDEN EQUIPMENT (COM)				
2260004016*	Rotary Tillers < 6 HP	2 Stroke	0.62	0.57
2260004021*	Chain Saws < 6 HP	2 Stroke	7.79	7.16
2260004026*	Trimmers/Edgers/Brush Cutter	2 Stroke	6.32	5.81
2260004031*	Leafblowers/Vacuums	2 Stroke	6.73	6.19
2260004036	Snowblowers	2 Stroke	0.00	0.00
2260004071*	Commercial Turf Equipment	2 Stroke	0.00	0.00
2265004011*	Lawn mowers	4 Stroke	0.77	0.71
2265004016*	Rotary Tillers < 6 HP	4 Stroke	0.87	0.80
2265004026*	Trimmers/Edgers/Brush Cutter	4 Stroke	0.01	0.01
2265004031*	Leafblowers/Vacuums	4 Stroke	0.26	0.24
2265004036	Snowblowers	4 Stroke	0.00	0.00
2265004041*	Rear Engine Riding Mowers	4 Stroke	0.03	0.03
2265004046*	Front Mowers	4 Stroke	0.04	0.03
2265004051*	Shredders < 6 HP	4 Stroke	0.11	0.10
2265004056*	Lawn & Garden Tractors	4 Stroke	0.43	0.40
2265004066*	Chippers/Stump Grinders	4 Stroke	0.07	0.07
2265004071*	Commercial Turf Equipment	4 Stroke	1.66	1.52
2265004076*	Other Lawn & Garden Eqp.	4 Stroke	0.17	0.16
2267004066*	Chippers/Stump Grinders	LPG	0.02	0.02
2270004031	Leafblowers/Vacuums	Diesel	0.00	0.00
2270004036	Snowblowers	Diesel	0.00	0.00
2270004046	Front Mowers	Diesel	2.44	2.37
2270004056	Lawn & Garden Tractors	Diesel	0.54	0.52
2270004066	Chippers/Stump Grinders	Diesel	2.87	2.78
2270004071	Commercial Turf Equipment	Diesel	0.34	0.33
2270004076	Other Lawn & Garden Eqp.	Diesel	0.02	0.02
Lawn and Garden Equipment (Com) Totals:			**32.11**	**29.85**
LAWN AND GARDEN EQUIPMENT (RES)				
2260004015*	Rotary Tillers < 6 HP	2 Stroke	0.07	0.06
2260004020*	Chain Saws < 6 HP	2 Stroke	0.63	0.58
2260004025*	Trimmers/Edgers/Brush Cutter	2 Stroke	1.18	1.09
2260004030*	Leafblowers/Vacuums	2 Stroke	0.77	0.71

Core Model Ver 2005, May 2005 *page 1 of 2*

SCC	Equipment Description	Engine Type	Exhaust PM10	Exhaust PM2.5
2260004035	Snowblowers	2 Stroke	0.00	0.00
2265004010*	Lawn mowers	4 Stroke	0.45	0.41
2265004015*	Rotary Tillers < 6 HP	4 Stroke	0.02	0.01
2265004025*	Trimmers/Edgers/Brush Cutter	4 Stroke	0.00	0.00
2265004030*	Leafblowers/Vacuums	4 Stroke	0.00	0.00
2265004035	Snowblowers	4 Stroke	0.00	0.00
2265004040*	Rear Engine Riding Mowers	4 Stroke	0.03	0.03
2265004055*	Lawn & Garden Tractors	4 Stroke	0.42	0.39
2265004075*	Other Lawn & Garden Eqp.	4 Stroke	0.07	0.07
Lawn and Garden Equipment (Res) Totals:			**3.64**	**3.35**
Grand Totals:			**35.75**	**33.21**

* Under 25 horsepower spark-ignition engines are lumped into either 2- or 4-stroke.

Emission Totals by Source Classification and Pollutant

All Fuels **Tons/Season** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Source Classification	Exhaust NMOG	Exhaust NOx	Exhaust CO	Exhaust PM25	Exhaust SO2	Exhaust CO2	Crankcase NMOG	Diurnal NMOG
Lawn and Garden Equipment (Com)	873.03	132.89	13,848.16	29.85	12.79	28,544.45	12.46	2.21
Lawn and Garden Equipment (Res)	209.51	14.11	3,798.07	3.35	1.43	6,934.01	6.19	5.89
Totals:	**1,082.54**	**147.00**	**17,646.23**	**33.21**	**14.22**	**35,478.46**	**18.65**	**8.10**

Core Model Ver 2005, May 2005 *page 1 of 2*

Emission Totals by Source Classification and Pollutant

All Fuels **Tons/Season** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Source Classification	Vapor Displacement NMOG	Spillage NMOG	Hot Soak NMOG	Running Loss NMOG	Tank Permeation NMOG	Hose Permeation NMOG	Total NMOG
Lawn and Garden Equipment (Com)	11.88	65.25	0.00	0.00	0.00	0.00	964.82
Lawn and Garden Equipment (Res)	3.32	19.15	0.00	0.00	0.00	0.00	244.06
Totals:	**15.19**	**84.40**	**0.00**	**0.00**	**0.00**	**0.00**	**1,208.88**

NONROAD Core Model Ver 2005, May 2005 *page 2 of 2*

Equipment Population and Fuel Consumption by HP and Source Classification for Travis County

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)

Total for Summer Season, 1998

Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Fuel Type	Source Classification	Horsepower	Equipment Population	Fuel Consumption (gallons/ Season)
Diesel				
	Lawn and Garden Equipment (Com)			
		3 < HP <= 6	2.85	36.68
		6 < HP <= 11	0.90	43.05
		11 < HP <= 16	56.15	3,651.71
		16 < HP <= 25	805.50	70,238.65
		25 < HP <= 40	288.58	38,725.47
		40 < HP <= 50	79.40	15,862.17
		50 < HP <= 75	137.45	31,328.54
		75 < HP <= 100	192.48	66,490.57
		100 < HP <= 175	57.29	27,194.08
		175 < HP <= 300	30.53	25,877.41
		300 < HP <= 600	26.03	39,654.95
		600 < HP <= 750	5.90	14,536.54
		750 < HP <= 1000	0.96	3,204.50
		1000 < HP <= 1200	0.91	3,511.47
	Diesel Lawn and Garden Equipment (Com) Totals:		*1,684.93*	*340,355.79*
Diesel Totals:			**1,684.93**	**340,355.79**
Gasoline				
	Lawn and Garden Equipment (Com)			
		0 < HP <= 1	216.68	996.22
		1 < HP <= 3	14,451.32	215,940.99
		3 < HP <= 6	20,323.07	761,321.15
		6 < HP <= 11	3,675.12	301,308.52
		11 < HP <= 16	3,086.33	611,985.93
		16 < HP <= 25	2,212.10	698,446.57
		25 < HP <= 40	298.67	109,351.73
		50 < HP <= 75	53.18	34,462.24
		100 < HP <= 175	32.92	37,059.36
	Gasoline Lawn and Garden Equipment (Com) Totals:		*44,349.39*	*2,770,872.71*

Core Model Ver 2005, May 2005 *page 1 of 2*

Fuel Type	Source Classification	Horsepower	Equipment Population	Fuel Consumption (gallons/ Season)
	Lawn and Garden Equipment (Res)			
		0 < HP <= 1	11,814	5,719
		1 < HP <= 3	58,738	54,288
		3 < HP <= 6	93,234	204,761
		6 < HP <= 11	5,270	43,874
		11 < HP <= 16	25,117	328,058
		16 < HP <= 25	7,522	137,020
	Gasoline Lawn and Garden Equipment (Res) Totals:		*201,695*	*773,719*
Gasoline Totals:			**246,044**	**3,544,592**
LPG				
	Lawn and Garden Equipment (Com)			
		25 < HP <= 40	*5*	2,716
		50 < HP <= 75	23	20,319
		100 < HP <= 175	*5*	9,402
	LPG Lawn and Garden Equipment (Com) Totals:		*34*	*32,437*
LPG Totals:			**34**	**32,437**
Grand Total:			**247,763**	

Equipment Population and Fuel Consumption by SCC for Travis County

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)

Total for Summer Season, 1998

Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Fuel Type	SCC	Equipment Description	Engine Type	Equipment Population	Fuel Consumption (gallons/ Season)
Diesel					
	Lawn and Garden Equipment (Com)				
	2270004031	Leafblowers/Vacuums	Diesel	2.34	33.91
	2270004036	Snowblowers	Diesel	0.00	0.00
	2270004046	Front Mowers	Diesel	1,042.64	122,305.84
	2270004056	Lawn & Garden Tractors	Diesel	263.78	25,231.79
	2270004066	Chippers/Stump Grinders	Diesel	322.08	171,466.09
	2270004071	Commercial Turf Equipment	Diesel	46.96	20,017.69
	2270004076	Other Lawn & Garden Eqp.	Diesel	7.12	1,300.47
	Diesel Lawn and Garden Equipment (Com) Totals:			*1,684.93*	*340,355.79*
Diesel Totals:				**1,684.93**	**340,355.79**
Gasoline					
	Lawn and Garden Equipment (Com)				
	2260004016*	Rotary Tillers < 6 HP	2 Stroke	430.68	13,222.59
	2260004021*	Chain Saws < 6 HP	2 Stroke	3,876.39	106,797.81
	2260004026*	Trimmers/Edgers/Brush Cutter	2 Stroke	9,693.68	118,486.20
	2260004031*	Leafblowers/Vacuums	2 Stroke	3,769.76	113,787.89
	2260004036	Snowblowers	2 Stroke	0.00	0.00
	2260004071*	Commercial Turf Equipment	2 Stroke	0.64	53.12
	2265004011*	Lawn mowers	4 Stroke	8,078.06	230,940.64
	2265004016*	Rotary Tillers < 6 HP	4 Stroke	2,679.42	140,620.44
	2265004026*	Trimmers/Edgers/Brush Cutter	4 Stroke	186.32	5,683.53
	2265004031*	Leafblowers/Vacuums	4 Stroke	1,847.41	238,802.18
	2265004036	Snowblowers	4 Stroke	0.00	0.00
	2265004041*	Rear Engine Riding Mowers	4 Stroke	259.80	28,719.38
	2265004046*	Front Mowers	4 Stroke	895.42	33,983.37
	2265004051*	Shredders < 6 HP	4 Stroke	1,631.00	16,449.46
	2265004056*	Lawn & Garden Tractors	4 Stroke	1,775.40	396,869.23
	2265004066*	Chippers/Stump Grinders	4 Stroke	151.02	66,211.24
	2265004071*	Commercial Turf Equipment	4 Stroke	5,179.81	1,218,978.57
	2265004076*	Other Lawn & Garden Eqp.	4 Stroke	3,894.56	41,267.09
	Gasoline Lawn and Garden Equipment (Com) Totals:			*44,349.39*	*2,770,872.71*

Core Model Ver 2005, May 2005 *page 1 of 2*

Fuel Type	SCC	Equipment Description	Engine Type	Equipment Population	Fuel Consumption (gallons/ Season)
	Lawn and Garden Equipment (Res)				
	2260004015*	Rotary Tillers < 6 HP	2 Stroke	1,268	1,421
	2260004020*	Chain Saws < 6 HP	2 Stroke	13,505	13,373
	2260004025*	Trimmers/Edgers/Brush Cutter	2 Stroke	35,658	25,169
	2260004030*	Leafblowers/Vacuums	2 Stroke	18,091	16,224
	2260004035	Snowblowers	2 Stroke	0	0
	2265004010*	Lawn mowers	4 Stroke	84,688	179,454
	2265004015*	Rotary Tillers < 6 HP	4 Stroke	7,890	16,449
	2265004025*	Trimmers/Edgers/Brush Cutter	4 Stroke	583	972
	2265004030*	Leafblowers/Vacuums	4 Stroke	940	1,877
	2265004035	Snowblowers	4 Stroke	0	0
	2265004040*	Rear Engine Riding Mowers	4 Stroke	4,782	34,542
	2265004055*	Lawn & Garden Tractors	4 Stroke	32,680	467,235
	2265004075*	Other Lawn & Garden Eqp.	4 Stroke	1,610	17,003
	Gasoline Lawn and Garden Equipment (Res) Totals:			*201,695*	*773,719*
Gasoline Totals:				**246,044**	**3,544,592**
LPG					
	Lawn and Garden Equipment (Com)				
	2267004066*	Chippers/Stump Grinders	LPG	34	32,437
	LPG Lawn and Garden Equipment (Com) Totals:			*34*	*32,437*
LPG Totals:				**34**	**32,437**
Grand Total:				**247,763**	

* Under 25 horsepower spark-ignition engines are lumped into either 2- or 4-stroke.

APPENDIX D

EXAMPLES OF MODEL COMPARISON REPORTS

Comparison reports for Travis County, Texas 1998 and 2010 nonroad emissions are printed in the following order. Note that only the first two pages are printed for the longer reports.

1. Compare Two Model Runs by HP and Source Classification
2. Compare Two Model Runs by Pop and Fuel
3. Compare Two Model Runs by SCC
4. Compare Two Model Runs by Source Classification
5. Compare Two Model Runs by County
6. Compare Two Model Runs by Horsepower
7. Compare Two Model Runs by Equipment Type
8. Compare Two Model Runs by HP and SCC

Comparison of Exhaust CO Emissions in Tons/Season by Horsepower and Source Classification

Model Run 1 : Travis 1998
Total for Summer Season, 1998
Lawn and Garden Equipment
Travis County Summertime
Date of Model Run 1: May 29 16:37:19: 2005

Model Run 2 : Travis 2010
Total for Summer Season, 2010
Lawn and Garden Equipment
Travis County Summertime
Date of Model Run 2: May 29 17:59:48: 2005

Today's Date: 5/29/2005

Horsepower Range	Model Run 1	Model Run 2	Run 2 - Run 1	%Difference
LAWN AND GARDEN EQUIPMENT (COM)				
0 < HP <= 1	3.84	2.45	-1.39	-36.22
1 < HP <= 3	685.47	478.75	-206.72	-30.16
3 < HP <= 6	3,533.29	4,218.28	684.99	19.39
6 < HP <= 11	1,691.43	2,271.11	579.68	34.27
11 < HP <= 16	3,467.00	4,634.68	1,167.68	33.68
16 < HP <= 25	4,031.78	5,384.88	1,353.10	33.56
25 < HP <= 40	248.34	39.01	-209.34	-84.29
40 < HP <= 50	1.67	1.14	-0.53	-31.45
50 < HP <= 75	86.92	52.68	-34.25	-39.40
75 < HP <= 100	5.44	6.68	1.23	22.63
100 < HP <= 175	86.44	56.91	-29.53	-34.16
175 < HP <= 300	1.91	1.52	-0.39	-20.64
300 < HP <= 600	2.99	2.66	-0.33	-10.94
600 < HP <= 750	1.10	1.10	0.01	0.47
750 < HP <= 1000	0.26	0.23	-0.03	-11.01

Model Run 1 Core Model Ver 2005, May 2005
Model Run 2 Core Model Ver 2005, May 2005

page 1 of 2

Horsepower Range	Model Run 1	Model Run 2	Run 2 - Run 1	%Difference
1000 < HP <= 1200	0.29	0.12	-0.17	-58.19
Lawn and Garden Equipment (Com) Totals:	**13,848.16**	**17,152.19**	**3,304.03**	**23.86**
LAWN AND GARDEN EQUIPMENT (RES)				
0 < HP <= 1	21.05	7.20	-13.84	-65.77
1 < HP <= 3	190.54	115.94	-74.59	-39.15
3 < HP <= 6	855.15	1,017.72	162.57	19.01
6 < HP <= 11	235.21	298.47	63.26	26.89
11 < HP <= 16	1,761.00	2,247.82	486.81	27.64
16 < HP <= 25	735.12	938.11	202.99	27.61
Lawn and Garden Equipment (Res) Totals:	**3,798.07**	**4,625.27**	**827.20**	**21.78**
Grand Totals:	**17,646.23**	**21,777.46**	**4,131.23**	**23.41**

Model Run 1 Core Model Ver 2005, May 2005
Model Run 2 Core Model Ver 2005, May 2005

Comparison of Equipment Population and Fuel Consumption by SCC

Model Run 1 : Travis 1998

Total for Summer Season, 1998

Lawn and Garden Equipment
Travis County Summertime

Date of Model Run 1: May 29 16:37:19: 2005

Model Run 2 : Travis 2010

Total for Summer Season, 2010

Lawn and Garden Equipment
Travis County Summertime

Date of Model Run 2: May 29 17:59:48: 2005

Today's Date: 5/29/2005

Fuel Type	SCC	Equipment Description	Engine Type	Equipment Population Run 1	Equipment Population Run 2	Fuel Consumption (gallons/ Season) Run 1	Fuel Consumption (gallons/ Season) Run 2
Diesel							
	Lawn and Garden Equipment (Com)						
	2270004071	Commercial Turf Equipment	Diesel	46.96	81.30	20,017.69	34,658.30
	2270004066	Chippers/Stump Grinders	Diesel	322.08	551.08	171,466.09	292,894.24
	2270004046	Front Mowers	Diesel	1,042.64	1,803.31	122,305.84	211,301.27
	2270004056	Lawn & Garden Tractors	Diesel	263.78	456.68	25,231.79	43,672.83
	2270004031	Leafblowers/Vacuums	Diesel	2.34	3.99	33.91	57.71
	2270004076	Other Lawn & Garden Eqp.	Diesel	7.12	12.24	1,300.47	2,225.77
	2270004036	Snowblowers	Diesel	0.00	0.00	0.00	0.00
	Diesel Lawn and Garden Equipment (Com) Totals:					*340,355.79*	*584,810.12*
Diesel Totals:						**340,355.79**	**584,810.12**
Gasoline							
	Lawn and Garden Equipment (Com)						
	2260004021*	Chain Saws < 6 HP	2 Stroke	3,876.39	4,929.88	106,797.81	94,910.80
	2260004071*	Commercial Turf Equipment	2 Stroke	0.64	1.27	53.12	71.01
	2265004071*	Commercial Turf Equipment	4 Stroke	5,179.81	6,587.52	1,218,978.57	1,335,210.50

Fuel Type	SCC	Equipment Description	Engine Type	Equipment Population Run 1	Equipment Population Run 2	Fuel Consumption (gallons/ Season) Run 1	Fuel Consumption (gallons/ Season) Run 2
	2265004066*	Chippers/Stump Grinders	4 Stroke	151.02	193.10	66,211.24	71,176.58
	2265004046*	Front Mowers	4 Stroke	895.42	1,138.77	33,983.37	36,119.05
	2260004031*	Leafblowers/Vacuums	2 Stroke	3,769.76	4,794.27	113,787.89	98,899.25
	2265004031*	Leafblowers/Vacuums	4 Stroke	1,847.41	2,349.49	238,802.18	256,665.01
	2265004056*	Lawn & Garden Tractors	4 Stroke	1,775.40	2,257.90	396,869.23	421,251.95
	2265004011*	Lawn mowers	4 Stroke	8,078.06	10,273.44	230,940.64	241,535.84
	2265004076*	Other Lawn & Garden Eqp.	4 Stroke	3,894.56	4,954.30	41,267.09	41,991.11
	2260004016*	Rotary Tillers < 6 HP	2 Stroke	430.68	547.72	13,222.59	11,005.31
	2265004016*	Rotary Tillers < 6 HP	4 Stroke	2,679.42	3,407.61	140,620.44	136,760.12
	2265004041*	Rear Engine Riding Mowers	4 Stroke	259.80	331.00	28,719.38	31,084.42
	2260004036	Snowblowers	2 Stroke	0.00	0.00	0.00	0.00
	2265004051*	Shredders < 6 HP	4 Stroke	1,631.00	2,074.26	16,449.46	15,890.21
	2265004036	Snowblowers	4 Stroke	0.00	0.00	0.00	0.00
	2260004026*	Trimmers/Edgers/Brush Cutter	2 Stroke	9,693.68	12,328.13	118,486.20	102,644.39
	2265004026*	Trimmers/Edgers/Brush Cutter	4 Stroke	186.32	236.95	5,683.53	5,864.10
	Gasoline Lawn and Garden Equipment (Com) Totals:					*2,770,872.71*	*2,901,079.64*
	Lawn and Garden Equipment (Res)						
	2260004020*	Chain Saws < 6 HP	2 Stroke	13,504.65	17,174.81	13,372.95	11,134.19
	2260004030*	Leafblowers/Vacuums	2 Stroke	18,091.15	23,007.79	16,223.63	13,500.58
	2265004055*	Lawn & Garden Tractors	4 Stroke	32,679.81	41,561.21	467,234.77	487,190.28
	2265004030*	Leafblowers/Vacuums	4 Stroke	940.46	1,196.05	1,877.01	1,732.55
	2265004010*	Lawn mowers	4 Stroke	84,687.57	107,703.15	179,453.89	166,643.11
	2265004075*	Other Lawn & Garden Eqp.	4 Stroke	1,609.68	2,047.15	17,003.12	17,233.19
	2260004015*	Rotary Tillers < 6 HP	2 Stroke	1,268.22	1,612.89	1,421.28	1,190.87
	2265004040*	Rear Engine Riding Mowers	4 Stroke	4,782.17	6,081.82	34,541.84	36,312.53
	2265004015*	Rotary Tillers < 6 HP	4 Stroke	7,890.13	10,034.43	16,448.88	14,901.39

Fuel Type	SCC	Equipment Description	Engine Type	Equipment Population Run 1	Equipment Population Run 2	Fuel Consumption (gallons/ Season) Run 1	Fuel Consumption (gallons/ Season) Run 2
	2260004035	Snowblowers	2 Stroke	0.00	0.00	0.00	0.00
	2265004035	Snowblowers	4 Stroke	0.00	0.00	0.00	0.00
	2260004025*	Trimmers/Edgers/Brush Cutter	2 Stroke	35,657.92	45,348.68	25,169.34	20,963.54
	2265004025*	Trimmers/Edgers/Brush Cutter	4 Stroke	582.96	741.40	972.29	906.37
	Gasoline Lawn and Garden Equipment (Res) Totals:					*773,719.00*	*771,708.61*
Gasoline Totals:						**3,544,591.72**	**3,672,788.25**
LPG							
	Lawn and Garden Equipment (Com)						
	2267004066*	Chippers/Stump Grinders	LPG	33.71	42.96	32,437.36	34,698.78
	LPG Lawn and Garden Equipment (Com) Totals:					*32,437.36*	*34,698.78*
LPG Totals:						**32,437.36**	**34,698.78**
Totals:						**3,917,384.87**	**4,292,297.15**

* Under 25 horsepower spark-ignition engines are lumped into either 2- or 4-stroke.

Comparison of Exhaust CO2 Emissions in Tons/Season by SCC

Model Run 1 : Travis 1998

Total for Summer Season, 1998

Lawn and Garden Equipment
Travis County Summertime

Date of Model Run 1: May 29 16:37:19: 2005

Model Run 2 : Travis 2010

Total for Summer Season, 2010

Lawn and Garden Equipment
Travis County Summertime

Date of Model Run 2: May 29 17:59:48: 2005

Today's Date: 5/29/2005

SCC	Equipment Description	Engine Type	Model Run 1	Model Run 2	Run 2 - Run 1	%Difference
LAWN AND GARDEN EQUIPMENT (COM)						
2260004016*	Rotary Tillers < 6 HP	2 Stroke	72.65	95.29	22.64	31.16
2260004021*	Chain Saws < 6 HP	2 Stroke	637.78	742.80	105.02	16.47
2260004026*	Trimmers/Edgers/Brush Cutter	2 Stroke	677.75	881.15	203.40	30.01
2260004031*	Leafblowers/Vacuums	2 Stroke	663.02	822.90	159.88	24.11
2260004036	Snowblowers	2 Stroke	0.00	0.00	0.00	NA
2260004071*	Commercial Turf Equipment	2 Stroke	0.30	0.62	0.32	105.37
2265004011*	Lawn mowers	4 Stroke	2,006.26	2,267.69	261.42	13.03
2265004016*	Rotary Tillers < 6 HP	4 Stroke	1,188.18	1,257.50	69.32	5.83
2265004026*	Trimmers/Edgers/Brush Cutter	4 Stroke	51.56	55.59	4.03	7.82
2265004031*	Leafblowers/Vacuums	4 Stroke	2,261.53	2,469.32	207.80	9.19
2265004036	Snowblowers	4 Stroke	0.00	0.00	0.00	NA
2265004041*	Rear Engine Riding Mowers	4 Stroke	272.22	298.69	26.47	9.72
2265004046*	Front Mowers	4 Stroke	320.89	346.31	25.43	7.92
2265004051*	Shredders < 6 HP	4 Stroke	138.56	145.57	7.00	5.05
2265004056*	Lawn & Garden Tractors	4 Stroke	3,756.08	4,047.85	291.77	7.77
2265004066*	Chippers/Stump Grinders	4 Stroke	631.04	688.10	57.06	9.04
2265004071*	Commercial Turf Equipment	4 Stroke	11,456.16	12,798.99	1,342.83	11.72
2265004076*	Other Lawn & Garden Eqp.	4 Stroke	366.08	392.41	26.33	7.19

Model Run 1 Core Model Ver 2005, May 2005
Model Run 2 Core Model Ver 2005, May 2005

SCC	Equipment Description	Engine Type	Model Run 1	Model Run 2	Run 2 - Run 1	%Difference
2267004066*	Chippers/Stump Grinders	LPG	216.58	233.14	16.56	7.65
2270004031	Leafblowers/Vacuums	Diesel	0.38	0.65	0.27	71.14
2270004036	Snowblowers	Diesel	0.00	0.00	0.00	NA
2270004046	Front Mowers	Diesel	1,372.99	2,384.76	1,011.77	73.69
2270004056	Lawn & Garden Tractors	Diesel	283.10	492.89	209.79	74.10
2270004066	Chippers/Stump Grinders	Diesel	1,931.61	3,307.68	1,376.07	71.24
2270004071	Commercial Turf Equipment	Diesel	225.11	391.74	166.63	74.02
2270004076	Other Lawn & Garden Eqp.	Diesel	14.63	25.14	10.51	71.86
Lawn and Garden Equipment (Com) Totals:			**28,544.45**	**34,146.76**	**5,602.31**	**19.63**
LAWN AND GARDEN EQUIPMENT (RES)						
2260004015*	Rotary Tillers < 6 HP	2 Stroke	7.76	10.10	2.34	30.15
2260004020*	Chain Saws < 6 HP	2 Stroke	73.71	96.44	22.73	30.84
2260004025*	Trimmers/Edgers/Brush Cutter	2 Stroke	137.32	181.73	44.41	32.34
2260004030*	Leafblowers/Vacuums	2 Stroke	89.13	117.00	27.87	31.27
2260004035	Snowblowers	2 Stroke	0.00	0.00	0.00	NA
2265004010*	Lawn mowers	4 Stroke	1,558.97	1,519.63	-39.35	-2.52
2265004015*	Rotary Tillers < 6 HP	4 Stroke	144.11	135.58	-8.53	-5.92
2265004025*	Trimmers/Edgers/Brush Cutter	4 Stroke	8.54	8.32	-0.21	-2.48
2265004030*	Leafblowers/Vacuums	4 Stroke	16.44	15.90	-0.54	-3.27
2265004035	Snowblowers	4 Stroke	0.00	0.00	0.00	NA
2265004040*	Rear Engine Riding Mowers	4 Stroke	327.44	348.99	21.54	6.58
2265004055*	Lawn & Garden Tractors	4 Stroke	4,419.80	4,682.29	262.48	5.94
2265004075*	Other Lawn & Garden Eqp.	4 Stroke	150.79	161.00	10.22	6.77
Lawn and Garden Equipment (Res) Totals:			**6,934.01**	**7,276.98**	**342.96**	**4.95**

Model Run 1 Core Model Ver 2005, May 2005
Model Run 2 Core Model Ver 2005, May 2005

SCC	Equipment Description	Engine Type	Model Run 1	Model Run 2	Run 2 - Run 1	%Difference
Grand Totals:			**35,478.46**	**41,423.74**	**5,945.27**	**16.76**

* Under 25 horsepower spark-ignition engines are lumped into either 2- or 4-stroke.

Model Run 1 Core Model Ver 2005, May 2005
Model Run 2 Core Model Ver 2005, May 2005

Comparison of Exhaust THC Emissions in Tons/Season by Source Classification

Model Run 1 : Travis 1998
Total for Summer Season, 1998
Lawn and Garden Equipment
Travis County Summertime
Date of Model Run 1: May 29 16:37:19: 2005

Model Run 2 : Travis 2010
Total for Summer Season, 2010
Lawn and Garden Equipment
Travis County Summertime
Date of Model Run 2: May 29 17:59:48: 2005

Today's Date: 5/29/2005

Source Classification	Model Run 1	Model Run 2	Run 2 - Run 1	%Difference
Lawn and Garden Equipment (Com)	881.45	397.63	-483.82	-54.89
Lawn and Garden Equipment (Res)	214.68	100.41	-114.27	-53.23
Grand Totals:	**1,096.13**	**498.04**	**-598.09**	**-54.56**

Model Run 1 Core Model Ver 2005, May 2005
Model Run 2 Core Model Ver 2005, May 2005
page 1 of 1

Comparison of Exhaust NOx Emissions in Tons/Season by County

Model Run 1 : Travis 1998

Total for Summer Season, 1998

Lawn and Garden Equipment
Travis County Summertime

Date of Model Run 1: May 29 16:37:19: 2005

Model Run 2 : Travis 2010

Total for Summer Season, 2010

Lawn and Garden Equipment
Travis County Summertime

Date of Model Run 2: May 29 17:59:48: 2005

Today's Date: 5/29/2005

County	Model Run 1	Model Run 2	Run 2 - Run 1	%Difference
Travis County	147.00	142.37	-4.63	-3.15
Grand Totals:	**147.00**	**142.37**	**-4.63**	**-3.15**

Model Run 1 Core Model Ver 2005, May 2005
Model Run 2 Core Model Ver 2005, May 2005

page 1 of 1

Comparison of Exhaust PM10 Emissions in Tons/Season by Horsepower

Model Run 1 : Travis 1998

Total for Summer Season, 1998

Lawn and Garden Equipment
Travis County Summertime

Date of Model Run 1: May 29 16:37:19: 2005

Model Run 2 : Travis 2010

Total for Summer Season, 2010

Lawn and Garden Equipment
Travis County Summertime

Date of Model Run 2: May 29 17:59:48: 2005

Today's Date: 5/29/2005

Horsepower	Model Run 1	Model Run 2	Run 2 - Run 1	%Difference
0 < HP <= 1	0.30	0.38	0.08	28.16
1 < HP <= 3	13.07	13.62	0.55	4.18
3 < HP <= 6	13.77	15.06	1.30	9.43
6 < HP <= 11	0.38	0.39	0.01	3.47
11 < HP <= 16	1.05	1.12	0.07	6.45
16 < HP <= 25	2.40	2.23	-0.18	-7.36
25 < HP <= 40	0.83	0.77	-0.06	-6.96
40 < HP <= 50	0.30	0.27	-0.04	-12.34
50 < HP <= 75	0.63	0.71	0.08	12.62
75 < HP <= 100	1.24	1.42	0.18	14.14
100 < HP <= 175	0.45	0.45	0.00	0.04
175 < HP <= 300	0.41	0.37	-0.04	-10.82
300 < HP <= 600	0.59	0.53	-0.06	-10.65
600 < HP <= 750	0.22	0.20	-0.02	-9.32
750 < HP <= 1000	0.05	0.05	0.00	-7.28
1000 < HP <= 1200	0.06	0.03	-0.03	-46.80

Model Run 1 Core Model Ver 2005, May 2005
Model Run 2 Core Model Ver 2005, May 2005

page 1 of 2

Horsepower	Model Run 1	Model Run 2	Run 2 - Run 1	%Difference
Grand Totals:	**35.75**	**37.59**	**1.83**	**5.13**

Model Run 1: Core Model Ver 2005, May 2005
Model Run 2: Core Model Ver 2005, May 2005

page 2 of 2

Comparison of Exhaust SO2 Emissions in Tons/Season by Equipment Type

Model Run 1 : Travis 1998

Total for Summer Season, 1998

Lawn and Garden Equipment
Travis County Summertime

Date of Model Run 1: May 29 16:37:19: 2005

Model Run 2 : Travis 2010

Total for Summer Season, 2010

Lawn and Garden Equipment
Travis County Summertime

Date of Model Run 2: May 29 17:59:48: 2005

Today's Date: 5/29/2005

Source Classification	Equipment Description	Model Run 1	Model Run 2	Run 2 - Run 1	%Difference
LAWN AND GARDEN EQUIPMENT (COM)					
	Lawnmowers	0.41	0.31	-0.10	-24.13
	Rotary Tillers < 6 HP	0.26	0.28	0.02	7.71
	Other Lawn & Garden Eqp.	0.11	0.13	0.03	25.55
	Shredders < 6 HP	0.03	0.03	0.00	5.36
	Leafblowers/Vacuums	0.60	0.68	0.08	13.08
	Trimmers/Edgers/Brush Cutter	0.15	0.04	-0.11	-73.49
	Trimmers/Edgers/Brush Cutter	0.15	0.19	0.05	30.62
	Chain Saws < 6 HP	0.13	0.02	-0.11	-84.63
	Lawn & Garden Tractors	1.35	0.97	-0.38	-28.24
	Rear Engine Riding Mowers	0.06	0.06	0.01	9.77
	Lawnmowers	0.41	0.47	0.06	13.33
	Snowblowers	0.00	0.00	0.00	NA
	Leafblowers/Vacuums	0.60	0.03	-0.57	-95.45
	Lawn & Garden Tractors	1.35	1.83	0.49	35.98
	Other Lawn & Garden Eqp.	0.11	0.03	-0.07	-68.35
	Front Mowers	2.84	4.89	2.05	72.18
	Rear Engine Riding Mowers	0.06	0.07	0.02	28.26

Model Run 1 Core Model Ver 2005, May 2005
Model Run 2 Core Model Ver 2005, May 2005

page 1 of 2

Source Classification	Equipment Description	Model Run 1	Model Run 2	Run 2 - Run 1	%Difference
	Rotary Tillers < 6 HP	0.26	0.03	-0.23	-88.41
	Commercial Turf Equipment	2.82	3.44	0.62	21.84
	Chippers/Stump Grinders	4.04	6.84	2.80	69.18
	Snowblowers	0.00	0.00	0.00	NA
	Chain Saws < 6 HP	0.13	0.15	0.02	17.90
LAWN AND GARDEN EQUIPMENT (RES)					
	Lawn & Garden Tractors	0.91	1.83	0.92	100.84
	Leafblowers/Vacuums	0.02	0.68	0.66	3,086.21
	Other Lawn & Garden Eqp.	0.03	0.13	0.10	324.31
	Lawnmowers	0.32	0.47	0.15	45.84
	Rear Engine Riding Mowers	0.07	0.06	-0.01	-8.74
	Rotary Tillers < 6 HP	0.03	0.28	0.25	793.06
	Chain Saws < 6 HP	0.01	0.15	0.14	924.52
	Trimmers/Edgers/Brush Cutter	0.03	0.19	0.16	554.93
	Chain Saws < 6 HP	0.01	0.02	0.00	33.53
	Lawn & Garden Tractors	0.91	0.97	0.05	5.99
	Lawnmowers	0.32	0.31	-0.01	-2.36
	Leafblowers/Vacuums	0.02	0.03	0.01	28.11
	Other Lawn & Garden Eqp.	0.03	0.03	0.00	6.96
	Rear Engine Riding Mowers	0.07	0.07	0.00	6.63
	Rotary Tillers < 6 HP	0.03	0.03	0.00	-3.87
	Snowblowers	0.00	0.00	0.00	NA
	Trimmers/Edgers/Brush Cutter	0.03	0.04	0.01	32.91
	Snowblowers	0.00	0.00	0.00	NA
Grand Totals:		**18.71**	**25.80**	**7.09**	**37.89**

Model Run 1 Core Model Ver 2005, May 2005
Model Run 2 Core Model Ver 2005, May 2005

page 2 of 2

Comparison of Crankcase TOG Emissions in Tons/Season by HP and SCC

Model Run 1 : Travis 1998

Total for Summer Season, 1998

Lawn and Garden Equipment
Travis County Summertime

Date of Model Run 1: May 29 16:37:19: 2005

Model Run 2 : Travis 2010

Total for Summer Season, 2010

Lawn and Garden Equipment
Travis County Summertime

Date of Model Run 2: May 29 17:59:48: 2005

Today's Date: 5/29/2005

Source Classification	Horsepower	Model Run 1	Model Run 2	Run 2 - Run 1	%Difference
LAWN AND GARDEN EQUIPMENT (COM)					
Chain Saws < 6 HP					
	1 < HP <= 3	0.00000	0.00000	0.00000	-95.23010
	3 < HP <= 6	0.00000	0.00000	0.00000	-95.23010
Chippers/Stump Grinders					
	3 < HP <= 6	0.00000	0.00000	0.00000	-95.23010
	6 < HP <= 11	0.00049	0.00000	-0.00049	-95.23010
	11 < HP <= 16	0.00319	0.00000	-0.00319	-95.23010
	16 < HP <= 25	0.16393	0.00003	-0.16390	-95.23010
	25 < HP <= 40	0.07865	0.00105	-0.07760	-95.23010
	40 < HP <= 50	0.00133	0.00060	-0.00074	-95.23010
	50 < HP <= 75	0.58145	0.17307	-0.40839	-95.23010
	75 < HP <= 100	0.02280	0.02329	0.00049	-95.23010
	100 < HP <= 175	0.27559	0.08606	-0.18953	-95.23010
	175 < HP <= 300	0.00963	0.00854	-0.00109	-95.23010
	300 < HP <= 600	0.01446	0.01187	-0.00259	-95.23010
	600 < HP <= 750	0.00524	0.00421	-0.00102	-95.23010
	750 < HP <= 1000	0.00131	0.00123	-0.00008	-95.23010

Model Run 1 Core Model Ver 2005, May 2005
Model Run 2 Core Model Ver 2005, May 2005

page 1 of 7

Source Classification	Horsepower	Model Run 1	Model Run 2	Run 2 - Run 1	%Difference
	1000 < HP <= 1200	0.00143	0.00082	-0.00061	-95.23010
Commercial Turf Equipment					
	1 < HP <= 3	0.00000	0.00000	0.00000	-95.23010
	3 < HP <= 6	1.28057	0.00000	-1.28057	-95.23010
	6 < HP <= 11	0.16771	0.00000	-0.16771	-95.23010
	11 < HP <= 16	0.59746	0.00012	-0.59733	-95.23010
	16 < HP <= 25	1.07611	0.00025	-1.07587	-95.23010
	25 < HP <= 40	2.40910	0.01486	-2.39425	-95.23010
	40 < HP <= 50	0.00205	0.00030	-0.00175	-95.23010
	50 < HP <= 75	0.04485	0.01123	-0.03362	-95.23010
	75 < HP <= 100	0.00208	0.00149	-0.00059	-95.23010
	100 < HP <= 175	0.00157	0.00123	-0.00035	-95.23010
Front Mowers					
	3 < HP <= 6	0.00002	0.00001	0.00000	-95.23010
	6 < HP <= 11	0.02261	0.00002	-0.02259	-95.23010
	11 < HP <= 16	0.13167	0.00111	-0.13056	-95.23010
	16 < HP <= 25	0.11623	0.03285	-0.08338	-95.23010
	25 < HP <= 40	0.03001	0.01499	-0.01502	-95.23010
	40 < HP <= 50	0.00814	0.00350	-0.00464	-95.23010
	50 < HP <= 75	0.00952	0.00912	-0.00040	-95.23010
	75 < HP <= 100	0.00305	0.00308	0.00002	-95.23010
Lawn & Garden Tractors					
	3 < HP <= 6	0.00000	0.00000	0.00000	-95.23010
	6 < HP <= 11	0.05317	0.00002	-0.05315	-95.23010
	11 < HP <= 16	0.82599	0.00023	-0.82576	-95.23010
	16 < HP <= 25	0.37981	0.00793	-0.37188	-95.23010
	25 < HP <= 40	0.00038	0.00013	-0.00025	-95.23010

Model Run 1 Core Model Ver 2005, May 2005
Model Run 2 Core Model Ver 2005, May 2005

APPENDIX E

EXAMPLES OF EMISSION FACTOR REPORTS

Reports for Travis County, Texas 1998 emission factors are printed in the following order. Note that only the first two pages are printed for the longer reports.

1. Grams per Operating Hour by SCC
2. Grams per Operating Hour by HP and SCC
3. Grams per Day by SCC
4. Grams per Day by HP and SCC
5. Grams per HP-Hour by SCC
6. Grams per HP-Hour by HP and SCC

Emission Factors by SCC and Pollutant

All Fuels **Grams/Operating Hour** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Fuel Type	SCC	Equipment Description	Engine Type	Exhaust THC	Exhaust NOx	Exhaust CO	Exhaust PM10	Exhaust SO2	Exhaust CO2	Crankcase THC	Diurnal THC
Diesel											
	Lawn and Garden Equipment (Com)										
	2270004031	Leafblowers/Vacuums	Diesel	10.79	47.52	32.13	5.77	7.31	3,616.88	0.22	0.00
	2270004036	Snowblowers	Diesel	NA	NA	NA	NA	NA	NA	NA	NA
	2270004046	Front Mowers	Diesel	20.24	96.51	65.11	13.04	14.83	7,334.21	0.40	0.00
	2270004056	Lawn & Garden Tractors	Diesel	15.40	76.38	48.84	10.01	10.66	5,274.23	0.31	0.00
	2270004066	Chippers/Stump Grinders	Diesel	57.02	481.18	240.38	51.19	69.73	34,479.30	1.14	0.00
	2270004071	Commercial Turf Equipment	Diesel	26.41	155.34	89.64	18.15	24.27	11,999.84	0.53	0.00
	2270004076	Other Lawn & Garden Eqp.	Diesel	27.44	170.22	99.89	20.80	25.65	12,685.89	0.55	0.00
Gasoline											
	Lawn and Garden Equipment (Com)										
	2260004016*	Rotary Tillers < 6 HP	2 Stroke	236.96	0.68	602.39	8.21	0.19	955.44	0.00	0.06
	2260004021*	Chain Saws < 6 HP	2 Stroke	400.22	4.05	1,087.42	24.05	0.40	1,970.42	0.00	0.05
	2260004026*	Trimmers/Edgers/Brush Cutter	2 Stroke	308.15	1.06	752.89	12.71	0.28	1,364.33	0.00	0.14
	2260004031*	Leafblowers/Vacuums	2 Stroke	360.12	2.02	926.87	16.92	0.34	1,667.34	0.00	0.24
	2260004036	Snowblowers	2 Stroke	NA	NA	NA	NA	NA	NA	NA	NA
	2260004071*	Commercial Turf Equipment	2 Stroke	424.45	1.09	1,001.29	16.58	0.37	1,830.27	0.00	0.36
	2265004011*	Lawn mowers	4 Stroke	68.79	4.14	970.14	0.63	0.34	1,635.37	0.88	0.10
	2265004016*	Rotary Tillers < 6 HP	4 Stroke	131.00	4.61	1,308.11	1.85	0.52	2,511.66	4.01	0.06

Core Model Ver 2005, May 2005 *page 1 of 6*

Emission Factors by SCC and Pollutant

All Fuels **Grams/Operating Hour** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Fuel Type	SCC	Equipment Description	Engine Type	Vapor Displacement THC	Spillage THC	Hot Soak THC	Running Loss THC	Tank Permeation THC	Hose Permeation THC	Total THC
Diesel										
	Lawn and Garden Equipment (Com)									
	2270004031	Leafblowers/Vacuums	Diesel	0.00	0.00	0.00	0.00	0.00	0.00	11.01
	2270004036	Snowblowers	Diesel	NA	NA	NA	NA	NA	NA	NA
	2270004046	Front Mowers	Diesel	0.00	0.00	0.00	0.00	0.00	0.00	20.65
	2270004056	Lawn & Garden Tractors	Diesel	0.00	0.00	0.00	0.00	0.00	0.00	15.71
	2270004066	Chippers/Stump Grinders	Diesel	0.00	0.00	0.00	0.00	0.00	0.00	58.17
	2270004071	Commercial Turf Equipment	Diesel	0.00	0.00	0.00	0.00	0.00	0.00	26.94
	2270004076	Other Lawn & Garden Eqp.	Diesel	0.00	0.00	0.00	0.00	0.00	0.00	27.99
Gasoline										
	Lawn and Garden Equipment (Com)									
	2260004016*	Rotary Tillers < 6 HP	2 Stroke	0.75	10.86	0.00	0.00	0.00	0.00	248.63
	2260004021*	Chain Saws < 6 HP	2 Stroke	1.41	45.30	0.00	0.00	0.00	0.00	446.98
	2260004026*	Trimmers/Edgers/Brush Cutter	2 Stroke	1.02	22.35	0.00	0.00	0.00	0.00	331.67
	2260004031*	Leafblowers/Vacuums	2 Stroke	1.23	7.66	0.00	0.00	0.00	0.00	369.25
	2260004036	Snowblowers	2 Stroke	NA	NA	NA	NA	NA	NA	NA
	2260004071*	Commercial Turf Equipment	2 Stroke	1.39	2.43	0.00	0.00	0.00	0.00	428.62
	2265004011*	Lawn mowers	4 Stroke	0.81	8.82	0.00	0.00	0.00	0.00	79.39
	2265004016*	Rotary Tillers < 6 HP	4 Stroke	1.27	18.57	0.00	0.00	0.00	0.00	154.91

Core Model Ver 2005, May 2005 *page 2 of 6*

Emission Factors by Horsepower, SCC, and Pollutant

All Fuels **Grams/Operating Hour** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Fuel Type	SCC	Equipment Description	Engine Type / Horsepower	Exhaust THC	Exhaust NOx	Exhaust CO	Exhaust PM10	Exhaust SO2	Exhaust CO2	Crankcase THC	Diurnal THC
Diesel											
	Lawn and Garden Equipment (Com)										
	2270004031	Leafblowers/Vacuums	Diesel								
			3 < HP <= 6	3.69	24.49	12.66	2.68	2.89	1,426.83	0.07	0.00
			25 < HP <= 40	21.89	83.50	62.54	10.59	14.23	7,038.25	0.44	0.00
			40 < HP <= 50	NA	NA	NA	NA	NA	NA	NA	NA
			50 < HP <= 75	NA	NA	NA	NA	NA	NA	NA	NA
			75 < HP <= 100	NA	NA	NA	NA	NA	NA	NA	NA
			100 < HP <= 175	NA	NA	NA	NA	NA	NA	NA	NA
	2270004036	Snowblowers	Diesel								
			100 < HP <= 175	NA	NA	NA	NA	NA	NA	NA	NA
			175 < HP <= 300	NA	NA	NA	NA	NA	NA	NA	NA
			300 < HP <= 600	NA	NA	NA	NA	NA	NA	NA	NA
	2270004046	Front Mowers	Diesel								
			3 < HP <= 6	3.30	21.76	11.77	2.67	2.55	1,258.77	0.07	0.00
			6 < HP <= 11	NA	NA	NA	NA	NA	NA	NA	NA

Core Model Ver 2005, May 2005 *page 1 of 18*

Emission Factors by Horsepower, SCC, and Pollutant

All Fuels **Grams/Operating Hour** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Fuel Type	SCC	Equipment Description	Engine Type / Horsepower	Vapor Displacement THC	Spillage THC	Hot Soak THC	Running Loss THC	Tank Permeation THC	Hose Permeation THC	Total THC
Diesel										
	Lawn and Garden Equipment (Com)									
	2270004031	Leafblowers/Vacuums	Diesel							
			3 < HP <= 6	0.00	0.00	0.00	0.00	0.00	0.00	3.77
			25 < HP <= 40	0.00	0.00	0.00	0.00	0.00	0.00	22.32
			40 < HP <= 50	NA	NA	NA	NA	NA	NA	NA
			50 < HP <= 75	NA	NA	NA	NA	NA	NA	NA
			75 < HP <= 100	NA	NA	NA	NA	NA	NA	NA
			100 < HP <= 175	NA	NA	NA	NA	NA	NA	NA
	2270004036	Snowblowers	Diesel							
			100 < HP <= 175	NA	NA	NA	NA	NA	NA	NA
			175 < HP <= 300	NA	NA	NA	NA	NA	NA	NA
			300 < HP <= 600	NA	NA	NA	NA	NA	NA	NA
	2270004046	Front Mowers	Diesel							
			3 < HP <= 6	0.00	0.00	0.00	0.00	0.00	0.00	3.37
			6 < HP <= 11	NA	NA	NA	NA	NA	NA	NA

Core Model Ver 2005, May 2005 *page 2 of 18*

Emission Factors by SCC and Pollutant

All Fuels **Grams/Day** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Fuel Type	SCC	Equipment Description	Engine Type	Exhaust THC	Exhaust NOx	Exhaust CO	Exhaust PM10	Exhaust SO2	Exhaust CO2	Crankcase THC	Diurnal THC
Diesel											
	Lawn and Garden Equipment (Com)										
	2270004031	Leafblowers/Vacuums	Diesel	4.78	21.03	14.22	2.55	3.24	1,600.89	0.10	0.00
	2270004036	Snowblowers	Diesel	NA	NA	NA	NA	NA	NA	NA	NA
	2270004046	Front Mowers	Diesel	35.84	170.87	115.27	23.09	26.26	12,984.98	0.72	0.00
	2270004056	Lawn & Garden Tractors	Diesel	30.90	153.26	98.00	20.08	21.40	10,582.89	0.62	0.00
	2270004066	Chippers/Stump Grinders	Diesel	97.81	825.29	412.28	87.79	119.59	59,136.79	1.96	0.00
	2270004071	Commercial Turf Equipment	Diesel	104.04	611.95	353.12	71.51	95.59	47,270.81	2.08	0.00
	2270004076	Other Lawn & Garden Eqp.	Diesel	43.83	271.85	159.53	33.22	40.97	20,260.73	0.88	0.00
Gasoline											
	Lawn and Garden Equipment (Com)										
	2260004016*	Rotary Tillers < 6 HP	2 Stroke	412.53	1.18	1,048.74	14.29	0.34	1,663.39	0.00	0.11
	2260004021*	Chain Saws < 6 HP	2 Stroke	329.53	3.33	895.35	19.81	0.33	1,622.38	0.00	0.04
	2260004026*	Trimmers/Edgers/Brush Cutter	2 Stroke	155.72	0.53	380.45	6.42	0.14	689.43	0.00	0.07
	2260004031*	Leafblowers/Vacuums	2 Stroke	374.57	2.10	964.08	17.60	0.35	1,734.28	0.00	0.25
	2260004036	Snowblowers	2 Stroke	NA	NA	NA	NA	NA	NA	NA	NA
	2260004071*	Commercial Turf Equipment	2 Stroke	1,067.71	2.73	2,518.78	41.71	0.93	4,604.11	0.00	0.91
	2265004011*	Lawn mowers	4 Stroke	103.01	6.19	1,452.80	0.94	0.50	2,449.00	1.32	0.15
	2265004016*	Rotary Tillers < 6 HP	4 Stroke	228.07	8.03	2,277.36	3.21	0.90	4,372.69	6.98	0.11

Core Model Ver 2005, May 2005 *page 1 of 6*

Emission Factors by SCC and Pollutant

All Fuels **Grams/Day** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Fuel Type	SCC	Equipment Description	Engine Type	Vapor Displacement THC	Spillage THC	Hot Soak THC	Running Loss THC	Tank Permeation THC	Hose Permeation THC	Total THC
Diesel										
	Lawn and Garden Equipment (Com)									
	2270004031	Leafblowers/Vacuums	Diesel	0.00	0.00	0.00	0.00	0.00	0.00	4.87
	2270004036	Snowblowers	Diesel	NA	NA	NA	NA	NA	NA	NA
	2270004046	Front Mowers	Diesel	0.00	0.00	0.00	0.00	0.00	0.00	36.55
	2270004056	Lawn & Garden Tractors	Diesel	0.00	0.00	0.00	0.00	0.00	0.00	31.52
	2270004066	Chippers/Stump Grinders	Diesel	0.00	0.00	0.00	0.00	0.00	0.00	99.76
	2270004071	Commercial Turf Equipment	Diesel	0.00	0.00	0.00	0.00	0.00	0.00	106.12
	2270004076	Other Lawn & Garden Eqp.	Diesel	0.00	0.00	0.00	0.00	0.00	0.00	44.71
Gasoline										
	Lawn and Garden Equipment (Com)									
	2260004016*	Rotary Tillers < 6 HP	2 Stroke	1.30	18.91	0.00	0.00	0.00	0.00	432.85
	2260004021*	Chain Saws < 6 HP	2 Stroke	1.16	37.30	0.00	0.00	0.00	0.00	368.03
	2260004026*	Trimmers/Edgers/Brush Cutter	2 Stroke	0.52	11.29	0.00	0.00	0.00	0.00	167.60
	2260004031*	Leafblowers/Vacuums	2 Stroke	1.28	7.97	0.00	0.00	0.00	0.00	384.07
	2260004036	Snowblowers	2 Stroke	NA	NA	NA	NA	NA	NA	NA
	2260004071*	Commercial Turf Equipment	2 Stroke	3.49	6.10	0.00	0.00	0.00	0.00	1,078.21
	2265004011*	Lawn mowers	4 Stroke	1.21	13.21	0.00	0.00	0.00	0.00	118.89
	2265004016*	Rotary Tillers < 6 HP	4 Stroke	2.22	32.33	0.00	0.00	0.00	0.00	269.70

Core Model Ver 2005, May 2005 *page 2 of 6*

Emission Factors by Horsepower, SCC, and Pollutant

All Fuels **Grams/Day** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Fuel Type	SCC	Equipment Description	Engine Type / Horsepower	Exhaust THC	Exhaust NOx	Exhaust CO	Exhaust PM10	Exhaust SO2	Exhaust CO2	Crankcase THC	Diurnal THC
Diesel											
	Lawn and Garden Equipment (Com)										
	2270004031	Leafblowers/Vacuums	Diesel								
			3 < HP <= 6	1.63	10.84	5.60	1.19	1.28	631.54	0.03	0.00
			25 < HP <= 40	9.69	36.96	27.68	4.69	6.30	3,115.25	0.19	0.00
			40 < HP <= 50	NA	NA	NA	NA	NA	NA	NA	NA
			50 < HP <= 75	NA	NA	NA	NA	NA	NA	NA	NA
			75 < HP <= 100	NA	NA	NA	NA	NA	NA	NA	NA
			100 < HP <= 175	NA	NA	NA	NA	NA	NA	NA	NA
	2270004036	Snowblowers	Diesel								
			100 < HP <= 175	NA	NA	NA	NA	NA	NA	NA	NA
			175 < HP <= 300	NA	NA	NA	NA	NA	NA	NA	NA
			300 < HP <= 600	NA	NA	NA	NA	NA	NA	NA	NA
	2270004046	Front Mowers	Diesel								
			3 < HP <= 6	5.85	38.53	20.83	4.73	4.51	2,228.61	0.12	0.00
			6 < HP <= 11	NA	NA	NA	NA	NA	NA	NA	NA

Core Model Ver 2005, May 2005 *page 1 of 18*

Emission Factors by Horsepower, SCC, and Pollutant

All Fuels **Grams/Day** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Fuel Type	SCC	Equipment Description	Engine Type / Horsepower	Vapor Displacement THC	Spillage THC	Hot Soak THC	Running Loss THC	Tank Permeation THC	Hose Permeation THC	Total THC
Diesel										
	Lawn and Garden Equipment (Com)									
	2270004031	Leafblowers/Vacuums	Diesel							
			3 < HP <= 6	0.00	0.00	0.00	0.00	0.00	0.00	1.67
			25 < HP <= 40	0.00	0.00	0.00	0.00	0.00	0.00	9.88
			40 < HP <= 50	NA	NA	NA	NA	NA	NA	NA
			50 < HP <= 75	NA	NA	NA	NA	NA	NA	NA
			75 < HP <= 100	NA	NA	NA	NA	NA	NA	NA
			100 < HP <= 175	NA	NA	NA	NA	NA	NA	NA
	2270004036	Snowblowers	Diesel							
			100 < HP <= 175	NA	NA	NA	NA	NA	NA	NA
			175 < HP <= 300	NA	NA	NA	NA	NA	NA	NA
			300 < HP <= 600	NA	NA	NA	NA	NA	NA	NA
	2270004046	Front Mowers	Diesel							
			3 < HP <= 6	0.00	0.00	0.00	0.00	0.00	0.00	5.96
			6 < HP <= 11	NA	NA	NA	NA	NA	NA	NA

Core Model Ver 2005, May 2005 *page 2 of 18*

Emission Factors by SCC and Pollutant

All Fuels **Grams/HP-Hour** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Fuel Type	SCC	Equipment Description	Engine Type	Exhaust THC	Exhaust NOx	Exhaust CO	Exhaust PM10	Exhaust SO2	Exhaust CO2	Crankcase THC
Diesel										
	Lawn and Garden Equipment (Com)									
	2270004031	Leafblowers/Vacuums	Diesel	1.75	7.68	5.19	0.93	1.18	584.80	0.03
	2270004036	Snowblowers	Diesel	NA	NA	NA	NA	NA	NA	NA
	2270004046	Front Mowers	Diesel	1.62	7.70	5.20	1.04	1.18	585.22	0.03
	2270004056	Lawn & Garden Tractors	Diesel	1.71	8.47	5.42	1.11	1.18	584.92	0.03
	2270004066	Chippers/Stump Grinders	Diesel	0.91	7.66	3.82	0.81	1.11	548.57	0.02
	2270004071	Commercial Turf Equipment	Diesel	1.25	7.37	4.25	0.86	1.15	569.43	0.03
	2270004076	Other Lawn & Garden Eqp.	Diesel	1.23	7.61	4.47	0.93	1.15	567.26	0.02
Gasoline										
	Lawn and Garden Equipment (Com)									
	2260004016*	Rotary Tillers < 6 HP	2 Stroke	255.23	0.73	648.84	8.84	0.21	1,029.11	0.00
	2260004021*	Chain Saws < 6 HP	2 Stroke	162.60	1.64	441.79	9.77	0.16	800.52	0.00
	2260004026*	Trimmers/Edgers/Brush Cutter	2 Stroke	221.91	0.76	542.17	9.16	0.20	982.50	0.00
	2260004031*	Leafblowers/Vacuums	2 Stroke	195.90	1.10	504.22	9.21	0.18	907.03	0.00
	2260004036	Snowblowers	2 Stroke	NA	NA	NA	NA	NA	NA	NA
	2260004071*	Commercial Turf Equipment	2 Stroke	235.80	0.60	556.27	9.21	0.21	1,016.82	0.00
	2265004011*	Lawn mowers	4 Stroke	51.21	3.08	722.29	0.47	0.25	1,217.57	0.65
	2265004016*	Rotary Tillers < 6 HP	4 Stroke	69.50	2.45	694.03	0.98	0.27	1,332.59	2.13

Core Model Ver 2005, May 2005 *page 1 of 3*

Fuel Type	SCC	Equipment Description	Engine Type	Exhaust THC	Exhaust NOx	Exhaust CO	Exhaust PM10	Exhaust SO2	Exhaust CO2	Crankcase THC
	2265004026*	Trimmers/Edgers/Brush Cutter	4 Stroke	33.79	3.38	721.38	0.21	0.26	1,257.69	0.71
	2265004031*	Leafblowers/Vacuums	4 Stroke	14.08	4.81	586.66	0.13	0.23	1,135.21	0.71
	2265004036	Snowblowers	4 Stroke	NA	NA	NA	NA	NA	NA	NA
	2265004041*	Rear Engine Riding Mowers	4 Stroke	14.73	3.52	719.22	0.14	0.25	1,215.65	0.36
	2265004046*	Front Mowers	4 Stroke	16.96	2.65	710.03	0.15	0.26	1,267.80	0.91
	2265004051*	Shredders < 6 HP	4 Stroke	71.88	2.37	691.55	1.04	0.28	1,348.80	2.30
	2265004056*	Lawn & Garden Tractors	4 Stroke	15.56	3.57	714.71	0.14	0.25	1,233.84	0.39
	2265004066*	Chippers/Stump Grinders	4 Stroke	10.61	6.09	451.39	0.12	0.21	1,028.04	1.25
	2265004071*	Commercial Turf Equipment	4 Stroke	17.15	4.03	661.50	0.17	0.24	1,148.83	0.54
	2265004076*	Other Lawn & Garden Eqp.	4 Stroke	45.67	2.41	696.94	0.62	0.27	1,318.57	1.72
	Lawn and Garden Equipment (Res)									
	2260004015*	Rotary Tillers < 6 HP	2 Stroke	260.83	0.77	676.22	8.73	0.21	1,036.07	0.00
	2260004020*	Chain Saws < 6 HP	2 Stroke	253.97	0.72	645.36	8.86	0.21	1,031.58	0.00
	2260004025*	Trimmers/Edgers/Brush Cutter	2 Stroke	256.90	0.76	654.99	8.80	0.21	1,019.54	0.00
	2260004030*	Leafblowers/Vacuums	2 Stroke	255.02	0.73	647.36	8.86	0.21	1,028.11	0.00
	2260004035	Snowblowers	2 Stroke	NA	NA	NA	NA	NA	NA	NA
	2265004010*	Lawn mowers	4 Stroke	61.65	2.41	704.88	0.42	0.30	1,465.61	2.88
	2265004015*	Rotary Tillers < 6 HP	4 Stroke	59.50	2.48	713.98	0.16	0.31	1,523.91	3.19
	2265004025*	Trimmers/Edgers/Brush Cutter	4 Stroke	55.45	2.62	716.62	0.18	0.30	1,448.47	2.61
	2265004030*	Leafblowers/Vacuums	4 Stroke	57.33	2.63	718.41	0.19	0.30	1,461.92	2.70
	2265004035	Snowblowers	4 Stroke	NA	NA	NA	NA	NA	NA	NA
	2265004040*	Rear Engine Riding Mowers	4 Stroke	15.17	2.92	714.53	0.12	0.26	1,255.59	0.74
	2265004055*	Lawn & Garden Tractors	4 Stroke	16.16	2.86	716.76	0.12	0.26	1,263.77	0.79
	2265004075*	Other Lawn & Garden Eqp.	4 Stroke	45.92	2.38	700.07	0.63	0.27	1,321.41	1.72
LPG										
	Lawn and Garden Equipment (Com)									
	2267004066*	Chippers/Stump Grinders	LPG	2.52	12.20	49.44	0.06	0.01	681.38	0.83

Fuel Type	SCC	Equipment Description	Engine Type	Exhaust THC	Exhaust NOx	Exhaust CO	Exhaust PM10	Exhaust SO2	Exhaust CO2	Crankcase THC

* Under 25 horsepower spark-ignition engines are lumped into either 2- or 4-stroke.

Core Model Ver 2005, May 2005 *page 3 of 3*

Emission Factors by Horsepower, SCC, and Pollutant

All Fuels **Grams/HP-Hour** **Travis County**

Lawn and Garden Equipment
Travis County Summertime (Travis 1998)
Total for Summer Season, 1998
Date of Model Run: May 29 16:37:19: 2005 Today's Date: 5/29/2005

Fuel Type	SCC	Equipment Description	Engine Type / Horsepower	Exhaust THC	Exhaust NOx	Exhaust CO	Exhaust PM10	Exhaust SO2	Exhaust CO2	Crankcase THC
Diesel										
	Lawn and Garden Equipment (Com)									
	2270004031	Leafblowers/Vacuums	Diesel							
			3 < HP <= 6	1.51	10.05	5.19	1.10	1.18	585.53	0.03
			25 < HP <= 40	1.82	6.93	5.19	0.88	1.18	584.57	0.04
			40 < HP <= 50	NA	NA	NA	NA	NA	NA	NA
			50 < HP <= 75	NA	NA	NA	NA	NA	NA	NA
			75 < HP <= 100	NA	NA	NA	NA	NA	NA	NA
			100 < HP <= 175	NA	NA	NA	NA	NA	NA	NA
	2270004036	Snowblowers	Diesel							
			100 < HP <= 175	NA	NA	NA	NA	NA	NA	NA
			175 < HP <= 300	NA	NA	NA	NA	NA	NA	NA
			300 < HP <= 600	NA	NA	NA	NA	NA	NA	NA
	2270004046	Front Mowers	Diesel							
			3 < HP <= 6	1.54	10.12	5.47	1.24	1.18	585.47	0.03
			6 < HP <= 11	NA	NA	NA	NA	NA	NA	NA

Core Model Ver 2005, May 2005 *page 1 of 9*

Fuel Type	SCC	Equipment Description	Engine Type	Exhaust THC	Exhaust NOx	Exhaust CO	Exhaust PM10	Exhaust SO2	Exhaust CO2	Crankcase THC
			Horsepower							
			11 < HP <= 16	1.74	8.60	5.47	1.12	1.18	584.82	0.03
			16 < HP <= 25	1.74	8.60	5.47	1.12	1.18	584.82	0.03
			25 < HP <= 40	1.84	6.98	5.47	0.99	1.18	584.49	0.04
			40 < HP <= 50	1.84	6.98	5.47	0.99	1.18	584.49	0.04
			50 < HP <= 75	1.05	7.28	4.30	0.98	1.19	587.01	0.02
			75 < HP <= 100	1.05	7.28	4.30	0.98	1.19	587.00	0.02
	2270004056	Lawn & Garden Tractors	Diesel							
			6 < HP <= 11	1.54	10.13	5.48	1.25	1.18	585.46	0.03
			11 < HP <= 16	1.74	8.61	5.48	1.12	1.18	584.81	0.03
			16 < HP <= 25	1.74	8.61	5.48	1.12	1.18	584.81	0.03
			25 < HP <= 40	1.84	6.99	5.48	1.00	1.18	584.48	0.04
			40 < HP <= 50	1.84	6.99	5.48	1.00	1.18	584.49	0.04
			75 < HP <= 100	1.04	7.22	4.23	0.97	1.19	587.04	0.02
	2270004066	Chippers/Stump Grinders	Diesel							
			16 < HP <= 25	1.74	8.60	5.47	1.12	1.18	584.82	0.03
			25 < HP <= 40	1.84	6.98	5.47	0.99	1.18	584.49	0.04
			40 < HP <= 50	1.84	6.98	5.47	0.99	1.18	584.49	0.04
			50 < HP <= 75	1.06	7.29	4.31	0.98	1.19	587.00	0.02
			75 < HP <= 100	1.06	7.29	4.31	0.98	1.19	587.00	0.02
			100 < HP <= 175	0.84	7.94	3.61	0.76	1.07	528.35	0.02
			175 < HP <= 300	0.82	7.75	3.46	0.74	1.07	528.44	0.02
			300 < HP <= 600	0.80	7.82	3.54	0.70	1.07	528.50	0.02
			600 < HP <= 750	0.79	7.78	3.54	0.70	1.07	528.53	0.02
			750 < HP <= 1000	0.89	8.29	3.81	0.74	1.07	528.19	0.02
			1000 < HP <= 1200	0.89	8.29	3.81	0.74	1.07	528.19	0.02