

# **Non-Road Assessment Tool and Estimator**

## **NATE**

## **User's Guide**

# FINAL

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For:  
Texas Natural Resource Conservation Commission

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# Non-Road Assessment Tool and Estimator User Guide

## Introduction

The Non-Road Assessment Tool and Estimator (NATE) was created under a work assignment conducted for the Texas Natural Resource Conservation Commission (TNRCC). The purpose of the work assignment was to develop a modeling tool that could relate specific pieces of equipment to the NONROAD model, an air emissions model being developed by the U.S. Environmental Protection Agency (EPA). The NATE modeling tool would have to be easy to use, and would be installed on typical personal computer hardware. The target audience would be people who want to evaluate medium and small sized fleets of non-road engine emissions.

As its name suggests, the NONROAD model estimates county-based air emissions for certain non-road equipment such as bulldozers, lawnmowers, welders, tractors, and pumps - ships, locomotives and aircraft are not included. Currently, the EPA has not officially approved NONROAD for use in developing emission inventories, although has granted the TNRCC the ability to use the new model in cases where local survey information has been collected, such as for diesel construction equipment in the Houston-Galveston area.<sup>1</sup> The Houston diesel construction inventory was a massive effort to collect data from highway, municipal, industrial, residential, and utility construction sectors that resulted in a major reduction to the emissions inventory.

Thus, use of NONROAD for fleet equipment, and by association NATE, appears to be consistent with this policy. The EPA has acknowledged that NONROAD is clearly “better science” than using the data and emission factors collected in prior to 1992,<sup>2</sup> and although NONROAD and NATE cannot be approved for widespread use until NONROAD is officially released – in approximately a year or even longer - they can be considered as a state-of-the-art modeling tools.

### *What problem does NATE solve?*

NONROAD was designed for developing countywide or statewide emission inventories. It was not designed to work very well for smaller fleets of equipment that have known model years. Let us use the example of a 1986 bulldozer. In technical terms, in order to estimate emissions from a small number of equipment, one would have to run NONROAD, select a by-model year feature, and then look up the results from over a megabyte of data. This is cumbersome because although we can find the 1986 model year there is no entry for “bulldozer,” since a numeric source category code has been used. The NATE model automates this process, in a simple manner using

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<sup>1</sup> See State Implementation Plan revision dated December 6, 2000, Appendix B.

<sup>2</sup> Non-road Equipment and Vehicle Emissions Study (NEVES), U.S. EPA, 1992.

pull-down screens and other features, and yields exactly the same as those obtained from the NONROAD model because NATE only uses NONROAD model output.

A fleet manager could then use NATE's reporting feature to compare a 1986 bulldozer's emissions to that of a brand new bulldozer, perhaps to get an idea about potential mobile source credits or whether to participate in a voluntary emission reduction plan. On the regulatory side, TNRCC could run the same inputs to obtain (hopefully) the exact same estimates for our hypothetical 1986 bulldozer, such as to verify mobile discrete emission reduction credits (MDERC) or to help qualify for state grants.

## ***Brief History***

NATE origins were as an "alternative compliance plan" calculator. In the year 2000 the TNRCC had adopted regulations that would prohibit morning use of certain kinds of equipment and accelerate the new emission standards: if the fleet owner wanted an "out" from the rule, he or she would have to file an alternative compliance plan with the TNRCC and EPA. An EXCEL spreadsheet was devised to help fleet owners calculate their target emissions, which would then have to be reduced by some other emissions-reducing measure. Based upon subsequent comments, the TNRCC agreed to outsource the alternative compliance plan calculator so as to reflect the best science, while at the same time being consistent as possible with the State Implementation Plan. This is where the idea for NATE evolved from.

## ***Senate Bill 5***

Subsequently, the Texas Legislature passed Senate Bill 5,<sup>3</sup> which created a Texas emission reduction plan (TERP). The TERP removed the morning use prohibition and accelerated standards for construction equipment (although at this time the morning lawn and garden use restriction is still in effect). The TERP also changed the nature of the non-road emission regulations from command-and-control more towards voluntary participation. NATE could be used to estimate emissions, emission reductions, and if the cost of the new equipment was known, the user could then evaluate cost-effectiveness. The new model would have to be able to address any piece of non-road equipment, not just construction, industrial, commercial, and lawn & garden equipment. Outboard motor engines, for example, might qualify under the TERP program, and someone might want to know the emission benefits of purchasing a brand-new four-stroke or even a diesel outboard engine, as compared to an older gasoline-powered outboard motor.

## ***Pollutants covered***

NATE outputs emissions in terms of tons for certain air pollutants known as criteria pollutants (see Table 1). The tonnage issue can be confusing to the newcomer because it is often confused with weight – such as a ton of steel in a bulldozer. For the purposes of air quality planning, a ton of emissions is estimated from the mass of emissions, using the atomic number of the pollutant

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<sup>3</sup> SB5, 77<sup>th</sup> Texas Legislature, Regular Session

and making some assumptions about concentration, volume, and density – these are computed by protocols set by the U.S. EPA. A ton is equal to 2,000 pounds, being a short ton or tons American (English tons and metric tons are 2,200 pounds). While SB5 and the Texas State Implementation Plan are primarily concerned with oxides of nitrogen, NATE will output several kinds of pollutants, all reported in tons.

**Table 1. Reported Pollutants**

<b>Pollutant</b>	<b>Abbreviation</b>	<b>Notes</b>
Oxides of Nitrogen	NO <sub>x</sub>	Main thrust of SB 5
Volatile Organic Compounds	VOC	Exhaust and evaporation sources
Carbon Monoxide	CO	Well known poisonous gas
Particulate Matter	PM	PM assumed to be PM-10 or PM-2.5
Sulfur Oxides	SO <sub>2</sub>	Dependent upon sulfur % in the fuel

Lead is another air quality criteria pollutant but is not included in NONROAD or NATE because it is not emitted in significant quantities. Nitrogen dioxide is another criteria pollutant but is no longer a public health threat, and is generally thought to be five to ten percent of NO<sub>x</sub>. Air toxics such as benzene and mercury are not reported in NONROAD because of the complexities required in the calculations; future versions of NONROAD or a “next generation” model might include some of the major toxics. Finally, NONROAD does report a “greenhouse gas,” carbon dioxide, but was not included in this initial work assignment.

### ***Organization of this report***

This User Guide contains all the steps from starting the model through interpreting the reported results. As is typical with many computer software packages, certain screens are printed, with special notes, comments, and troubleshooting tips along the way. NATE is intended for use on Windows<sup>™</sup> compatible computers. No special programming experience is needed. The main sections of this User Guide are:

- Getting Started
- Overview of NATE
- Running NONROAD
- Model Output
- Reporting Features
- Advanced Options
- Troubleshooting

As shown in the next section, the NONROAD model is a completely separate model to be downloaded first by the user.

## Getting Started

### *Two Components: NONROAD and NATE*

There are two main parts to NATE: the NONROAD model and the NATE software itself. The NONROAD model is discussed first because it has the core processor that does the emission calculations. The user must first download NONROAD from the EPA website at:

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

### *NONROAD Model*

The NONROAD installation directions are clear, and many of the file attribute problems are avoided because NATE uses its own support files – which are not “locked.” The NONROAD model is very large and could take some time to download if using a regular 56K byte per second modem. You may also request a CD-ROM from the EPA if download time becomes excessive. For technical problems with installing NONROAD, please send an email to the EPA at:

[nonroad@epamail.epa.gov](mailto:nonroad@epamail.epa.gov)

You may also contact Karla Smith of the TNRCC at (512) 239-0408 if you are having NONROAD installation difficulties. After you have installed NONROAD, download the NATE model at:

<http://www.tnrcc.state.tx.us/>

### *NATE Model Setup*

Installation of the NATE model is discussed in this section. Click on the “Download NATE Model Now” button. Your browser will ask for a directory to download the file, such as “C:\Download” or C:\AOL\Download. This download will proceed much faster than that for NONROAD because the program is much smaller in size. When completed, double-click on the SETUP.EXE file. The installation program will create all of the needed directories. In addition, the NATE program, once activated, searches for all applicable NONROAD files that are needed.



**Tip: Run an example NONROAD file before installing NATE to be sure that everything works correctly.**

## Overview of NATE Input Screens

The NATE model is divided into two main parts:

- Model Inputs
- Model Outputs

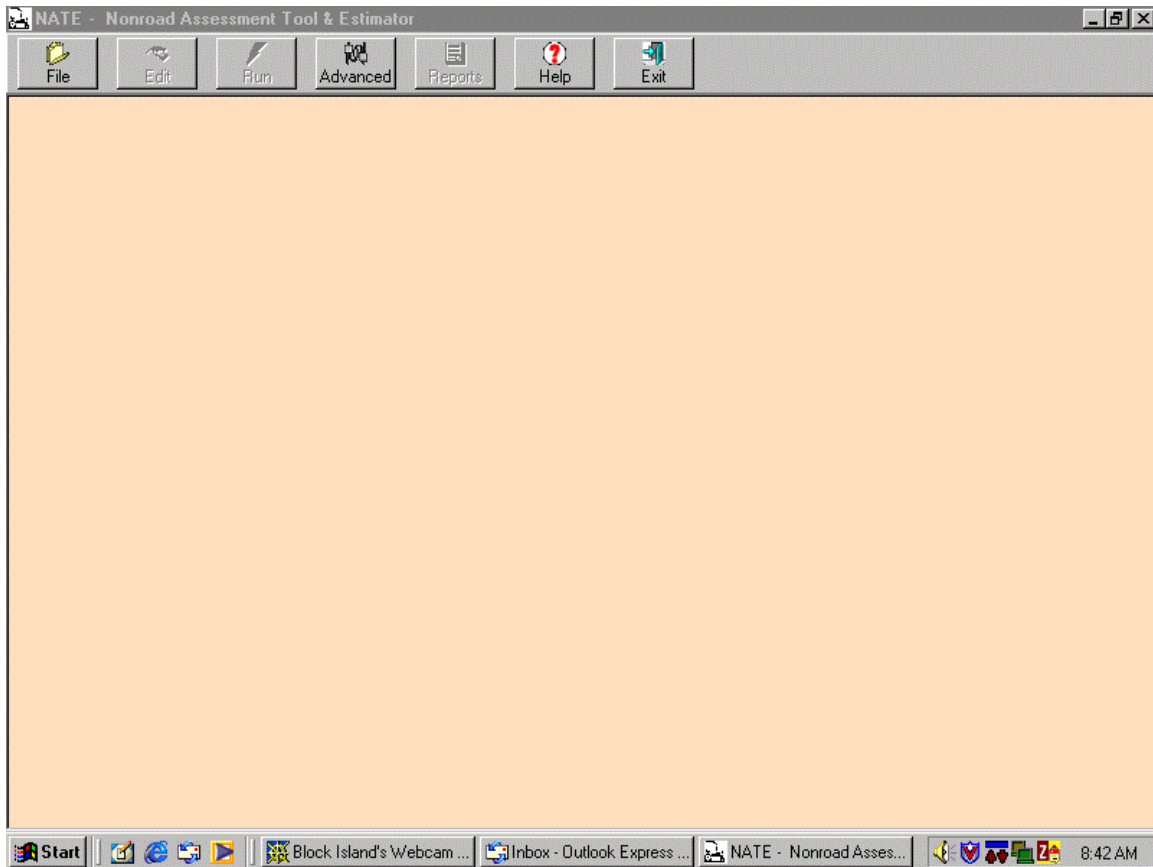
The purpose of the model input screens is to run the NONROAD model for many pieces of equipment and model years. The specific equipment you want – such as a 1986 bulldozer - will be specified in later model output sections, after NONROAD runs. The benefit of this philosophy is that many reports can be generated from a single database of emissions, without having to run NONROAD each time. This section deals with the input parameters needed to run NONROAD.

The inputs are used to run the NONROAD model, such as to set up the correct equipment groups, temperatures, and fuel qualities. NATE will have all the default temperatures and fuel qualities needed; these are discussed further under Advanced Topics. The user can select from the following input screens:

- Equipment Type
- Period Information (year, month, season)
- Regional Information (county)
- Fuel Type
- Other optional information

The following slides walk the user through the inputs needed to run the NATE processor.

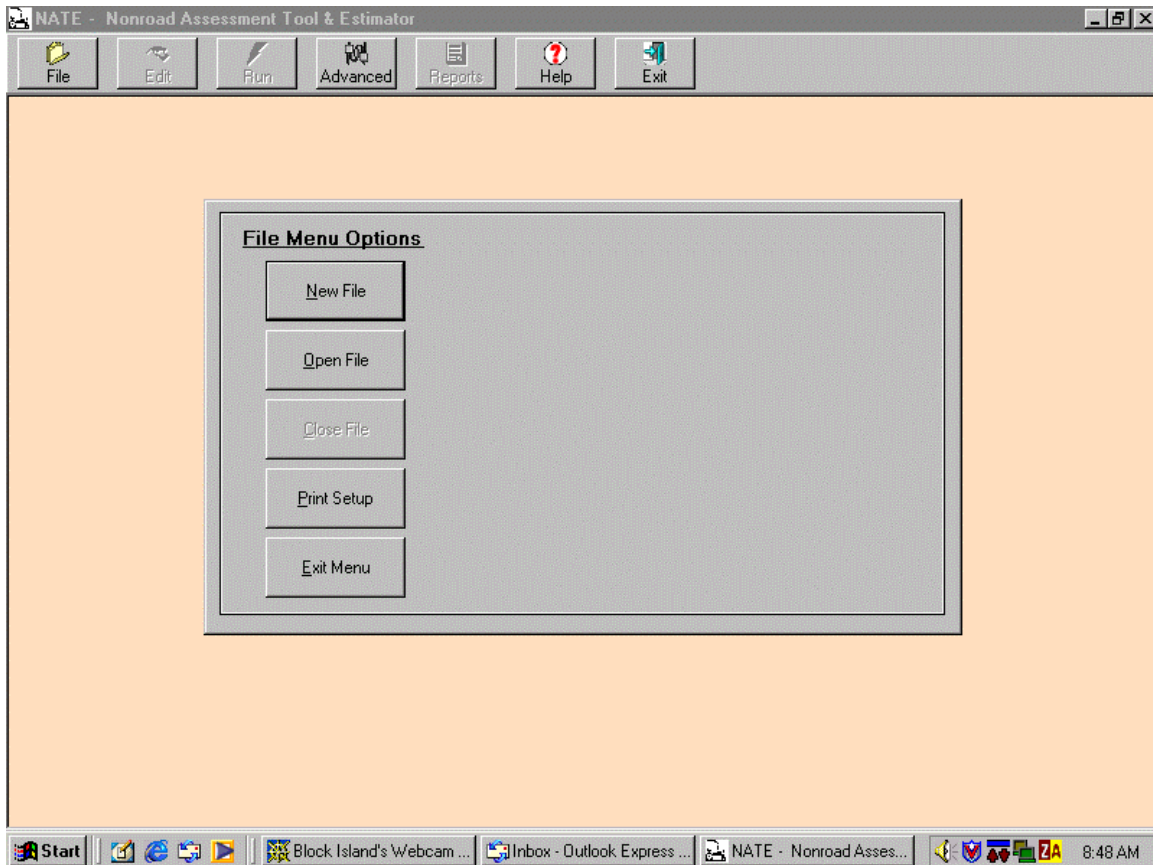
## *Introductory Screen*



This is the first screen in the NATE model that contains all the main buttons along the top. The buttons along the bottom of the screen will vary by your computer's configuration and what programs you are running.



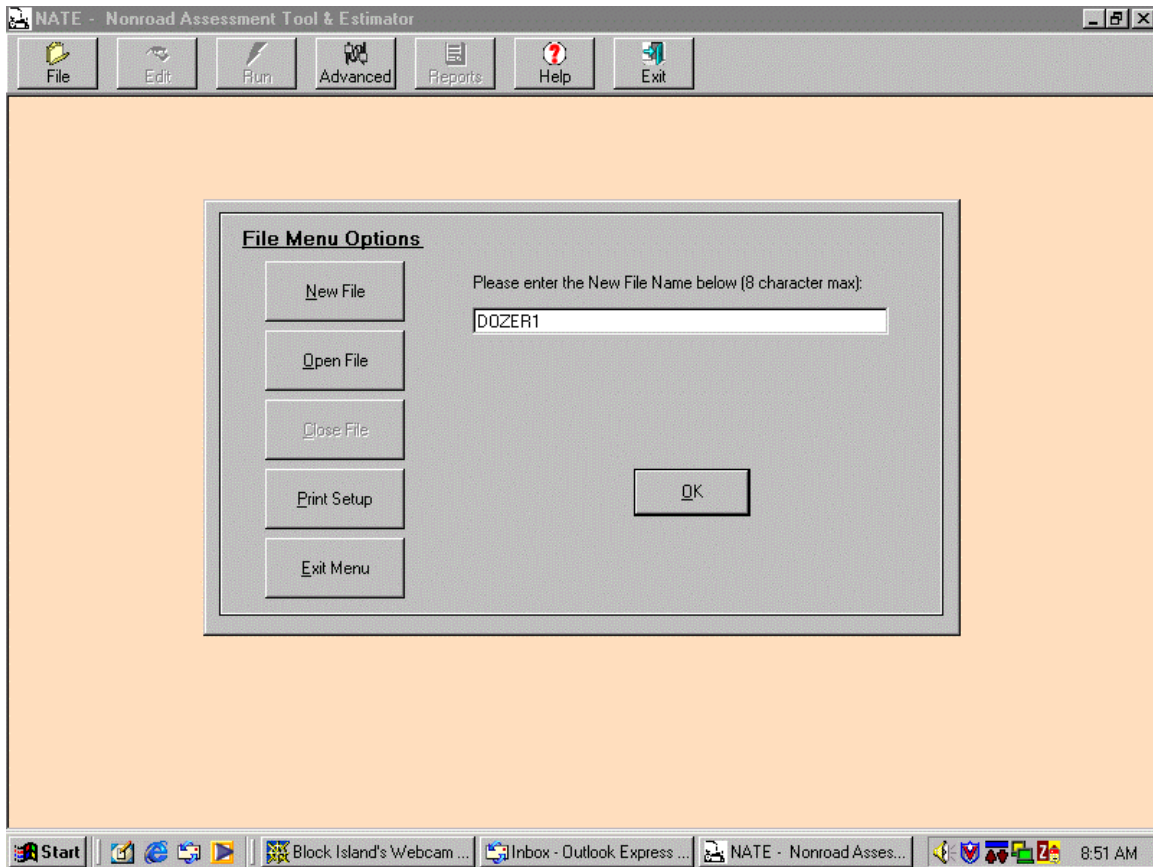
## Naming the Scenario



Select the FILE button to start working on a NATE scenario. We will then be selecting the NEW FILE button in the next step.

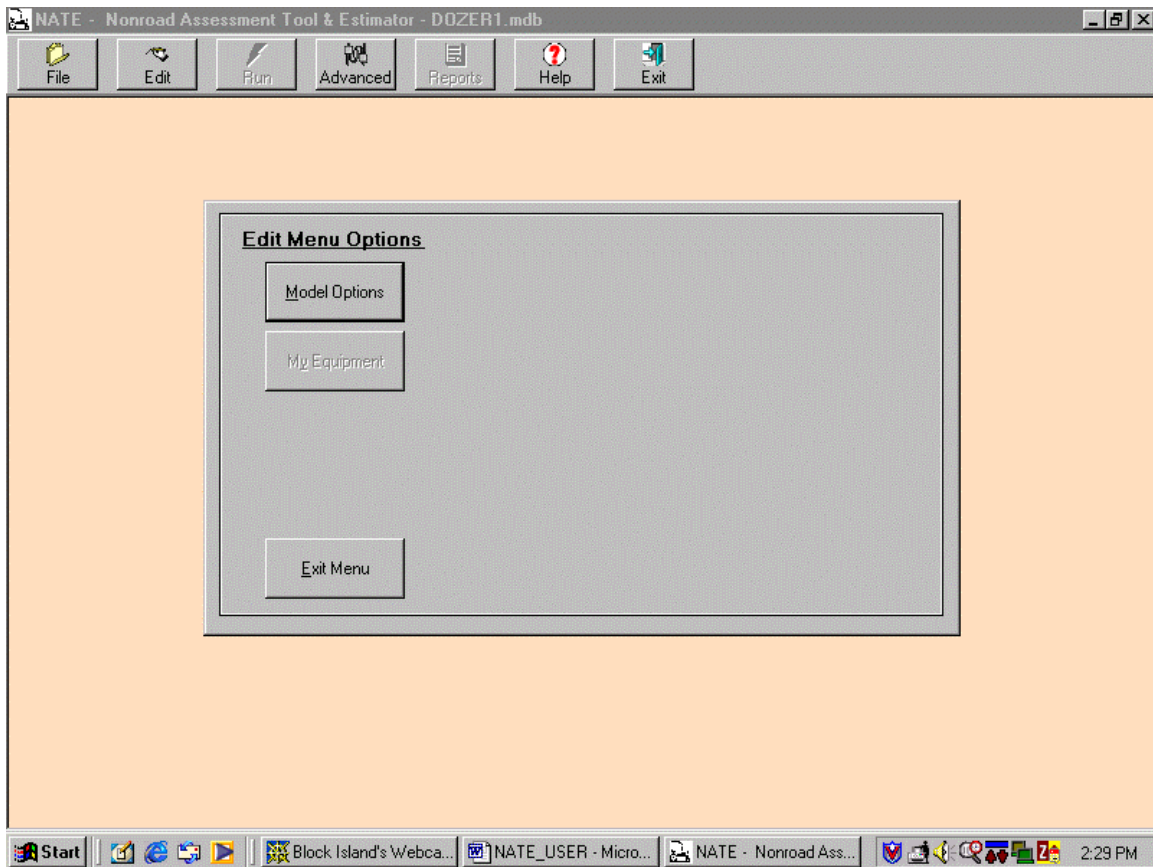
The OPEN FILE button will show previous NATE scenarios, if you have done any. It is also useful to set up your printer for the NATE Reports at this time.

## Naming the Scenario, Continued



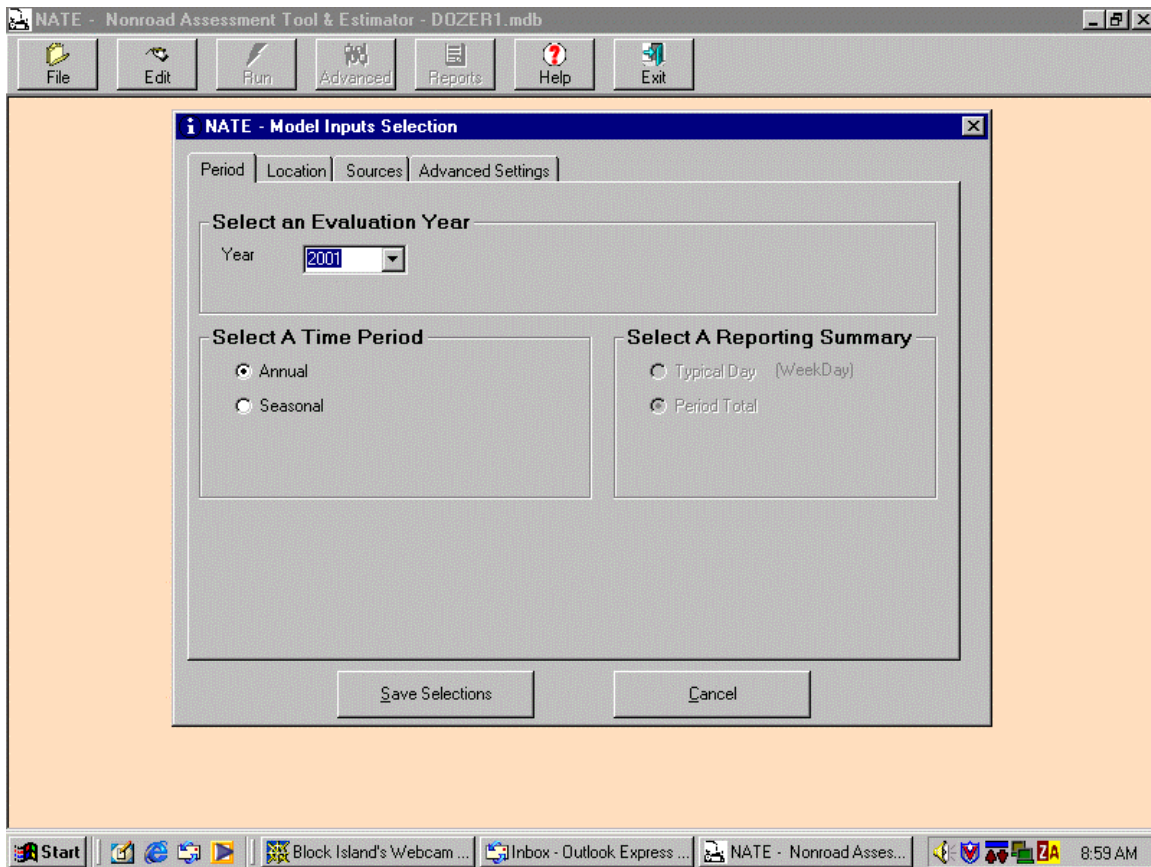
You must select the **NEW FILE** option and give the scenario a name. This one is called **DOZER1**. Click the **OK** box to close this screen.

## *Edit the Scenario Inputs*



Now that you have named the scenario, click on the EDIT button on the NATE toolbar and select the MODEL OPTIONS button.

## Entering Model Options: Selecting the Time Period



There are four tabs in this screen. The first allows you to input the year of evaluation and other information. Most people will want to use the present year or a future year such as 2007, an ozone attainment date. NATE will allow years up to 2015. “Evaluation year” and equipment “model year” should not be confused – we will examine equipment model years in later sections.

Next, select whether you want emissions in tons per year (ANNUAL) or another seasonal alternative. If you select SEASONAL you will have the opportunity to select a period total or a typical weekday.



There are four available seasons, which are needed to input temperatures, seasonal activity, and fuel parameters for the NONROAD model. Temperatures are based upon 1999 National Weather Service data from regional, national, and international airports. The temperature seasons use average minimum and maximum monthly temperatures and are defined as:

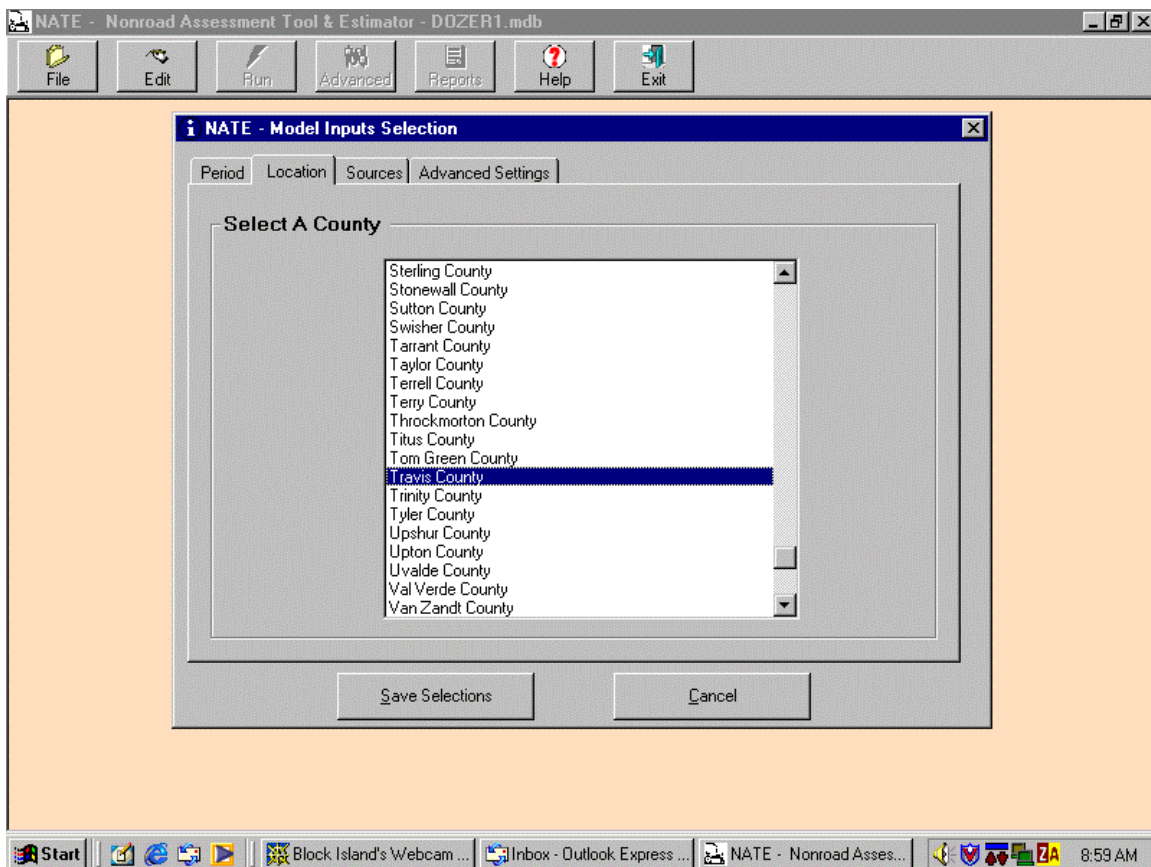
- Summer ozone season: June, July, and August
- Autumn: September, October, and November
- Winter: December, January, and February
- Spring: March, April and May



Annual emissions are based upon summer fuels – this affects gasoline equipment emissions because summer fuel volatility (RVP) is the lowest in the summer. Diesel equipment is not affected. For large fleets of gasoline equipment, it may be best to run four seasons of the year, specifying RVP for each quarter, and then add them up together from four NATE reports – this process has not been automated in NATE Version 1.

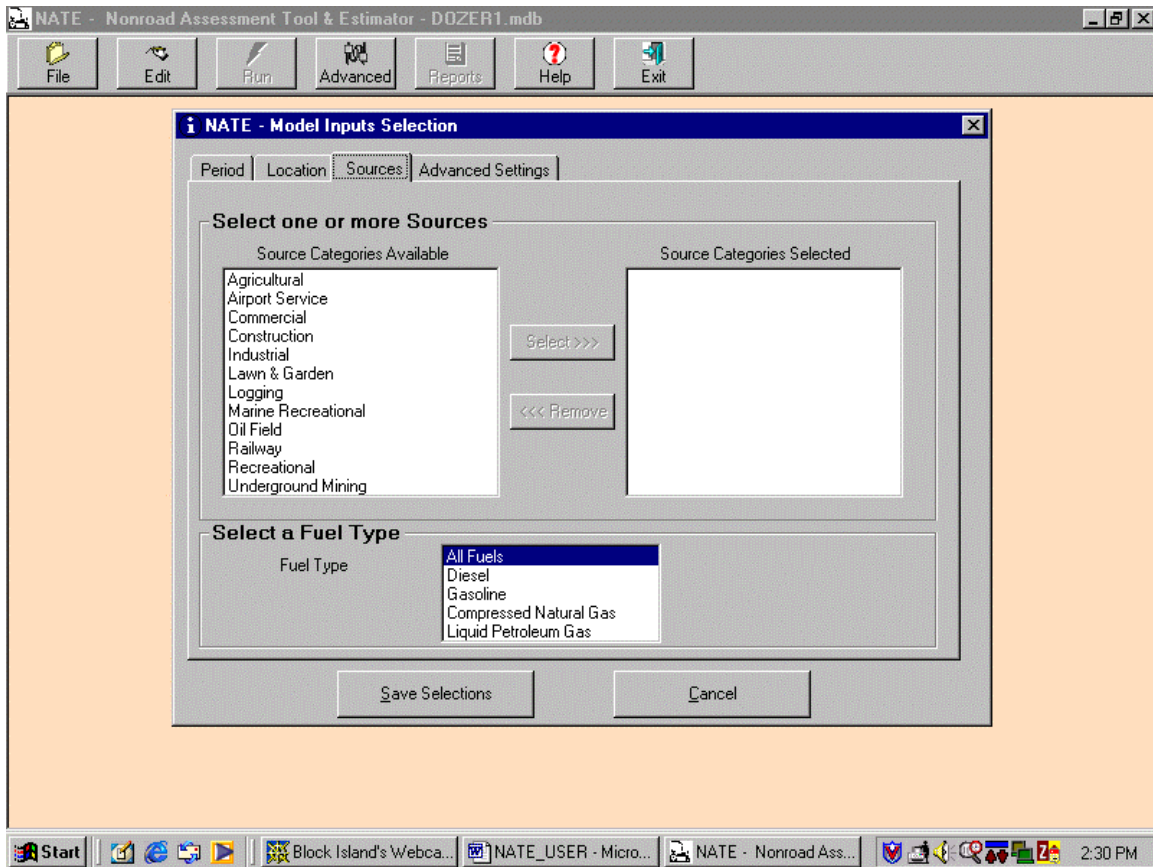
You can now proceed to the next tab.

## Select a County



The user can only select one representative county – not all equipment has to be in that county because we only use counties to select the correct temperatures and fuel parameters. The only time that “time in county” becomes an issue is if the equipment is operated outside an ozone planning area (e.g. the 8-county Houston-Galveston ozone non-attainment area) or outside Texas.

## Equipment Type



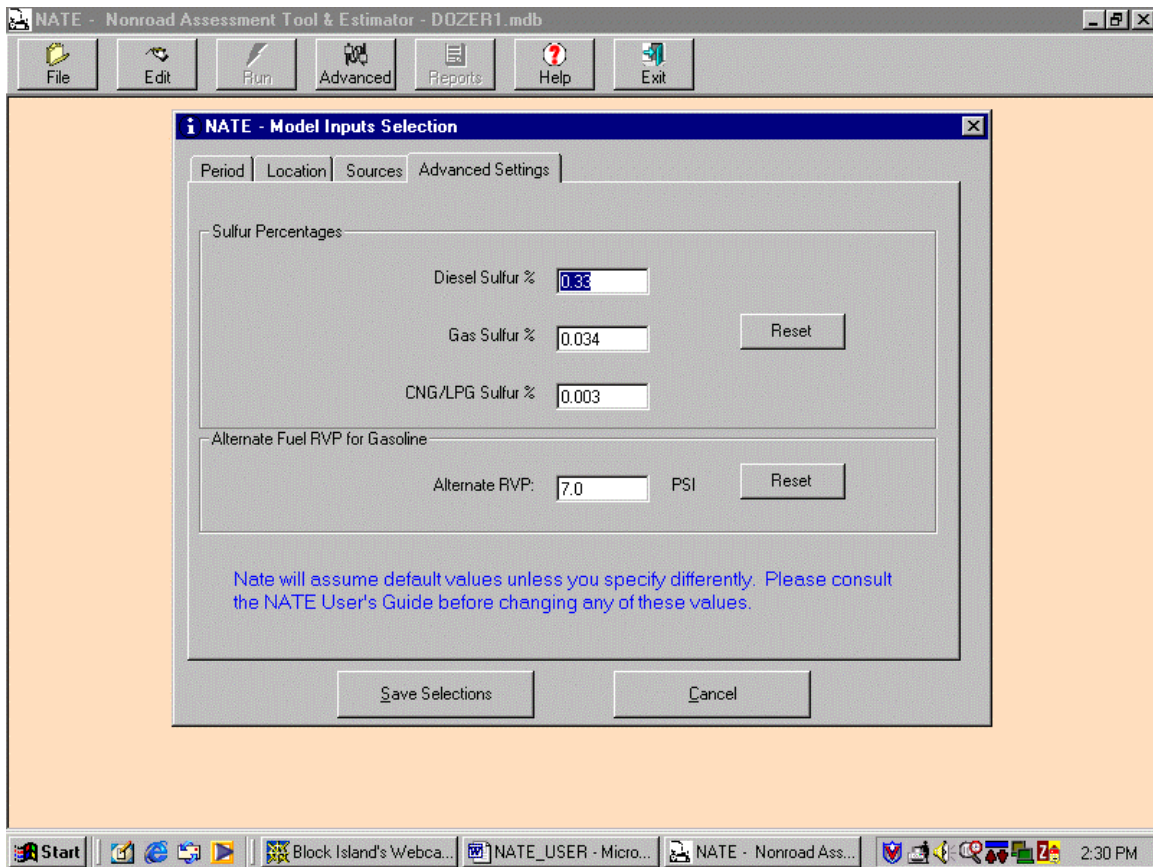
Select an equipment category and add it to the box on the right using the SELECT button. More than one grouping can be put in the selection box if you are not certain about what kind of equipment you have in your inventory. More than two equipment categories will cause the NONROAD model to slow down, however. Note that the following equipment cannot be modeled:

- Locomotive engines – only railway maintenance is included
- Commercial marine vessels – only smaller inboards and outboards
- Aircraft – only ground support equipment is included

Then, you can select the kinds of fuels you are using in your fleet. If you have a mixture of diesel and gasoline engines, then highlight the ALL FUELS option.



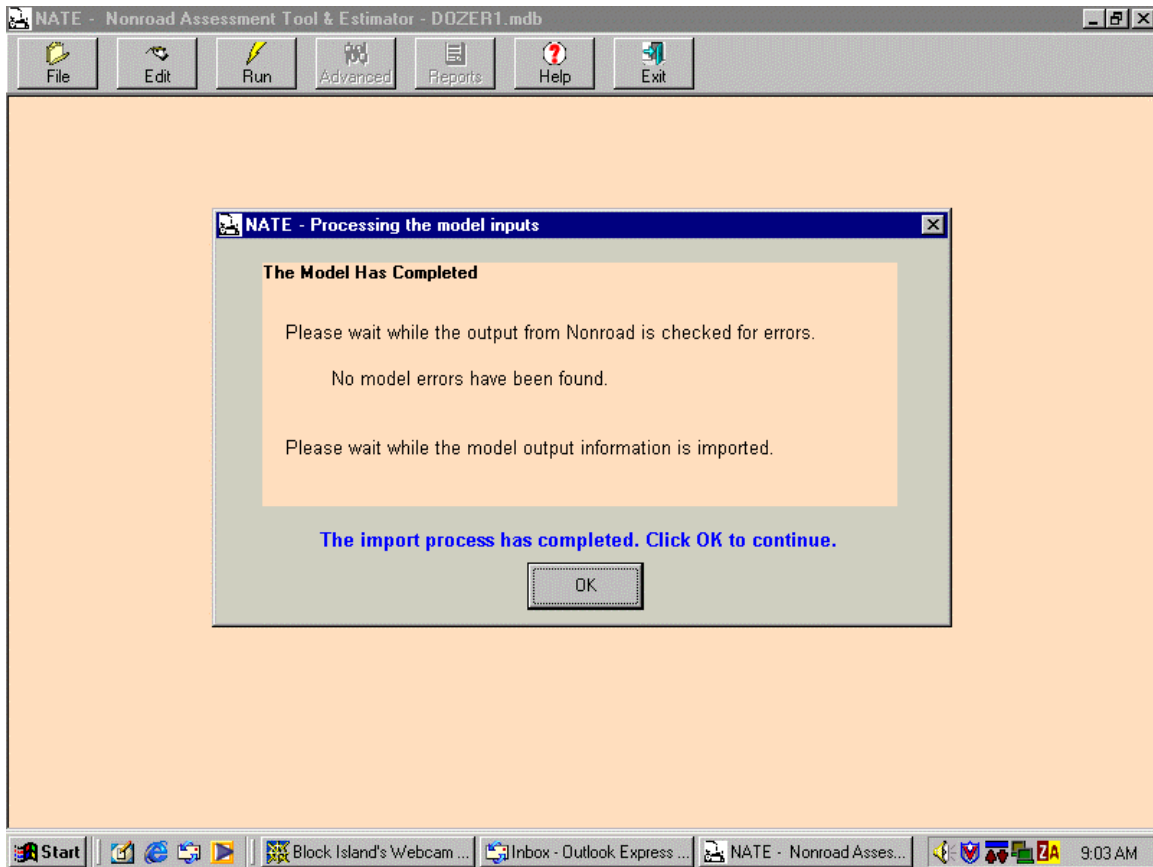
## Advanced Settings



Gasoline volatility (RVP) and fuel sulfur can be modified in this tab. For example, off-road diesel is .33% sulfur, but on-highway diesel is 0.05% sulfur. Changing these inputs will affect particulate matter (PM) and sulfur dioxide (SO<sub>2</sub>) emissions only. Changing RVP will only affect gasoline engines, but changes may be required because “real” 1999 RVP values were used as NATE defaults. Please contact the TNRCC if you are in doubt about any RVP or sulfur settings for evaluation years after the year 1999.



## Run Button



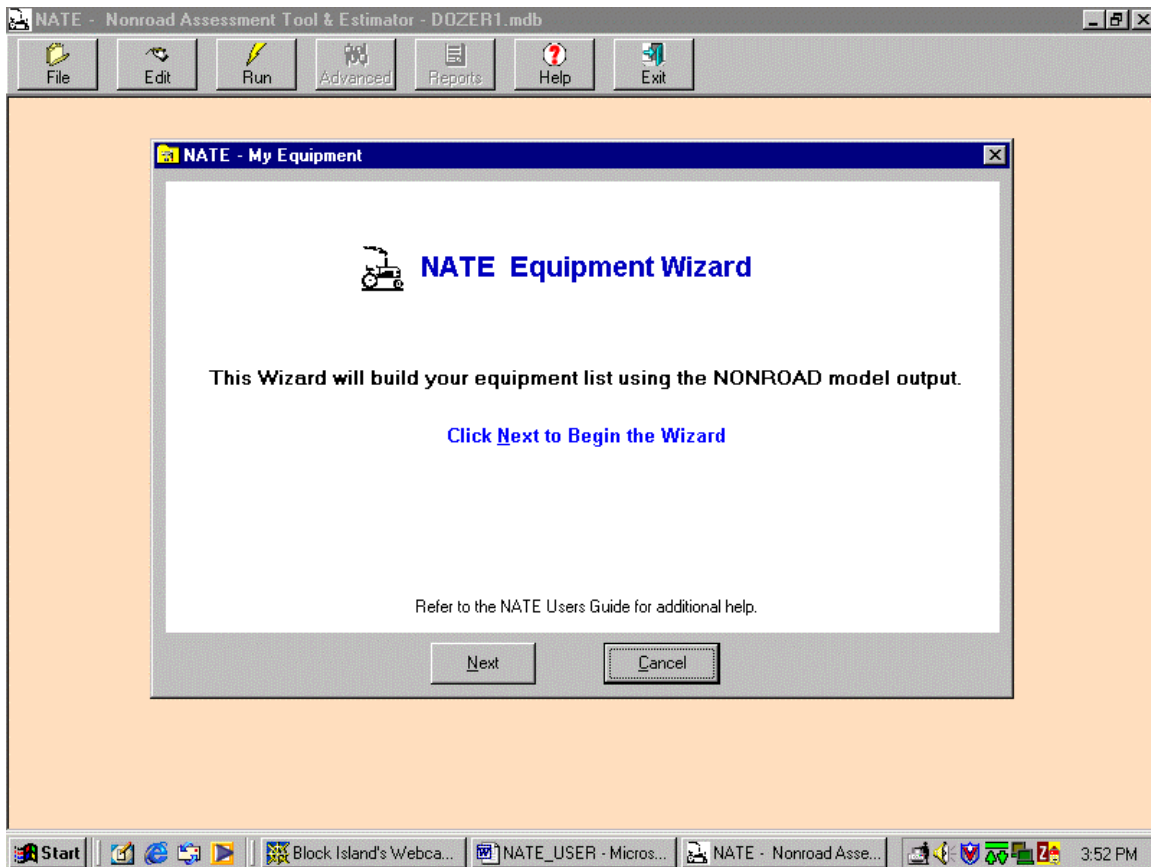
**Tip:** NATE is designed so that DOS will run automatically, and will report successful completion of NONROAD, but the subsequent Reports will not work unless NONROAD has terminated without errors. Therefore, it helps to verify that NONROAD works if there are any error messages.

## Report Building Features

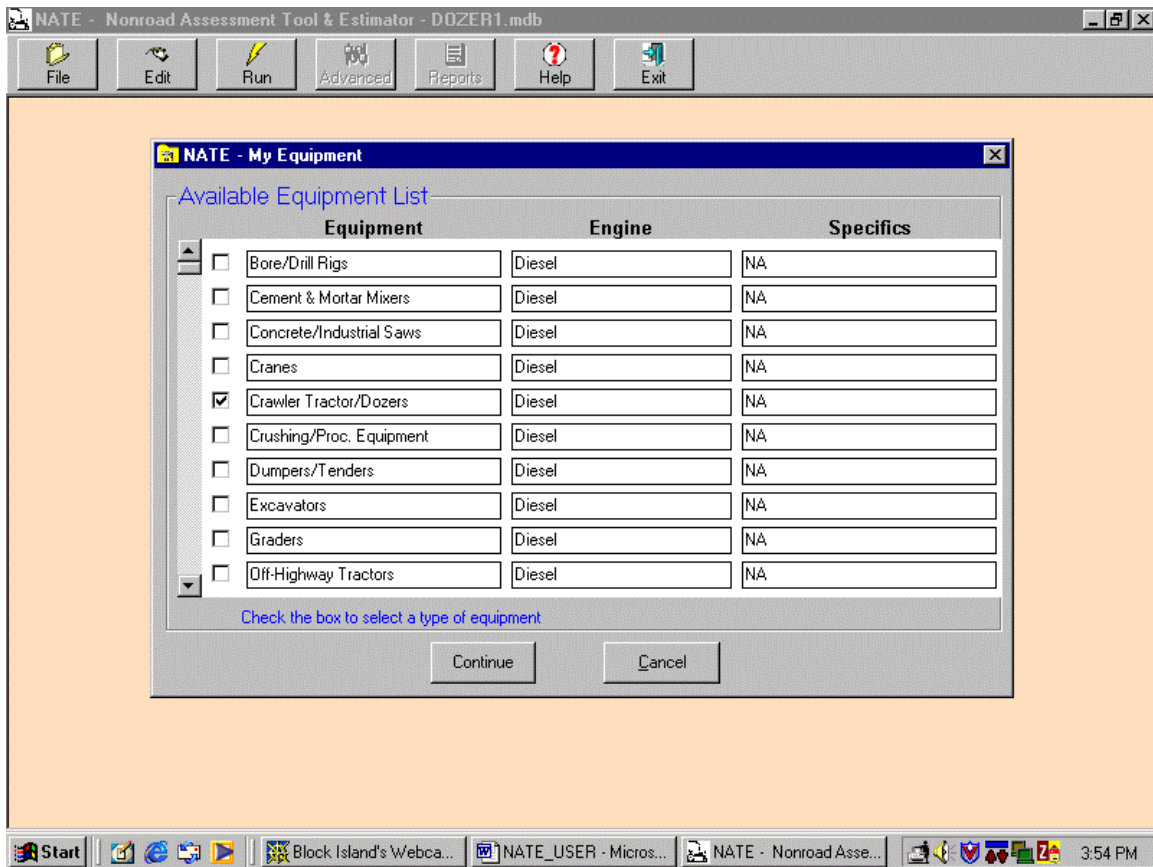


NATE uses a “wizard” to select equipment from the master NONROAD file, and then creates a database of entries you have selected. These steps must be completed before generating a Report that can be viewed, printed, and even exported electronically. First click the EDIT button. Then click the My Equipment button. This will bring up the following window.

### *NATE Equipment Wizard*



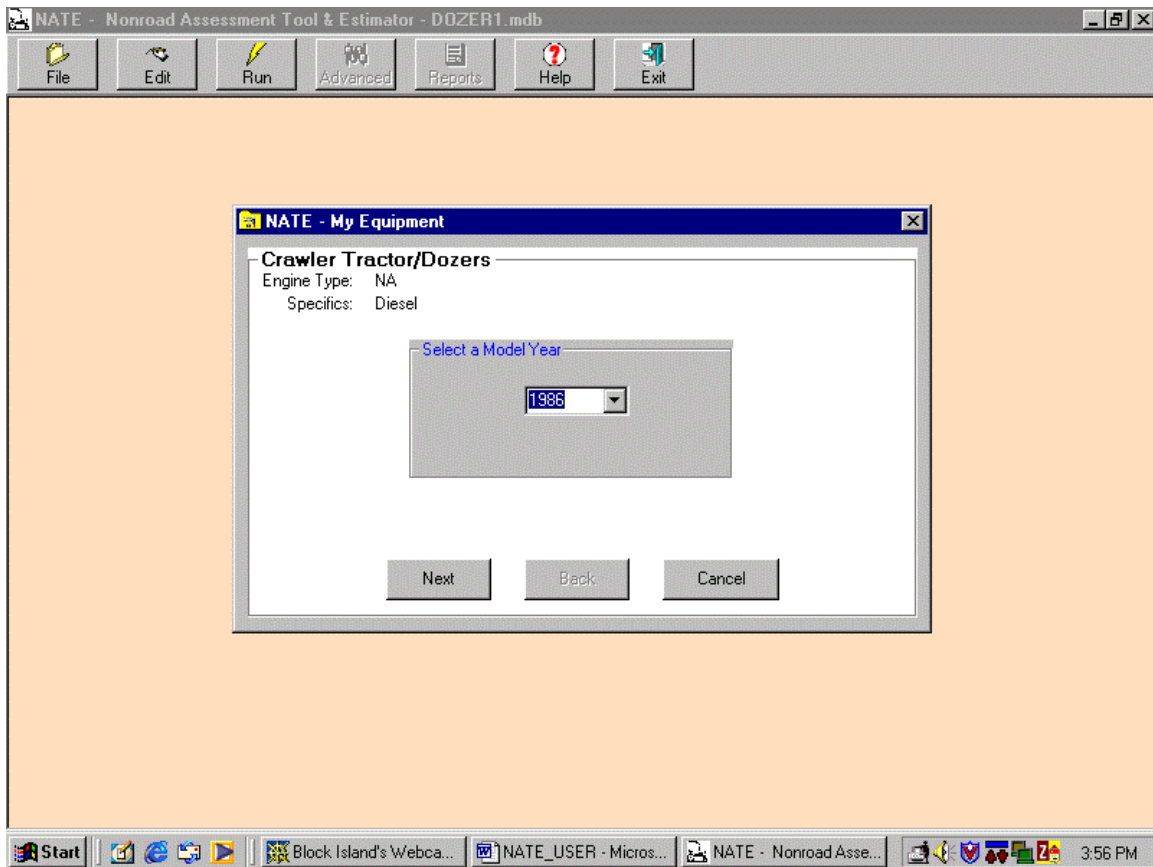
## List of Available Equipment



The first screen allows the user to select a type of equipment. Equipment SPECIFICS are mainly used for gasoline equipment that may have different configurations of valves or even have a catalytic converter. The most common SPECIFICS for gasoline engines are:

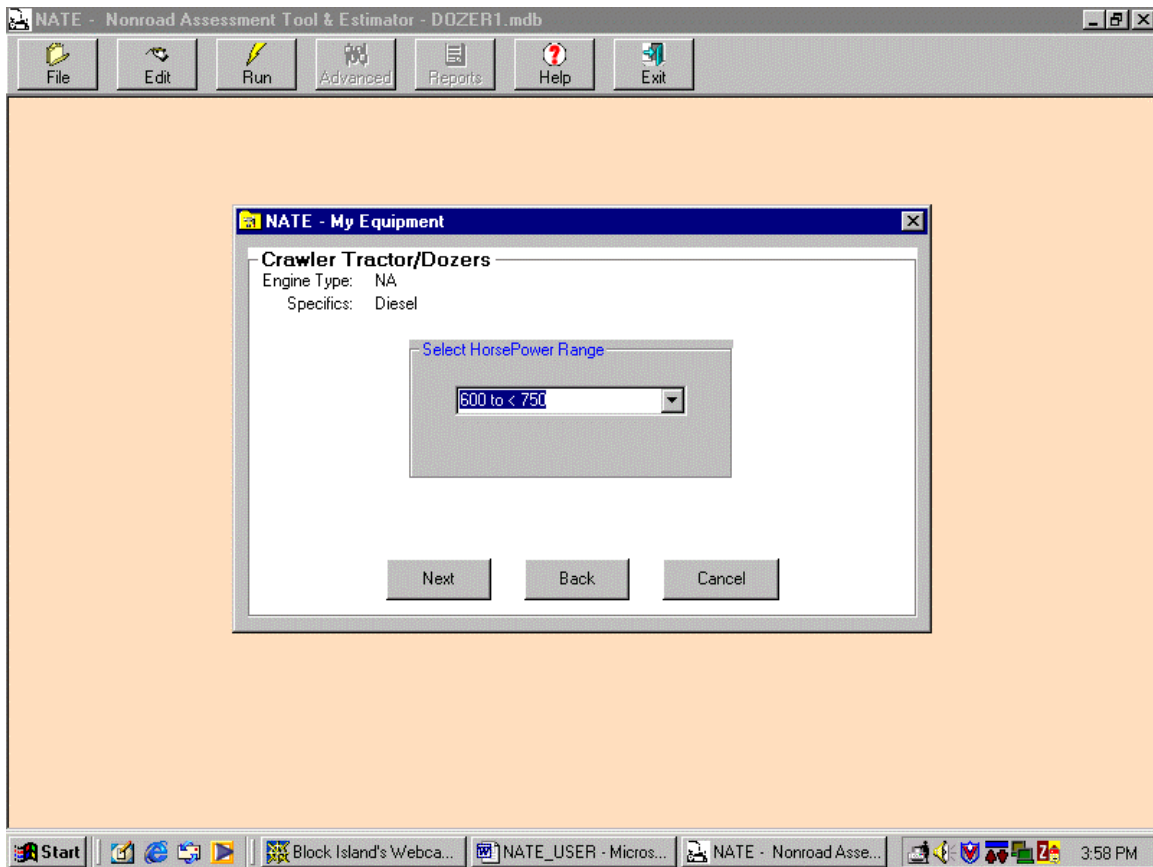
- Presence of an exhaust catalyst
- Side-valve (most common in the past)
- Over-head valve (common to some new 4-stroke engines)

## Model Year



Each model year of the equipment/engine must be selected individually. Here we are looking for a 1986 bulldozer.

## Horsepower Range

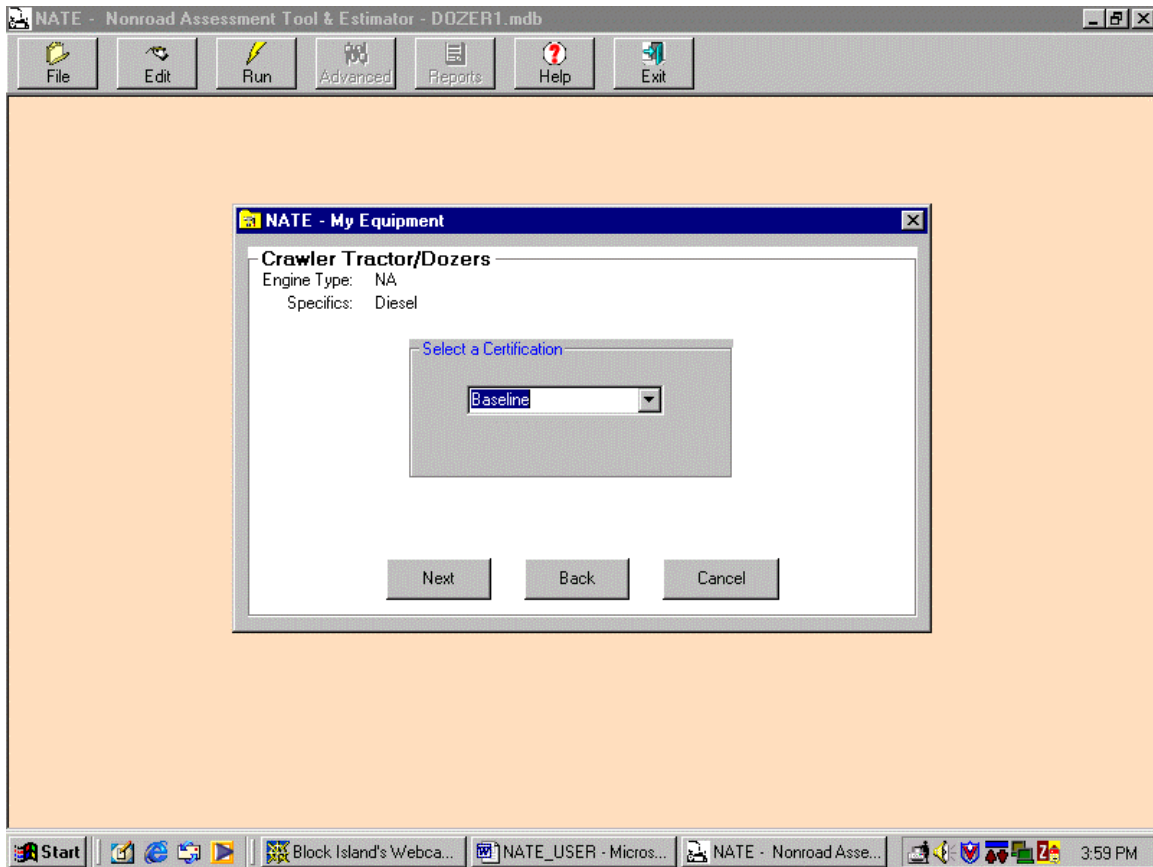


Available horsepower ranges will be displayed, along with an “I don’t know” option that uses a median value. The only 1986 model-year bulldozer category in the NONROAD model for this scenario is above 600 horsepower.



Note that NATE uses horsepower ranges, not “real” engine horsepower. This approach is meant to be consistent with NONROAD and to prevent confusion over obtaining “maximum rated horsepower” for each entry.

## Certification Level



Certification level refers to the EPA standard, which can be Baseline (generally pre-1990's), Phase 1 or Phase 2 for gasoline engines, or TIER 0 through TIER 3 for diesel engines. This is important when two certification levels are found in the NONROAD output at the same time, due to manufacturer phase-in schedules. The "I Don't Know" option selects the older, higher-emitting standard.

## Other Information

NATE - Nonroad Assessment Tool & Estimator - DOZER1.mdb

File Edit Run Advanced Reports Help Exit

**NATE - My Equipment**

**Crawler Tractor/Dozers**

Engine Type: NA  
Specifics: Diesel

Enter Other Information

Quantity: 1  
Hrs. per Year: 936 Reset

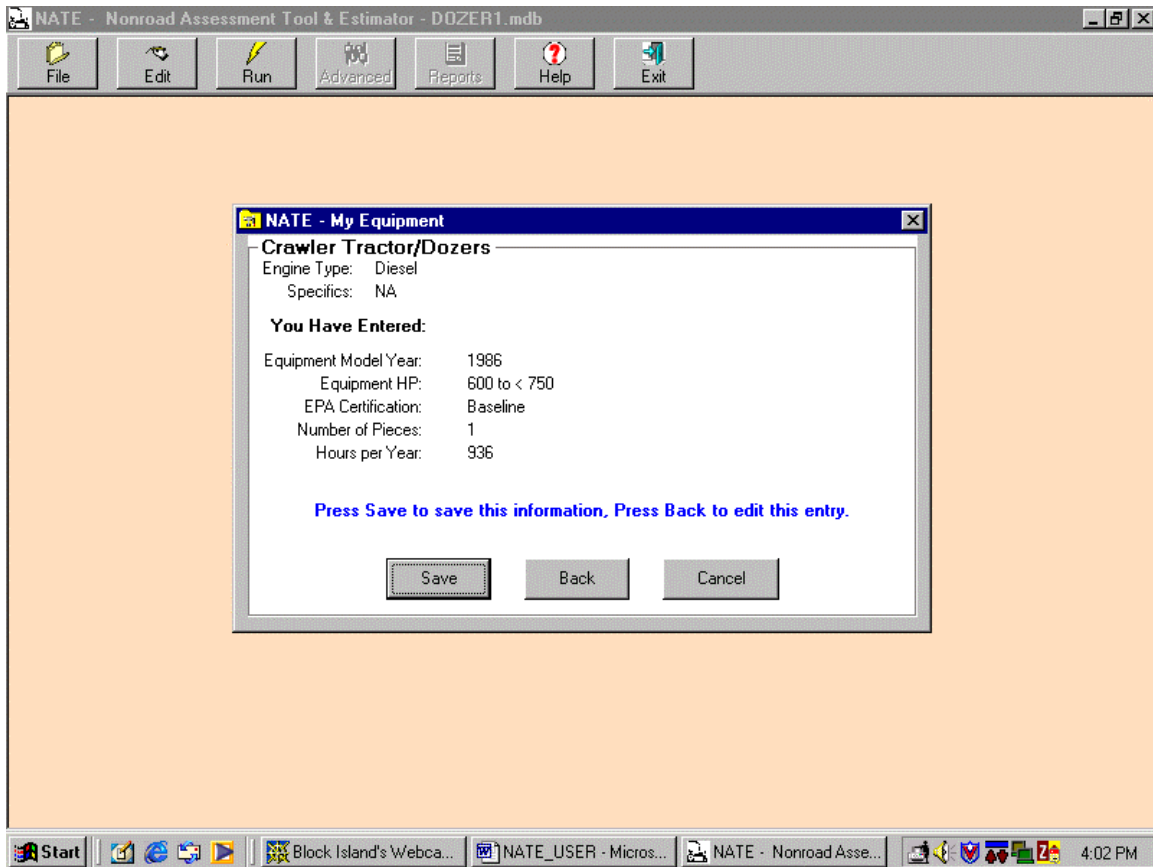
Next Back Cancel

Start Block Island's Webca... NATE\_USER - Micros... NATE - Nonroad Asse... 4:00 PM



This screen allows the user to select multiple numbers of the same equipment. It also allows the user to examine the default NONROAD hours of use per year entry and modify it. Changing the hours of use is not recommended unless (1) you have fleet documentation or (2) you are performing a “what-if” analysis. The RESET button will return the hours-of-use value back to the default. See the TECHNICAL ANALYSIS section for further details.

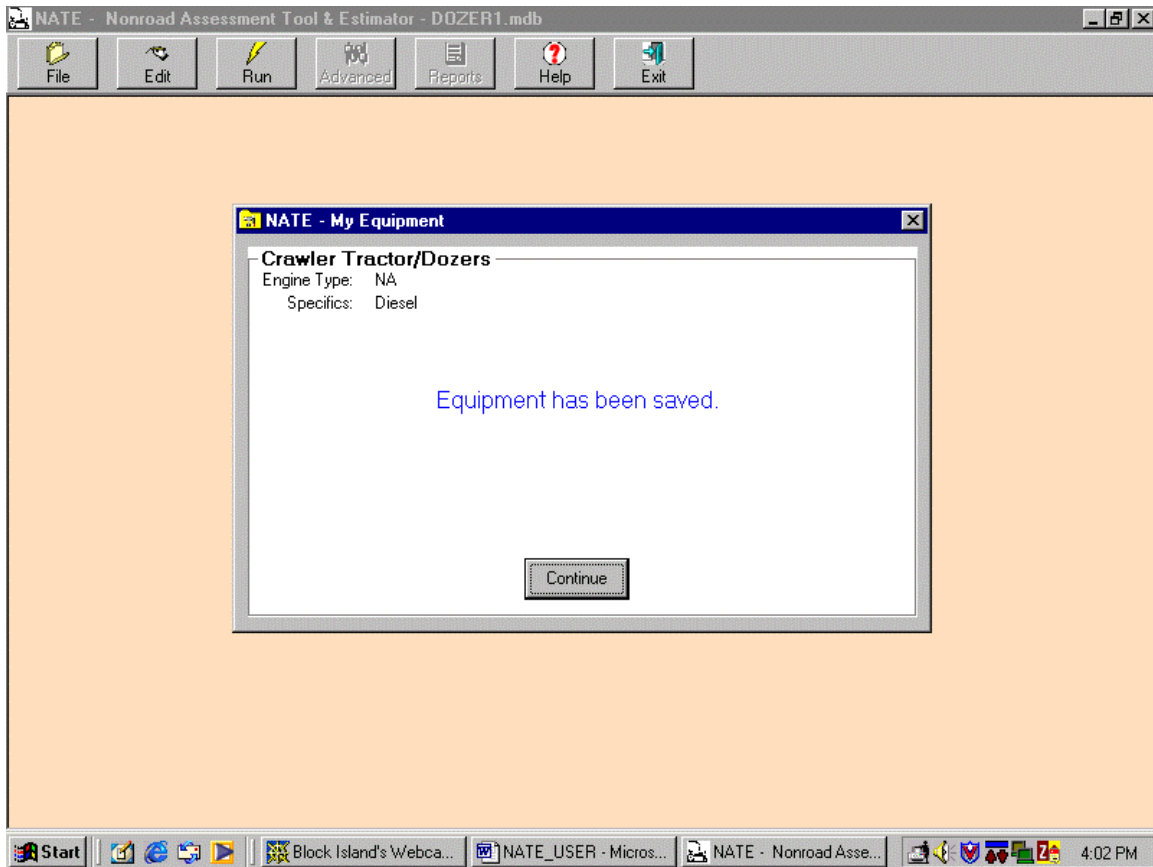
## Summary of the Entry



Here is what you entered. You can go back and edit the query or save the query, which will end up becoming a row of information in the NATE REPORT.



## *Add Additional Equipment or End the Equipment Wizard*

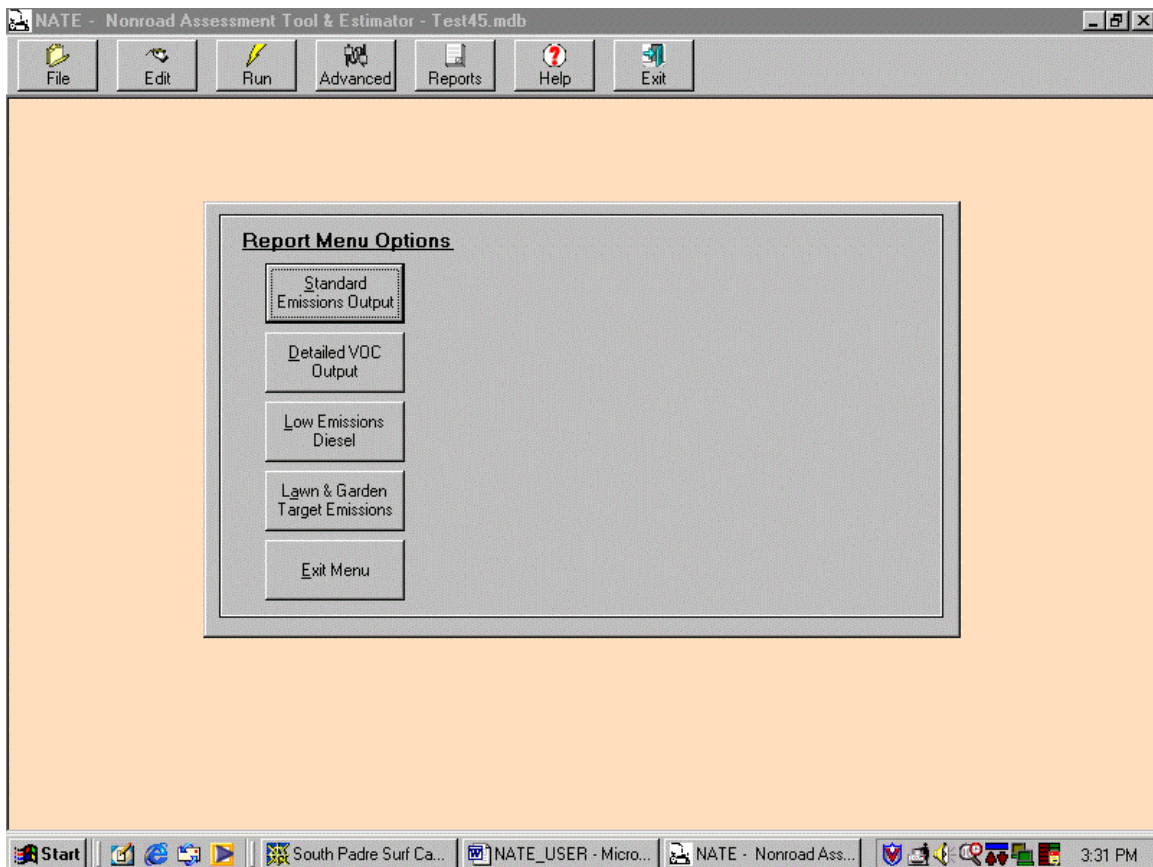


This screen verifies that your query has been saved. It will allow you to go back to the Wizard to add more equipment or to terminate the process.

## NATE Reports

### *Report Menu Options*

The reporting feature allows several options as are discussed below. First, close all other NATE windows and push the REPORTS button. This is what you should see.



After running the NATE Equipment Wizard, you can select any database by using the FILE | OPEN FILE command. You can also go back to the Equipment Wizard and add more equipment to your list. Whatever scenario is open at the time will be the one used for generating a report.

## Example Report – Standard Emissions Output

**NATE - Nonroad Assessment Tool & Estimator**

1 of 1 100% Total:1 100% 1 of 1

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**Annual Emissions Totals by Equipment - Detailed**

Location: TRAVIS COUNTY, TEXAS  
 Summary Type: PERIOD TOTAL  
 Time Period: ANNUAL  
 Year: 2001  
 Fuel Selection: DIESEL

	NO <sub>x</sub>	Total VOC	CO
<b>Construction and Mining Equipment</b>			
1990 Crawler Tractor/Dozers NA, 100 HP	0.437	0.0501	0.273
Subtotals:	0.44	0.05	0.27
<b>Grand Totals:</b>	<b>0.44</b>	<b>0.05</b>	<b>0.27</b>

Start NAT... My D... ERG NATE NAT... NA... 6:31 PM



This is an example of a NATE summary report. Detailed VOC Emissions Output (hydrocarbons) are also available in the button below – to return to the main menu close this report.

## Low Emission Diesel

NATE - Nonroad Assessment Tool & Estimator	
1 of 1	Total:5 100% 5 of 5
<b>Low Emissions Diesel - Detailed</b>	
<b>Location:</b> TRAVIS COUNTY, TEXAS	
<b>Summary Type:</b> PERIOD TOTAL	
<b>Time Period:</b> ANNUAL	
<b>Year:</b> 2001	
<b>Fuel Selection:</b> ALL FUELS	
	<u>tons/yr</u>
	<u>NOx Diesel</u>
<b>Construction and Mining Equipment</b>	
1989 Crawler Tractor/Dozers NA, 100 HP, Qty: 1	0.41
<i>Construction and Mining Equipment Subtotals:</i>	0.41
<b>Lawn and Garden Equipment (Com)</b>	
1998 Leafblowers/Vacuums (Com) Non-handheld, 40 HP, Qty: 10	0.69
1998 Leafblowers/Vacuums (Com) Non-handheld, 40 HP, Qty: 10	0.69
<i>Lawn and Garden Equipment (Com) Subtotals:</i>	1.38
<b>Grand Totals:</b>	<b>1.79</b>



Texas currently has a Low Emissions Diesel regulation that would regulate diesel in the year 2006. Some of the diesel fuel qualities result in a slight reduction in NOx (6.2%). We do not have the factors for other pollutants, however, and only report "NoxDiesel" at this time.

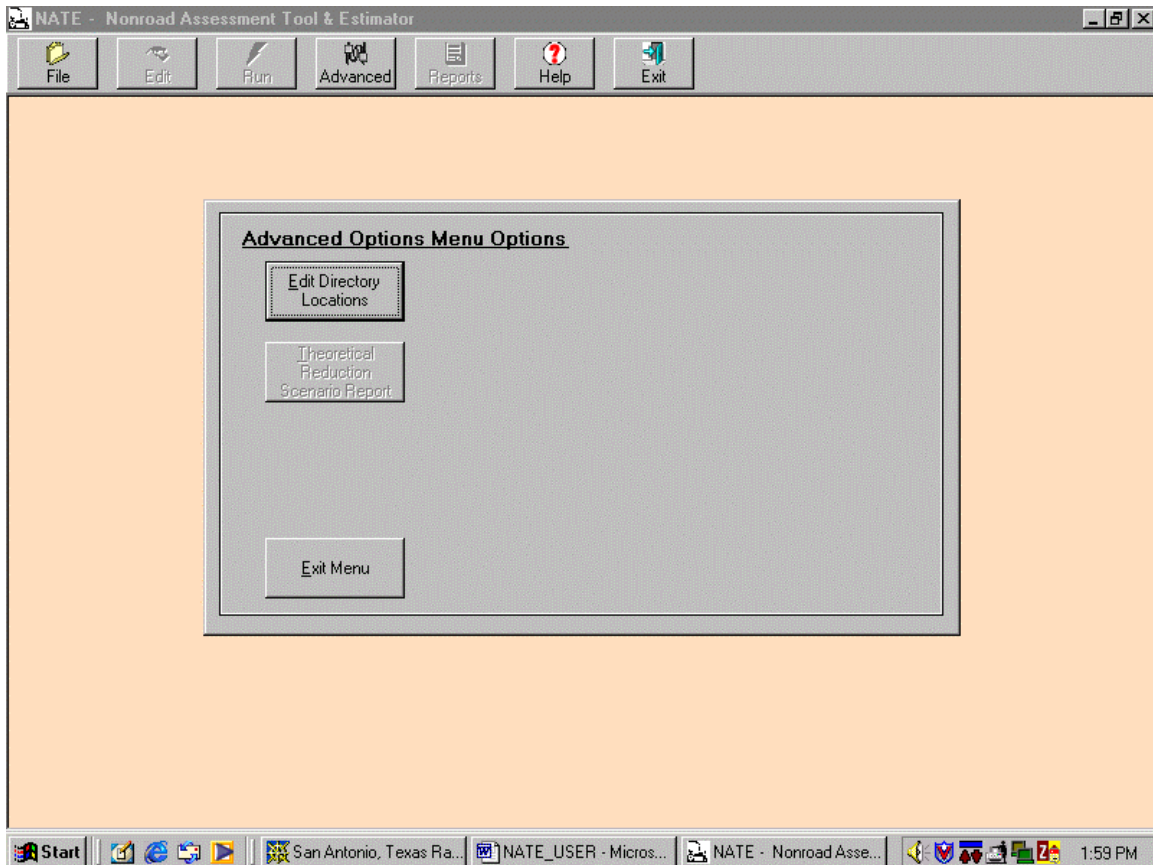
## Advanced Report Options - Lawn & Garden

Lawn & Garden Target Emissions - Detailed			
<b>Location:</b> TRAVIS COUNTY, TEXAS			
<b>Summary Type:</b> PERIOD TOTAL			
<b>Time Period:</b> ANNUAL			
<b>Year:</b> 2001			
<b>Fuel Selection:</b> ALL FUELS			
	Total VOC	<u>tons/yr</u> Total NOx	Equivalent NOx
1998 Leafblowers/Vacuums (Com) Non-handheld, 40 HP, Qty: 10	1.51	0.69	1.77
1998 Leafblowers/Vacuums (Com) Non-handheld, 40 HP, Qty: 10	1.51	0.69	1.77
<b>Grand Totals:</b>	<b>3.02</b>	<b>1.38</b>	<b>11.3</b>



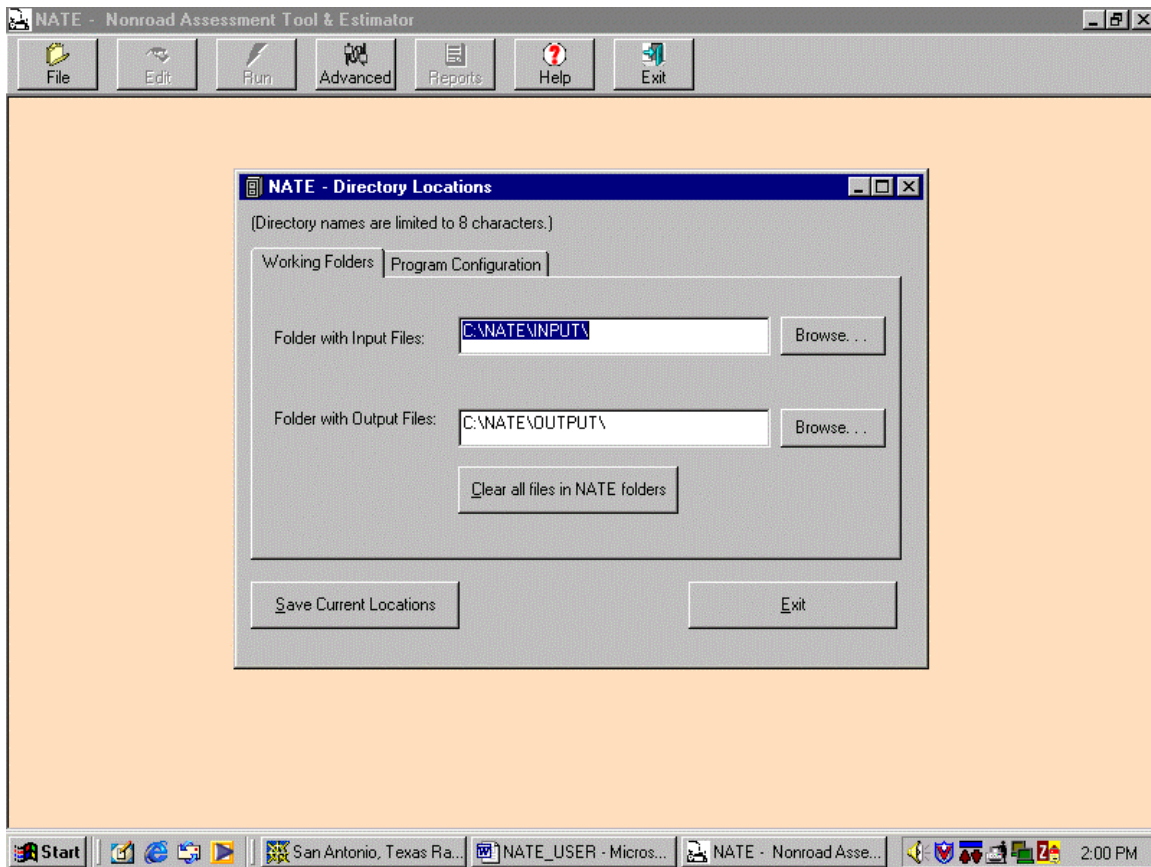
Emissions generated using this report feature are expressed as “equivalent NOx.” See the TECHNICAL ANALYSIS section for a further discussion.

## Advanced Options



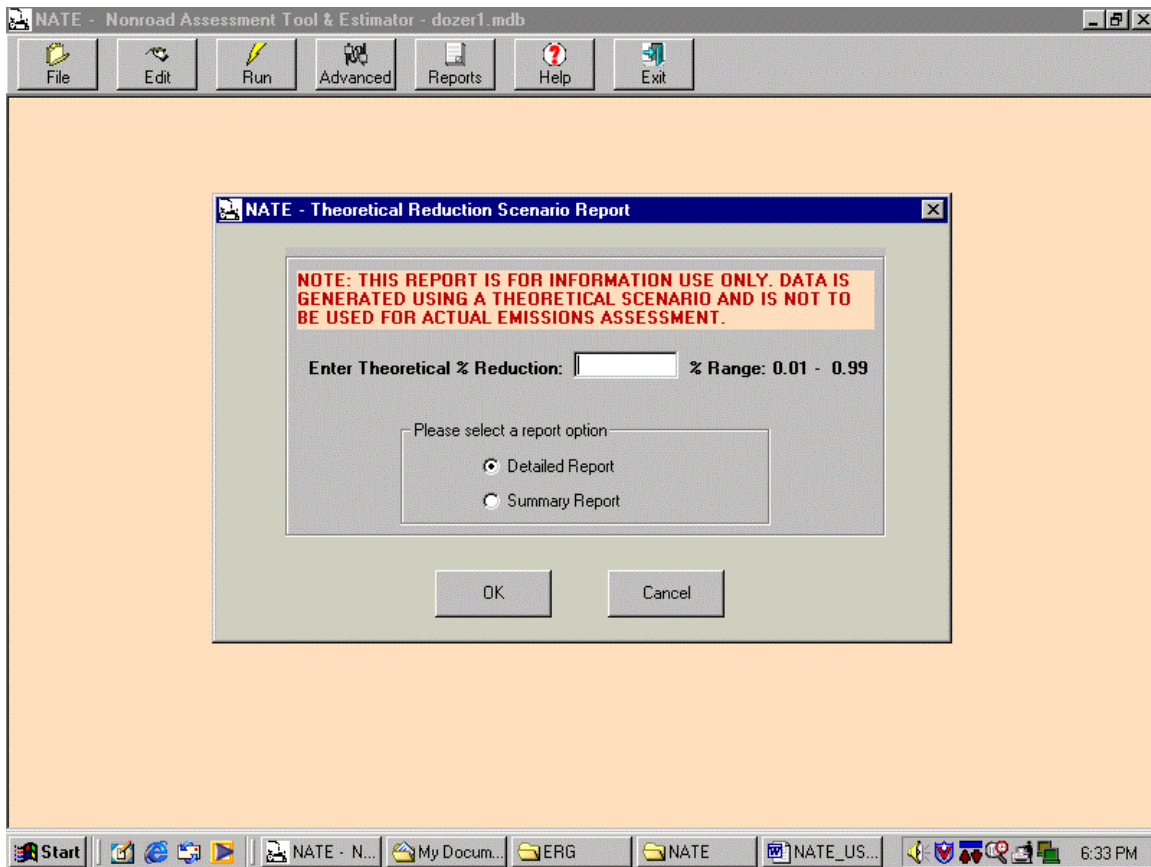
This is the Advanced Options button. You can edit your files by using this feature, as many NATE and NONROAD runs will rapidly consume computer file space. Note that if you are currently running a NATE scenario, this option will be dimmed – in this case go back to FILE | CLOSE and try the ADVANCED button on the toolbar again.

## Edit Directory Locations, Continued



This the window that allows you to revise file locations, remove NATE working files, and change the location of the NONROAD model – for example, if you download a newer NONROAD version.

## Theoretical Reduction Scenario

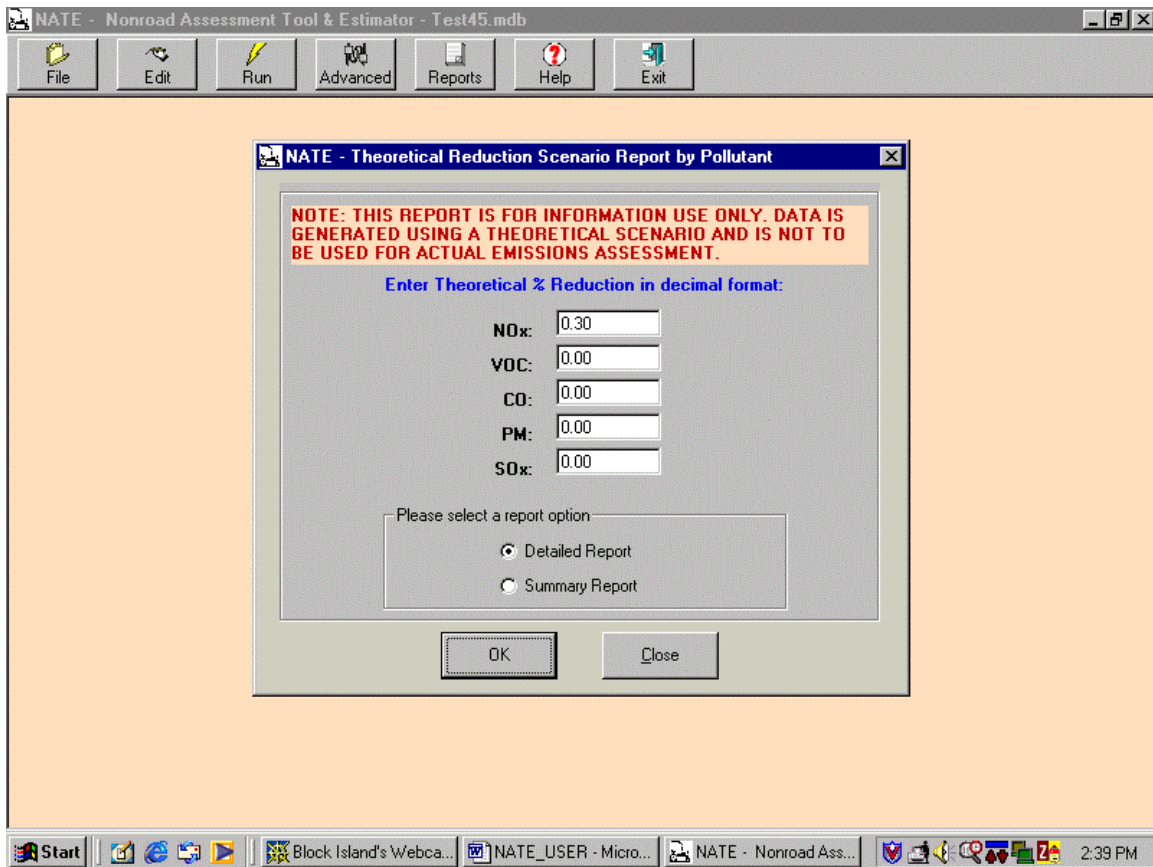


**You can apply one set of reductions to all emissions using this window. For example, you may want to estimate a 30 percent reduction in equipment activity. Examples of when you might use this feature include:**

- Emissions that occur outside the State or nonattainment region
- "What if" scenarios



## Theoretical reductions by Individual Pollutant



The screenshot shows the 'NATE - Theoretical Reduction Scenario Report by Pollutant' dialog box. At the top, a red-bordered box contains a disclaimer: 'NOTE: THIS REPORT IS FOR INFORMATION USE ONLY. DATA IS GENERATED USING A THEORETICAL SCENARIO AND IS NOT TO BE USED FOR ACTUAL EMISSIONS ASSESSMENT.' Below this, a blue text prompt reads 'Enter Theoretical % Reduction in decimal format:'. There are five input fields for pollutants: NOx (0.30), VOC (0.00), CO (0.00), PM (0.00), and SOx (0.00). Below the input fields, a section titled 'Please select a report option' contains two radio buttons: 'Detailed Report' (selected) and 'Summary Report'. At the bottom are 'OK' and 'Close' buttons. The background window is 'NATE - Nonroad Assessment Tool & Estimator - Test45.mdb' with a menu bar (File, Edit, Run, Advanced, Reports, Help, Exit) and a taskbar at the bottom showing the Start button and several open applications.



This option allows the user to select “what-if” options for one or more pollutants. Here we are estimating a 30% reduction in NOx.

## Advanced Report Options – Theoretical Reductions

**NATE - Nonroad Assessment Tool & Estimator**

1 of 1 100% Total:5 100% 5 of 5

**NOTE: THIS REPORT REPRESENTS DATA FROM A THEORETICAL SCENARIO. NOT TO BE USED FOR A**

### Standard Emissions Percent Reduction by Pollutant - Detailed

**Location:** TRAVIS COUNTY, TEXAS  
**Summary Type:** PERIOD TOTAL  
**Time Period:** ANNUAL  
**Year:** 2001  
**Fuel Selection:** ALL FUELS  
**Percent Reduction Factors Used:**

		NOx	Total VOC	CO
		30%	0%	0%
<b>Construction and Mining Equipment</b>				
1989 Crawler Tractor/Dozers, 100 HP, Qty: 1	Actual Emissions	0.437	0.0537	0.273
	Reduction Amount	0.131	0	0
	Theoretical Emissions	0.306	0.0526	0.273
<b>Construction and Mining Equipment Subtotals:</b>				
	Actual Emissions	0.437	0.0537	0.273
	Reduction Amount	0.131	0	0
	Theoretical Emissions	0.306	0.0526	0.273
<b>Lawn and Garden Equipment (Com)</b>				
1998 Leafblowers/Vacuums (Com), 40 HP, Qty: 10	Actual Emissions	0.69	1.51	31.6
	Reduction Amount	0.207	0	0
	Theoretical Emissions	0.483	1.01	31.6
1998 Leafblowers/Vacuums (Com), 40 HP, Qty: 10	Actual Emissions	0.69	1.51	31.6
	Reduction Amount	0.207	0	0
	Theoretical Emissions	0.483	1.01	31.6

Start Block Isla... NATE\_U... NATE - ... NATE - ... 2:38 PM



Note that the percentage reductions will apply to all equipment you have selected. You can go back to the Equipment Wizard and de-select equipment if you would like. The EPA Retrofit Calculator, shown on the next page, if specific to single engines, not an entire inventory of equipment – but it will give the user specific reduction percentages by pollutant.

## EPA Retrofit Calculator Model

SubFleet Number: 1 Store SubFleet

1. Type of Equation	Fuel Consumption	10. Number of Vehicles	3000	veh
2. Industry	On-Highway	11. BSFC	150	g/bhp-hr
3. Engine Manufacturer	CPMH - Caterpillar	12. Fuel Density	3215	g/gal
4. Model Year	1988	13. Amount of Fuel	28000	gal/veh
5. Engine Family	JCT0636FPA4	14. Fraction of Fuel used w/in State	1	
6. Retrofit Manufacturer	EngelHard	15. Certification Fuel Sulphur Fraction	.002	
7. Retrofit Equipment	Catalyst Muffler	16. In-Use Fuel Sulphur Fraction	.0005	

	HC	CO	NOx	PM
8. Cert Levels g/bhp-hr	1.2	2.7	4.4	0.6
9. Fractional Reductions	0.4	0.5	0.15	0.2

SubFleet 1 of 1: Tons of Reductions

#Vehicles	HC	CO	NOx	PM	
3000	952.34	2678.46	1309.47	229.9	Calculate

Total Tons of Reductions for your Fleet (1 SubFleet)

#Vehicles	HC	CO	NOx	PM	
3000	952.34	2678.46	1309.47	229.9	Totals



**Tip:** At this writing there are no diesel retrofit kits that are approved by the EPA's Environmental Technology Verification (ETV) program that could achieve substantial NO<sub>x</sub> reductions, but there will be some in the near future. Reductions of particulate matter should not be overlooked.

## Technical Analysis

This section addresses some of the more technical and “what-if” scenarios that can be handled by NATE. The first deals with the Lawn & Garden sector, since at this writing the morning operations ban was still in effect.<sup>4</sup> Other options deal with entering in actual hours of use, or more specialized features of the NATE model.

### *Lawn & Garden target emissions*

The Lawn & Garden morning operating ban allows commercial landscapers an exemption to the rule if emissions are otherwise reduced, such as by using no-spill gasoline cans. The NATE model cannot estimate gasoline can emissions, but can calculate what the emissions from the morning operations ban in Houston would result in, including exhaust and gasoline spillage emissions. Equivalent NOx emissions are defined as:

$$(\text{VOC} + \text{NOx}) * 0.364$$

Equation 2

Based upon TNRCC modeling of ozone, approximately 36 percent of the total emissions reduced by not emitting between 6:00 a.m. and 12:00 noon was calculated as being “equivalent NOx” emissions. There was some backwards engineering in this equation, and the method is to some people a little cumbersome or questionable, but until the regulation or modeling is revised, NATE shall be based upon this assumption regarding the morning operating ban for commercial lawn & garden equipment.



**Tip:** By selecting the “Houston Commercial Lawn & Garden scenario in NATE, all the computations are included except for your equipment list, and your year of analysis.

### *Annual hours of use*

Unless specified, NATE will assume the default hours of use contained in the NONROAD model. One of the Model Output screens will allow the user to specify

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<sup>4</sup> 30 Texas Annotated Code, sections 114.452-114.459. The rule becomes effective on April 1, 2005, and covers commercial lawn & garden operators in the counties of: Brazoria, Fort Bend, Galveston, Harris, and Montgomery.

annual hours of use. Note that one and only one number can be input for each source category – so a bulldozer with 500 hours of operation per year will have five times the emissions of one having only 100 hours per year (they should be run separately, perhaps, or averaged together). Default annual hours of operation are contained in the Appendix. First, so a “sanity check” to see if the default hours appear to be reasonable. If not, then update the Model Output file to incorporate updated annual hours of use. It is up to the user to maintain any records associated with modified annual hours of use data.

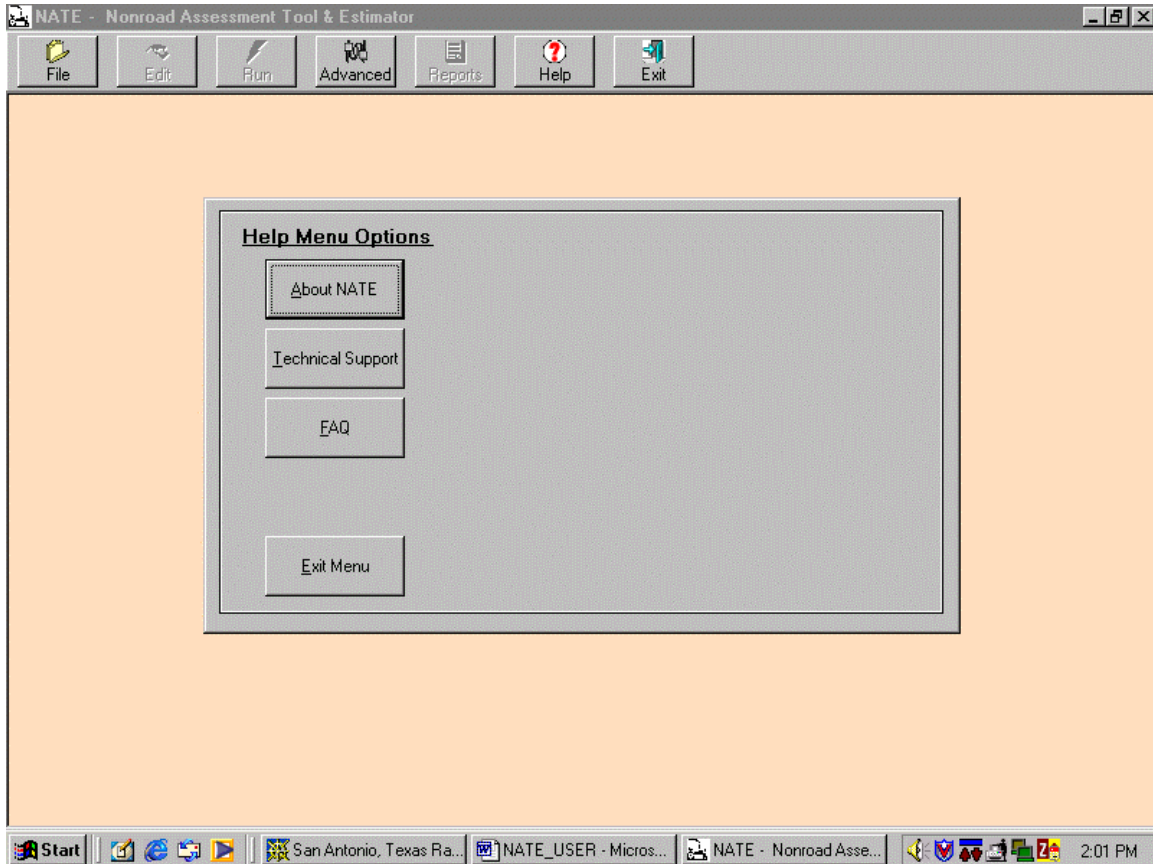
### ***Link to EPA Retrofit Calculator Software***

The EPA has a separate model to be used for estimate emission reductions from diesel retrofit equipment that lowers emissions. Called the *Retrofit Calculator*, this model will report percentage reduction in emissions by engine family and new technology. For information background and the model itself, please use the following link:

<http://www.epa.gov/otaq/retrofit/retrofitfleet.htm>

The NATE model will allow users to manually enter in output from the *Retrofit Calculator* – there is no automated linkage. At this writing, most of the new technology retrofit equipment is based upon particulate traps that lower exhaust soot, although equipment that reduces oxides of nitrogen will be available within the next several years. Note that NATE cannot estimate emissions for on-road vehicles and trucks, so only non-road engines would be applicable to NATE – it is up to the user to input these percentage reductions correctly.

## Troubleshooting



The HELP button provides some technical notes as well as some contacts at TNRCC and EPA.

### ***Why can't I find some older pieces of equipment?***

1. The NONROAD model might not allocate any equipment to the county you selected. Several counties in Texas do not have any equipment allocated for the following equipment types: marine recreational (boats), railway maintenance equipment, oil and gas (drilling) equipment, and agricultural equipment. One solution would be to pick another county close by, and then try again.
2. The horsepower or certification standard selected by NATE might not be present in the NONROAD model. We have attempted to use some intelligence when selecting these combinations – but sometimes NONROAD has gaps in its supporting data files.
3. The NONROAD model sometimes assumed rapid “turnover” of equipment, meaning that the engine life span might be very short. One sees this with equipment having lower horsepower ratings – in general higher horsepower engines last longer.

### ***Why are there sometimes multiple standards for the same year?***

The U.S. EPA allows engine manufacturers to phase-in their new engines certified to lower standards, using concepts known as averaging, banking, and trading (ABAT). The situation is similar to the Corporate Average Fuel Economy (CAFÉ) standards for on-road fuel economy, which allows larger vehicles to be averaged in with smaller, more efficient ones. In the 1999 to 2009 time period, non-road diesels may have two listing for each model year

### ***NONROAD runtime errors***

Most problems in the modeling can be traced back to the NONROAD input file; these end in the file extension called <OPT>. There also is a message file with the file extension <MSG> in the NONROAD model that contains any warnings or errors. If your problem cannot be traced to a simple NONROAD issue, the TNRCC staff will ask for a copy of the OPT and MSG files.

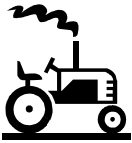
### ***NONROAD Model Updates***

The NONROAD core model used in the NATE model was based upon a version issued by the U.S. EPA in June, 2000. The EPA intends to update this model sometime in 2002, and these newer versions may cause fatal errors in the NATE model. If there is enough TNRCC interest, such as from users who like the NATE model, it can be easily revised to accommodate new NONROAD model versions. Please let the TNRCC know about your suggestions and comments.

## ***Operating Systems***

The NATE model only works on Windows 3.x and Windows85, Windows 95, and Windows ME. The system does not work on other operating systems such as Windows NT, Unix, or Linux.

Memory requirements are only 64 megabytes of RAM. The physical space required by NONROAD is quite large, about nine megabytes, so personal computers close to their limit on file space may cause “overspills” because the output and reporting file can be very large, as they may accumulate over time.



**Tip:** be sure to periodically delete old NATE scenarios not needed for reporting to the TNRCC or your business, as they will rapidly consume file space.



## **Appendix**

Files have been appended in the CD-ROM version of the *NATE User Guide*.