



# **NONROAD2005**

---

1



## **NONROAD2005 Training**

Craig Harvey, US EPA, OTAQ

15<sup>th</sup> Annual Emission Inventory Conference  
New Orleans, Louisiana  
15 May 2006

2

## Logistics

---

- Hours: 1:30 PM - 5:00 PM
- One break
- Please turn off or set pagers and cell phones on vibrate
- If you need to talk on your cell phone, please leave the room.

3

## Training Support

---

- NONROAD Model Team:
  - Craig Harvey
  - Penny Carey
  - Larry Landman
- And on nonroad NMIM issues:
  - Harvey Michaels
- Web
  - <http://www.epa.gov/otaq/nonrdmdl.htm>
- Email
  - [nonroad@epa.gov](mailto:nonroad@epa.gov)

4

## Course Objectives

---

- Overview of NONROAD2005
  - versus NMIM and NR2004
- Running NONROAD from the GUI
- Creating output summaries with the reporting utility
- Viewing and post-processing raw output
- Modifying inputs
- Using new features of NONROAD2005
- Deciding whether to use NONROAD vs NMIM

5

## Other topics, as time permits:

---

- Using Daily Temperature & RVP inputs
- Getting & using "By-Model-Year" output
- BATch (multiple) model runs
- Site-specific inventories
- Growth and Technology Year inputs
- Creating your own Access queries

6



## Topics You Care About?

---

- What modeling challenges do you face?
- What is the most creative thing you've done (or tried to do) using NONROAD?
- What would you love to be able to model that you can't?
- etc.

7



## Logistics (cont.)

---

- For the hands-on exercises, I'll explain how to do it while I do it, then you do it, asking questions as needed.
  - So pay attention rather than typing along.
  - Work together – you'll learn more.
  - If you finish an exercise, please help others who are having trouble.
  - Ask questions if you get stuck.

8

## Expected Preparation

---

- NONROAD2005 software installed
- Basic familiarity with the Windows operating system
  - Browsing folder structure with Windows Explorer
- How to use Notepad or another text editor
- How to open Excel or other spreadsheet

9

## Questions

---

- Feel free to ask at any time -- if you are confused, so are other people
- The answer may be
  - I'll cover that later
  - I don't know
  - I'll provide an answer later by email
  - Out of the scope

10

## Miscellaneous

---

- We won't be able to cover everything
- Apologies to the most experienced for going too slowly, and to novices for possibly going too quickly
- Students are from States, EPA, RPOs, MPOs, cities, consulting firms, industry, etc.
- I'll be here only through Tuesday morning

11

## Course Materials

---

- **Handouts**
  - These slides
  - NONROAD2005 Update Chronology
- **Documentation on install disk or download**
  - NONROAD2005 User's Guide
  - NONROAD Model Technical Reports  
( NR-001 – NR-015 )

12

## What is NONROAD2005

---

- **Final version of nonroad equipment inventory model**
  - Generates inventory estimates for
    - ✓ All off-highway mobile equipment & recreational vehicles
    - ✓ Except locomotive, commercial marine, and aircraft
  - Several draft versions issued since 1998, last was 2004
  - Changes since NONROAD2004 are in later slide

13

## NONROAD Model Overview

---

- Stand Alone (*No User Data Necessary*)
- Differentiated by Equipment Type and Other Characteristics
- HC, CO, NO<sub>x</sub>, PM, SO<sub>2</sub>, CO<sub>2</sub>
- Equip Population & Fuel Consumption

14

## NONROAD Model Overview

---

- **Past, Present, and Future Years**
  - 1970 - 2050
- **Temporal Allocation**
  - Annual, Seasonal, Monthly, Typical Day
- **Geographic Allocation**
  - US, State, County

15

## NONROAD Model Overview

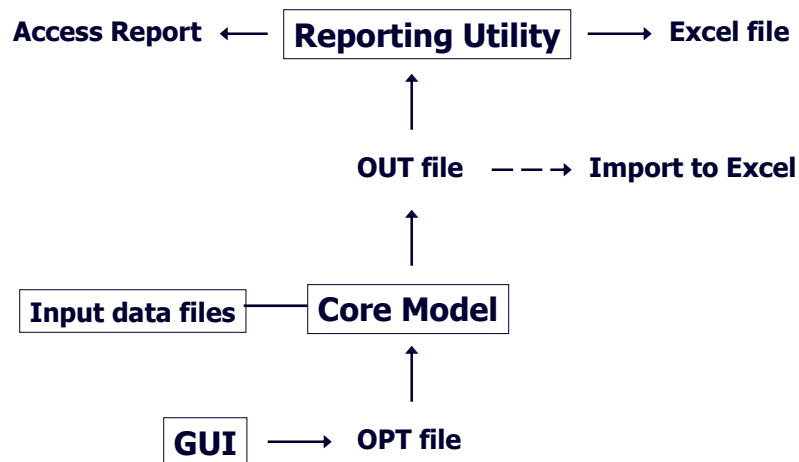
---

- **Graphical User Interface** ("GUI", Visual Basic)
  - Scenario definition
- **Core Model** (Fortran)
  - Calculations
  - Generates raw output (.OUT file)
- **Reporting Utility** (Microsoft Access)
  - Output summaries

16



## How NONROAD Works



17

## NONROAD Model Overview

### ➤ Input Options

- Evaluation Year
- Temporal Period  
(Year, Season, Month, Weekday, Weekend day)
- Geographic Area (National, State, County)
- Equipment Types (by fuel type, Hp, SCC)
- Fuel Characteristics (RVP, sulfur, oxygen)
- Temperature (min, max, avg)

18

## NONROAD Model Overview

---

### ➔ **Output Options**

#### ➤ **From Core Model**

- ✓ ASCII File (.OUT comma separated text)

#### ➤ **From Reporting Utility** (Access not required)

- ✓ Pre-formatted MS Access Reports
- ✓ Access database tables (NIF 3)
- ✓ Excel Spreadsheet

19

## NONROAD Model Overview

---

### ➔ **Pre-Formatted Inventory Reports**

- Tons by County
- Tons by Source Category
- Tons by Equipment type & SCC
- Tons By Horsepower range

### ➔ **Emission Factor Reports**

- Grams per Day by SCC (& Hp)
- Grams per Operating Hour by SCC (& Hp)
- Grams per Hp-Hour by SCC (& Hp), exhaust only

20

## NONROAD Model Overview

### Exhaust Emissions Calculation

$$I = EF \cdot DF \cdot Act \cdot LF \cdot RP \cdot Pop$$

I = Exhaust Emissions Inventory (ton/year)

EF = Emission Factor (g/hp-hr)

DF = Deterioration Factor

Act = Activity (hours/year)

LF = Load Factor

RP = average rated power (hp)

Pop = Equipment population (units)

21

## NONROAD versus NMIM

### What NMIM does that NONROAD does not:

- Multiple county-specific temperature & fuel properties in a single run
- Full fleet-specific retrofit modeling
- Ammonia (NH<sub>3</sub>) and Toxics (HAPS)
- Distributed processing (multiple computers)
- National county-level inventories for the National Emission Inventory (NEI) and AQ modeling

22

## NONROAD versus NMIM

---

### What NONROAD does that NMIM does not:

- Equipment population & fuel consumption output\*
- Detailed output by specific evap pollutant\*
- Seasonal, annual, or typical day outputs (but you can post-process to get most of these)
- Inventory years prior to 1999
- Daily temperature inputs.

\* (unless run NMIM from DOS and ask for OUT file)

23

## NONROAD2005

---

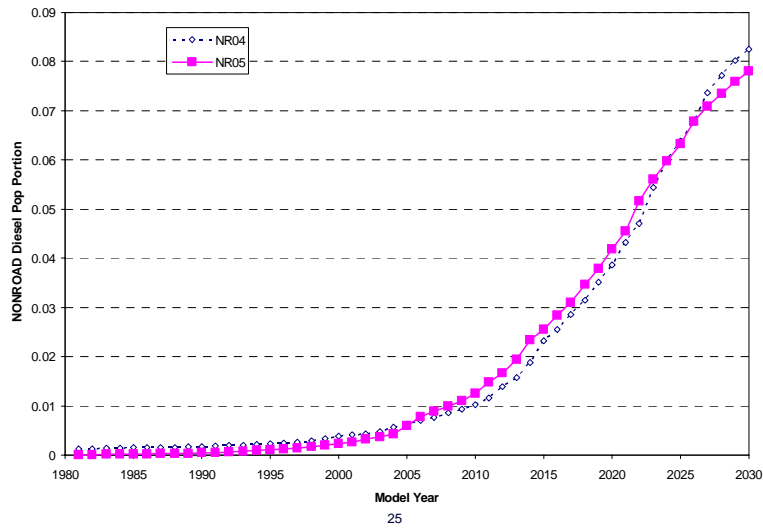
### ➔ Changes from NONROAD2004

- Added evap categories: tank permeation, hose permeation, running loss, and hot soak
- Enhanced output: Load Factor & Avg Hp
- Revised diurnal methodology and estimates
- Includes Rec/Large SI rule evap controls
- Updated scrappage/age distribution
- Updated state and county allocations
- Daily inputs for temp and RVP at national/state level
- Adds Puerto Rico and the Virgin Islands
- Added report options (especially Emission Factors)
- Added diesel retrofit modeling capability

24

## NONROAD2005 vs NR2004

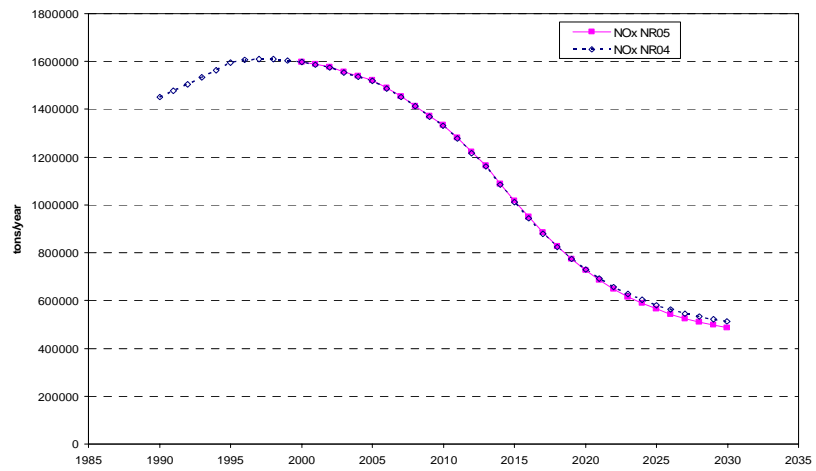
### 2030 Diesel Model Year Distribution



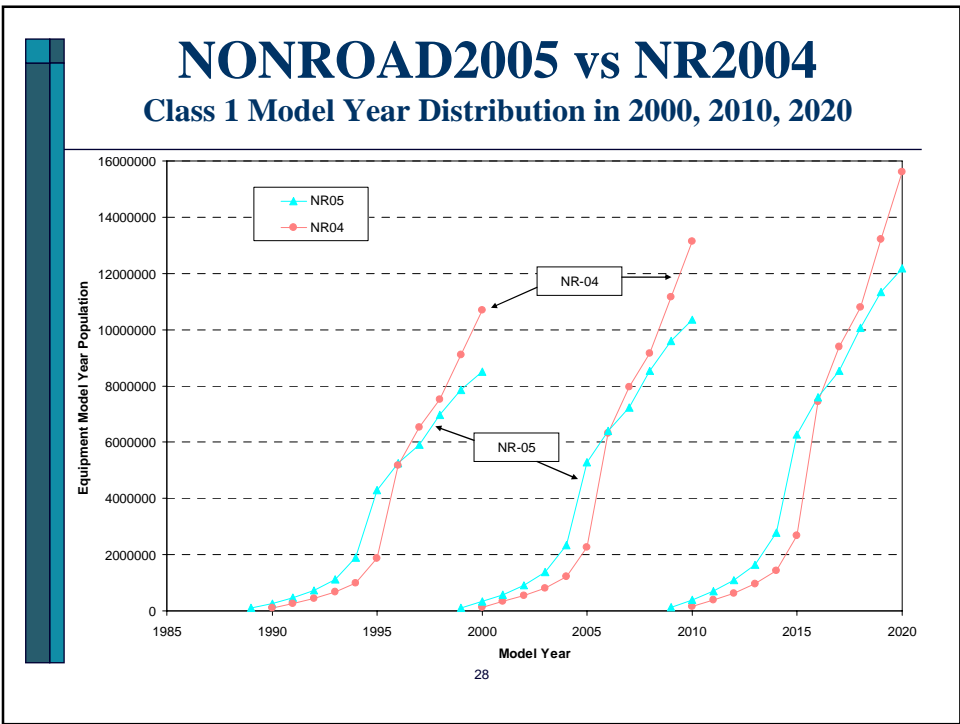
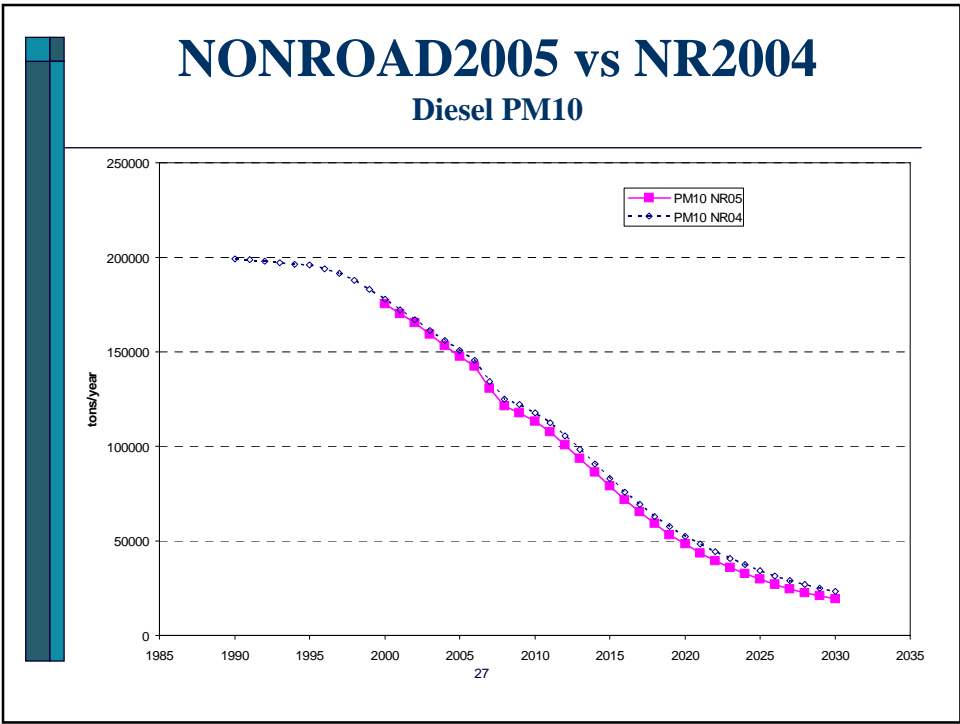
25

## NONROAD2005 vs NR2004

### Diesel NOx

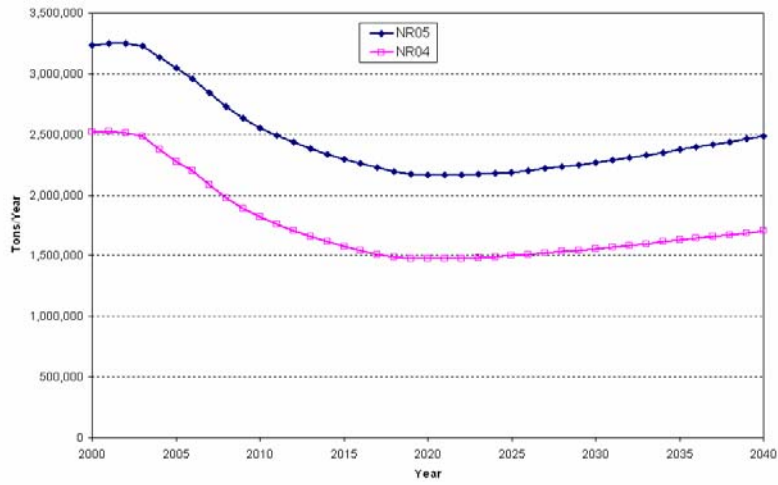


26



## NONROAD2005 vs NR2004

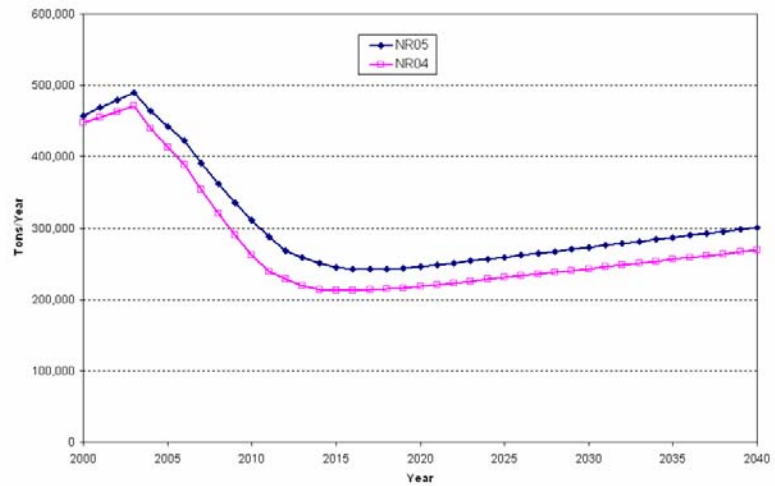
### SI THC total (exh & evap)



29

## NONROAD2005 vs NR2004

### SI NO<sub>x</sub>



30



## Future Changes

---

- Update per future rulemakings  
( e.g., likely small gasoline engines and recreational marine, final rule in 2007? )
- Transition to MOVES ( draft in 2007/2008? )

31



## Questions?

---

... on what NONROAD2005 is, or changes since NONROAD2004 ?

32



## Hands-on Exercises

---

33

## Configuring NONROAD

---

→ **Relevant files & directory structure:**

- nr-gui.ini
- template.opt (note use of relative file paths)

```
c:\nonroad
  \data
    \activity
    \allocate
    \daily
    \detfac
    \emsfac
    \retrofit
    \season
    \tech
  \outputs
  \reports
```

34

## Exercise 1: Use GUI to Run NONROAD with default data

---

- Open GUI (nrgui.exe)
- Save as... nrtest1.opt (suggest in outputs folder)
- Scenario => Options, Period, Region, Sources (make any desired changes)
- Model => Run with nrtest1.opt

35

## Post-run checks

---

- If DOS window is still open, look at it for errors and warnings.
- Open MSG file to check for errors and warnings
- Can open OUT file in text editor to check for desired counties, SCCs, pollutants

36

## Exercise 2: Use Reporting Utility to Generate Reports

---

- From GUI select Model => Reports
- In Reporting Utility select
  - Data => Re-attach tables (only needed after install)
  - Data => Import data
  - Give brief description such as location, year, & scenario designation (e.g., "Base")
- Select Reports => Emission Totals by SCC
  - Select Run, Pollutants, Fuel, HC & PM types
  - Run
  - File => Export to Excel

37

## Exercise 3: Postprocessing with Excel

---

- Open Excel (or other spreadsheet software)
- Select File => Open...
  - c:\nonroad\outputs\nrtest1.out
  - Delimited: comma (only)
- Scroll to bottom and add a Totals line  
= sum( ) select lastcell up to firstcell.

38

## Exercise 4: Export to NIF3

- In Reporting Utility...
- Select Data => Export NIF File
- Choose available simulation to export
- Fill in contact info and any notes  
(See sample on next slide)
- Click Export button

39

## Exercise 4: Export to NIF3

The screenshot shows a software window titled "Export to NIF 3.0" with a teal background. The window contains a form for exporting simulation data. The form is titled "Exporting Simulation: p3fv Bond Base 2005". It includes several input fields and dropdown menus:

- Previously Exported to Database:** An empty text input field.
- ContactPerson:** Text input field containing "Craig Harvey".
- OrganizationName:** Text input field containing "EPA".
- ContactPhone:** Text input field containing "734-214-4237".
- Telephone Number Type:** A dropdown menu with "Office" selected.
- Electronic Address:** Text input field containing "nonroad@epa.gov".
- Electronic Address Type:** A dropdown menu with "Email" selected.
- Affiliation Type:** Text input field containing "Report Certifier".
- Tribal Code:** Text input field containing "000".
- Time Period:** Text input field containing "Total for year: 2005".
- Start Date (yyyymmdd):** Text input field containing "20050101".
- End Date (yyyymmdd):** Text input field containing "20051231".
- Period Type:** A dropdown menu with "30" selected.
- Episode Year:** Text input field containing "2005".
- RunMemo:** A text area containing "2005 baseline, No Daily inputs".

At the bottom of the form, there are two buttons: "Export" and "Done".

40

## Exercise 4: Export to NIF3

---

- Save as niftest1.mdb (Access MDB file)
- Click Open button, which saves the file
- Double-click on niftest1.mdb, which should open MS-Access
- Look at database tables

41

## Exercise 5: Modify Input Data

---

- **Inputs you might modify**
  - Equipment population (\*.pop)
  - Activity (activity.dat)
  - Geographic allocation (\*.alo)
  - Temporal allocation (season.dat)
  - Growth at state level (\*.grw)
- **We recommend not changing**
  - Emission Factors (\*.emf)
  - Deterioration Factors (\*.det)
  - Useful life and scrappage (\*.pop)

42

## Exercise 5: Modify Input Data

### → Working with ASCII data files

- Use Text Editor (e.g., Notepad) not word processor
- Must be in proper space-delimited vertical columns
- If display font option, use Courier or Courier New
- No word wrap
- Use spaces not tabs
- Refer to column descriptions near top of each file
- Actual data is inside "packets"
  - /POPULATION/
  - ... data ...
  - /END/
- Anything outside of packet is just a comment

43

## Exercise 5: Modify Input Data

The screenshot shows a Notepad window titled 'LAPOP - Notepad'. The window contains a data file with the following structure:

```

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 HP range
76 - 80 maximum HP range (ranges must match those internal to model)
82 - 86 average HP in range (if blank model uses midpoint)
88 - 92 expected useful life (in hours of use)
93 - 102 flag for scrappage distribution curve (DEFAULT = standard curve)
106 - 122 population estimate
  
```

FIPS	Year	SCC	Equipment Description	HPmn	HPmx	HPavg	Life	Scrapflag	Population
/POPULATION/									
22000	1998	2260001020	2-str Snowmobiles	100	175	112.4	252	DEFAULT	0.0
22000	1998	2260001010	2-str offroad Motorcycles	0	1	1	19200	DEFAULT	23454.7
22000	1998	2265001010	4-str offroad Motorcycles	0	1	1	19200	DEFAULT	11552.3
22000	1998	2260001030	2-str All Terrain Vehicles	0	1	1	20410	DEFAULT	11854.4
22000	1998	2265001030	4-str All Terrain Vehicles	0	1	1	20410	DEFAULT	102591.6
22000	1998	2265001050	4-str Golf Carts	6	11	9.15	400	DEFAULT	1867.7
22000	1998	2260001060	2-str Specialty Vehicle Carts	6	11	8.046	200	DEFAULT	5077.6
22000	1998	2260001060	2-str Specialty Vehicle Carts	25	40	37	942	DEFAULT	1.5
22000	1998	2260001060	2-str Specialty Vehicle Carts	50	75	55	942	DEFAULT	0.9
22000	1998	2265001060	4-str Specialty Vehicle Carts	1	3	3	200	DEFAULT	2.6
22000	1998	2265001060	4-str Specialty Vehicle Carts	3	6	4.424	200	DEFAULT	1.04
22000	1998	2265001060	4-str Specialty Vehicle Carts	11	16	15.99	400	DEFAULT	197.5
22000	1998	2265001060	4-str Specialty Vehicle Carts	16	25	19.62	750	DEFAULT	1555.6
22000	1998	2265001060	4-str Specialty Vehicle Carts	25	40	30.55	942	DEFAULT	15.9

44

## Exercise 5: Modify Input Data

### → **Saving from Excel spreadsheet**

- Save As... Formatted Text (Space delimited)(\* .prn)
- Column widths & font sizes must be set to yield text in correct columns
- Setting this up can be tedious trial & error
- Can request sample XLS files from EPA
- No guarantee that settings will work right on different systems, due to effects of:
  - ✓ Desktop display settings
  - ✓ Fonts
  - ✓ Print driver
  - ✓ etc.

45

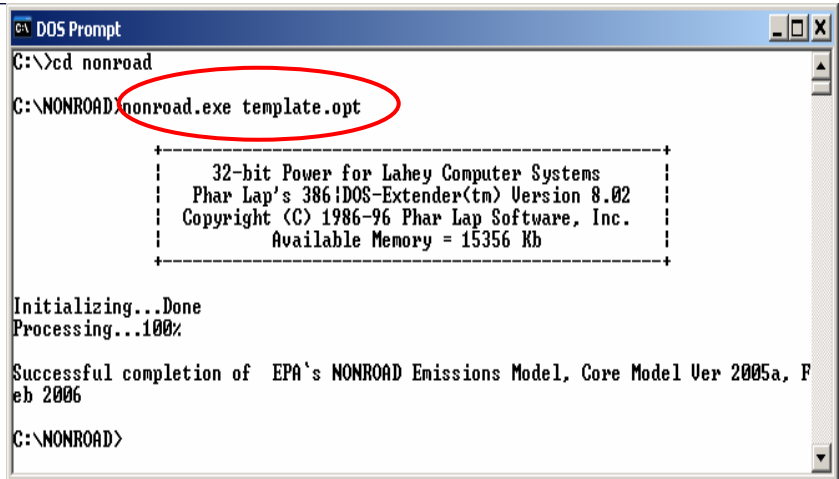
## Exercise 6: Running from DOS

### → **Why run from the Command line? (DOS window)**

- Run BATch file (multiple model runs)
- Can send screen output to a file  
c:\nonroad>nonroad.exe template.opt >outputs\screenout.txt
- Verify that core model works if having problems running from GUI

46

## Exercise 6: Running from DOS



```
CA DOS Prompt
C:\>cd nonroad
C:\NONROAD>nonroad.exe template.opt

+-----+
| 32-bit Power for Lahey Computer Systems |
| Phar Lap's 386!DOS-Extender(tm) Version 8.02 |
| Copyright (C) 1986-96 Phar Lap Software, Inc. |
| Available Memory = 15356 Kb |
+-----+

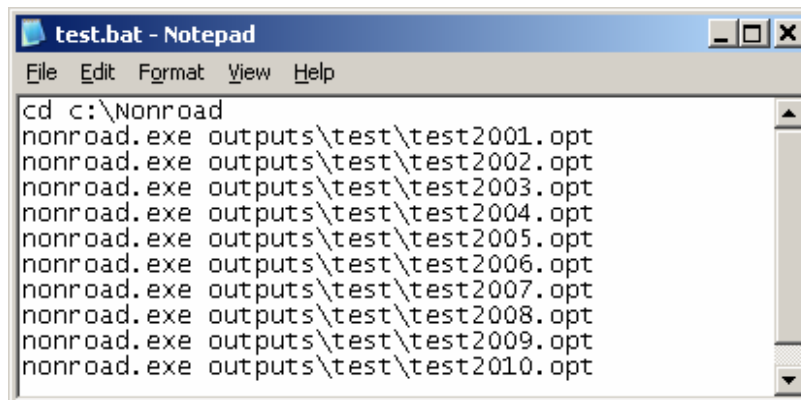
Initializing...Done
Processing...100%

Successful completion of EPA's NONROAD Emissions Model, Core Model Ver 2005a, Feb 2006
C:\NONROAD>
```

47

## Exercise 6: Running from DOS

### Example BATch file



```
test.bat - Notepad
File Edit Format View Help
cd c:\Nonroad
nonroad.exe outputs\test\test2001.opt
nonroad.exe outputs\test\test2002.opt
nonroad.exe outputs\test\test2003.opt
nonroad.exe outputs\test\test2004.opt
nonroad.exe outputs\test\test2005.opt
nonroad.exe outputs\test\test2006.opt
nonroad.exe outputs\test\test2007.opt
nonroad.exe outputs\test\test2008.opt
nonroad.exe outputs\test\test2009.opt
nonroad.exe outputs\test\test2010.opt
```

48





## Ongoing Support

---

- Web
  - <http://www.epa.gov/otaq/nonrdmdl.htm>
- Email
  - [nonroad@epa.gov](mailto:nonroad@epa.gov)