NONROAD2005

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NONROAD2005 Training

Craig Harvey, US EPA, OTAQ

15th Annual Emission Inventory Conference
New Orleans, Louisiana
15 May 2006

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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.

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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

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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

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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

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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.

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Logisitics (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.

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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

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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

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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

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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)

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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

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NONROAD Model Overview

- Stand Alone *(No User Data Necessary)*
- Differentiated by Equipment Type and Other Characteristics
- HC, CO, NO_x, PM, SO_2, CO_2
- Equip Population & Fuel Consumption

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NONROAD Model Overview

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

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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

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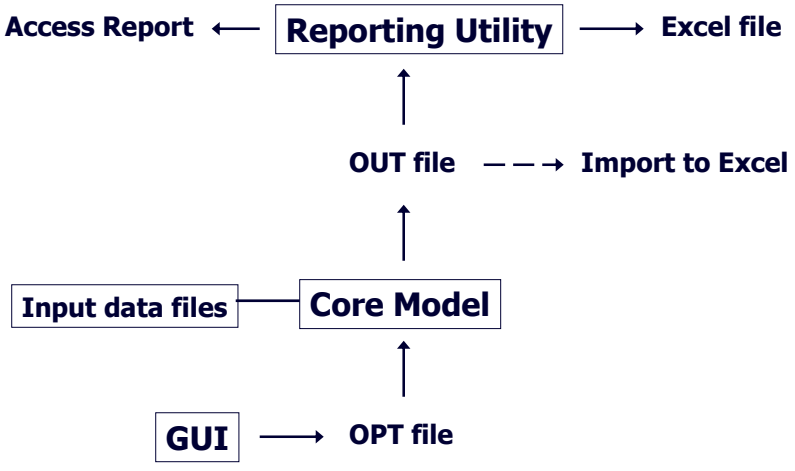
How NONROAD Works



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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)

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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

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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

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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)

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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_3) and Toxics (HAPS)
- Distributed processing (multiple computers)
- National county-level inventories for the National Emission Inventory (NEI) and AQ modeling

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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)

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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

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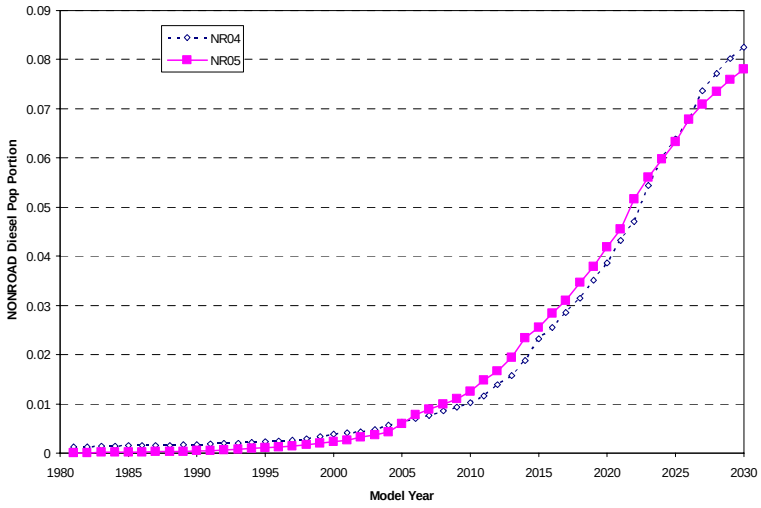
NONROAD2005 vs NR2004

2030 Diesel Model Year Distribution



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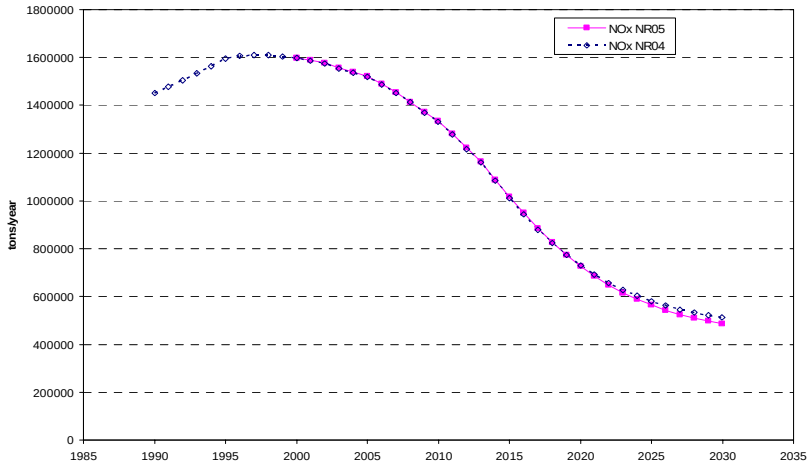
NONROAD2005 vs NR2004

Diesel NOx



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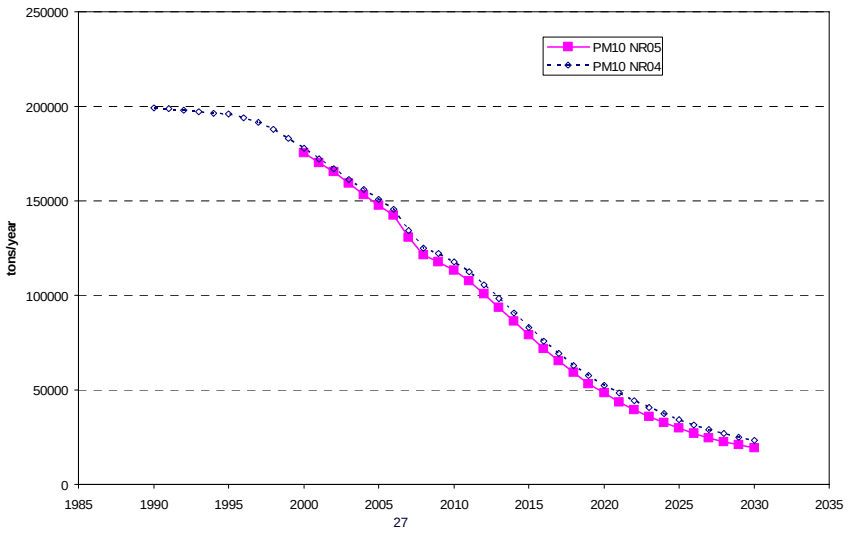
NONROAD2005 vs NR2004

Diesel PM10



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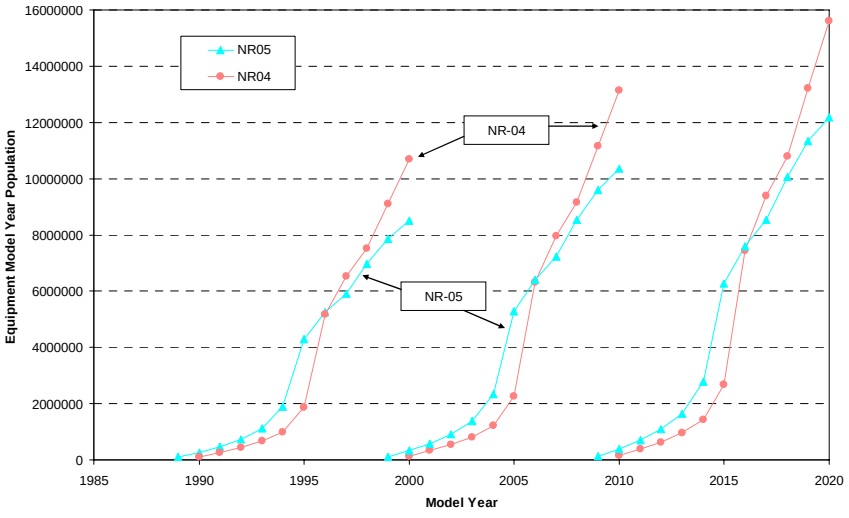
NONROAD2005 vs NR2004

Class 1 Model Year Distribution in 2000, 2010, 2020



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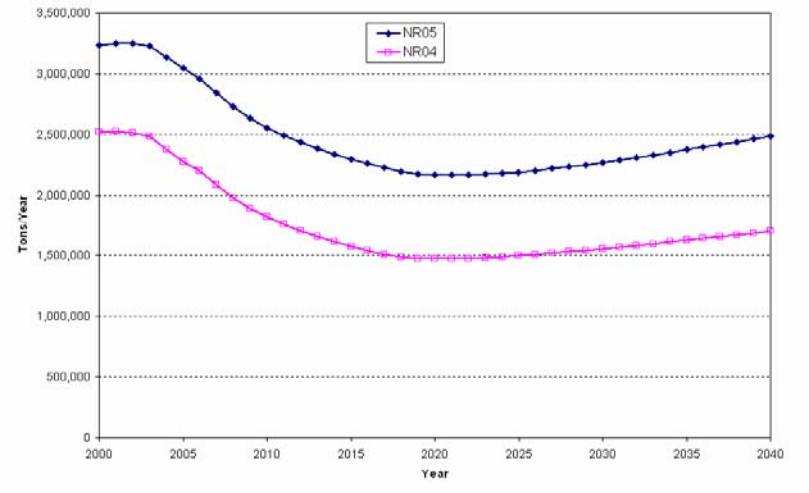
NONROAD2005 vs NR2004

SI THC total (exh & evap)



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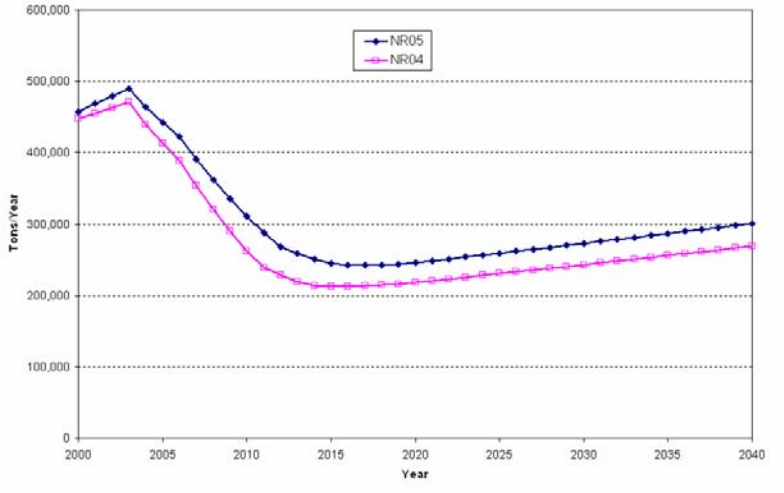
NONROAD2005 vs NR2004

SI NOx



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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?)

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Questions?

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

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Hands-on Exercises

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
```

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

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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

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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

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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.

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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

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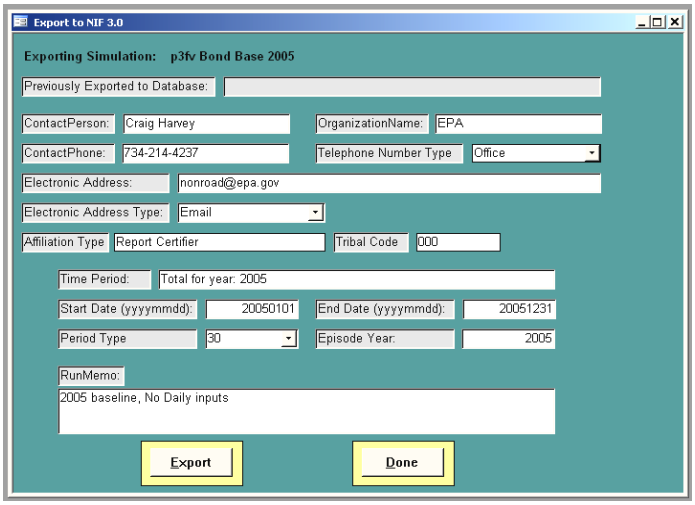
Exercise 4: Export to NIF3



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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

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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)

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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

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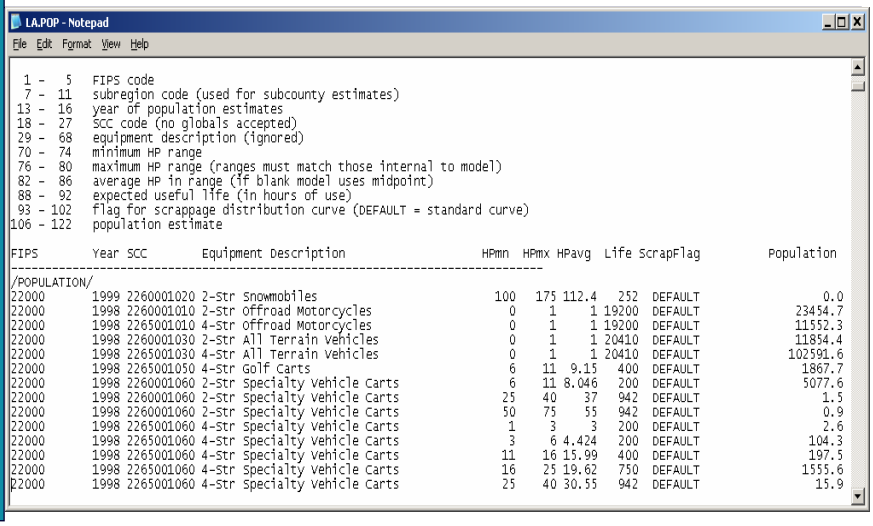
Exercise 5: Modify Input Data



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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.

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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

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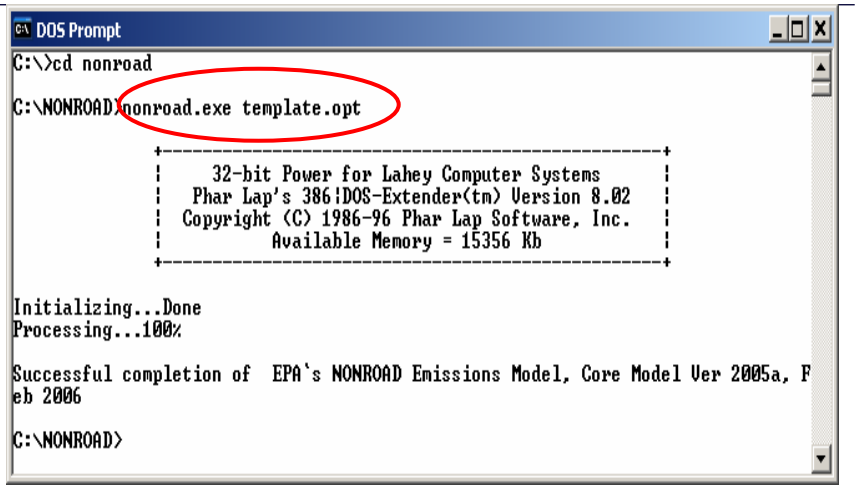
Exercise 6: Running from DOS



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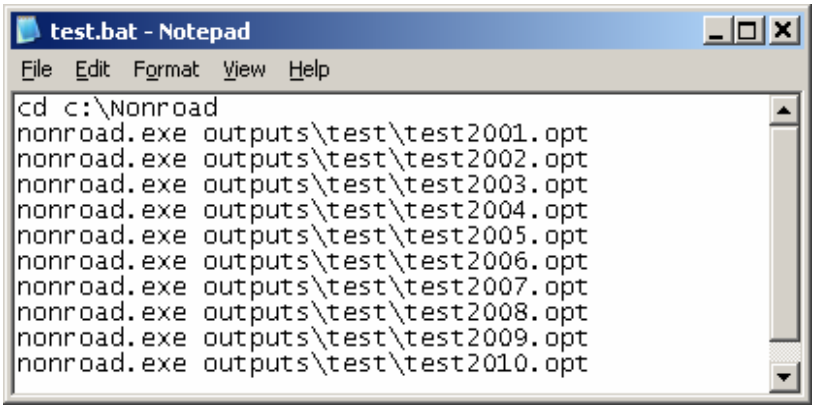
Exercise 6: Running from DOS

Example BATch file



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Ongoing Support

- Web
  - http://www.epa.gov/otaq/nonrdmdl.htm
- Email
  - nonroad@epa.gov

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