

NONROAD2005

NONROAD2005 Training

Craig Harvey, US EPA, OTAQ

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

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.

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

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

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

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.

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.

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

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

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

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)

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

NONROAD Model Overview

- Stand Alone (*No User Data Necessary*)
- Differentiated by Equipment Type and Other Characteristics
- HC, CO, NO_x, PM, SO₂, CO₂
- Equip Population & Fuel Consumption

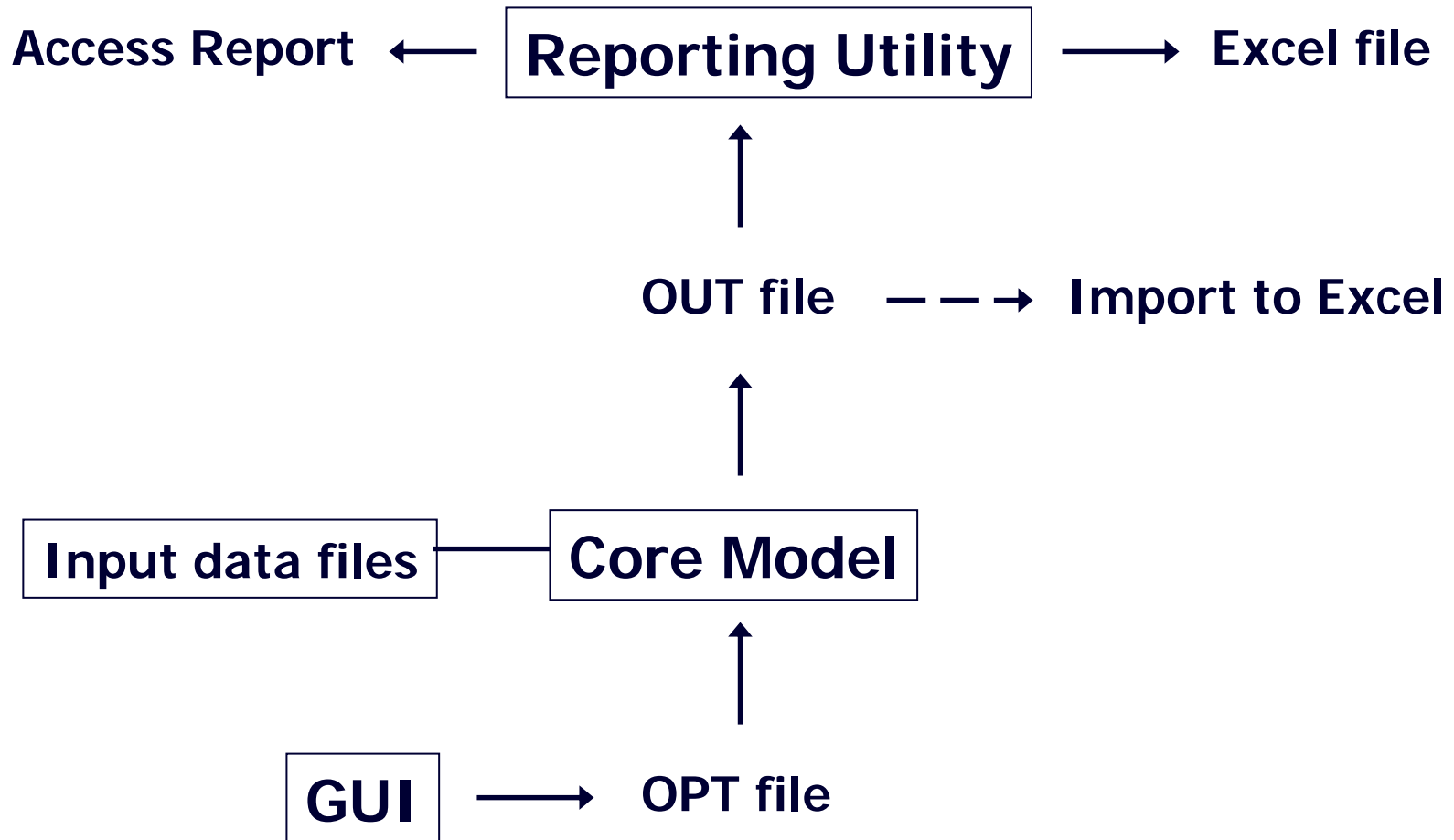
NONROAD Model Overview

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

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

How NONROAD Works



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)

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

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

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)

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 (NH₃) and Toxics (HAPS)
- Distributed processing (multiple computers)
- National county-level inventories for the National Emission Inventory (NEI) and AQ modeling

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)

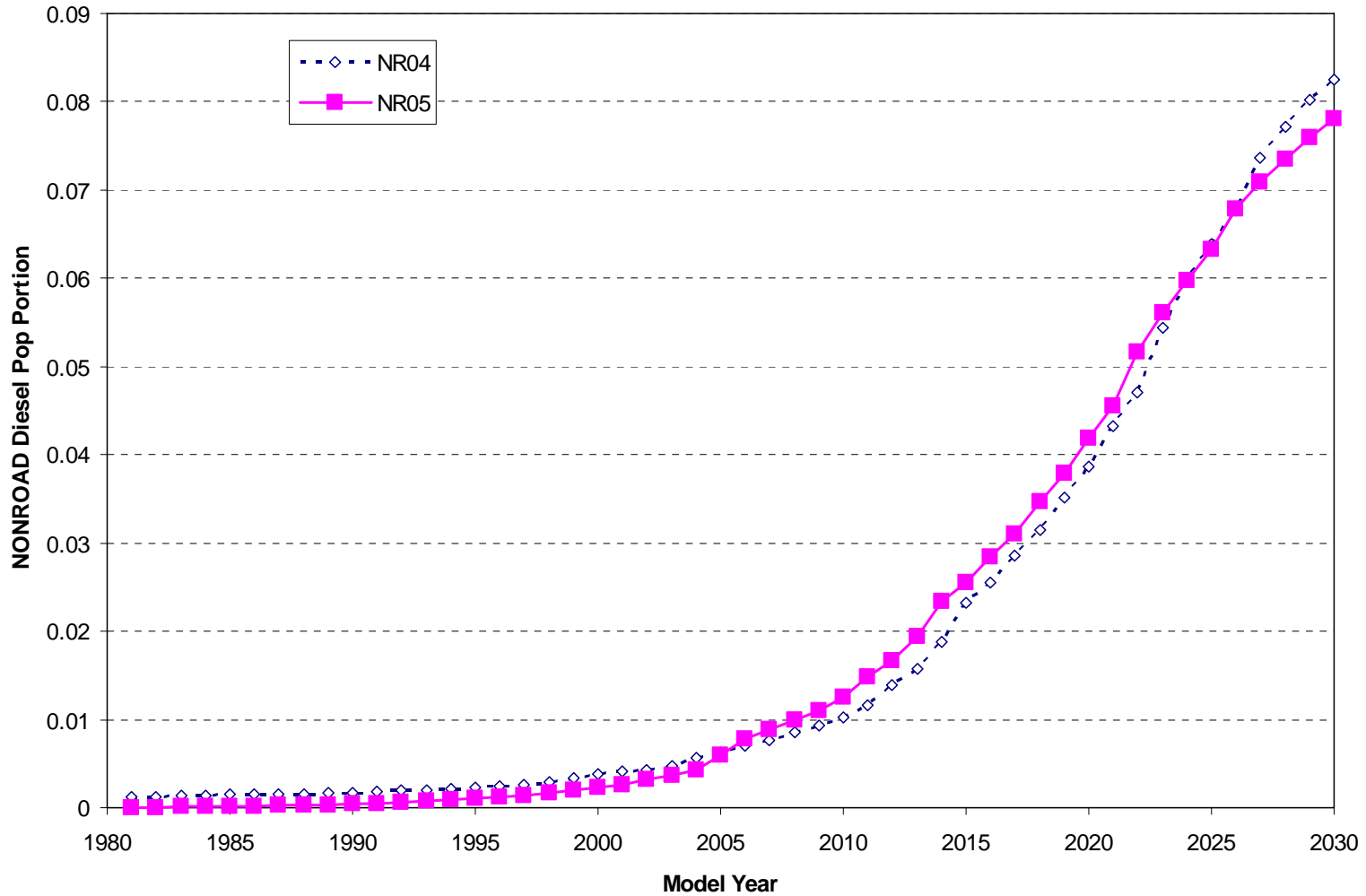
NONROAD2005

→ **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

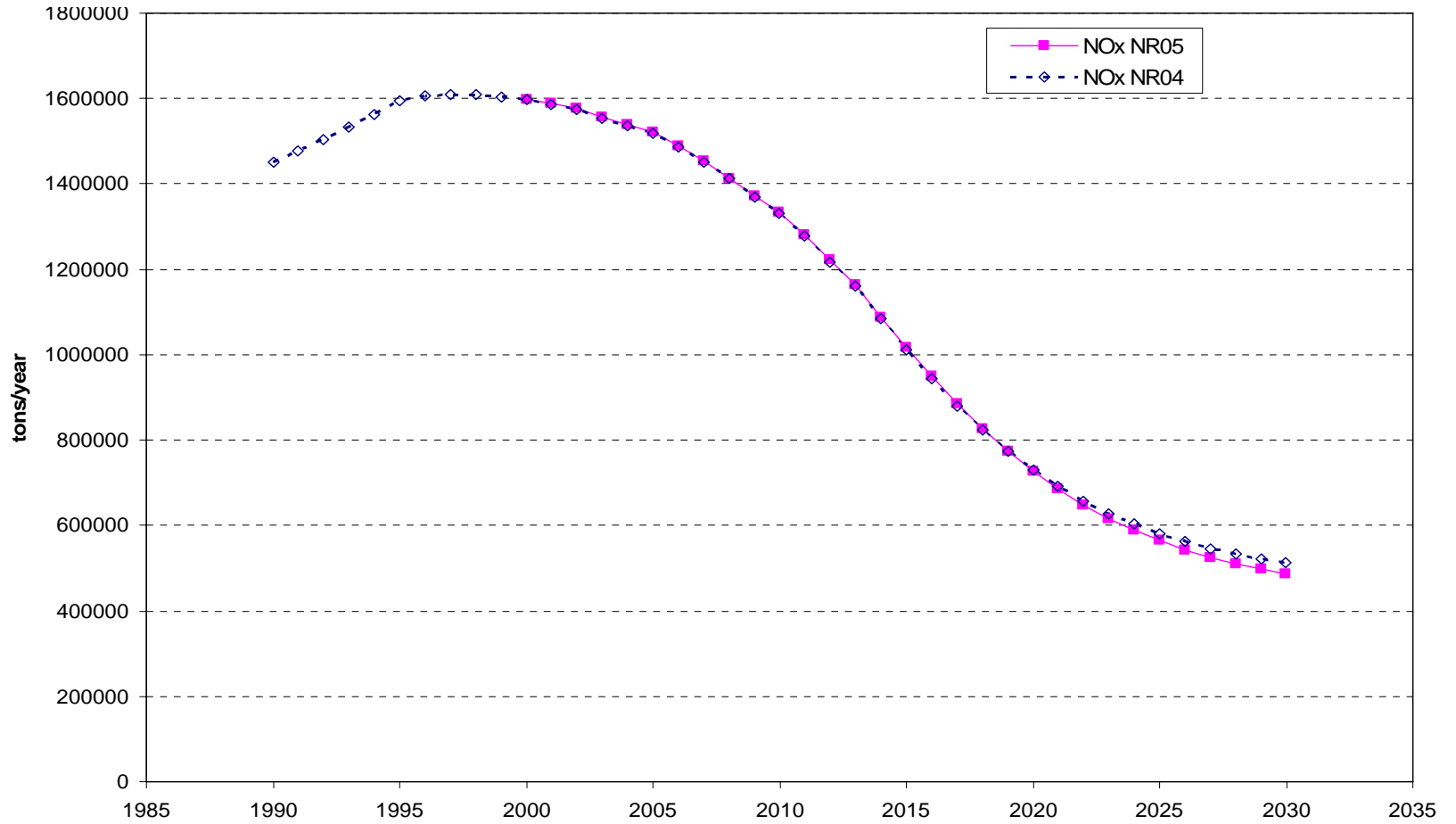
NONROAD2005 vs NR2004

2030 Diesel Model Year Distribution



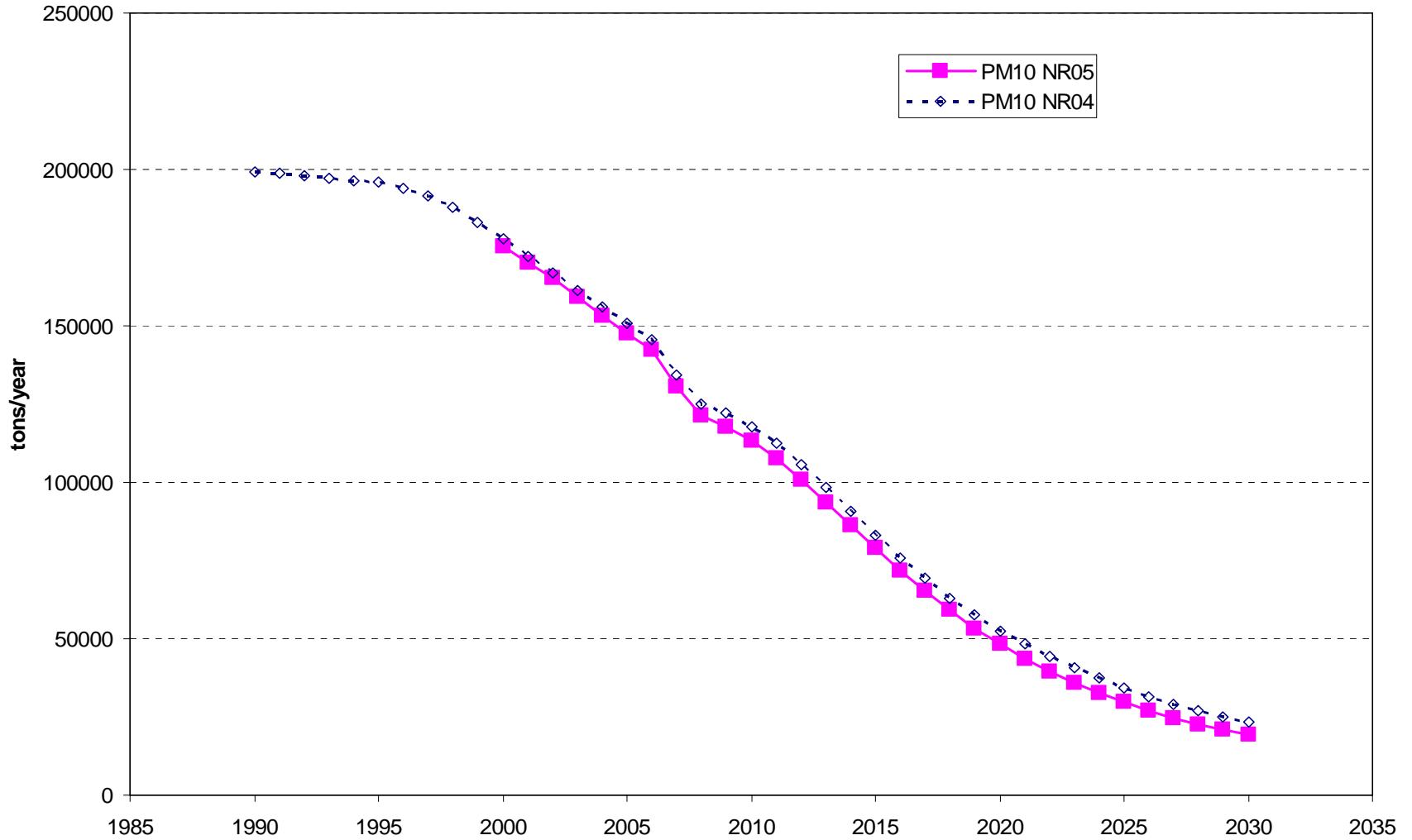
NONROAD2005 vs NR2004

Diesel NOx



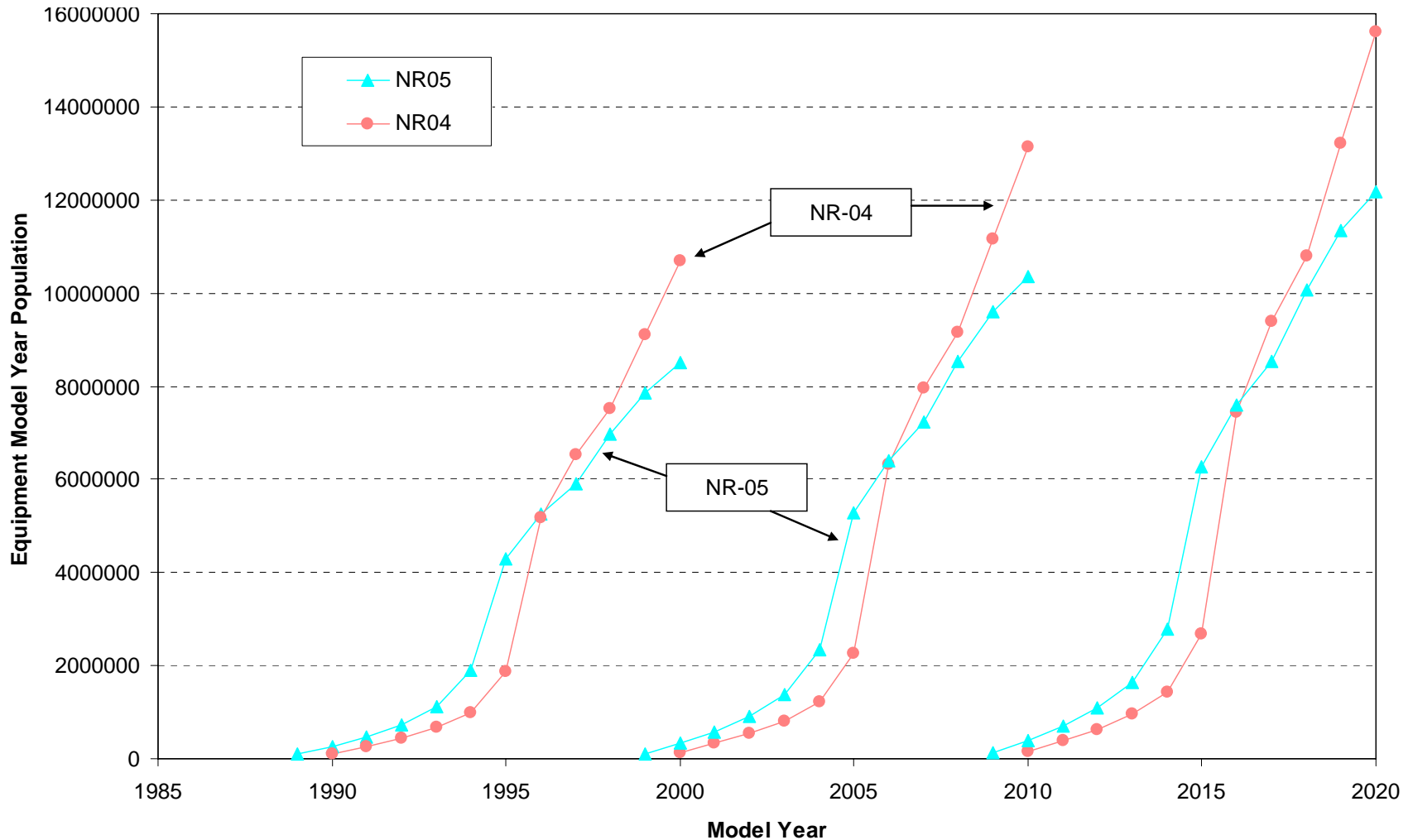
NONROAD2005 vs NR2004

Diesel PM10



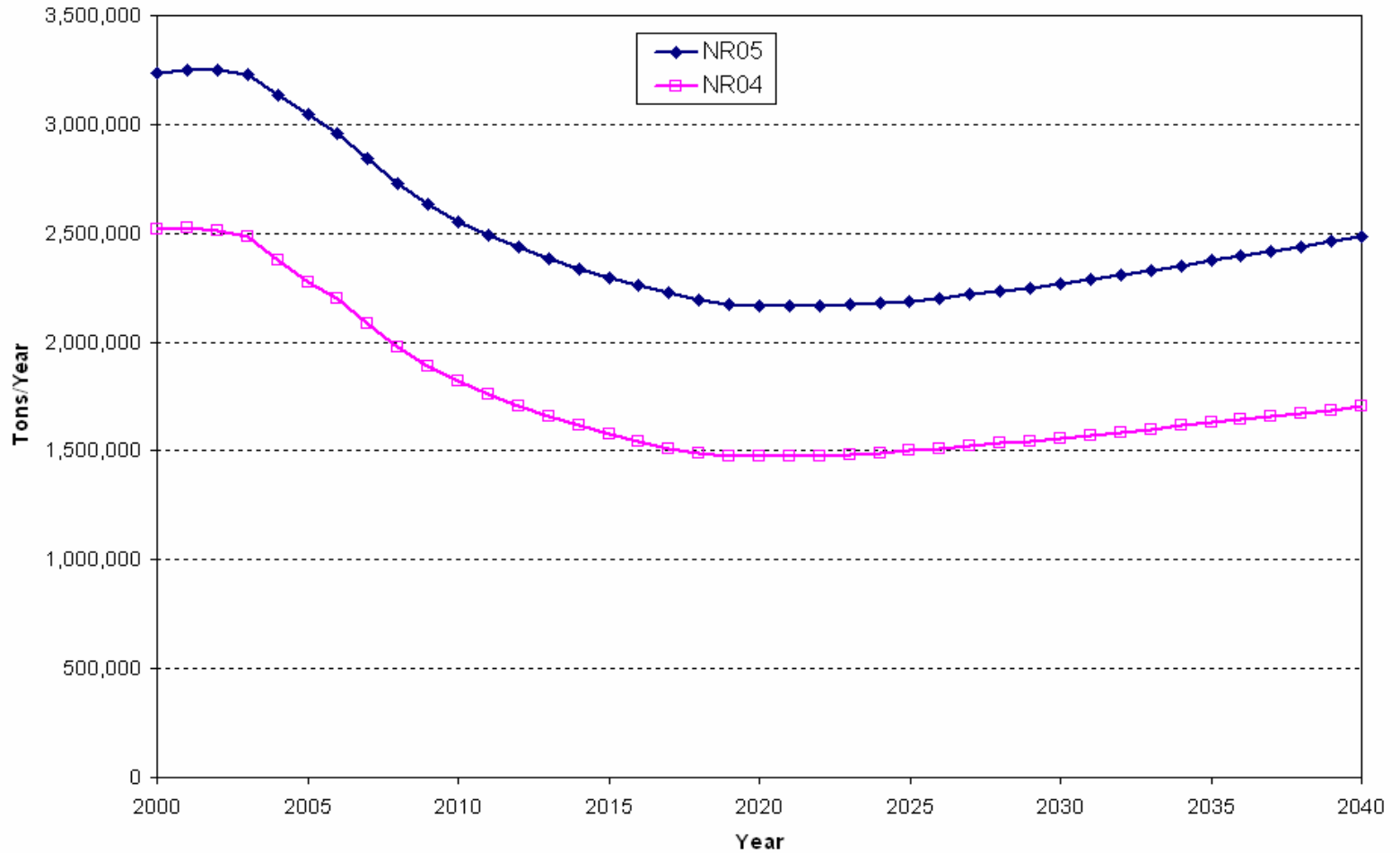
NONROAD2005 vs NR2004

Class 1 Model Year Distribution in 2000, 2010, 2020



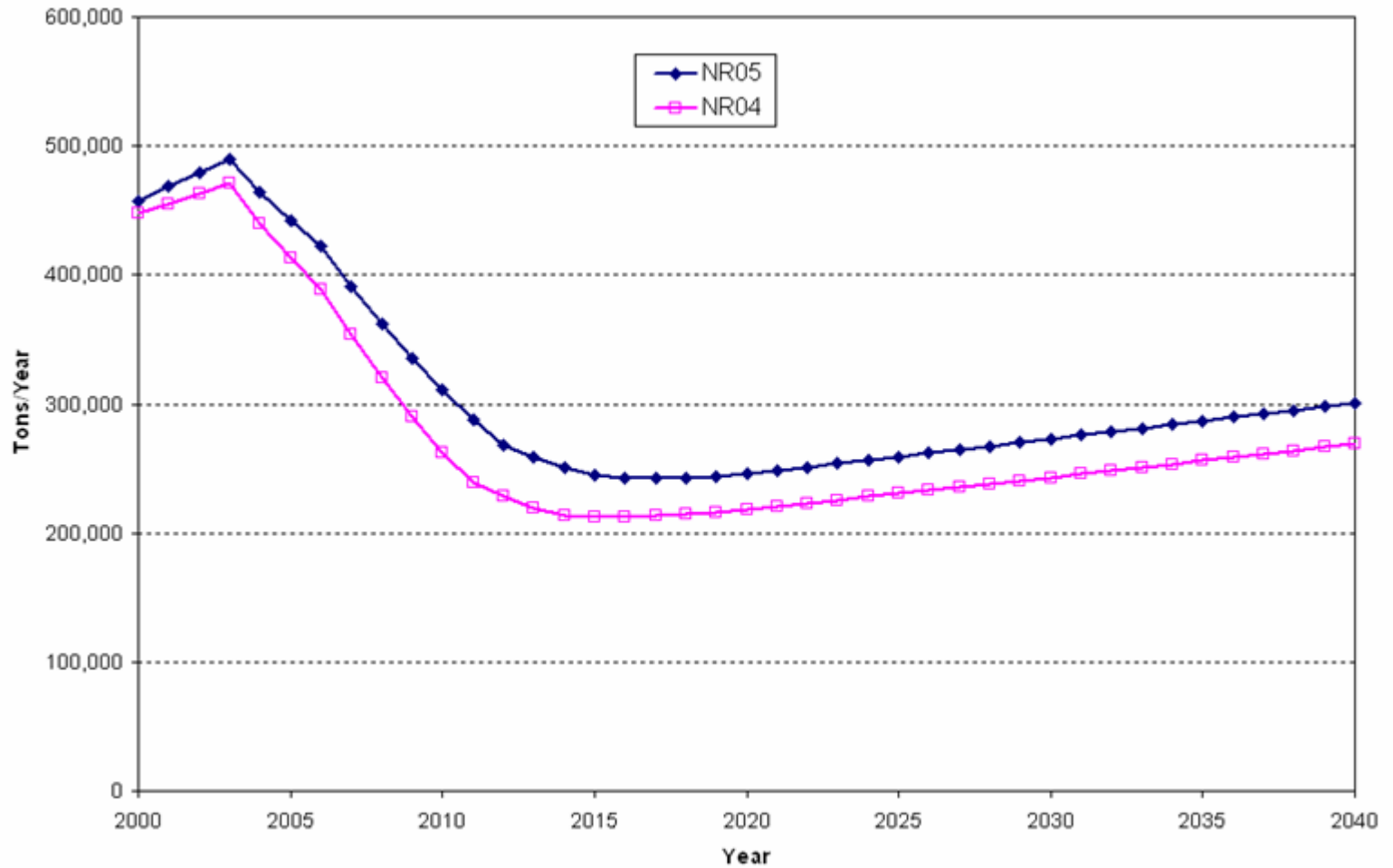
NONROAD2005 vs NR2004

SI THC total (exh & evap)



NONROAD2005 vs NR2004

SI NO_x



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?)



Questions?

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



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

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

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

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.

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

Exercise 4: Export to NIF3

Export to NIF 3.0

Exporting Simulation: p3fv Bond Base 2005

Previously Exported to Database:

ContactPerson: OrganizationName:

ContactPhone: Telephone Number Type:

Electronic Address:

Electronic Address Type:

Affiliation Type: Tribal Code:

Time Period:

Start Date (yyyymmdd): End Date (yyyymmdd):

Period Type: Episode Year:

RunMemo:

Export **Done**

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

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)

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

Exercise 5: Modify Input Data

LA.POP - Notepad

File Edit Format View Help

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	1999	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	104.3
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

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.

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

Exercise 6: Running from DOS

C:\ 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

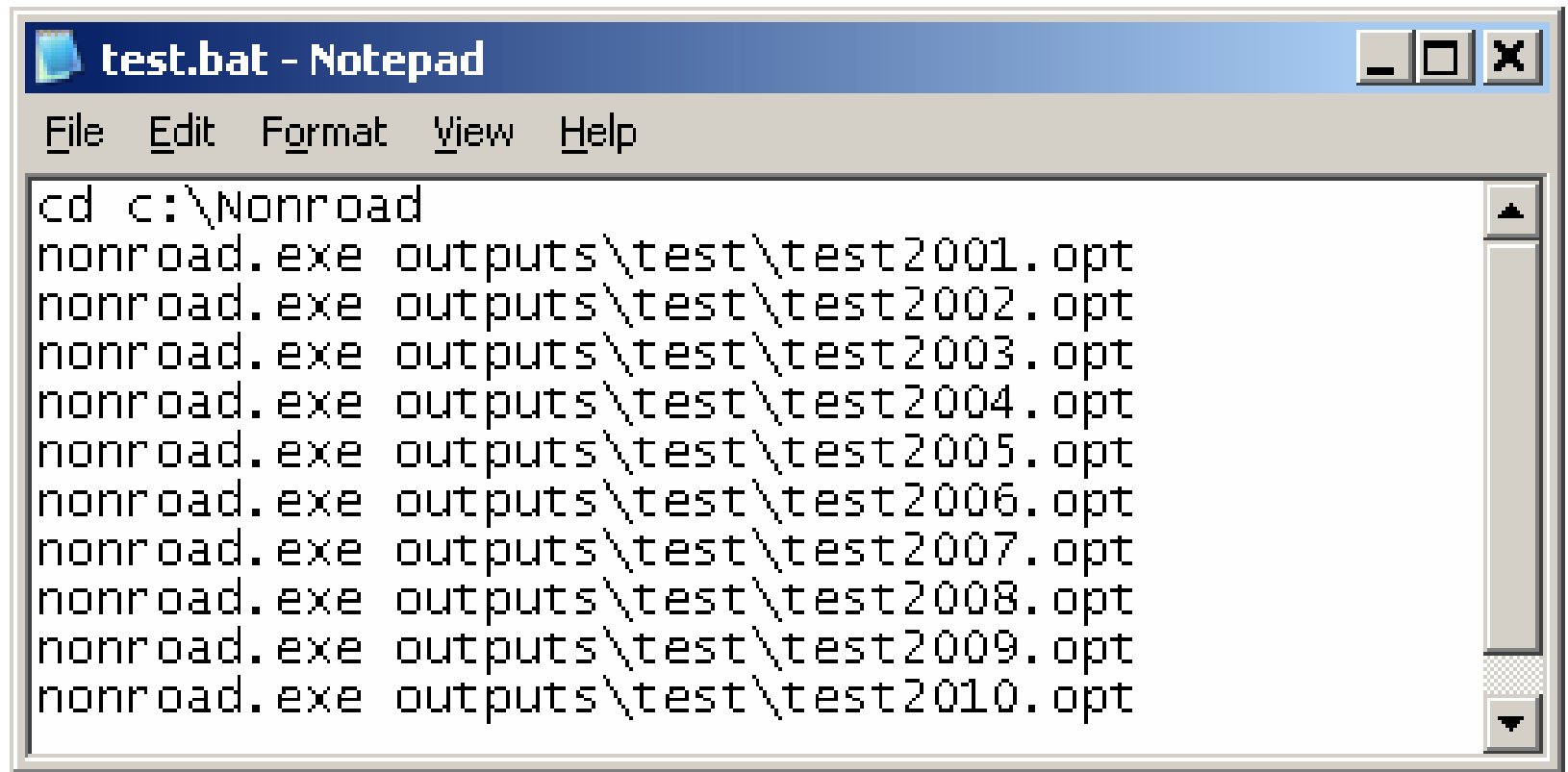
Processing...100%

Successful completion of EPA's NONROAD Emissions Model, Core Model Ver 2005a, Feb 2006

C:\NONROAD>

Exercise 6: Running from DOS

Example BATch file



```
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
```


Ongoing Support

→ Web

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

→ Email

➤ nonroad@epa.gov

NONROAD2005 Update Chronology

Reporting Utility Updates: (reports.mdb)

Dec 21, 2005, version 2005a

- Fix Leap Year operation (just treat it like other years).
- Change Pop/Fuel decimal places from 2 to 0, 1, or 2, depending on aggregation level.

Jan 31, 2006, version 2005b

- Remove limit on number of Import Data records.

Mar 21, 2006, version 2005c

- Fixes the reporting utility Export to Excel function for emission factor reports.
- Corrects the NIF export label for hydrocarbons from "HC" to "VOC" (since the NONROAD2005 reporting utility has always exported VOC when exporting to NIF).
- Adds CNG fuel volume explanation to Fuel Consumption reports.
- Adds reporting utility version number to all report page footers.

Please see the file rpt05c-mdb.txt in the nonroad\Reports\ folder for a more complete description of all these changes and other issues to be aware of when using the reporting utility.

Core Model Updates: (nonroad.exe)

Feb 8, 2006

A problem was corrected in the core model (NONROAD.EXE file only) with the calculation of evaporative Diurnal, Tank Permeation, and Hose Permeation emissions for time periods less than annual (i.e., seasonal, monthly, or typical day). Annual model runs did not have the problem. Outputs generated from this corrected version of the core model will say:

"Core Model Ver 2005a, Feb 2006"
instead of:
"Core Model Ver 2005, Nov 2005"

Data File Updates:

Jan 13, 2006

- Corrected geographic allocation files for Puerto Rico and Virgin Islands (PR_WIB.ALO, VI_WIB.ALO, VI_RVPRK.ALO).

Jan 26, 2006

- Corrected geographic allocation file for Washington D.C. recreational vehicle parks (DC_RVPRK.ALO).

Feb 1, 2006, corrected geographic allocation file for West Virginia underground mining equipment (WV_COAL.ALO).

=====

Keeping Yourself Informed

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

Listserver: send blank email to: join-EPA-MOBILENEWS@lists.epa.gov

Email: nonroad@epa.gov

Fax: 734-214-4939