

US EPA ARCHIVE DOCUMENT

EPA National Nonroad Emissions Inventory Model (NONROAD)

Emission Inventory Workshop
March 20, 1997

Introduction

Who We Are?

- Assessment and Modeling Division
- Nonroad Emissions Modeling Team
 - » Rich Wilcox
 - » Greg Janssen
 - » Chris Lindhjem
 - » Craig Harvey

Introduction (cont'd)

- What Are We Doing?
 - National Nonroad Model for SIP Inventories
 - Software -- Contract Support
 - Specifications and Default Data -- EPA Team
 - Basic Schedule
 - » Fall 1997 -- Beta version completed
 - » Summer 1998 -- Final Release
 - » Ongoing -- Stakeholder Assistance/Review
 - » Later 1997 -- Peer Review

Introduction (cont'd)

- What We Want to Do Today
 - Begin Dialogue
 - Identify User Needs
 - Solicit Assistance
 - Share Experience/Expertise
- Written Comments Encouraged

Overview of Remaining Presentation

- Past and Present Inventory Tools
- Design Philosophy/Goals
- Overview of Structure/IO Features
- Default Inputs and Adjustments
- Open Discussion
- Wrap-Up

Past and Present Inventory Tools

■ Past

- AP-42
- Nonroad Engine and Vehicle Emission Study (NEVES)
- Procedures for Emission Inventory Preparation -- Volume 4
- EPA Guidance on Adjusting/Enhancing NEVES
- EPA Trends Report
- CARB Offroad

Past and Present Inventory Tools (cont'd)

- Present (or anticipated)
 - EPA Nonroad SIP Model
 - Revised AP-42 (ongoing project)
 - EPA Large CI Engine Rule
 - EPA Small SI Engine Rule
 - EPA Trends
 - ARB MVOFF
 - Others (NESCAUM, FAA-FAEED&EDMS)

EPA National Nonroad Emissions Inventory Model (NONROAD) Overview

March 20, 1997

Design Philosophy/Goals

- **Make model flexible for user needs**
 - Front-end interface
 - User can change inputs to reflect local parameters or use default data in model
 - User could model multiple scenarios in one run (batch mode)
 - Detailed user's guide
 - Programmer's guide
- **Eventually inclusive of all nonroad sources**

Design Philosophy/Goals

- Updated and improved data
 - In use emission factors are first priority
- Compatible with other models and reporting tools
 - California ARB Nonroad Model (MVOFF)
 - » Similar results if CA scenario run done on EPA NONROAD
 - Output compatible for input to EPS 2.0
 - Output equivalent to Trends Report

Overview of Model Design Interface

- Not included in current work effort on beta version due to lack of funding
- Goal is to add it on to final version before it is released
- Programmed in Visual Basic to allow Windows-based control panel
- Basic interface would allow users to set scenario parameters

Overview of Model Design Interface

- **User sets time period (calendar year, month), geographical region (state, county), equipment types to be modeled**
- **Advanced interface would allow users to view and change input data**
- **Without interface**
 - **Enter scenario parameters into ASCII control file with and change data input files with text editor**

Overview of Model Design

Core Model: Technical Specifications

- **Core Model does the calculations**
- **Programmed in FORTRAN**
 - FORTRAN is common and familiar
 - Precedent of MOBILE
 - CARB MVOFF programmed in FORTRAN
- **For optimal operation, will need 16 megabytes of RAM, but can operate at much slower speed with 8 megabytes**
- **Program will run from MS-DOS, Windows 3.1, or Windows 95**

Overview of Model Design

Core Model: Structure

- Input files in ASCII text tables
- Model contains emission factor, population, and activity modules
- Control strategies reflected through either changing emission factors or activity data in input files.
- First version of model will most likely only be able to model one scenario at a time

Overview of Model Design

Core Model: Equipment Categories

■ Based on 1991 NEVES report

- Recreational
- Logging
- Agricultural
- Construction
- Industrial
- Light Commercial
- Lawn and Garden - Commercial/Residential Split
- Airport Service
- Recreational and Commercial Marine

Overview of Model Design

Core Model: Equipment Categories

- **Aircraft and locomotives not included in current effort due to lack of funds**
- **Additional equipment (e.g., mining and oil field equipment) to be added in the future**
- **Engine types**
 - 4-stroke
 - 2-stroke
 - Diesel
 - CNG
 - LPG

Overview of Model Design Reporting Utility

- **Utility derived from Microsoft Access**
 - Separate from core model
 - More flexible and easier to modify than programming output routines into FORTRAN, and uses less memory
 - Core Model creates unformatted data file which user imports into reporting utility
- **Output formats: ASCII, Lotus Spreadsheet, EPS 2.0**

Overview of Model Design

Reporting Utility: Outputs

- **Pollutants reported**
 - VOC, THC, NMHC, TOG, NMOG
 - » Exhaust, Refueling, Diurnal, Hot Soak, Running Loss, and Crankcase
 - CO, NO_x, PM 10 and 2.5, and SO₂
- **Emissions are in metric tons**
- **Emissions reported by:**
 - Geographic areas: National, State, County

Overview of Model Design

Reporting Utility: Outputs

- **Emissions reported by:**
 - **Time period: year, month, average week and weekend days in month or year, and average summer and winter days**
 - **Engine type**
 - **Source category code with name of equipment type or category**
 - **horsepower ranges**

Overview of Model Status and Schedule

■ Status

- OMS currently working with contractor to create default data inputs and algorithms
- Contractor is working on programming

■ Schedule of Model Development

- Draft core model completed June 30th
- Draft user's and programmer's guides completed in mid-July

Overview of Model Status and Schedule

- **Schedule of model development(continued)**
 - **Tested and debugged beta-version of model completed July 31st**
 - **User's and programmer's guide completed August 31st**
 - **Beta version model and guides sent out to interested parties for review**
 - **Final comments incorporated September 30th**

Overview of Model Status and Schedule

- **Next Phase**
 - **Input data evaluation and upgrade**
 - **Adding Interface, Aircraft, and Locomotives**
 - **FACA Review**
 - **Peer Review - late Fall/early Winter 1997**
 - **Release of model - mid 1998**

National Average Inputs

- Base Emission Factors (Emission Factor File)
 - Exhaust
 - » Diesel, 4-stroke gasoline, 2-stroke gasoline, LPG, & CNG
 - » THC, NMHC, TOG, NMOG, NO_x, PM, SO₂, CO, and Fuel Use
 - » Most new data will be from steady-state certification testing
 - » Adjusted for in-use activity and deterioration with respect to data availability
 - » 1991 NEVES values if no data is available
 - » New Final Standards

National Average Inputs

- Evaporative (Gasoline only)
 - » Refueling, diurnal, hot soak, minimal running loss, crankcase
 - Test data where available
 - Existing guidance
 - » Spillage (likely major portion of evaporative emissions)
 - Existing guidance
 - » Gas Cans?

Adjustments to Emission Factors

- Fuel Effects
 - Gasoline
 - » MOBILE RVP (adjustment to only refueling, diurnal, and hot soak)
 - » Gasoline Fuel Oxygen
 - Fuel\air adjustment affects HC, CO, and NO_x
 - » Gasoline Sulfur (effect on SO₂ primarily, few catalyst equipped engines)
 - Diesel Fuel
 - » Sulfur (PM and SO₂); Highway and Nonroad Fuel Oil
 - » Cetane & Aromatics (Interested in information here)
 - CNG Fuel Quality (converting THC to NMHC)

Adjustments to Emission Factors

- Temperature Corrections
 - Exhaust (MOBILE Defaults)
 - » Gasoline (cold start but without catalysts; not much data)
 - » Diesel (effect on combustion temperature; not much data)
 - Evaporative (MOBILE Defaults)
- Altitude (MOBILE Defaults)
- Different Technologies
 - Possible but not planned other than fuel type
- Others?

Other Baseline Inputs

- Engine\Equipment Populations
 - National Default
 - » PSR Populations
 - State Defaults
 - » PSR allocation
 - » Other allocations to state level
 - Economic Indicators (\$Income by sector)
 - Others (Farm acreage, population, other suggestions?)
 - County Level Default
 - » PSR allocation
 - » Economic or other indicators

Other Baseline Inputs

- Emission Rate Calculation Method
 - $\text{grams/engine} = \text{Emission Factor} * \text{Load} * \text{Hours}$
 - » Emission Factor is emissions per hp-hr (or kW-hr)
 - » Load is average power for a given engine
 - » Hours is use per day/month/year

Other Baseline Inputs

- Activity (hours/year)
 - NEVES
 - Encourage surveys
- Load Factor (% of available power)
 - NEVES
 - Encourage Surveys
- Individual Regional Adjustments
 - Equipment populations, load factor, and hours use must be surveyed concurrently for methodological consistency

Other Baseline Inputs

- Seasonal\Daily Adjustment (% by month, day of week, and hour)
 - NEVES, CARB, and other estimates if available
 - Obvious for special applications; snowmobiles & snowblowers
 - Other categories show marked useage by season, day of week, and hour of day
- Growth
 - BEA indicators, fuel consumption trends, and other methods
 - Will recommend a national strategy