



# **MOVES Update for FACA Modeling Workgroup**

**February 11, 2003**





# Outline

- **Implementation Plan**
- **Publication Status**
- **Peer Review Panel**
- **Analysis Issues**
  - Emission Data Gathering
  - Fleet & Activity Data Sources
  - VSP Refinement
  - Vehicle Characterization
  - Modal Binning Options
  - Well-To-Pump Modeling
  - Advanced Technology Issues



# MOVES Implementation Plan

- **MOVES GHG (on-road)**
  - Scope change under consideration:
    - Draft release: December 2003
    - Fuel consumption, CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O inventories 1999 forward
    - Would include well-to-pump and policy evaluation components
  - Add mesoscale implementation mid-2004
- **Full on-road implementation: Fall 2005**
  - Add HC, CO, NO<sub>x</sub>, Toxics, PM, NH<sub>3</sub>, SO<sub>2</sub>
  - Microscale analysis capability
  - Will replace MOBILE6
- **Off-Road: 2006**
  - Will replace NONROAD



# Publication Status

- **Design and Implementation Plan**
  - Comment period closed December 20<sup>th</sup>
  - Comments under evaluation
- **Emission Analysis Plan for MOVES GHG**
  - Comment period extended to March 3rd
  - Background reports:
    - Shootout reports (Sensors, EPA, UCR, NCSU, ENVIRON)
    - Modal binning analysis (NCSU)
    - Physical Emission Rate Estimator (Ed Nam)
    - Data gathering summary (ERG)
    - CO<sub>2</sub>/CH<sub>4</sub> analysis (ERG)



# Peer Review Panel

- **Established per agency guidelines**
- **Independent panel chosen and administered by 3<sup>rd</sup> party contractor (Southwest Research)**
- **Panel members:**
  - **Dr. Ted Russell**, Georgia Tech, Chair of NRC panel which reviewed EPA models
  - **Dr. Marc Ross**, University of Michigan
  - **Michael Replogle**, Co-Director of the Environmental Defense Fund Transportation Project



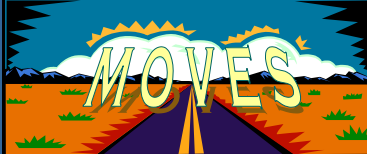
# Emission Data Gathering

- **Adding data (mostly second-by-second) in EPA Mobile Source Observation Database from:**
  - CARB (UCC data, N<sub>2</sub>O)
  - CRC (E-55 and other studies)
  - UC Riverside (CMEM, HD Trailer, N<sub>2</sub>O)
  - Environment Canada (N<sub>2</sub>O and other studies)
  - WVU (Thousands of HD chassis tests)
  - IM240 programs (Millions of vehicles)
  - NC State (on-board testing)
  - New York State (IM240 tests)
  - University of Texas



# Fleet & Activity Data Sources

- **Registration databases**
  - Populations, vehicle characteristics
- **Vehicle In-Use Survey**
  - Truck subpopulations, mileage accumulation
- **Ward's Automotive Yearbook**
  - Sales, vehicle characteristics
- **Weigh-In-Motion Data**
  - Heavy-duty weight distribution
- **Highway Performance Monitoring System**
  - Total VMT, VMT distributions by time/roadway/vehicle class
- **Heavy-Duty Driving Surveys**
- **MOBILE6 analyses**
  - Driving surveys, speed distributions



## VSP Refinement

- 14 VSP bin approach showed bias by average speed for fuel and pollutants
- Emission analysis plan proposed to bin by VSP and average speed
- Further investigation reveals bias might be eliminated with improved road load terms (for fuel)
- To be presented at CRC (Nam et al)





# Vehicle Characterization

- **Source Use Types**

- Subsets of HPMS vehicle classes
- Grouped by differences in activity

- **Source Bins**

- Subsets of source use types
- Grouped by differences in emissions



# Source Use Types

HPMS Class	MOVES Use Type
Passenger Cars	Passenger Cars
Other 2-axle / 4-tire Vehicles	Passenger Trucks
	Light Commercial Trucks
Single Unit Trucks	Refuse Trucks
	Single-Unit Commercial Trucks
	Single-Unit Delivery Trucks
	Motorhomes
Buses	Interstate Buses
	Urban Buses
	School Buses
Combination Trucks	Combination Commercial Trucks
	Combination Delivery Trucks
Motorcycles	Motorcycles



# MOVES GHG Source Bins

- **Fuel consumption / CO<sub>2</sub>**
  - Fuel/engine technology
  - Average weight (if VSP is used)
  - Engine size
- **CH<sub>4</sub>/N<sub>2</sub>O**
  - Fuel/engine technology
  - Emission standard
  - Aftertreatment technology



# Modal Binning Options

<b>Fuel</b>	<b>Criteria Pollutants</b>	<b>Emission Rates</b>	<b>Comments</b>
<b>VSP &amp; Weight Bins</b>	<b>VSP Bins</b>	<b>Gram/sec</b>	<b>Current proposal; hundreds of bins</b>
<b>Power Bins</b>	<b>Power Bins</b>	<b>Gram/sec</b>	<b>Significantly reduces bins</b>
<b>Power Bins</b>	<b>VSP Bins</b>	<b>Gram/sec</b>	<b>VSP better than power for criteria pollutants</b>
<b>Power Bins</b>	<b>VSP Bins</b>	<b>Gram/Gallon</b>	<b>Likely fewest number of bins</b>



# Well-To-Pump Modeling

- **Initiating cooperative effort with DOE and ANL to integrate GREET and MOVES**
  - Would add well-to-pump emission capability to MOVES for life cycle policy analysis
- **Issues:**
  - Improving time resolution of GREET
  - Inclusion of vehicle cycle emissions
  - Technology and fuel pathways to include



# Advanced Technology Issues

- **Modeling hybrid electric vehicles**
  - Many implementation strategies
    - Engine sizing, engine use strategies
  - How to fit in modal binning framework?
- **Modeling fuel cell vehicles**
  - Direct H<sub>2</sub> vs. On-board reforming
  - Hybrid strategies