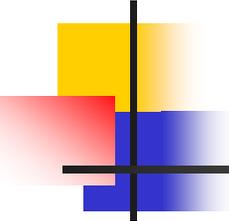


NMIM: EPA's Consolidated Emissions Modeling System for MOBILE and NONROAD

Harvey Michaels, David Brzezinski, Rich Cook,
Craig Harvey, Mitch Cumberworth (EPA/OTAQ)

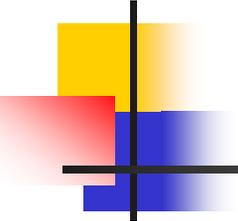
13th International Emission Inventory Conference
Clearwater Beach, Florida
10 June 2004





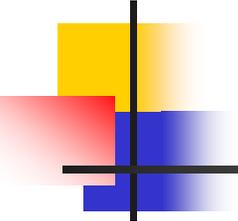
What is NMIM?

- The **National Mobile Inventory Model**
 - a consolidated emissions modeling system for MOBILE and NONROAD
- Main use case:
 - national county-level inventories for the National Emission Inventory (NEI) and for rulemaking
- Combines a Java™ framework with MOBILE, NONROAD, and a national county database.
- Capable of stand-alone or distributed processing.



What NMIM is not

- NMIM is not
 - a complete GUI front-end for MOBILE and NONROAD.
 - a replacement for MOBILE or NONROAD.
 - a substitute for the complete reworking of MOBILE and NONROAD that is taking place in MOVES.



County Database

- Single consistent data source
- Hourly temperatures, relative humidity (real and 20-year averages)
- Fuel properties, altitude, barometric pressure, stage 2, VMT, VMT monthly allocation, etc.
- References to MOBILE and NONROAD external files
- Updated with state inputs

- ≈ Description
- ! Geography
- ! Time
- + ! **Vehicles/Equipment**
- ! Pollutants
- ≈ Growth Rates
- ≈ Advanced Features
- + ! **Output**



-  Description
-  Geography
-  Time
-   **Vehicles/Equipment**
-  Pollutants
-  Growth Rates
-  Advanced Features
-   **Output**

Description:

Florida test run

-  Description
-  Geography
-  Time
-   **Vehicles/Equipment**
-  Pollutants
-  Growth Rates
-  Advanced Features
-   **Output**

Region:

All
 State
 County

-  Description
-  Geography
-  Time
-   **Vehicles/Equipment**
-  Pollutants
-  Growth Rates
-  Advanced Features
-   **Output**

Region:

- All
- State
- County

States:

- OKLAHOMA
- OREGON
- PENNSYLVANIA
- PUERTO RICO
- RHODE ISLAND
- SOUTH CAROLINA
- SOUTH DAKOTA
- TENNESSEE
- TEXAS

Selections:

- FLORIDA
- ILLINOIS
- TEXAS

Select All

Add

Remove

- ✓ Description
- ✓ Geography
- ! Time
- ! Vehicles/Equipment
 - ! On Road
 - ! Off Road
- ! Pollutants
- ~ Growth Rates
- ~ Advanced Features
- + ! Output

Region:	States:	Counties:	Selections:
<input type="radio"/> All	CONNECTICUT	FLORIDA - Nassau County	ILLINOIS - Cook County
<input type="radio"/> State	DELAWARE	FLORIDA - Okaloosa County	ILLINOIS - DeKalb County
<input type="radio"/> County	DISTRICT OF COLUMBIA	FLORIDA - Okeechobee County	FLORIDA - Hillsborough County
	FLORIDA	FLORIDA - Orange County	FLORIDA - Pinellas County
	GEORGIA	FLORIDA - Osceola County	
	HAWAII	FLORIDA - Palm Beach County	
	IDAHO	FLORIDA - Pasco County	
	ILLINOIS	FLORIDA - Pinellas County	
	INDIANA	FLORIDA - Polk County	

Select All Add Remove

- ✓ Description
- ✓ Geography
- ✓ Time
- [-] ! Vehicles/Equipment
- ! On Road
- ! Off Road
- ! Pollutants
- ≈ Growth Rates
- ≈ Advanced Features
- [+] ! Output

Years

Year: 2004 [v] [Add]

Year 2024

2025

2001 2026

2004 2027

2028

2029

2030

2031

2000

[Remove]

Months

January July

February August

March September

April October

May November

June December

Yearly Weather Data

Use Yearly Weather Data

- Description
- Geography
- Time
- Vehicles/Equipment**
- On Road
- Off Road
- Pollutants
- Growth Rates
- Advanced Features
- Output**

- LDGV Light-Duty Gas Vehicle
- LDGT2,3 Light-Duty Gas Trucks 1 and 2
- LDGT3,4 Light-Duty Gas Trucks 3 and 4
- HDGV Heavy-Duty Gas Vehicles
- MC Motorcycles
- LDDV Light-Duty Diesel Vehicles
- LDDT Light-Duty Diesel Trucks
- 2BHDDV 2b Class Heavy-Duty Diesel Vehicles
- LHDDV Light Heavy-Duty Diesel Vehicles
- MHDDV Medium Heavy-Duty Diesel Vehicles
- HHDDV Heavy Heavy-Duty Diesel Vehicles
- Buses Diesel Buses

- ✓ Description
- ✓ Geography
- ✓ Time
- [-] ✓ **Vehicles/Equipment**
- ✓ On Road
- ✓ Off Road
- ! Pollutants
- ≈ Growth Rates
- ≈ Advanced Features
- [+] ! **Output**

Fuels:

- CNG
- Dies**
- Gas
- LPG

Segments:

- 1 - Recreational
- 2 - Construction
- 3 - Industrial
- 4 - Lawn/Garden
- 5 - Agriculture
- 6 - Commercial**
- 7 - Logging
- 8 - Airport Support
- 9 - Underground Mining

Selections:

- Dies - 5 - Agriculture
- Dies - 6 - Commercial
- Dies - 7 - Logging
- Dies - 8 - Airport Support
- Dies - 9 - Underground Mining
- Dies - 10 - Oil Field
- Dies - 11 - Pleasure Craft
- Dies - 12 - Railroad
- Gas - 1 - Recreational

Select All

Select All

Remove

Add Fuel/Segment Combinations

- Description
- Geography
- Time
- Vehicles/Equipment**
- On Road
- Off Road
- Pollutants**
- Growth Rates
- Advanced Features
- Output**

- Aerosols**
- Exhaust PM 10 microns
 - Tire PM 10 microns
 - Brake PM 10 microns
 - Exhaust PM 2.5 microns
 - Tire PM 2.5 microns
 - Brake PM 2.5 microns
 - SOA

- Toxics**
- Acetaldehyde
 - Acrolein
 - Benzene
 - Butadiene
 - Formaldehyde
 - MTBE
 - Additional HAPS
 - Dioxin/Furan

- Gasses**
- CO
 - CO2
 - HC as: **VOC** **refueling**
 - NH3
 - NOx
 - SO2

- VOC
- NMHC
- NMOG
- THC
- VOC
- TOG

Select All

Clear

- ✓ Description
- ✓ Geography
- ✓ Time
- [-] ✓ **Vehicles/Equipment**
- ✓ On Road
- ! Off Road
- ✓ Pollutants
- ✓ Growth Rates
- ✓ **Advanced Features**
- [+] ! **Output**

County Database

Server:

Database: ▼

File with Additional MOBILE6 Run-Level Commands

File with Additional MOBILE6 Scenario-Level Commands

File with Alternative NONROAD Packets

- ✓ Description
- ✓ Geography
- ✓ Time
- [-] ✓ **Vehicles/Equipment**
 - ✓ On Road
 - ✓ Off Road
- ✓ Pollutants
- ✓ Growth Rates
- ✓ Advanced Features
- [-] ! **Output**
 - ✓ Geographic Represent
 - ! General Output

County Group
 County

- Description
- Geography
- Time
- Vehicles/Equipment**
 - On Road
 - Off Road
- Pollutants
- Growth Rates
- Advanced Features
- Output**
 - Geographic Representat
 - General Output

Output Database

Server: Database: ▼

Pre aggregate for NIF3

- New...
- Open...
- Close
- Save
- Save As...
- Print...
- 1 D:\NMIM\NMIMSource20040419\testpm25.nrs
- 2 [No recent file]
- 3 [No recent file]
- 4 [No recent file]
- Exit

- Pollutants
- Growth Rates
- Advanced Features
- Output**
 - Geographic Representat
 - General Output

Database

Database: FloridaTest

Create Database...

Pre aggregate for NIF3

- ✓ Desc
- ✓ Geog
- ✓ Time

- ▶ Execute
- Stop
- || Pause
- ▶ Resume
- 💡 NMIM Run Error Log...

- [-] ✓ **Vehicles/Equipment**
 - ✓ On Road
 - ✓ Off Road
- ✓ Pollutants
- ✓ Growth Rates
- ✓ Advanced Features
- [-] ✓ **Output**
 - ✓ Geographic Representat
 - ✓ General Output

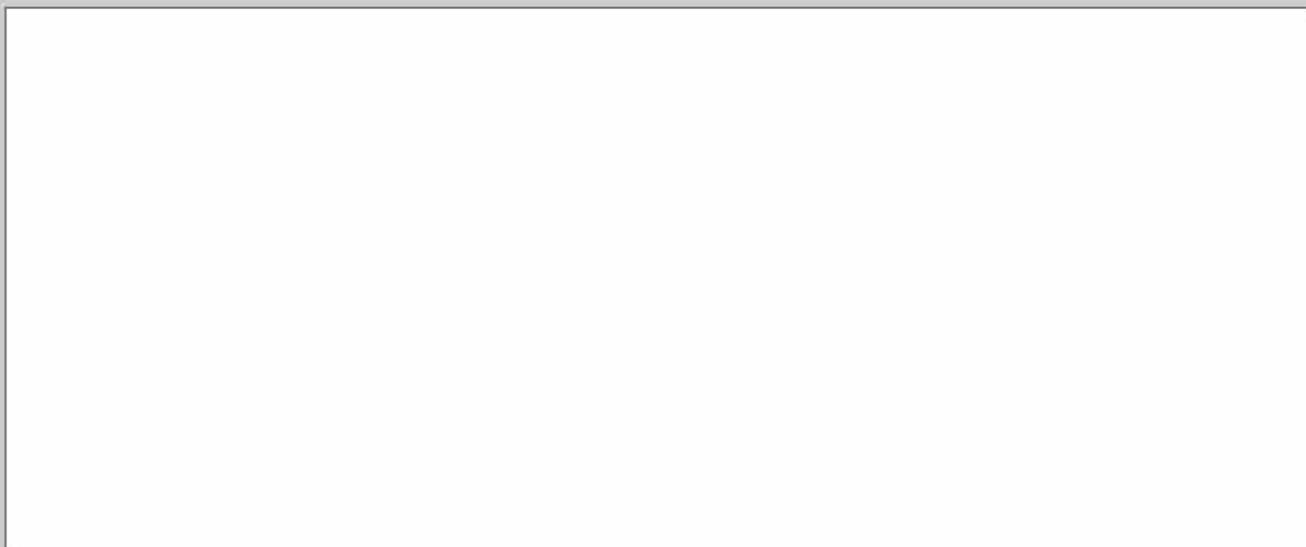
Output Database

Server: Database:

Pre aggregate for NIF3



Master ID = 34606



- Description
- Geography
- Time
- Vehicles/Equipment**
 - On Road
 - Off Road
- Pollutants
- Growth Rates
- Advanced Features
- Output**
 - Geographic Representation
 - General Output



Aggregate And Export

Source Output Server: localhost

Database: FloridaTest

OK

Cancel

Run:

Run: 3 - 2004-05-06 13:53:24 FloridaWholeState.nrs

Load

Save

Output Format

- NMIM native, normalized.
- Wide Tables (with column for each pollutant).
- NIF3

Get Additional Data ...

FIPSCounty (combine all counties within each state)

Month (combine all months within each year)

Weights: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0

Emission Type (combine exhaust, evaporative, brake, and tire results for relevant pollutants)

Power Class (combine all power classes within a NONROAD SCC)

Nonroad (combine all SCC Codes within Segment / Fuel Type)

HPMS Roadway Type (combine all roadway types)

Aggregate And Export

Source Output Server:

localhost

Database:

FloridaTest

OK

Cancel

Run:

Run: 3 - 2004-05-06 13:53:24 FloridaWholeState.nrs

Load

Save

- Emission Type (combine exhaust, evaporative, brake, and tire results for relevant pollutants)
- Power Class (combine all power classes within a NONROAD SCC)
- Nonroad (combine all SCC Codes within Segment / Fuel Type)
- HPMS Roadway Type (combine all roadway types)
- All NONROAD (combine all NONROAD SCCs yielding a NONROAD total)
- All Highway (combine all Highway SCCs yielding a MOBILE total)

Output

Data Table

Table Name:

Tab-Delimited ASCII Text File

File Name: FloridaTest.txt

Browse...

Fixed Length Text Files for NIF3 Output

NIF3 Directory:

Browse...



Source Output Server: localhost

Database: FloridaTest

OK

Cancel

Run:

Run: 3 - 2004-05-06 13:53:24 FloridaWholeState.nrs

Load

Save

Output Format

- NMIM native, normalized.
- Wide Tables (with column for each pollutant).
- NIF3

Get Additonal Data ...

FIPSCounty (combine all counties within each state)

Month (combine all months within each year)

Weights:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Emission Type (combine exhaust, evaporative, brake, and tire results for relevant pollutants)

Power Class (combine all power classes within a NONROAD SCC)

Nonroad (combine all SCC Codes within Segment / Fuel Type)

HDMS Roadway Type (combine all roadway types)

NIF3 Additional Data



Monthly Annual Typical ozone season day

OK

Cancel

Organization Name:

U.S. EPA/OTAQ

Contact Person:

Harvey Michaels

Contact Phone:

734-214-4184

Telephone Type:

Office

Electronic Address:

h Michaels.harvey@epa.gov

Electronic Address Type:

email

Affiliation Type:

report certifier

Submittal Flag:

Transaction Type:

00

Incremental Submission #:

1

Reliability Indicator:

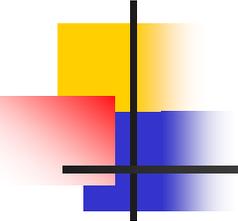
0.0

Transaction Comments:

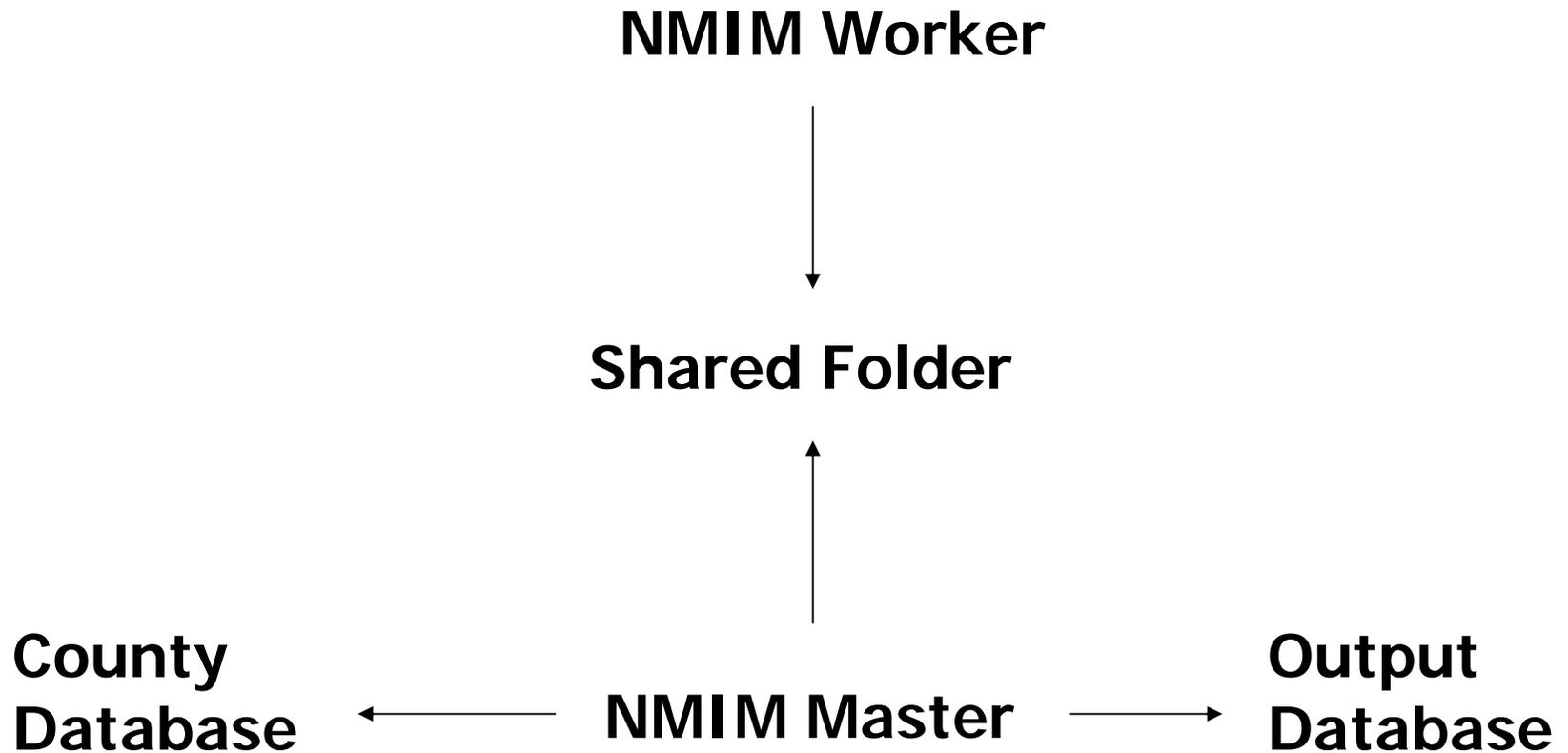
NMIM December 2003



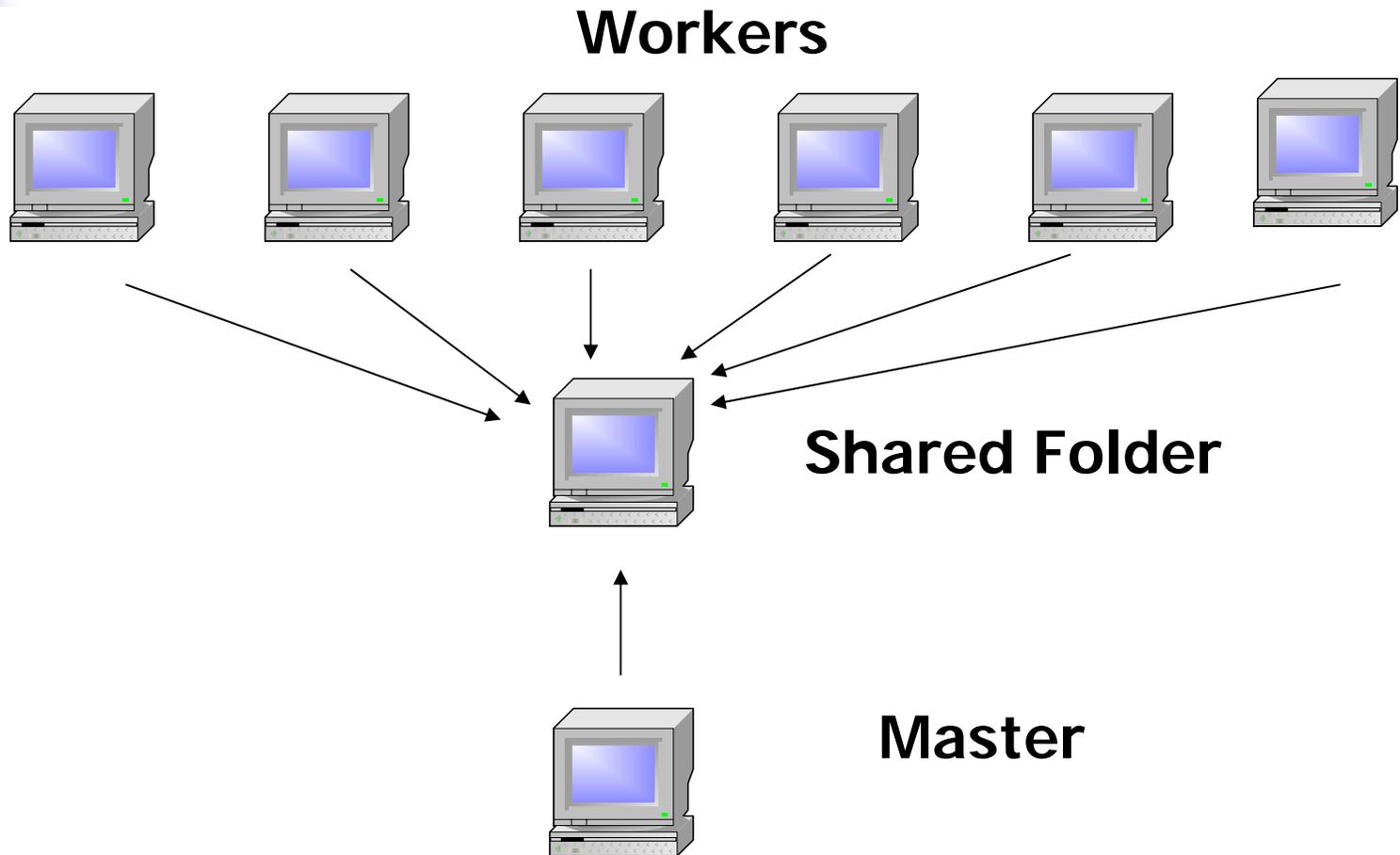
EPA

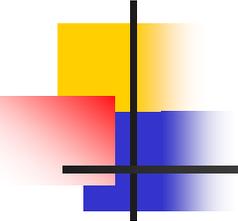


Standalone Processing



Distributed Processing





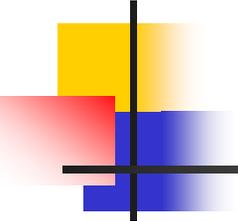
Shared Folder

WorkerConfiguration.txt

```
mobileWorkingFolderPath = C:\NMIM\Mobile6\Run  
mobileApplicationPath = C:\NMIM\Mobile6\Run\M62_45x.exe  
nonroadWorkingFolderPath = C:\NMIM\NONROAD  
nonroadApplicationPath = C:\NMIM\NONROAD\nr02b.exe  
sharedDistributedFolderPath = T:\NMIM\SharedWork
```

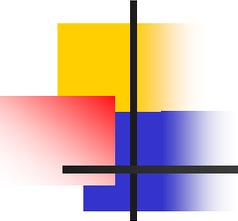
NMIMConfiguration.txt

```
countyServerName = localhost  
countyDatabaseName = County20040229  
outputServerName = localhost  
sharedDistributedFolderPath = T:\NMIM\SharedWork
```



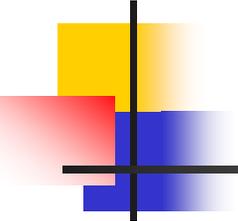
How NMIM Runs NONROAD

- Reads RunSpec
- Looks up data in NCD
- Writes opt file for county or rep county
- Runs NONROAD
- Reads output
- Post processes for NH₃, HAPs, etc.
- Puts output in database



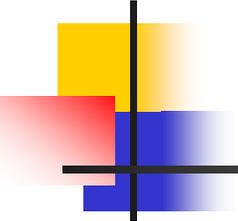
How NMIM Runs MOBILE6

- Reads RunSpec
- Looks up temp, RH, alt, I/M, etc. in NCD
- Writes MOBILE 'in' file
- Runs MOBILE6
- Reads output
- Post processes for HAPs, dioxins
- Puts output in database



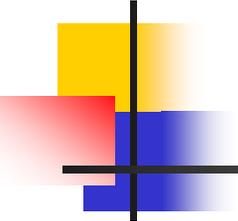
NMIM Creates a Very Particular M6 input file

- Designed to accommodate detailed input and to use a consistent set of commands
- Hourly temperatures and RH
- SPEED VMT rather than AVERAGE SPEED
- OXYGENATE not OXYGENATED FUELS
- 9 scenarios representing 18 vehicle class-roadway type combinations.



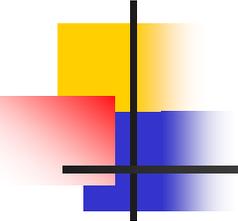
Post-Processed Pollutants Are Estimated Using Methods from the 1999 NEI

- Gaseous HAPs
 - Six inside MOBILE
 - Ratios to VOC
- Polyaromatic Hydrocarbons (PAHs)
 - Ratios to PM10
- Metals, Dioxins and Furans
 - On-road: g/mile
 - Non-road: g/gallon



Limitations of NMIM

- No multiple weighted county runs
- Ramps are always 8% of freeway VMT
- Output
 - splits only exh, evap, brake, tire
 - no model year or hourly output
 - monthly
- Speed distributions for 18 vehicle type - roadway type combinations.



In Summary, NMIM...

- Integrates MOBILE, NONROAD, and a county database
- Generates monthly inventories at the county level
- Produces NIF3 and other outputs
- Provides post-processing generation of HAPs and dioxin/furans.
- Allows for more county-specific data than previous NEIs

Appendix: 18 vehicle type-roadway type combinations for which speed distributions can be specified.

RURAL						
	Interstate	Principal Arterial	Minor Arterial	Major Collector	Minor Collector	Local
LDV	FW1	AR1	AR2	AR3	AR5	AR5
LDT	FW2	AR1	AR2	AR3	AR5	AR5
HDV	FW3	AR4	AR6	AR8	AR8	AR8

URBAN						
	Interstate	Other Freeways and Expressways	Principal Arterial	Minor Arterial	Collector	Local
LDV	FW4	FW5	AR7	AR7	AR7	Local
LDT	FW7	FW8	AR7	AR7	AR7	Local
HDV	FW6	FW9	AR9	AR9	AR9	Local