



MOVES

Motor Vehicle Emission Simulator

Welcome to EPA's webinar:
MOVES3 Information
for Experienced MOVES Modelers

This webinar will begin at 2:00 pm Eastern, or a few moments thereafter





MOVES3 Information for Experienced MOVES Modelers

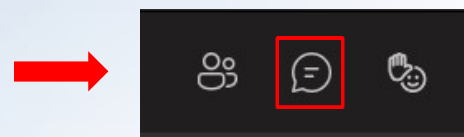
May 5, 2021

U.S. Environmental Protection Agency
Office of Transportation and Air Quality



General Housekeeping

- We are using Microsoft Teams for this webinar
 - We are muting the audience for this presentation
 - Please use the chat icon, top right, to ask a question or to comment at any time
 - If you are on by phone only, slides can be downloaded from EPA’s MOVES training webpage
- We will have a Q&A session at the end
 - On Teams: Either type your question in the chat or click “Raise Your Hand” and we will call on you
 - On the phone: email your questions to mobile@epa.gov we will share your question verbally
 - We may not be able to get to every question today
- Technical difficulties?
 - Email Ben VanGessel at: vangessel.benjamin@epa.gov



Overview

Purpose of this webinar

New content: emissions and activity updates

Improved user interface

Built-in MOVES tools

Resources

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Purpose of this Webinar

- Designed for modelers who already have hands-on experience using MOVES2014 for national, county and/or project level runs and want to adapt their modeling to use MOVES3
- Supplements the [MOVES3 Introduction and Overview Webinar](#) and [existing training](#)
- Does not replace MOVES guidance, reference or user support documents

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MOVES3—New Content

- Based on analyses of millions of emission test results and considerable advances in EPA’s understanding of vehicle emissions
- Incorporates rules not in MOVES2014
 - Heavy-Duty GHG Phase 2 (2016)
 - SAFE Light-Duty Fuel Economy (2020)
- Explicitly models “Off-Network Idling” (ONI), (e.g., idling in a parking lot or driveway)

MOVES3 Highlights: Light-duty and Fuel Updates

- Updated light-duty (LD) vehicle emission rates for hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NO_x) based on in-use testing data
- Updated LD particulate matter (PM) rates, incorporating data on gasoline direct injection engines
- Added new fuel characteristic data from EPA fuel compliance submissions
- Incorporated the effects of the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule on light-duty fuel economy



Denver Post, 2007



Bishop, 2017

LD in-use testing data includes results from Inspection and Maintenance programs and remote sensing.

MOVES3 Highlights: Heavy-duty Updates

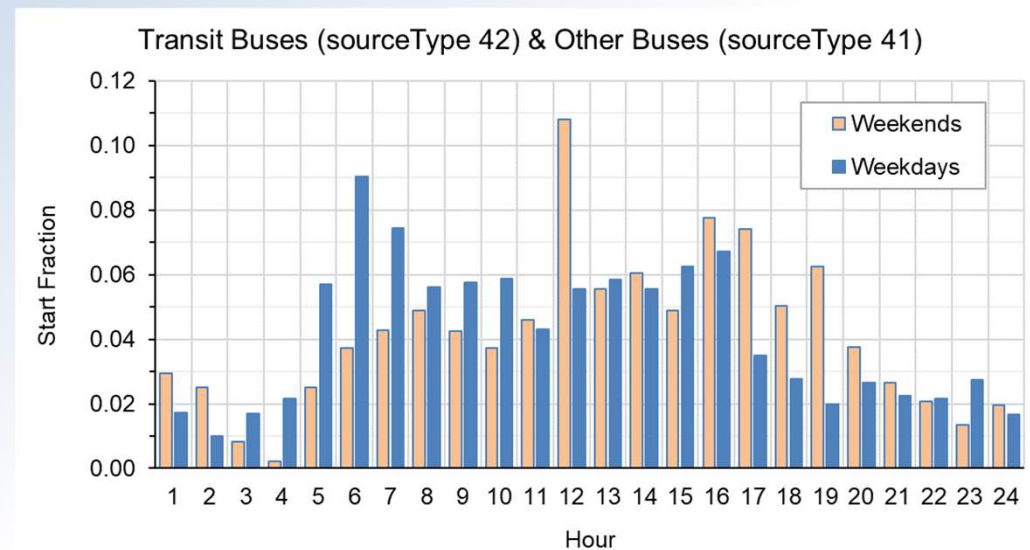
- Improved heavy-duty (HD) diesel running emission rates based on manufacturer-run in-use testing program data from hundreds of HD trucks
- Updated emission rates for HD diesel starts and extended idle
- Updated emission rates for HD gasoline and compressed natural gas (CNG) trucks
- Incorporated the effects of the HD GHG Phase 2 rule



NVFEL testing used to estimate crankcase emissions for 2010+ HD trucks

MOVES3 Highlights: Activity Updates

- Updated national vehicle miles travelled (VMT) and vehicle population defaults
- Updated default fuel, regulatory class, and age distributions based on newer vehicle registration data
- Includes vehicle start and idling activity patterns based on real-world instrumented vehicle data



Data from instrumented trucks and buses provided information such as the distribution of vehicle starts per hour.

MOVES3.0.1

- MOVES3.0.1, a minor patch, was released in March 2021
 - Fixes a number of minor issues in Default Scale and Nonroad
 - Improves the user interface and pre-aggregation/post-aggregation options
 - Adds scripts to assist with 2020 National Emissions Inventory submissions
 - Does not change onroad criteria pollutant emission rates in MOVES3 at the County or Project Scale
 - See [MOVES3 Update Log](#) for more information
- Use MOVES3.0.1 rather than MOVES3.0.0 if you, e.g.,:
 - Intend to use Default Scale or Nonroad features that were updated
 - Are preparing an NEI submission

Overview

Purpose of this webinar

New content: emissions and activity updates

Improved user interface

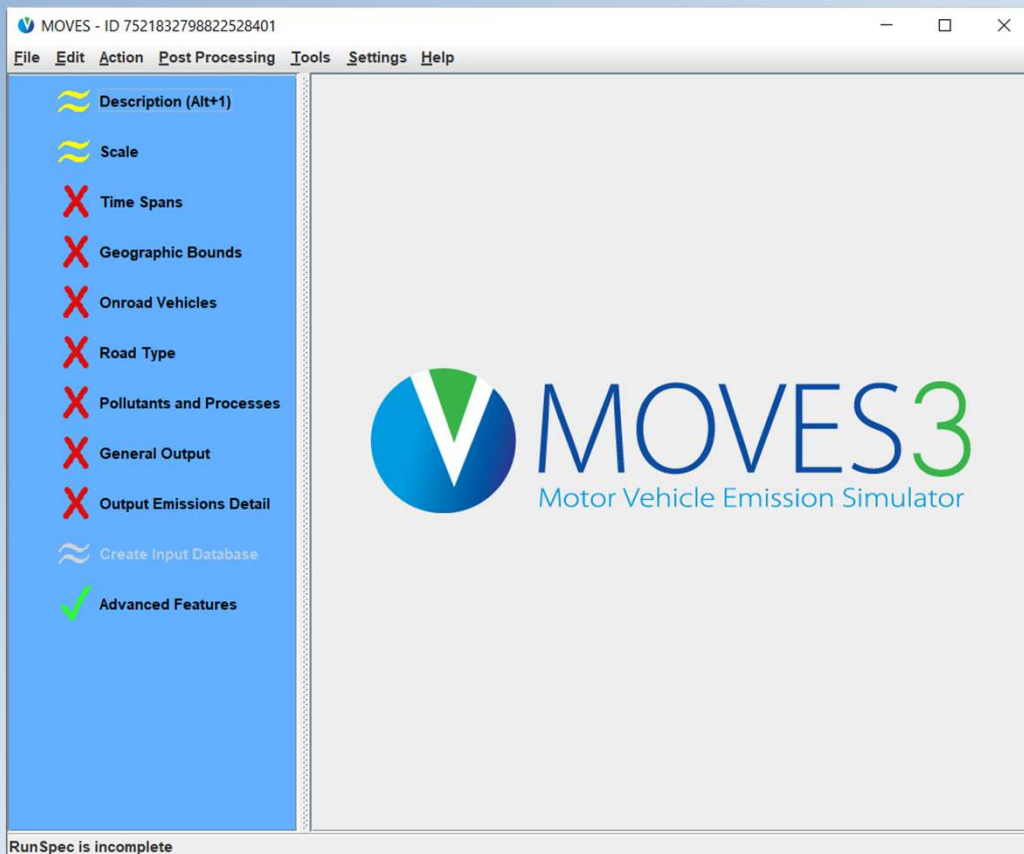
Built-in MOVES tools

Resources

MOVES3—Improved User Interface

- Changes to MOVES Graphical User Interface (GUI)
- New capabilities and output
- New categories and definitions

MOVES GUI Changes

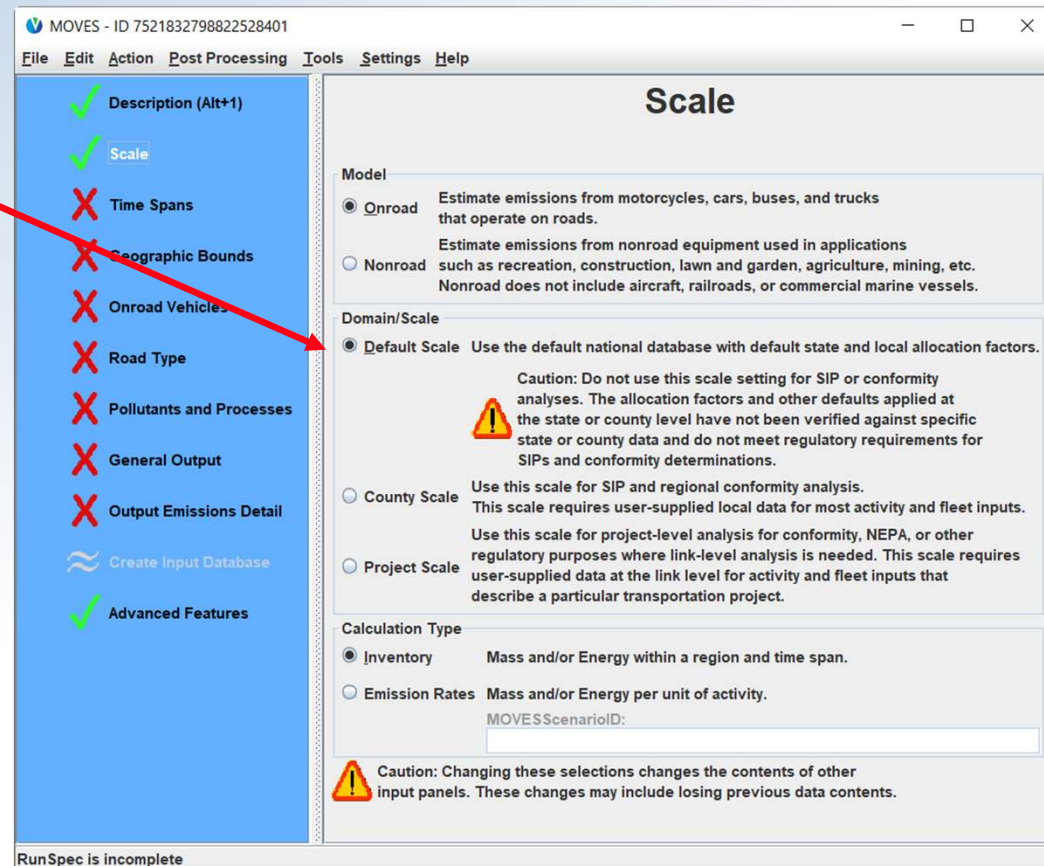


- The MOVES3 GUI has minor changes throughout the RunSpec
 - Most changes made to prevent user error and to separate “typical” from “advanced” options
 - Improved flow and accessibility
- *Create Input Database* is now its own panel and occurs at the end of the RunSpec
- Manage Input Data Sets feature now on *Advanced Features* Panel
- Removed *Rate of Progress* Panel

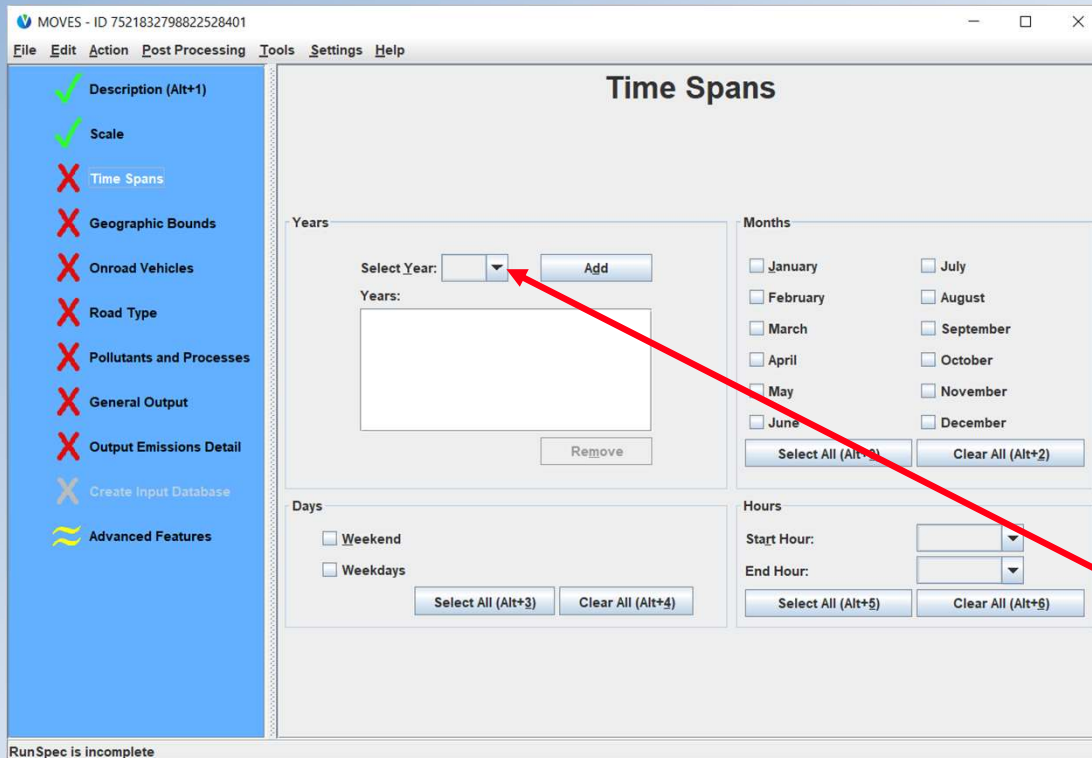
Scale Panel

- “National Scale” in MOVES2014 was renamed “Default Scale”
 - Originally named because it uses national defaults
 - Renamed to eliminate confusion since this scale can be used for runs at different geographic levels (nation, state, county)
 - Reminder: cannot be used for SIP or conformity purposes

MOVES3 Technical Guidance Section 3.2



Time Spans Panel

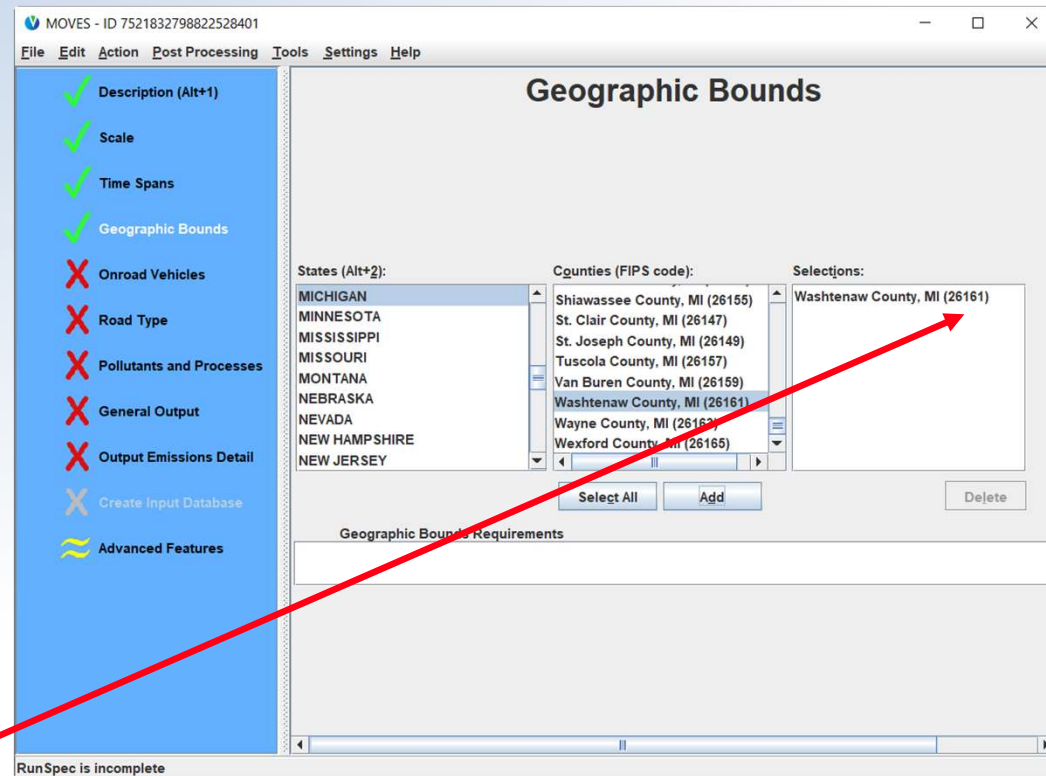


- Time Preaggregation (e.g., annual) removed from this panel
 - Preaggregation is not acceptable for SIP or conformity purposes because more precision is necessary in these state and local analyses (as described in the *Technical Guidance*)
 - This feature is still available for other uses on the *Advanced Features Panel*
- Now models years through 2060

MOVES3 Technical Guidance Section 3.3

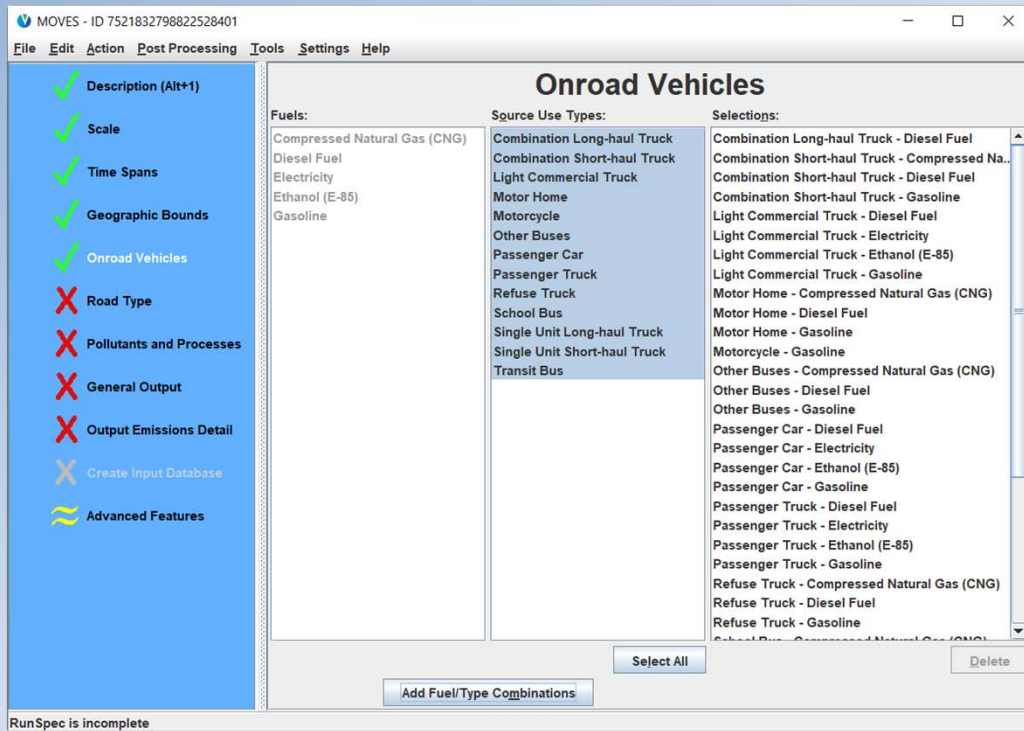
Geographic Bounds Panel

- Region Preaggregation (e.g., Nation) removed from this panel
 - Preaggregation is not acceptable for SIP or conformity purposes because more precision is necessary for these state and local analyses (as described in the *Technical Guidance*)
 - This feature is still available for other uses on the *Advanced Features Panel*
- Custom Domain is no longer available
- FIPS codes are now listed next to the county name



MOVES3 Technical Guidance Section 3.4

Onroad Vehicles Panel

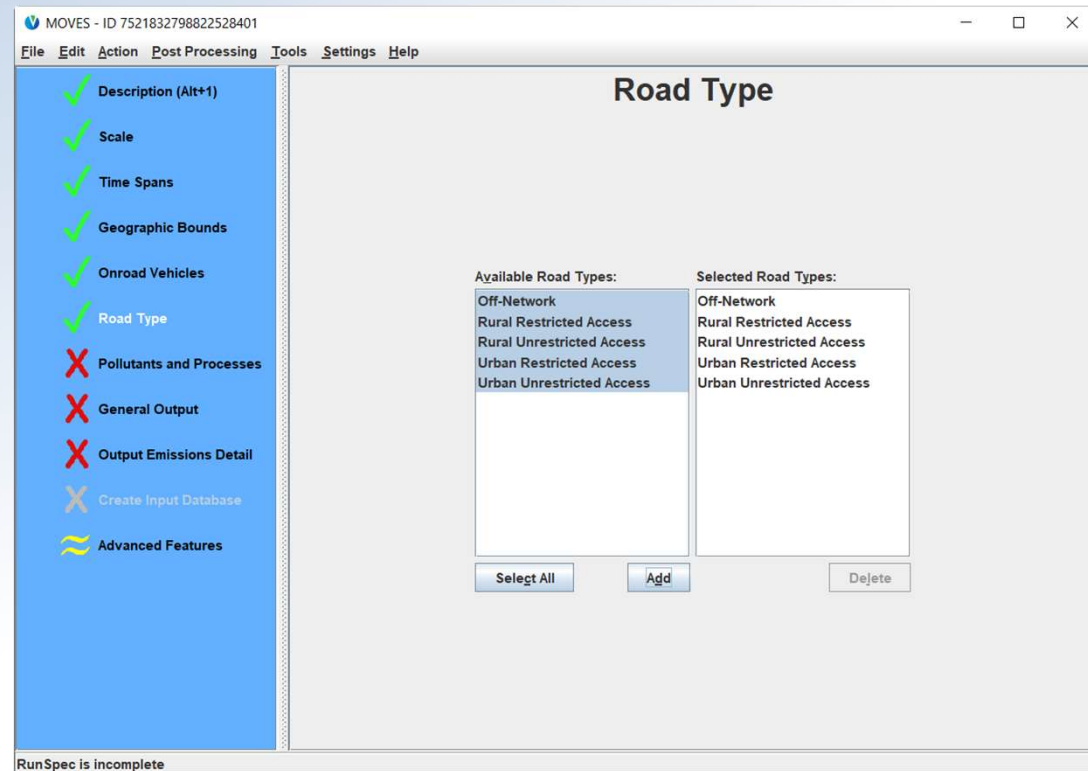


- Expanded definition of Source Type 41 from “Intercity” to “Other”
 - All buses except school buses or transit agency-owned buses
- Expanded source type / fuel type combinations:
 - All HD vehicles have gasoline, diesel, and CNG options (except long-haul combination trucks, which are still diesel-only)
- All fuel types automatically selected
 - User cannot delete a vehicle/fuel type

MOVES3 Technical Guidance Section 3.5

Road Type Panel

- Removed capability of modeling ramps separately in County Scale
 - Ramps are included in the Restricted Access road types
 - In Project Scale, ramps can and should be modeled as unique links
- All road types (including off-network) must be selected if a running process is selected on the next panel
 - Due to the addition of ONI (discussed later)



MOVES3 Technical Guidance Section 3.6

Pollutants and Processes Panel

MOVES - ID 7521832798822528401

File Edit Action Post Processing Tools Settings Help

Pollutants and Processes

Selected	Pollutant	Running Exhaust	Crankcase Running Exhaust	Brakewear	Tirewear	Start Exhaust	Crankcase Start Exhaust	Extended Idle Exhaust	Crankcase Extended Idle Exhaust	Auxiliary Power Exhaust	Evap Permeation	Evap Fuel Vapor Venting	Evap Fuel Leaks	Refueling Displacement Vapor Loss	Refueling Spillage Loss
<input checked="" type="checkbox"/>	Total Gaseous Hydrocarbons	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	Non-Methane Hydrocarbons	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Non-Methane Organic Gases	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Total Organic Gases	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Volatile Organic Compounds	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Methane (CH4)	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Carbon Monoxide (CO)	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Oxides of Nitrogen (NOx)	<input checked="" type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Nitrogen Oxide (NO)	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Nitrogen Dioxide (NO2)	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Nitrous Acid (HONO)	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Ammonia (NH3)	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Nitrous Oxide (N2O)	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Primary Exhaust PM2.5 - Total	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Primary Exhaust PM2.5 - Species	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Primary PM2.5 - Brakewear Particulate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Primary PM2.5 - Tirewear Particulate	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Primary Exhaust PM10 - Total	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Primary PM10 - Brakewear Particulate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Primary PM10 - Tirewear Particulate	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

when pollutants are listed in the box at right, MOVES needs to calculate those emissions first, before calculating the pollutants you selected. In this case, click "Select Prerequisites" to proceed.

Select Prerequisites

Clear All

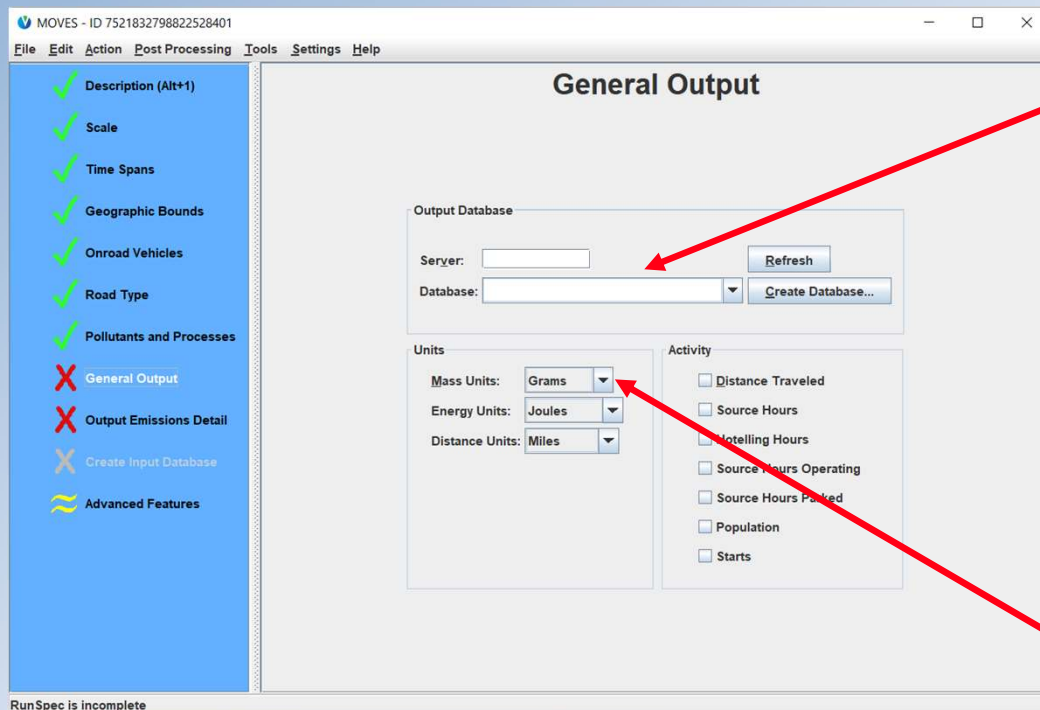
RunSpec is incomplete

Tri-state checkboxes indicate if all, some, or no processes have been selected

Emission processes have been logically grouped:

- Running
- Brakewear/Tirewear
- Start
- Extended Idle
- Evap

General Output Panel



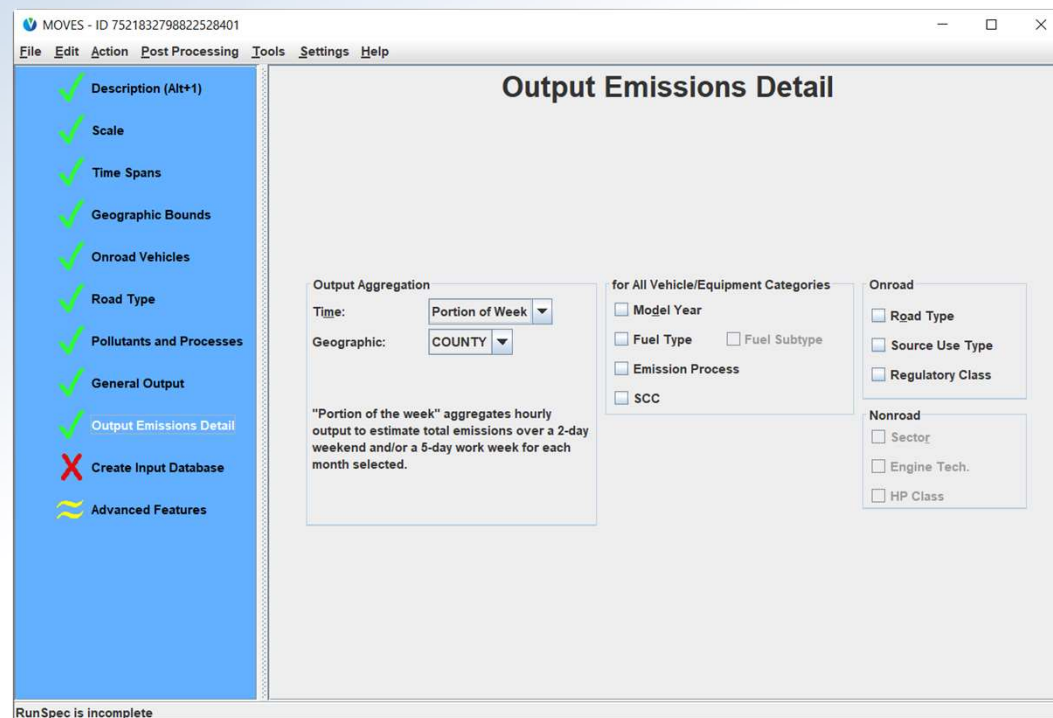
- Database drop-down menu only includes existing output databases
 - No more accidentally selecting an input database on this panel
- Can't reuse MOVES2014 output databases with MOVES3
 - MOVES3 output databases include a new column for nonroad activity output (fuelSubTypeID)
- Default units are pre-selected:
 - Grams, Joules, Miles

MOVES3 Technical Guidance Section 3.8

Output Emissions Detail Panel

- Reorganized output options into logical groupings
- Removed elements that were always on or always off
- Added descriptive text for some options (when selected)
- Added error messages (when incompatible selections are made)

MOVES3 Technical Guidance Section 3.9



Create Input Database Panel

MOVES - ID 10761796578097030520

File Edit Action Post Processing Tools Settings Help

Create Input Database

Domain Input Database

Server: localhost

Database: training_in

Description:

Refresh

Create Database Enter/Edit Data

RunSpec is incomplete

✓ Description (Alt+1)

✓ Scale

✓ Time Spans

✓ Geographic Bounds

✓ Onroad Vehicles

✓ Road Type

✓ Pollutants and Proces

✓ General Output

✓ Output Emissions Det

✗ Create Input Database

⚡ Advanced Features

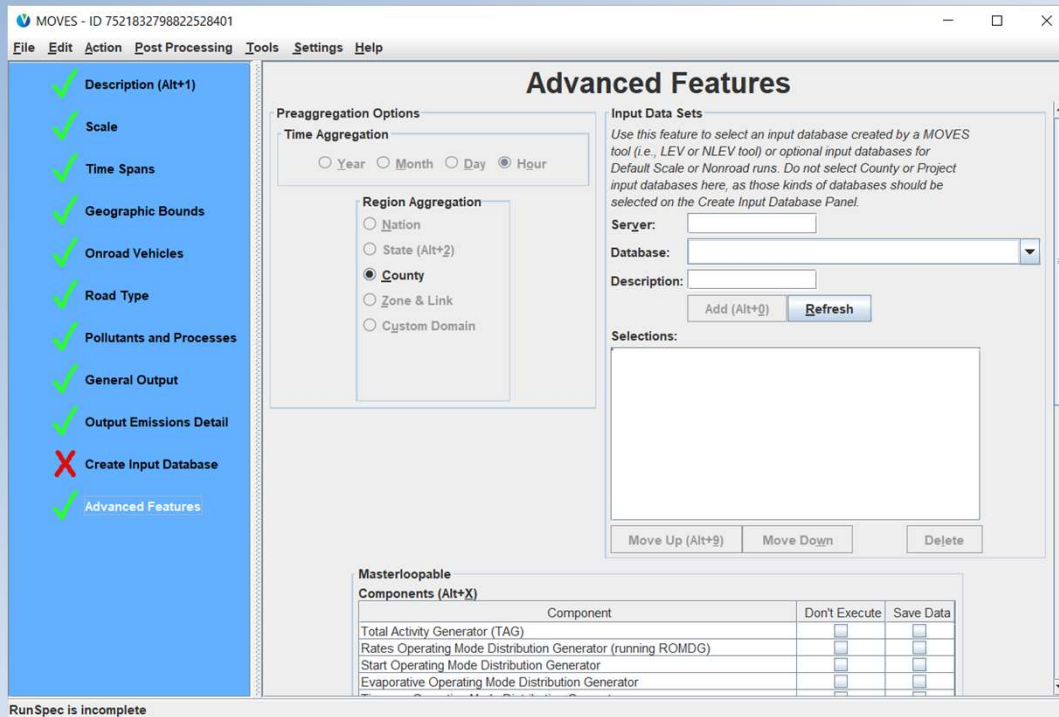
Type database name here and then open Data Manager

No green check until input database is complete with a green check on each tab

Can create new input database here or in the Data Manager

MOVES3 Technical Guidance Section 3.10

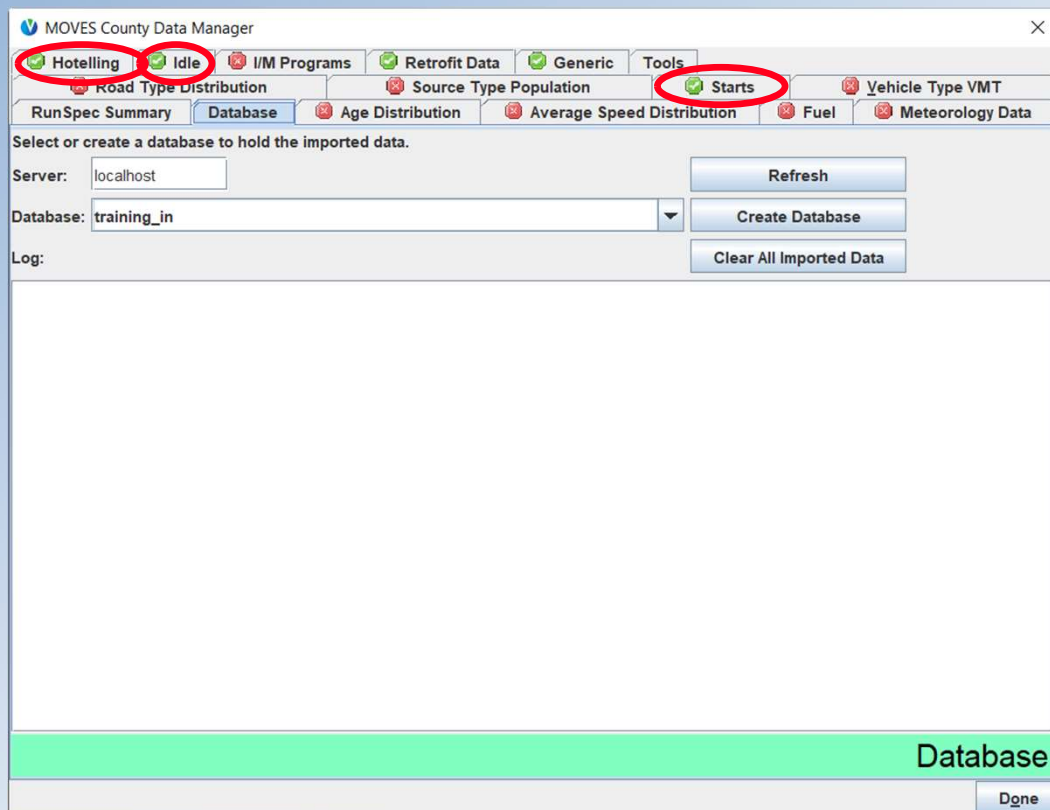
Advanced Features



- Time and Region Preaggregation options are available here (if applicable and appropriate)
- The MOVES2014 *Manage Input Data Sets* Panel is available here, called “Input Data Sets”
 - Used to select input databases created by MOVES tools or optional input databases at Default Scale or Nonroad

MOVES3 Technical Guidance Section 3.11

MOVES3 Input Database Changes



- New tab (at County & Default scale)
 - Idle (Off-Network Idle, or ONI)
- Changed tabs:
 - Hotelling and Starts
- Other changes:
 - State and County tables have changes related to ONI (automatically populated by MOVES based on RunSpec selections)
 - Improved error checking
 - See [GitHub](#) for more info

MOVES3 Technical Guidance Sections 4.10, 4.11, 4.12

New: Idle Inputs

- Idle Tab is used to import optional data on off-network idle (ONI) activity and should only be used if better local data are available
- ONI is the time during which a vehicle engine is running idle not on the road network (e.g., in a parking lot or driveway)
 - ONI **does** include idling while waiting to pick up passengers or loading/unloading cargo
 - ONI does **not** include combination truck hotelling (which is input on the Hotelling Tab)
 - ONI does **not** include idling at traffic signals, stop signs, and in congested traffic

MOVES3 Technical Guidance Section 4.12

Idle Inputs—Inventory Mode

- If used, follow only Method 1 or Method 2, not both
- Method 1: **TotalIdleFraction**
 - Input total time spent idling as a fraction of source hours operating by source type, model year range, month, and day type
 - These fractions are total idle times, including ONI and on-network idling—the amount of time idling between “key-on” and “key-off” (excluding long-haul hotelling time)
 - “Export Default Data” is available for this method
 - “Create Template” fills in the following fields from the RunSpec:

idleRegionID	countyTypeID	sourceTypeID	monthID	dayID	minModelYearID	maxModelYearID	totalIdleFraction
102	1	21	1	2			

Idle Inputs—Inventory Mode

- Method 2: **IdleModelYearGrouping** with shaping tables
 - This method uses the same units as Method 1, but is more flexible
 - Supply the total idle fraction in **IdleModelYearGrouping**:

sourceTypeID	minModelYearID	maxModelYearID	totalIdleFraction
21			

- Vary the idle fraction by month with a multiplicative factor in **IdleMonthAdjust**:

sourceTypeID	monthID	idleMonthAdjust
21	1	

- Vary the idle fraction by day type with a multiplicative factor in **IdleDayAdjust**:

sourceTypeID	dayID	idleDayAdjust
21	2	

Idle Inputs—Emission Rates Mode

- When using Emission Rates mode, users calculate ONI emissions by multiplying roadTypeID 1 emission rates in the RatePerDistance table with the corresponding hours of ONI
- The relevant idle activity data are different between different modes:
 - Inventory Mode: fractional input (total idle hours / hours operating)
 - Emission Rates Mode: hours of off-network idle
- To obtain the default number of hours for use with Emission Rates, use the ONI Tool

MOVES3 Technical Guidance Section 4.12.2

Changed: Hotelling Inputs

- The Hotelling Tab is used to import information on long-haul combination truck (62s) hotelling activity and should only be used if better local data are available
 - By default, MOVES will calculate hotelling activity based on 62s VMT on restricted access roads
- There are five importers that can be used in any combination:
 - MOVES defaults will be used for any inputs that are not provided
 - HotellingHoursPerDay
 - HotellingHourFraction
 - HotellingAgeFraction
 - HotellingMonthAdjust
 - HotellingActivityDistribution

MOVES3 Technical Guidance Section 4.11

Hotelling Inputs

- **HotellingHoursPerDay:**

- Supply total hours of hotelling (for all operating modes) for a typical weekday and weekend day
- No “Export Default Data” option for this table

yearID	zoneID	dayID	hotellingHoursPerDay
2021	261610	2	

- **HotellingHourFraction:**

- Used to allocate hotelling activity to hour of day
- Fractions should sum to 1 for each day type
- “Export Default Data” is available for this table

zoneID	dayID	hourID	hourFraction
261610	2	1	

Hotelling Inputs

- **HotellingAgeFraction:**

- Used to allocate hotelling activity to vehicle age
- Fractions should sum to 1
- No “Export Default Data” option for this table

zoneID	ageID	ageFraction
261610	0	

- **HotellingMonthAdjust:**

- Adjusts hotelling hours per day by months with a multiplicative factor
- “Export Default Data” is available for this table (defaults are all 1.0)

zoneID	monthID	monthAdjustment
261610	1	

Hotelling Inputs

- **HotellingActivityDistribution:**

- Used to allocate operating mode distribution by model year

- 4 opModeIDs:

200	Extended Idling
201	Diesel Auxiliary Power (APU)
203	Battery Power
204	Engine-Off

- “Export Default Data” is available for this table

zoneID	beginModelYearID	endModelYearID	opModeID	opModeFraction
261610	2021	2023	200	0.48
261610	2021	2023	201	0.24
261610	2021	2023	203	0.08
261610	2021	2023	204	0.2

Changed: Starts Inputs

- The Starts Tab is used to import information on vehicle start activity and should only be used if local data are available
 - Could be derived from origin/destination studies or telematics data
- Three importers for the number of starts:
 - Starts, StartsPerDay, or StartsPerDayPerVehicle
- Three shaping tables to adjust or allocate the number of starts:
 - StartsHourFraction, StartsMonthAdjust, StartsAgeAdjustment
- Note: No structural changes to the vehicle soak activity input StartsOpModeDistribution, so it is not covered in this presentation

MOVES3 Technical Guidance Section 4.10

Starts Inputs

- **Starts:**

- Used to completely replace the MOVES-calculated number of starts
- Provide number of starts by hour, day, month, and age
- No “Export Default Data” option for this table
- Cannot be used with StartsPerDay, StartsPerDayPerVehicle, StartsHourFraction, StartsMonthAdjust, or StartsAgeAdjustment

hourDayID	monthID	yearID	ageID	zoneID	sourceTypeID	starts	startsCV	isUserInput
12	1	2021	0	261610	21			

Starts Inputs

- **StartsPerDay:**

- Used to supply the total number of vehicle starts by source type for a typical weekday or weekend day
- The total number of vehicle starts may be adjusted using StartsMonthAdjust or allocated using StartsHourFraction and StartsAgeAdjustment, if local data exist for those parameters
- No “Export Default Data” option for this table
- Cannot be used with Starts or StartsPerDayPerVehicle

dayID	sourceTypeID	startsPerDay
2	21	

Starts Inputs

- **StartsPerDayPerVehicle:**

- Used to supply the average number of vehicle starts per vehicle by source type for a typical weekday or weekend day
- MOVES will calculate total vehicle starts using vehicle populations
- The number of vehicle starts may be adjusted using StartsMonthAdjust or allocated using StartsHourFraction and StartsAgeAdjustment, if local data exist for those parameters
- “Export Default Data” option is available for this table
- Cannot be used with Starts or StartsPerDay

dayID	sourceTypeID	startsPerDayPerVehicle
2	21	

Starts Inputs

- **StartsHourFraction:**

- Used to allocate start activity to hour of day
- Fractions should sum to 1 for each day type
- “Export Default Data” is available for this table

dayID	hourID	sourceTypeID	allocationFraction
2	1	21	

- **StartsMonthAdjust:**

- Adjusts number of starts by month with a multiplicative factor
- “Export Default Data” is available for this table

monthID	sourceTypeID	monthAdjustment
1	21	

Starts Inputs

- **StartsAgeAdjustment:**

- Used to adjust start activity by vehicle age
 - Makes relative adjustments—absolute values are not used
 - This input conserves total number of starts—only affects allocation of starts
- “Export Default Data” is available for this table
- A partial, simple example for illustrative purposes:

sourceTypeID	ageID	ageAdjustment
21	0	1
21	1	0.9
21	2	0.8

- Age 0 vehicles will have 1.11x more starts per vehicle than age 1 vehicles (because $1/0.9 = 1.11$)
- Age 0 vehicles will have 1.25x more starts per vehicle than age 2 vehicles (because $1/0.8 = 1.25$)

Improved Error Checking

The image displays two screenshots from the MOVES software interface. The left screenshot, titled 'MOVES County Data Manager', shows a toolbar with various data management options. A red oval highlights the toolbar area. Below the toolbar, there are fields for 'Server: localhost', 'Database: training_in', and 'Log:'. A 'Create Database' button is visible. A text box on the left contains the following list:

- Error messages persist across sessions
- Expanded checks
- Can only run with all green checks

The right screenshot, titled 'MOVES - ID 10761796578097030520', shows a 'Create Input Database' dialog box. On the left side of this dialog, a vertical list of checks is displayed with green checkmarks for most items and a red 'X' for 'Create Input Database'. The items in the list are: Description (Alt+1), Scale, Time Spans, Geographic Bounds, Onroad Vehicles, Road Type, Pollutants and Proces, General Output, Output Emissions Det, Create Input Database, and Advanced Features. A red arrow points from the text box on the left to the 'Create Input Database' check. At the bottom of the dialog, a status bar shows 'RunSpec is incomplete' circled in red. The dialog box itself has fields for 'Server: localhost', 'Database: training_in', and 'Description', along with 'Refresh', 'Create Database', and 'Enter/Edit Data' buttons.

Ready to Run with All Green Checks

The image displays two overlapping windows from the MOVES software. The left window, titled 'MOVES County Data Manager', has a red oval around its top menu bar which includes: Vehicle Type VMT, Hotelling, Idle, I/M Programs, Retrofit Data, Generic, Tools, Meteorology Data, Road Type Distribution, Source Type Population, Starts, RunSpec Summary, Database, Age Distribution, Average Speed Distribution, and Fuel. Below the menu bar, there are fields for 'Server: localhost', 'Database: training_in', and 'Log:'. A green arrow points from the 'Database' section of this window towards the right window.

The right window, titled 'MOVES - ID 10761796578097030520', shows a 'Create Input Database' dialog box. On the left side of this dialog is a checklist with 12 items, each preceded by a green checkmark: Description (Alt+1), Scale, Time Spans, Geographic Bounds, Onroad Vehicles, Road Type, Pollutants and Proces, General Output, Output Emissions Det, Create Input Database, and Advanced Features. On the right side of the dialog, there is a 'Domain Input Database' section with fields for 'Server: localhost', 'Database: training_in', and 'Description'. Below these fields are buttons for 'Refresh', 'Create Database', and 'Enter/Edit Data'. At the bottom of the dialog, the status 'Ready to run...' is circled in red.

Overview

Purpose of this webinar

New content: emissions and activity updates

Improved user interface

Built-in MOVES tools

Resources

Built-in MOVES Tools

- Database Conversion Tools
- NLEV and LEV Tools
- ONI Tool
- NEI Submissions QA Tool
- MOVES Command Line

Database Conversion Tools

- Generally, new input databases using new information should be created for MOVES3
- However, if input databases still contain the latest available information, they can be “converted” for use with MOVES3:
 - Converters are available in the GUI under Tools menu (also in Ant)
 - Will not convert fuels, starts, or hotelling inputs
 - User will need to open the Data Manager to finish the process
 - Data based on MOVES2014 defaults should be replaced with defaults from MOVES3
 - A help file is available in the GUI or on [GitHub](#)

NLEV and LEV Tools

- Designed for:
 - States that have adopted California Low Emission Vehicle (LEV) criteria pollutant standards
 - States in the Ozone Transport Commission (OTC) that received early implementation of National Low Emitting Vehicle (NLEV) standards
- Available in the GUI under Tools menu, along with detailed instructions
- A help file is available in the GUI or on [GitHub](#)
- Section 3.11 of the Technical Guidance describes when these tools should be used

ONI Tool

- Used with MOVES at the County Scale in Emission Rates Mode when users want to use default hours of ONI
 - Not used with Inventory Mode, as MOVES will calculate ONI activity during runtime in this mode
 - Not used with Project Scale, as ONI (if needed for the analysis) would be modeled as a link with average speed 0
- The RunSpec and County Scale Input should be fully populated before running the ONI Tool
- Available in Tools menu > ONI Tool (see help on [GitHub](#))
- Produces a spreadsheet of ONI activity in hours

NEI Submissions QA Tool

- Developed for users creating County Database (CDB) submissions for the National Emissions Inventory (NEI)
- Verifies that all table contents meet naming convention, format, data validity, and other checks
- Includes onroad and nonroad checks
- The QA tool is run in MOVES via the command line using `Ant`
- A help file is available on [GitHub](#)

MOVES Command Line

- To simplify working with MOVES from the command line, MOVES3 includes all command line options in `Ant`
 - No longer necessary to invoke Java directly
- These commands include:
 - Batch MOVES runs
 - Starting multiple workers
 - Batch input database creation
 - Converting MOVES2014 input databases to MOVES3 format
- See more information on command line usage at [GitHub](#)

MOVES Software Changes

- Java Runtime Environment and MariaDB are included with MOVES3, eliminating the manual installation steps
- MariaDB replaces MySQL Server
 - MariaDB should be used with both MOVES2014 and MOVES3
 - MySQL Server should not be used
 - MOVES3 installer includes the “HeidiSQL” interface, which is the MariaDB equivalent of MySQL Workbench
 - You can continue using MySQL Workbench if you prefer
 - Additional help in [Quick Start Guide to Accessing MariaDB Data](#)

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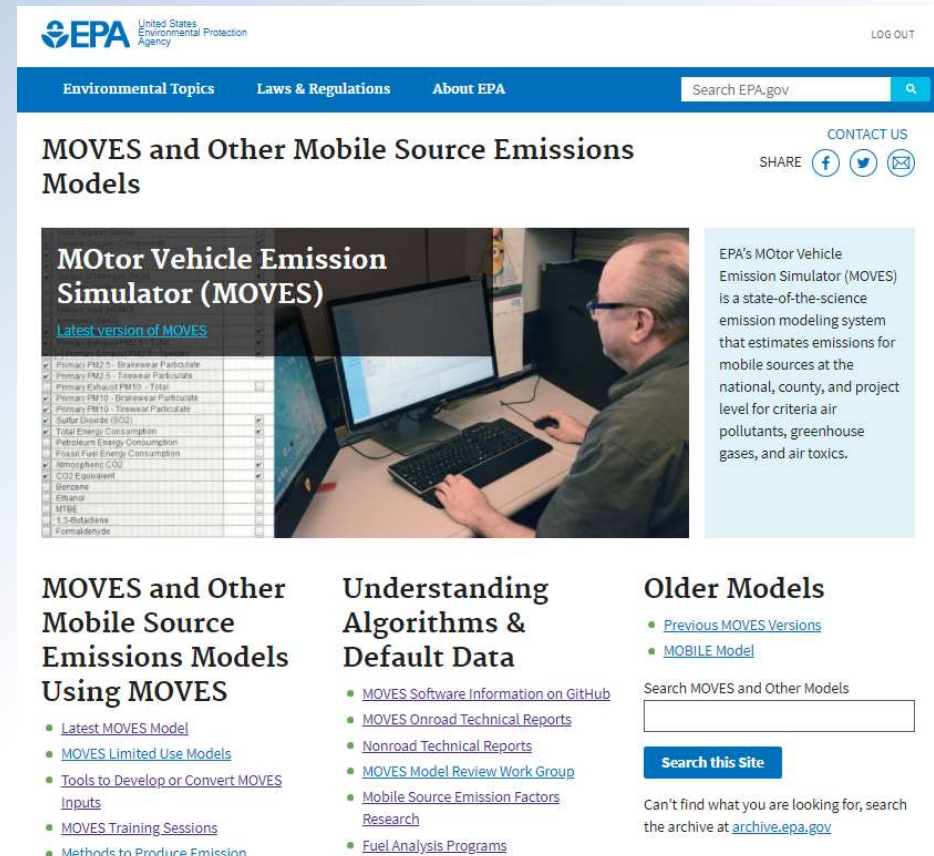
Built-in MOVES tools

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MOVES Webpage

<https://www.epa.gov/moves> is the starting point for all MOVES information, with links to:

- Latest model (MOVES3)
- Limited use models (MOVES2014)
- Tools
- Training
- Background Information
 - Technical Reports
 - Software Information



The screenshot shows the EPA website's page for MOVES and Other Mobile Source Emissions Models. At the top is the EPA logo and navigation menu. The main heading is "MOVES and Other Mobile Source Emissions Models". Below this is a featured article titled "MOTOR Vehicle Emission Simulator (MOVES)" with a sub-link for the "Latest version of MOVES". To the right of the article is a text box describing MOVES as a state-of-the-science emission modeling system. Below the featured article are three columns of links: "MOVES and Other Mobile Source Emissions Models Using MOVES", "Understanding Algorithms & Default Data", and "Older Models". A search bar is located at the bottom right of the page.

MOVES and Other Mobile Source Emissions Models

MOTOR Vehicle Emission Simulator (MOVES)
Latest version of MOVES

EPA's MOTOR Vehicle Emission Simulator (MOVES) is a state-of-the-science emission modeling system that estimates emissions for mobile sources at the national, county, and project level for criteria air pollutants, greenhouse gases, and air toxics.

MOVES and Other Mobile Source Emissions Models Using MOVES

- [Latest MOVES Model](#)
- [MOVES Limited Use Models](#)
- [Tools to Develop or Convert MOVES Inputs](#)
- [MOVES Training Sessions](#)
- [Methods to Produce Emission](#)

Understanding Algorithms & Default Data

- [MOVES Software Information on GitHub](#)
- [MOVES Onroad Technical Reports](#)
- [Nonroad Technical Reports](#)
- [MOVES Model Review Work Group](#)
- [Mobile Source Emission Factors Research](#)
- [Fuel Analysis Programs](#)

Older Models

- [Previous MOVES Versions](#)
- [MOBILE Model](#)

Search MOVES and Other Models

[Search this Site](#)

Can't find what you are looking for, search the archive at archive.epa.gov

MOVES3 Webpage

<https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves> has links and documents for MOVES3, including:

- EPA Releases MOVES3 Mobile Source Emissions Model: Questions and Answers
- *Federal Register* Notice of Availability - official release of MOVES3
- MOVES3 Policy Guidance
- MOVES3 Technical Guidance
- MOVES3 Installation File (Instructions and troubleshooting guide are included)
- MOVES Overview Report
- Links to training materials and additional user materials

MOVES3 *Federal Register* Notice and Policy Guidance

- The MOVES3 Policy Guidance covers when to use MOVES3 for SIPs, conformity determinations, and other purposes (in states other than California)
- The MOVES3 *Federal Register* notice (January 7, 2021) announces the availability of the model and establishes
 - A two-year grace period before MOVES needs to be used in regional emissions analyses for conformity
 - Unless MOVES3-based SIP budgets become applicable sooner
 - A two-year grace period before MOVES needs to be used in project-level conformity hot-spot analyses
 - Grace period ends on January 9, 2023

MOVES Technical Guidance

Provides guidance on

- Using MOVES at the County Scale for onroad emission inventory development in SIPs and conformity (in states other than California)
 - Section 2, planning an onroad emissions analysis with MOVES
 - Section 3, creating a MOVES Run Specification
 - Section 4, entering local data using the County Data Manager
- Developing nonroad inventories – Section 5
- Other guidance covers MOVES at the Project Scale (used for hot-spot analyses), using MOVES to model specific control programs (e.g., diesel retrofits/replacements), and using MOVES to estimate GHGs
 - Until updated, existing guidance generally applicable to MOVES3

MOVES GitHub Site

- MOVES source code can be viewed/downloaded from [GitHub](#)
- The [/docs](#) folder on GitHub hosts additional user support documents for:
 - Getting started with MOVES
 - MOVES Cheat Sheets
 - Help for MOVES Tools
 - Developer References
- Tracking known [issues](#):
 - Users are encouraged to search for issues here before contacting the inbox to see if the issue is already known and if there is a workaround

Additional MOVES3 Tools

- VMT Offset Tool
 - Applies to Severe and Extreme Ozone Areas only, to meet Clean Air Act Section 182(d)(1)(A) requirements
- Age Distribution Projection Tool
 - Allows users to create future vehicle age distributions that account for past economic conditions
- AADVMT Converter Tool
 - Converts Annual Average Daily Vehicles Miles Travelled (AADVMT) to annual VMT inputs
- MOVES2AERMOD tool
 - For use in PM hot-spot analyses for transportation conformity
 - Allows users to easily convert results from 16 MOVES runs into the format needed for an AERMOD input file

Additional Resources

- MOVES FAQs at <https://www.epa.gov/moves/frequent-questions-about-moves-and-related-models>
- MOVES3 Policy Guidance and Technical Guidance are also available at: www.epa.gov/state-and-local-transportation/policy-and-technical-guidance-state-and-local-transportation#emission
- In the future: other guidance updates and information about other training
- Join EPA's MOVES listserv to receive MOVES announcements, including training: www.epa.gov/moves/forms/epa-mobilenews-listserv

MOVES3 Overview Report

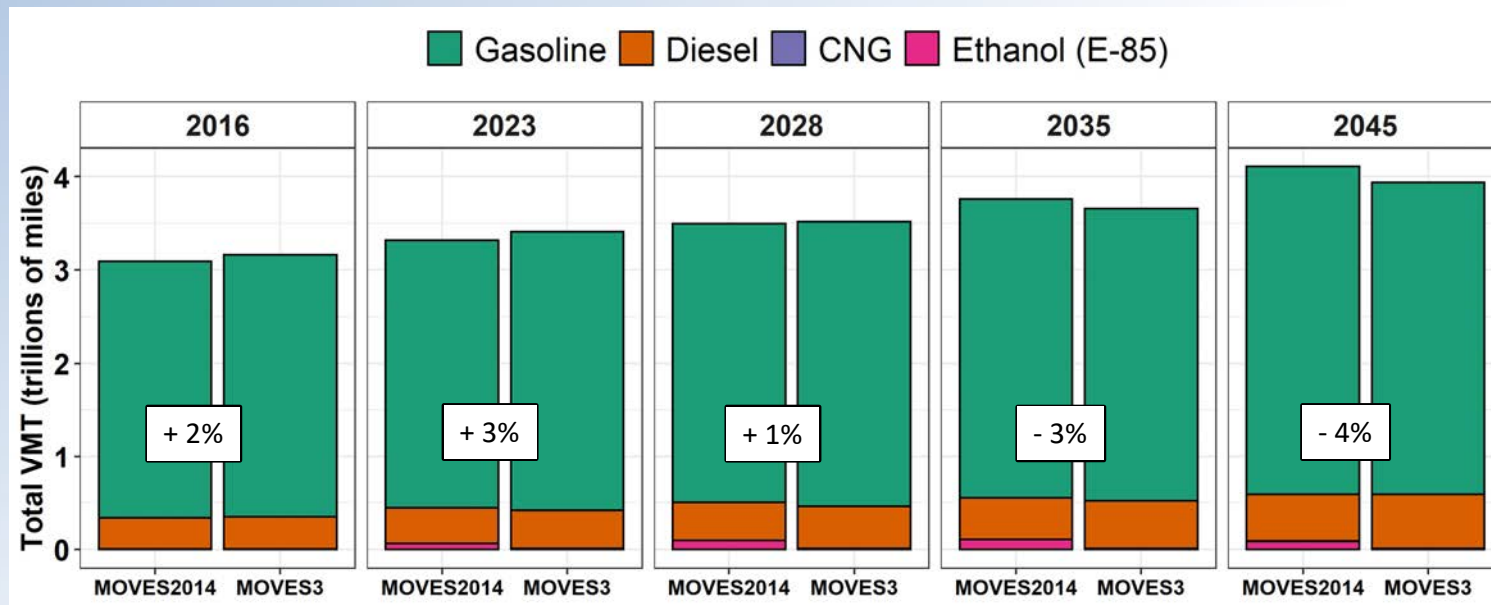
- [Overview of EPA's MOtor Vehicle Emissions Simulator](#), released March 2021 (EPA-420-R-21-004)
- Report provides a high-level overview of MOVES3, including
 - MOVES3 functional scope (what it can model)
 - New regulations in MOVES3, new features, updated emission rates, updated fuel characteristics, vehicle populations, and activity,
 - Onroad and nonroad algorithms
 - Documentation and data sources
 - Sample MOVES3 results
- The graphs on the following slides are excerpts from the report

Changes in Emission Estimates

- In general, MOVES3 national emission estimates are:
 - higher for greenhouse gases in near future years compared to MOVES2014b
 - lower for most criteria pollutants in future years compared to MOVES2014b
- Results will vary based on local inputs in a given area, for example:
 - MOVES3 NOx HD running rates are higher than MOVES2014 at low speed (low exhaust temperature) operation
 - Urban areas may see NOx increases
 - MOVES3 NOx HD extended idle rates and default activity are lower than MOVES2014
 - Areas with truck stops and other heavy-duty hotelling may see NOx decreases

National: Onroad VMT

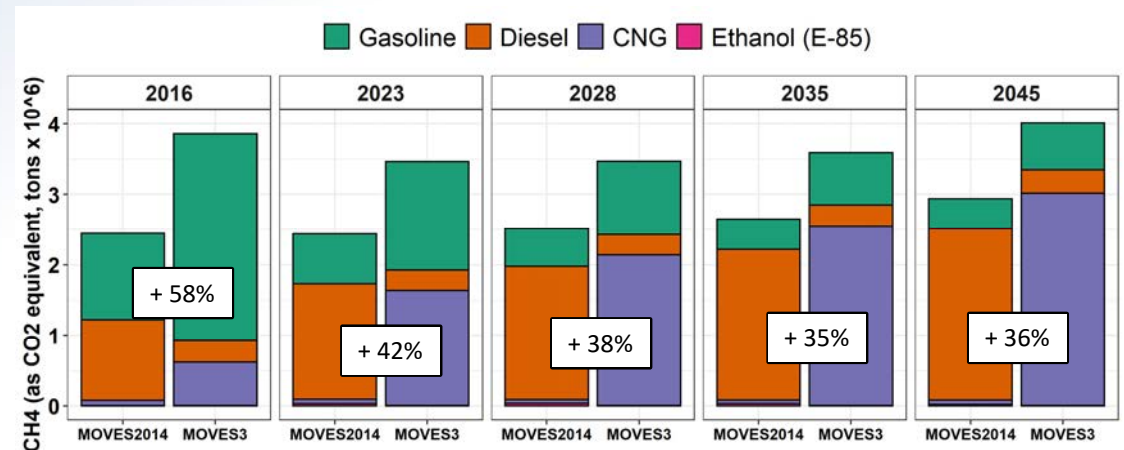
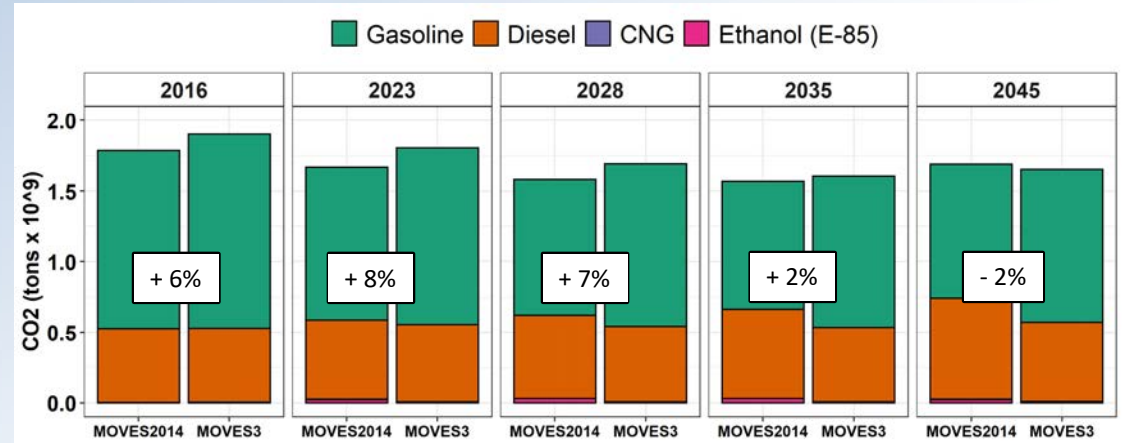
- Small changes due to new historical data & AEO forecast
- Predicted VMT continues to increase across onroad sectors



Percentage label indicates change from MOVES2014b to MOVES3.

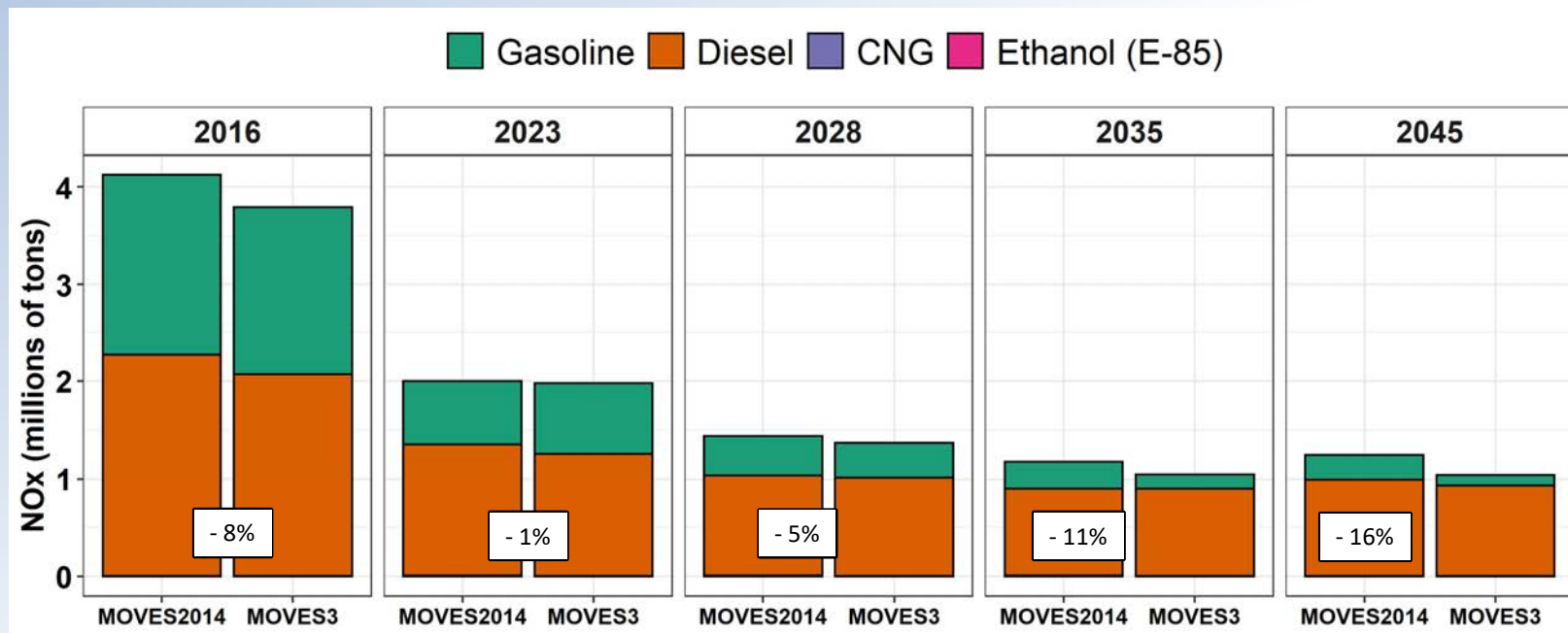
National: Onroad GHGs

- LDGHG and HDGHG rules reduce future CO₂
- SAFE rule impacts seen in MOVES3 gasoline values
- Increase in CH₄
 - Updates to CNG population increase HD emissions
 - Updates to speciation (CH₄/THC ratios) change gasoline and diesel emissions
 - But still only a small fraction of a percent of GHG emissions.



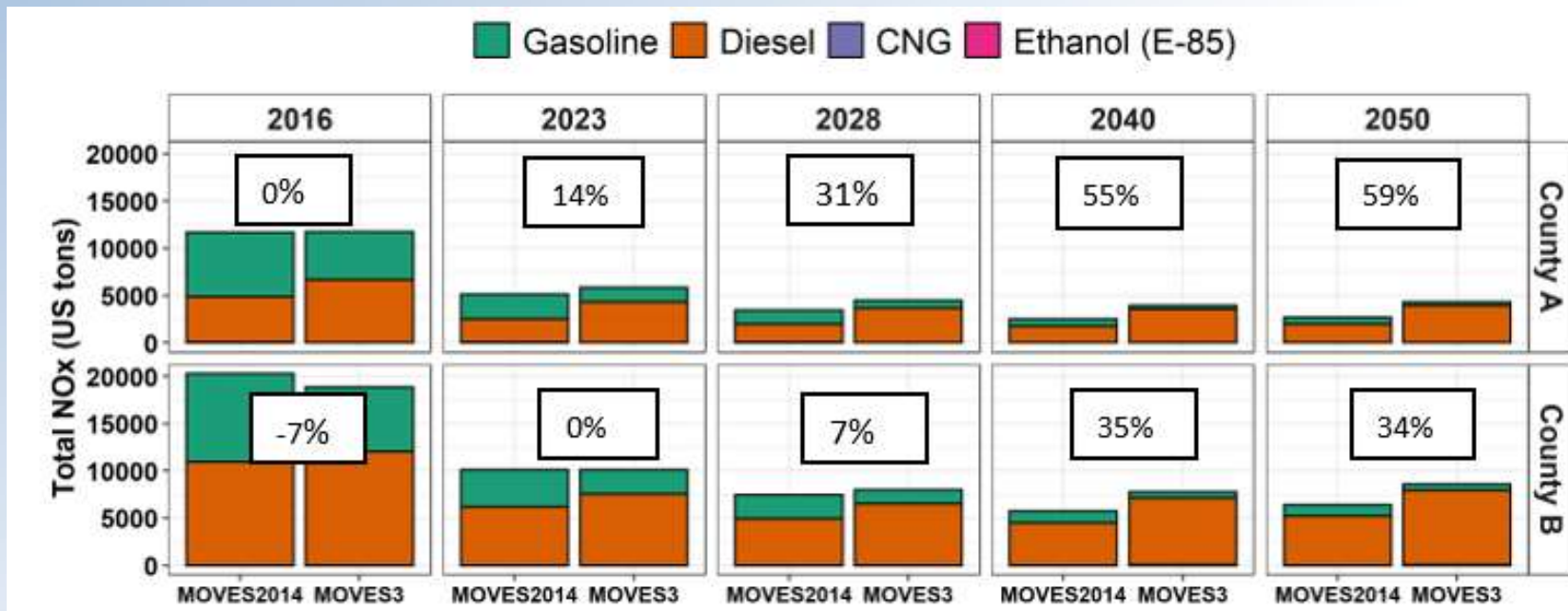
National: Onroad NOx

- Continue to see large drop in gasoline (LD) NOx with Tier 3
- At national scale, increase in diesel running NOx is outweighed by reduced extended idle from HD hotelling



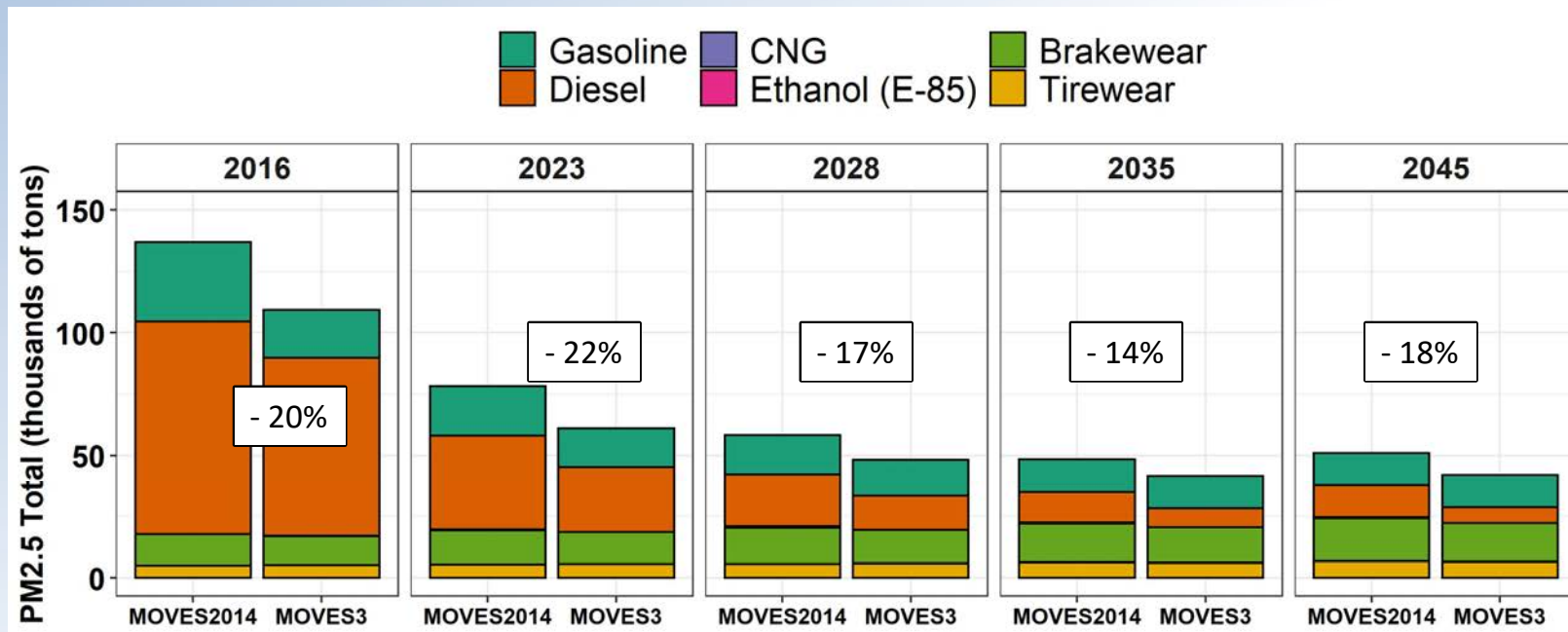
Sample Counties: Onroad NOx

- In these counties, compared to MOVES2014b: lower gasoline NOx, but higher diesel NOx
- Urban diesel is dominated by running NOx (which increased) rather than extended idle (which decreased)



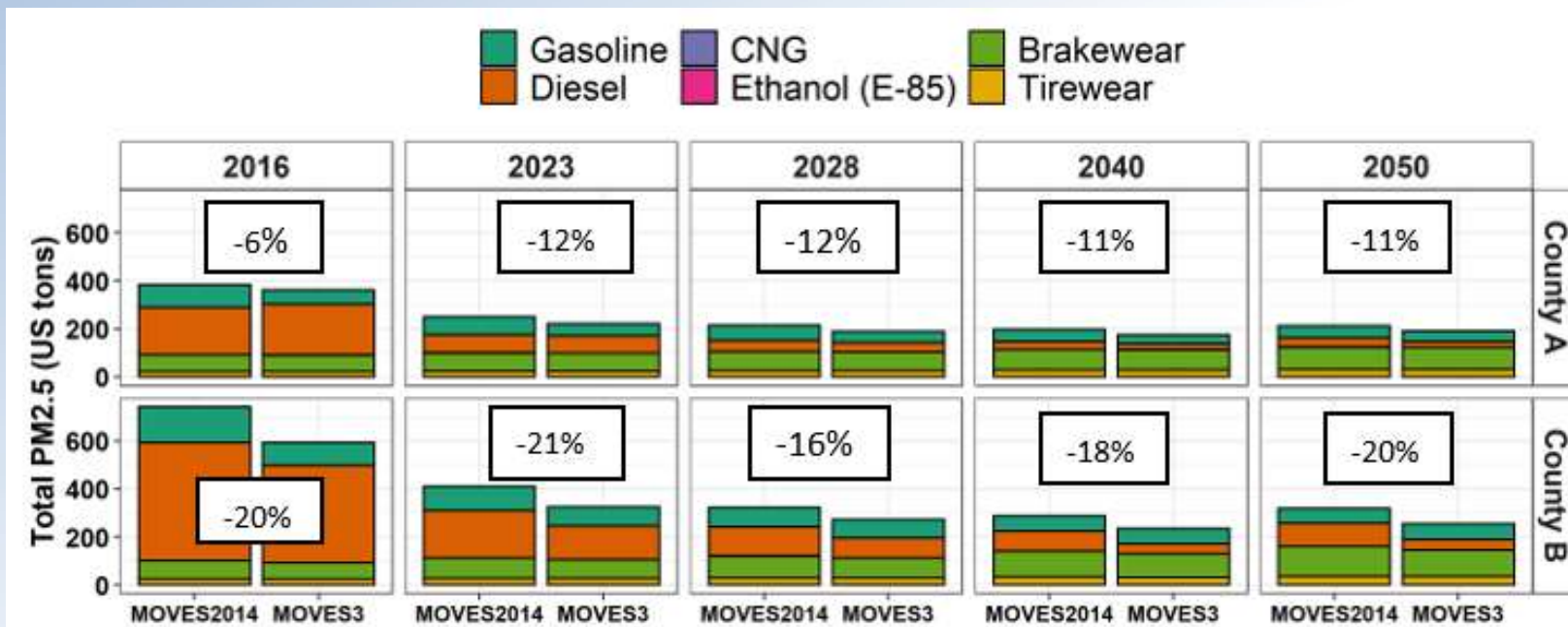
National: Onroad PM_{2.5}

- MOVES3 has less exhaust PM_{2.5} due to decreased extended idle activity and lower HD emission rates
- Brake and tire wear constitute a growing fraction of PM emissions



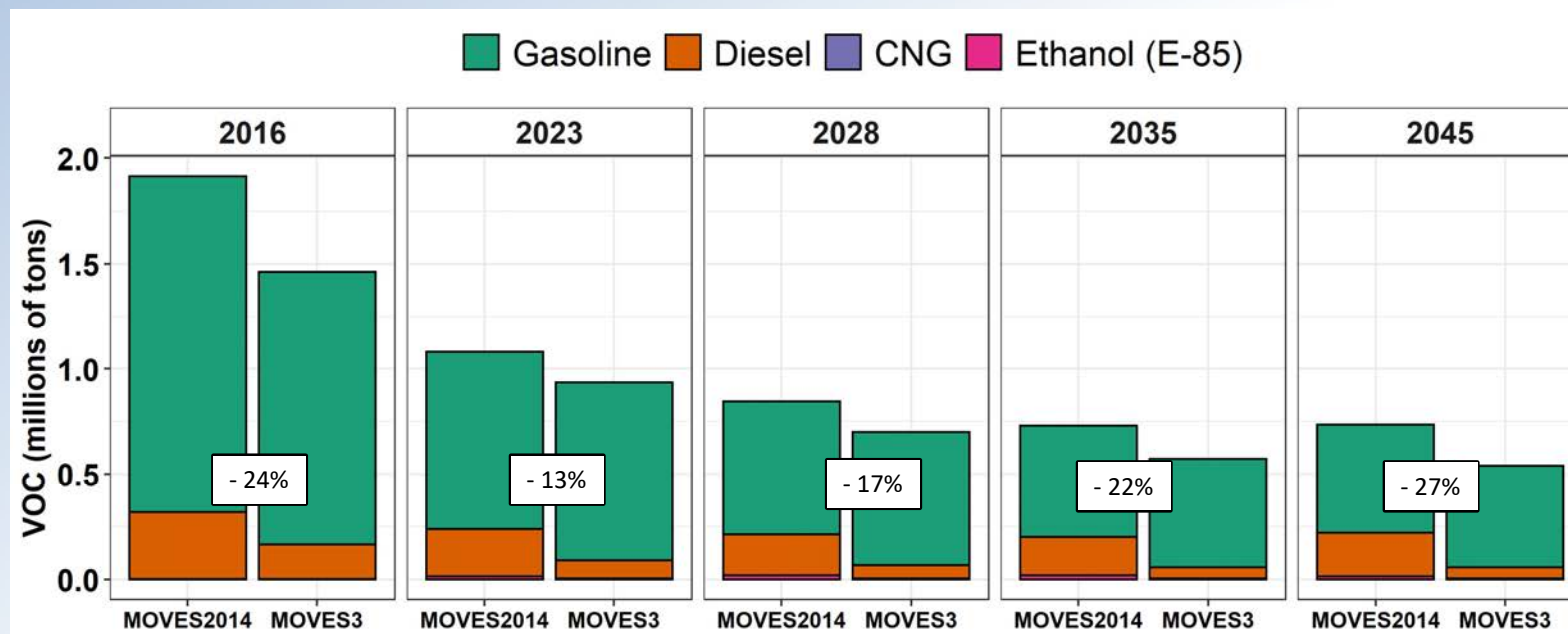
Sample Counties: Onroad PM_{2.5}

- In these counties, compared to MOVES2014b, lower PM from gasoline, lower PM from diesel (dominated by running emissions & sensitive to local fleet mix)
- Brake and tire wear emissions are unchanged, but contribute a significant fraction of future year PM



National: Onroad VOC

- Continue to see large drop in gasoline (LD) VOC with Tier 3
- Diesel declines in MOVES3 with extended idle
- Evaporative emissions are a growing fraction of future onroad VOC

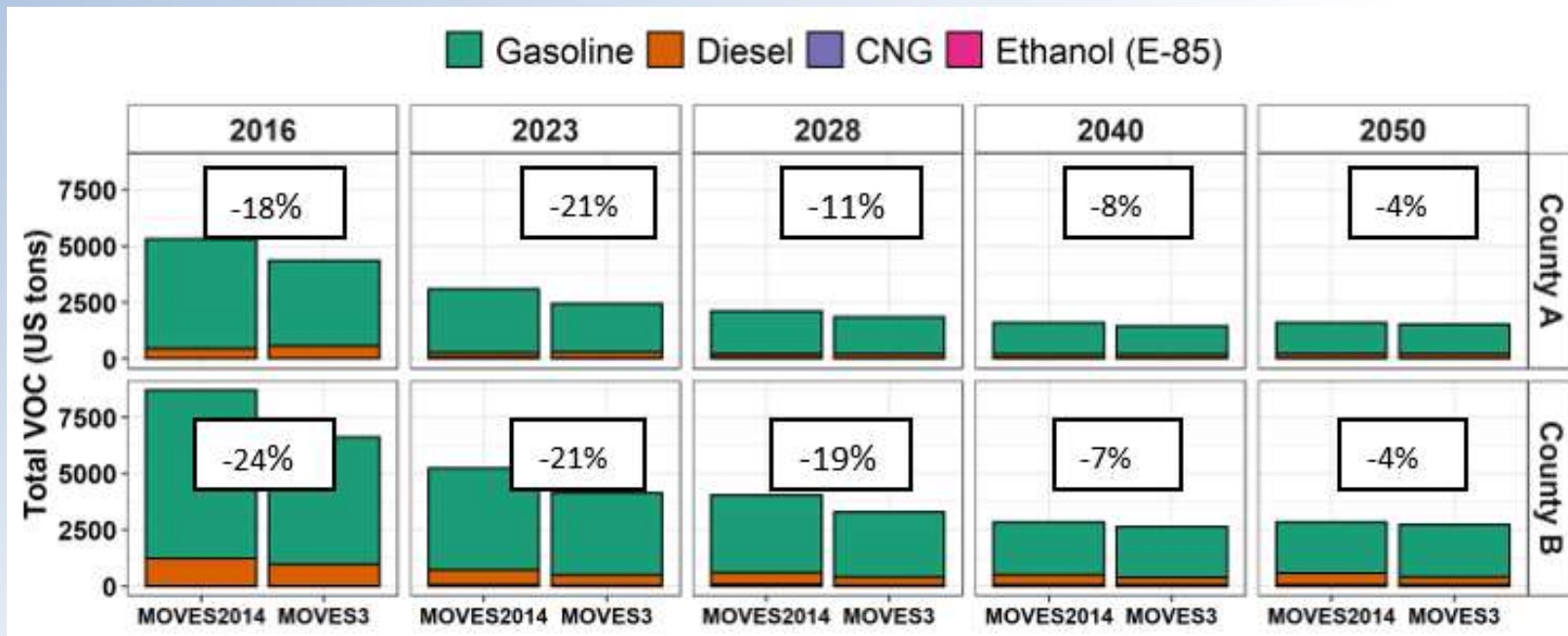


U.S. ENVIRONMENTAL PROTECTION AGENCY Call in: 202-991-0477, phone conference ID 180 213 02#

Sample Counties: Onroad VOC

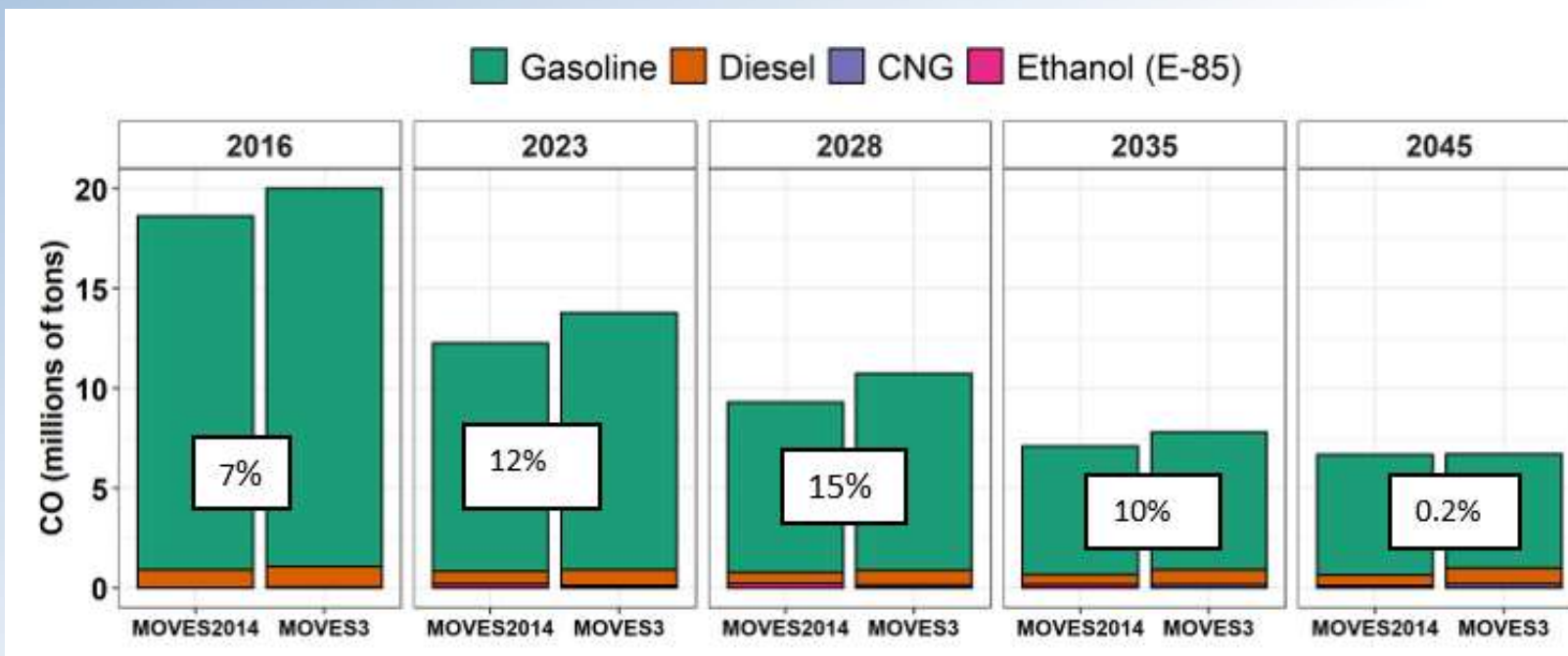
In these counties, compared to MOVES2014b:

1. Less gasoline VOC; driven by reduced start emissions
2. Similar or less diesel VOC; dominated by running emissions



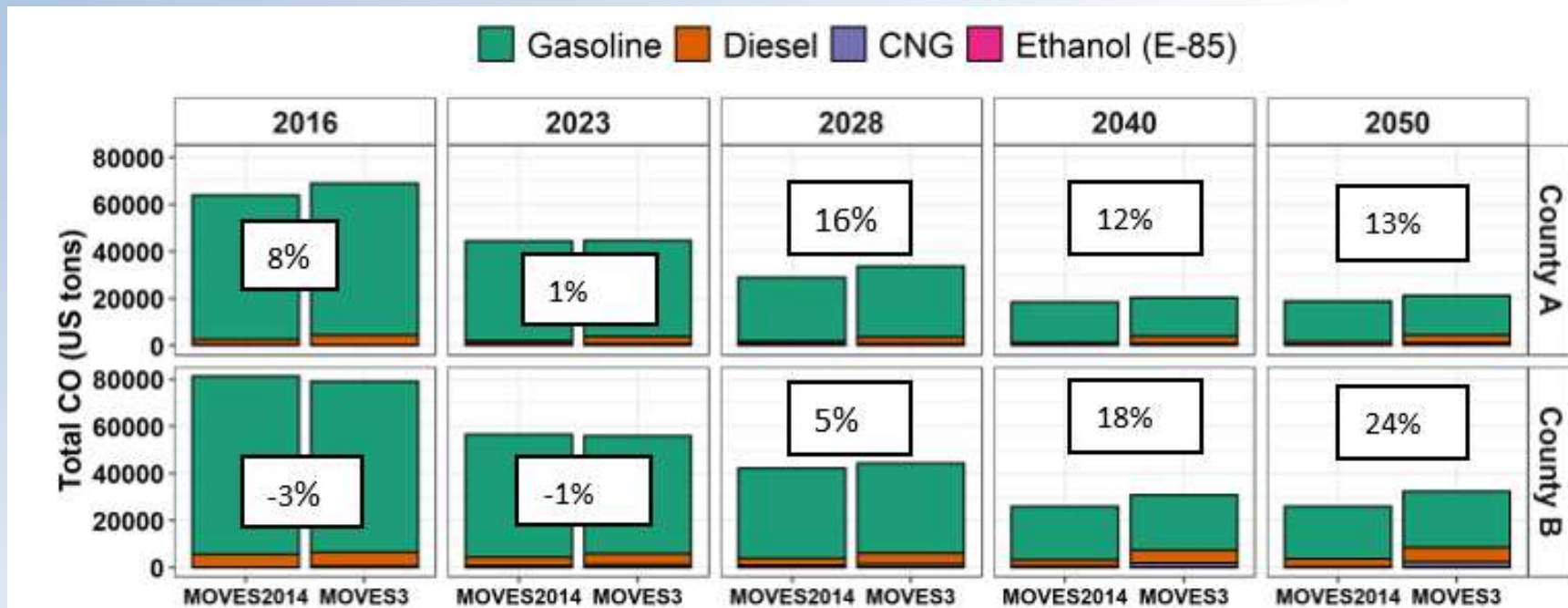
National: Onroad CO

Increases in CO are due to increased running emission rates for light-duty gasoline vehicles and heavy-duty diesel vehicles



Sample Counties: Onroad CO

- While national CO increases, County B shows CO decreases in near term
- Highlights sensitivity to local inputs



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Any questions?

