Module 2
Generating Inventories at the County Scale

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Module Overview

- Developing a County-scale RunSpec
  - Exercise: Building a county-scale MOVES RunSpec to produce an emissions inventory, including guidance for each panel
- Entering data using the County Data Manager (CDM)
  - What is the CDM and how does it work?
  - Entering local data
  - Using the AADVMT converter
  - Description/guidance for each table in the MOVES input database
- Running MOVES (Executing the RunSpec)
  - Class exercise: Run MOVES for the county inventory scenario
- Available EPA converters

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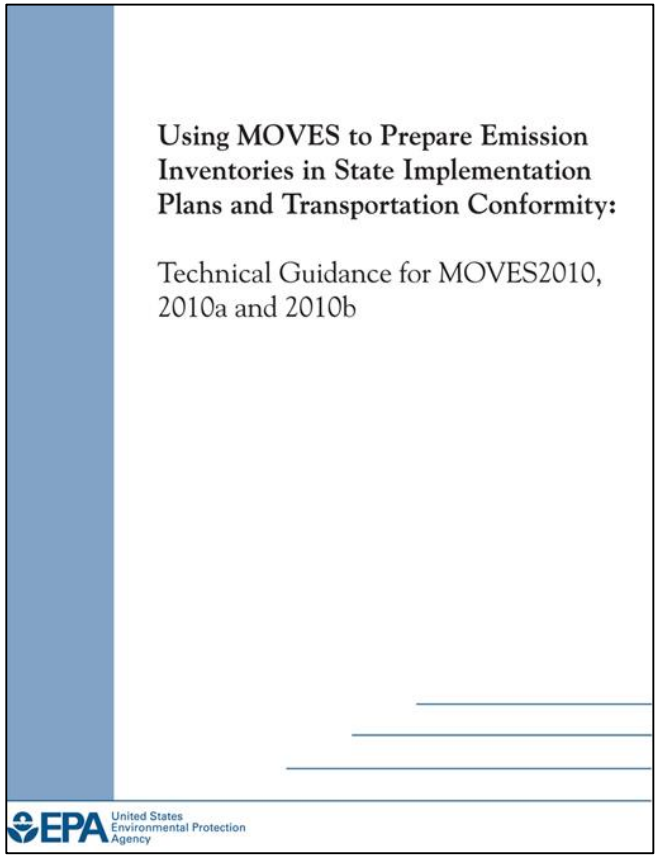
Key References

- The MOVES Technical Guidance provides guidance on use of local inputs and defaults

- Consult the MOVES User Guide for a basic reference for use of the County Data Manager

- Some input guidance is presented in this course, but refer to Technical Guidance for more detail



www.epa.gov/otaq/models/moves/index.htm

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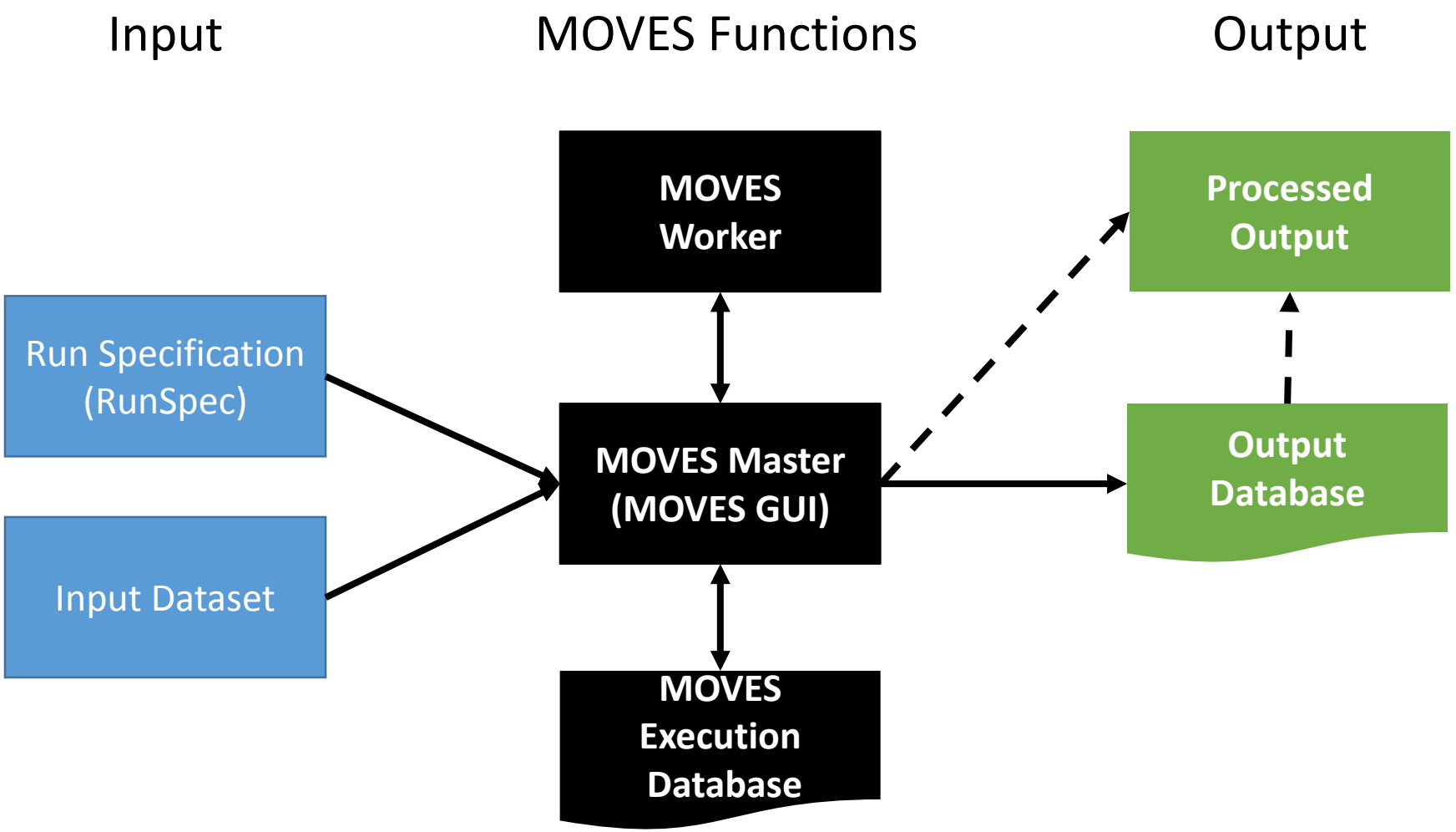
MOVES Process Overview



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Introduction to County Scale

- County Scale is required for State Implementation Plan (SIP) and Conformity analyses

- Local county-specific data must be entered when the County Scale is selected
  - You can import or export data with the County Data Manager
  - Local data should be used for most inputs
  - For some inputs, default data may not be the best or most current information; for other inputs, default data ok

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Developing a County-Scale RunSpec

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Using MOVES at the County Scale

- County scale required for SIP and conformity analyses
- County-specific data must be entered when the County scale is selected
- Data can be exported or imported with the County Data Manager (CDM)
- Local data should be used for most inputs
- Access to default data is limited

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Developing a County-scale RunSpec

- Set up the entire RunSpec file first before the county inputs are added
  - This enables the County Data Manager (CDM) to filter the default database for relevant information
  - CDM also conducts error-checks on imported data based on selections made in the RunSpec
  - Output database must be identified to store the results

- The RunSpec can only have
  - A single county selected
  - A single calendar year selected

- A County input database with local inputs must be provided (can be created/populated with CDM – more later)

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Developing a County-scale RunSpec

- Purpose:
  - Provide hands-on practice building a RunSpec and entering data for a county-scale emissions inventory run
  - Give the user knowledge of guidance related to using MOVES at the county-scale for official purposes

- NOTE: This exercise scenario is intentionally simplified to facilitate learning, limit complexity, and reduce MOVES run time. Therefore, it should **NOT** be used as an example of an official County scale run using MOVES
  - A RunSpec being constructed to calculate an inventory for a SIP or conformity analysis would have to completely address all variables as described in EPA guidance

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Exercise Overview

- Modeling one county: Lake County, Indiana
  - This is a portion of Chicago-Gary ozone nonattainment area

- Typical summer day in 2015
  - Will select month of July and model only “weekday” days, all hours to represent this typical day

- Subset of vehicle types
  - Diesel, gasoline, and ethanol (E-85) passenger cars and trucks
  - Diesel transit buses
  - Normally, all vehicle types would be selected

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Exercise Overview

- All road types
  - Urban restricted and unrestricted
  - Rural restricted and unrestricted
  - Off-network

- Total gaseous hydrocarbons, all processes
  - All processes = starts, running, evaporative, crankcase, etc.
  - One pollutant (THC) selected for training purposes; normally, more pollutants would need to be modeled for a SIP or conformity run

Developing a County-scale Runspec

- Instructions for Developing a County-scale RunSpec:
  - If you've closed MOVES, open MOVES2014 by double-clicking the "MOVES2014 Master" icon

  - If MOVES is open, click *File* on the menu bar and click *New…* in the dropdown menu to start building a new RunSpec (and close any current RunSpec)
  - Click *No* when prompted to save the existing RunSpec

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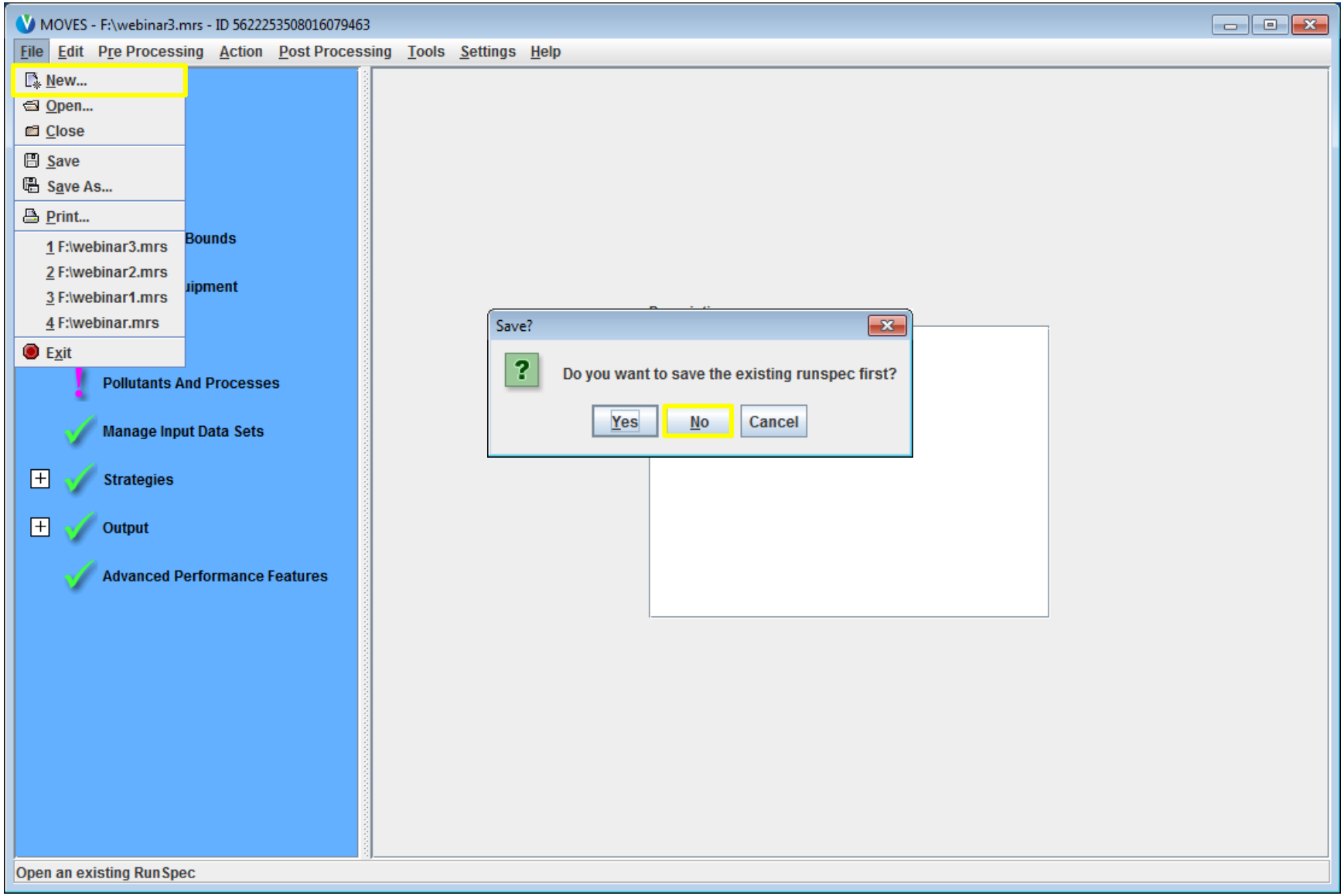
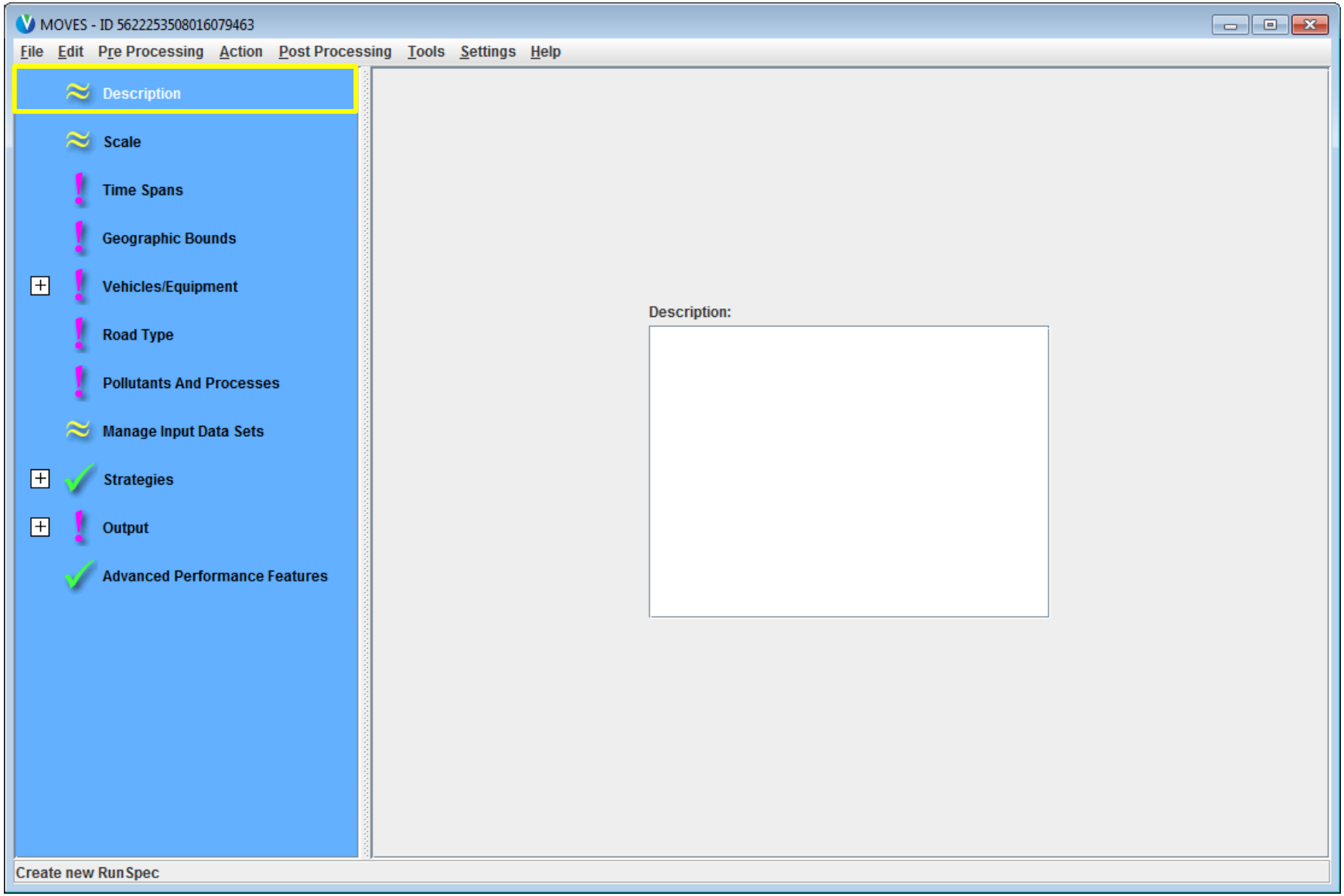
File, New… to start a new RunSpec



Description Panel



Description Panel

- Allows the user to describe the RunSpec
  - Include details like location, time period, pollutant type, or whatever else is unique about the run
  - Up to 5,000 characters of text, but no quotation marks, ampersand or backslash characters allowed
  - Description appears in the MOVESRun table of the output database
  - Description is optional but useful to keep track of runs

- Instructions for Developing a County-scale RunSpec:
  - Type, “Lake County July 2015 Inventory Training RunSpec”

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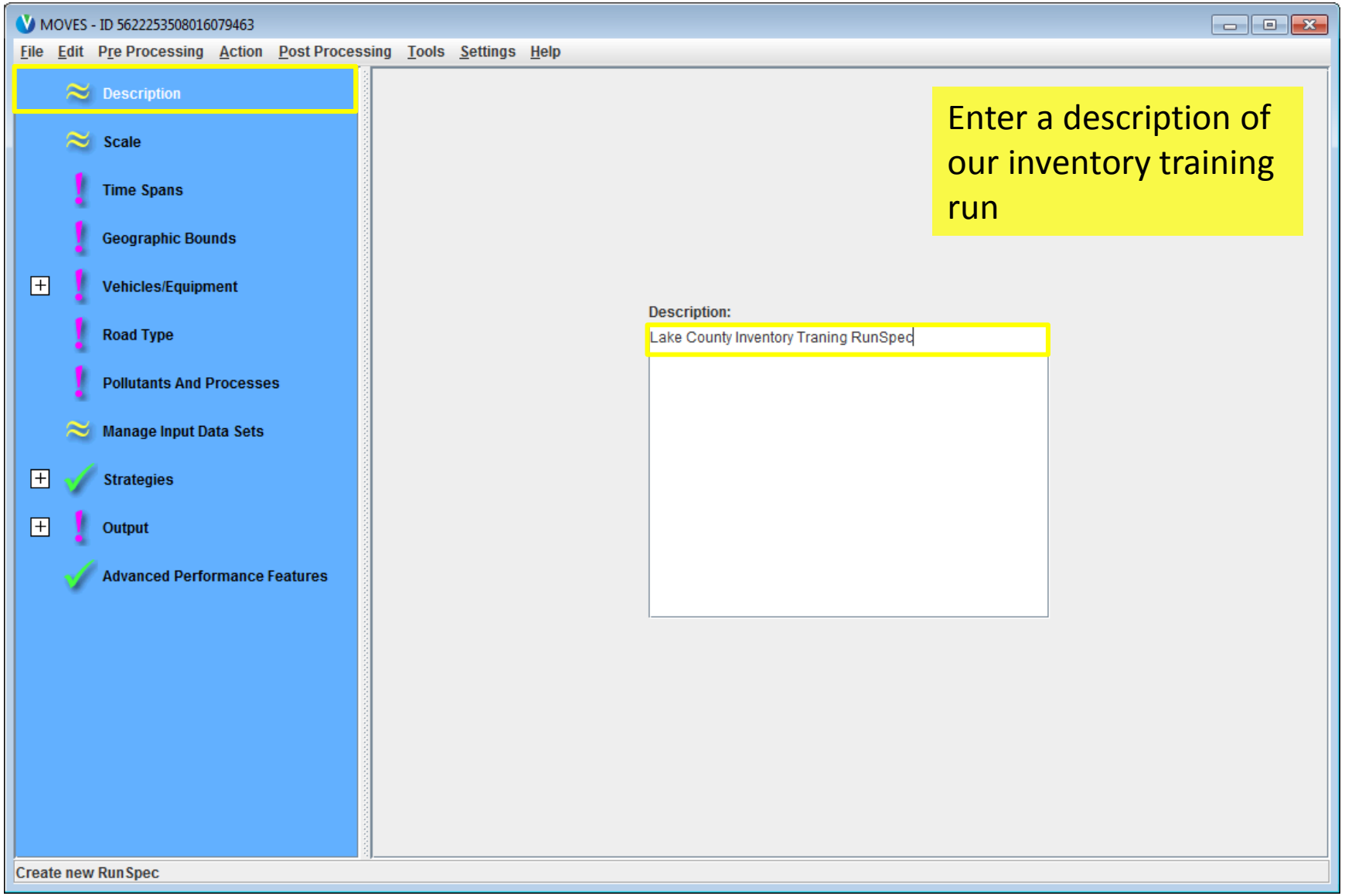
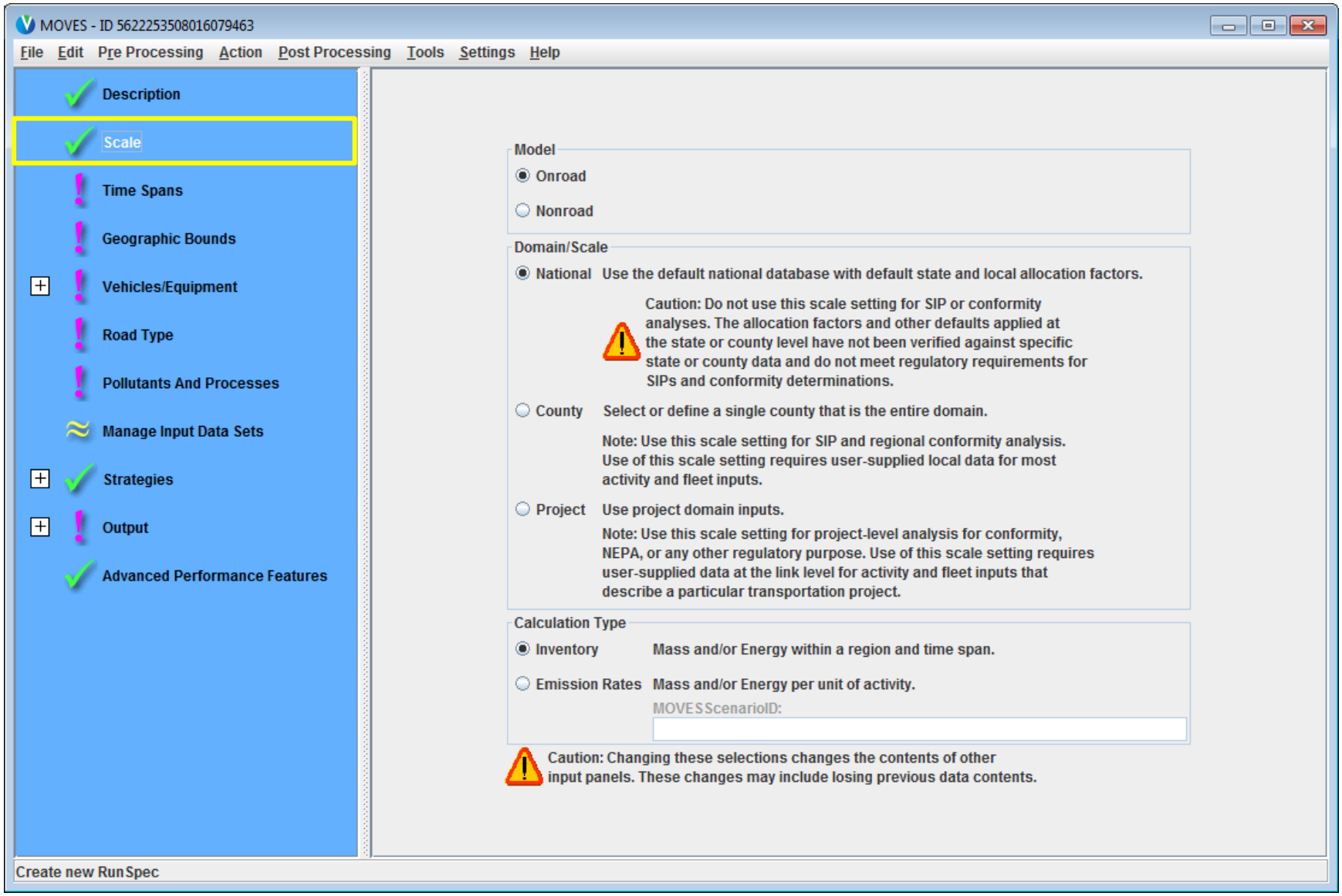
Description Panel



Scale Panel


MOVES - ID 5622253508016079463
File Edit Pre Processing Action Post Processing Tools Settings Help
Description
Scale
Time Spans
Geographic Bounds
Vehicles/Equipment
Road Type
Pollutants And Processes
Manage Input Data Sets
Strategies
Output
Advanced Performance Features
Model
Onroad
Nonroad
Domain/Scale
National Use the default national database with default state and local allocation factors.
Caution: Do not use this scale setting for SIP or conformity analyses. The allocation factors and other defaults applied at the state or county level have not been verified against specific state or county data and do not meet regulatory requirements for SIPs and conformity determinations.
County Select or define a single county that is the entire domain.
Note: Use this scale setting for SIP and regional conformity analysis. Use of this scale setting requires user-supplied local data for most activity and fleet inputs.
Project Use project domain inputs.
Note: Use this scale setting for project-level analysis for conformity, NEPA, or any other regulatory purpose. Use of this scale setting requires user-supplied data at the link level for activity and fleet inputs that describe a particular transportation project.
Calculation Type
Inventory Mass and/or Energy within a region and time span.
Emission Rates Mass and/or Energy per unit of activity.
MOVESScenarioID:
Caution: Changing these selections changes the contents of other input panels. These changes may include losing previous data contents.
Create new RunSpec

Scale Panel: Inventory Guidance

- Domain/Scale
  - County scale must be used for SIPs or transportation conformity analyses
  - NOTE: National scale relies on national defaults and allocation factors that are not appropriate for regulatory purposes

- Calculation Type
  - Either *Inventory* or *Emission Rates* options may be used for SIPs or transportation conformity analyses
  - Both methods can give the equivalent results, but post-processing errors are more common when using emission rates
  - It is best to use the same approach to compare two or more cases
    - Base year and attainment year
    - Budget and regional conformity analysis
  - Use interagency consultation process to agree upon a common approach or to minimize differences in results if different approaches are used

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Scale Panel

- Instructions for Developing a County-scale RunSpec:
  - Model: Select *Onroad*
  - Domain/Scale: Select *County*
  - Calculation Type: Select *Inventory*

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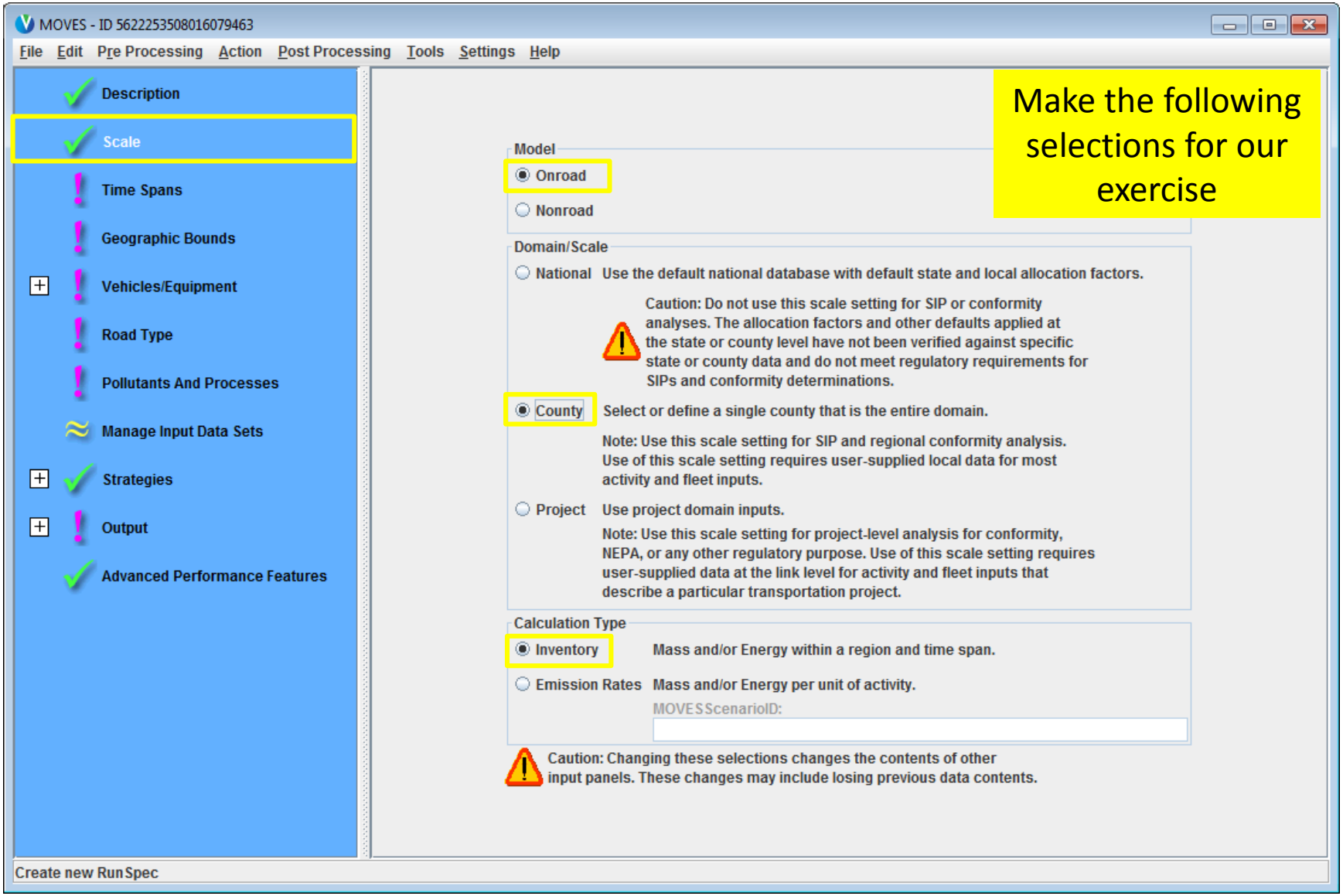
Scale Panel


MOVES - ID 5622253508016079463
File Edit Pre Processing Action Post Processing Tools Settings Help
Description
Scale
Time Spans
Geographic Bounds
Vehicles/Equipment
Road Type
Pollutants And Processes
Manage Input Data Sets
Strategies
Output
Advanced Performance Features
Make the following selections for our exercise
Model
Onroad
Nonroad
Domain/Scale
National Use the default national database with default state and local allocation factors.
Caution: Do not use this scale setting for SIP or conformity analyses. The allocation factors and other defaults applied at the state or county level have not been verified against specific state or county data and do not meet regulatory requirements for SIPs and conformity determinations.
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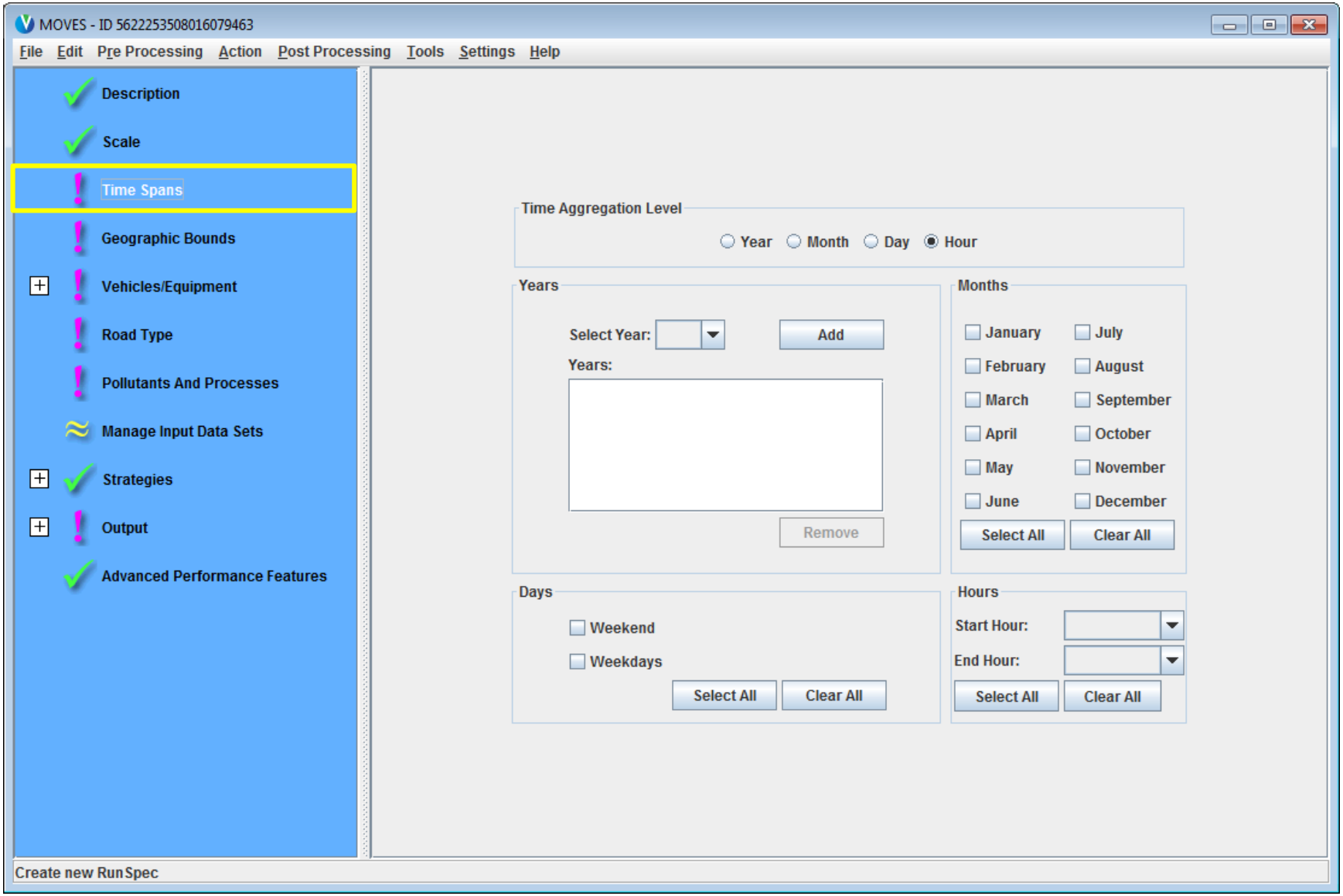
Emission Rates Mass and/or Energy per unit of activity.
MOVESScenarioID:
Caution: Changing these selections changes the contents of other input panels. These changes may include losing previous data contents.
Create new RunSpec

Time Spans Panel



Time Spans Panel

- For all regulatory purposes
  - Time Aggregation Level should be set to Hour
  - All hours should be selected
  - Only one calendar year can be selected

- Consult with EPA and the MOVES Technical Guidance to determine the appropriate year, month(s), and type of day(s)
  http://www.epa.gov/otaq/models/moves/#sip

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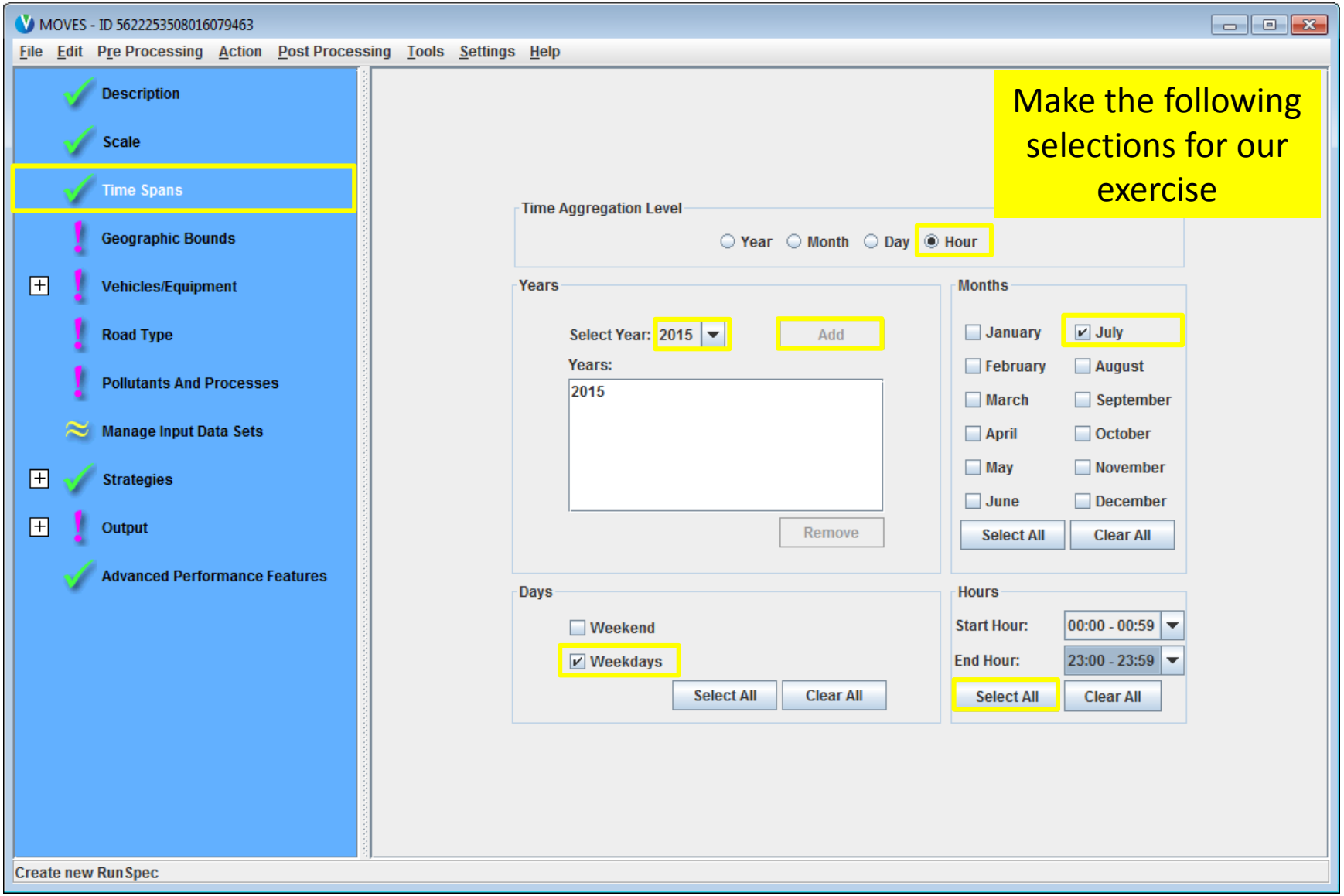
Time Spans Panel

- Instructions for Developing a County-scale RunSpec:

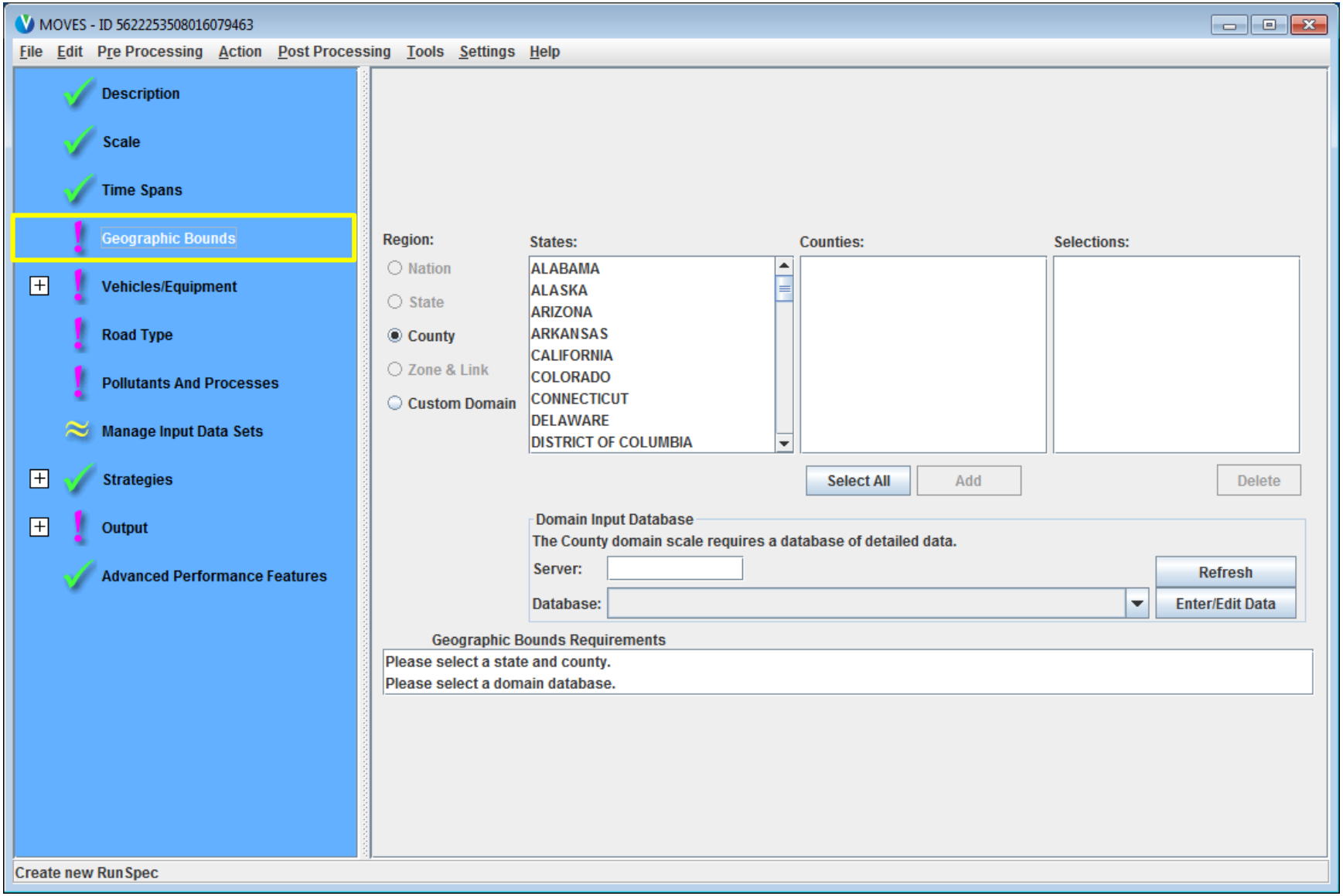
  Make the following selections for our exercise

  - Time Aggregation Level: Hour
  - Years: 2015
  - Days: Weekdays
  - Months: July
  - Hours: Select All

Time Spans Panel



Geographic Bounds Panel



Geographic Bounds Panel

- Once you have selected the County scale, you may
  - Choose a single county from the list or
  - Create a Custom Domain (will cover later in course)

- Choosing a county accesses the available default data stored for that county

- The Enter/Edit Data button in the Domain Input Database portion of the panel opens the County Data Manager
  - A County database must be created or selected to store the county specific data (done later)

- Will show ✓ after County database has been provided

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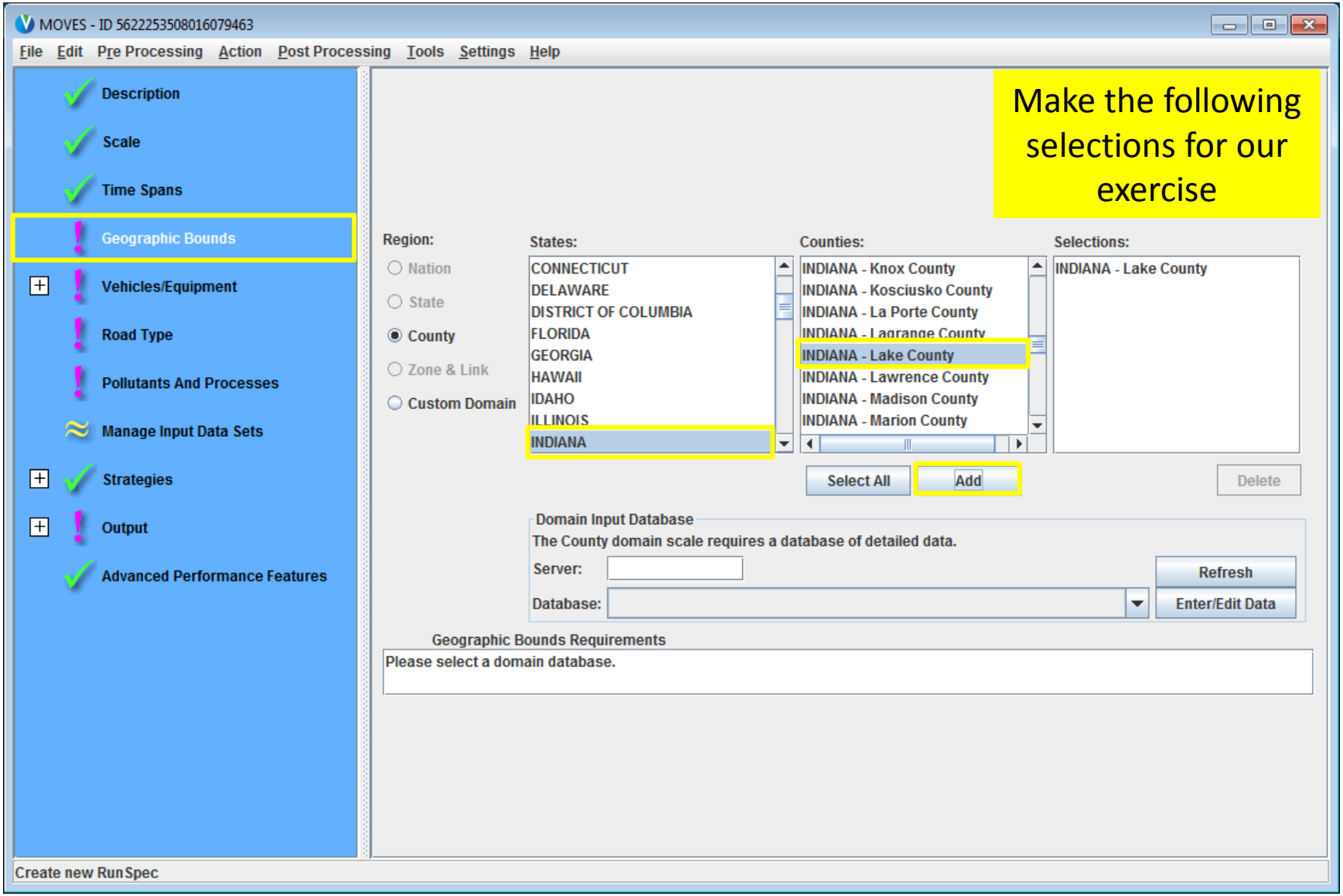
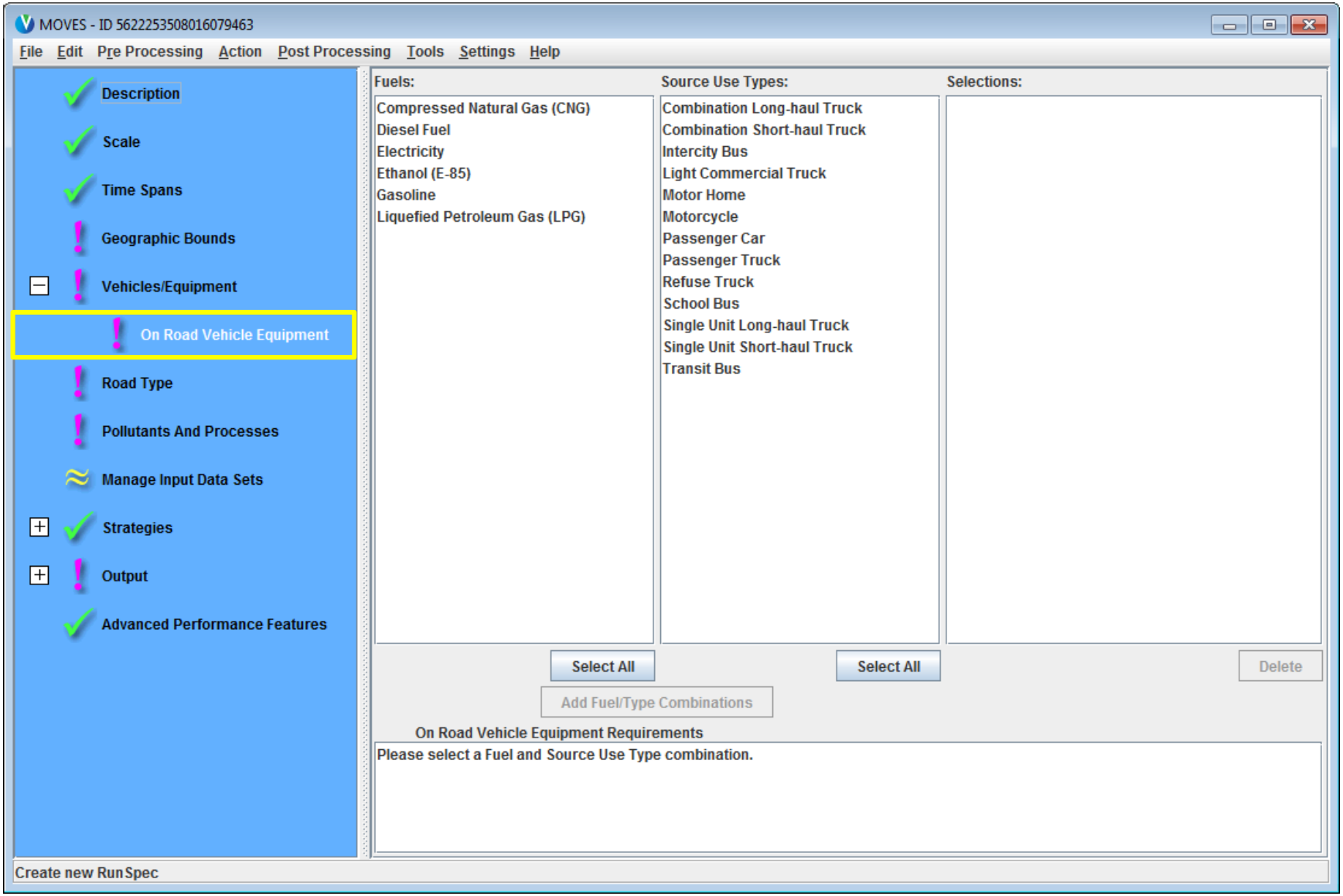
Geographic Bounds Panel



On Road Vehicle Equipment Panel



On Road Vehicle Equipment Panel

For **most** analyses, select all valid **gasoline, ethanol, diesel, and CNG** vehicle combinations

- Invalid combinations: diesel motorcycle, gasoline long-haul combination truck, and gasoline intercity bus

When transit buses are selected, default database allocates some VMT to Compressed Natural Gas (CNG) transit buses

- Therefore, users should either select the CNG transit bus vehicle combination; or
- Edit the AVFT table in the CDM so that no VMT is allocated to CNG buses.
- If one of these approaches is not used, some VMT assigned to buses (HPMS class 40) will be "lost"
- We will cover this more when discussing the CDM

On Road Vehicle Equipment Panel

Instructions for Developing a County-scale RunSpec:

- Select
  - Fuels: Diesel Fuel, Ethanol (E-85), and Gasoline
  - Source Use Types: Select Light Commercial Truck, Passenger Car, Passenger Truck
- Click Add Fuel/Type Combinations

- Also select
  - Fuels: Diesel Fuel
  - Source Use Type: Transit Bus
- Click Add Fuel/Type Combinations

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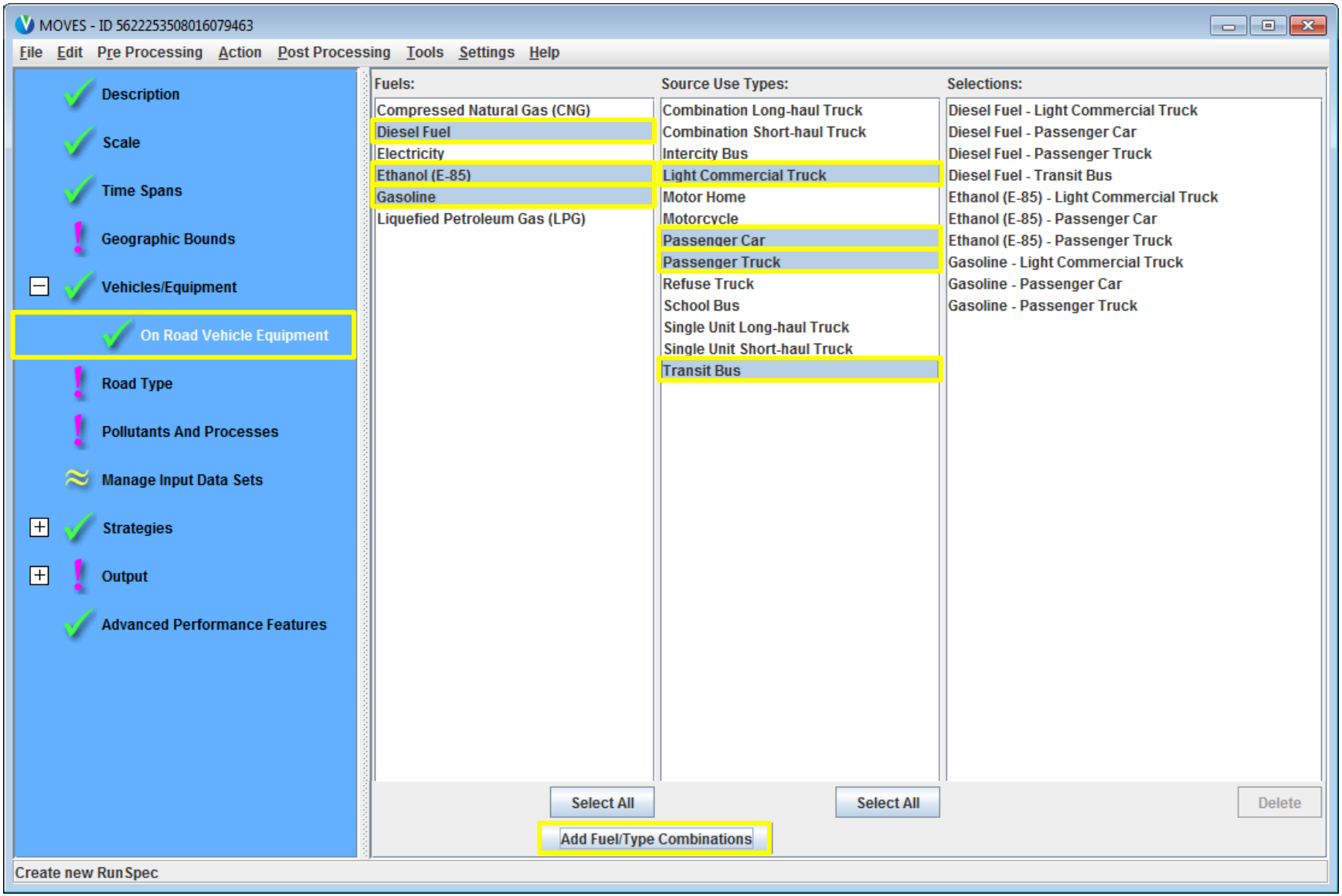
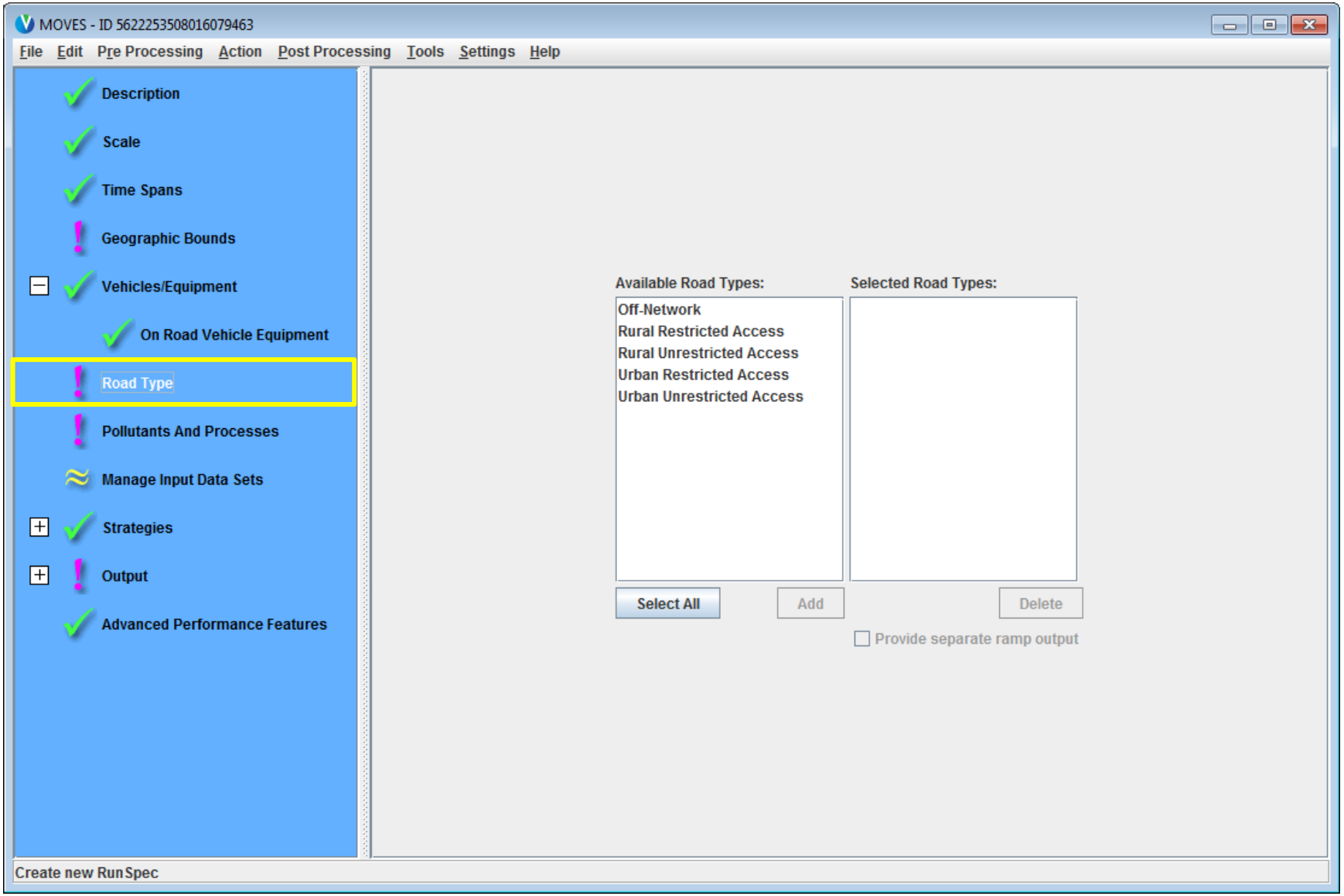
On Road Vehicle Equipment Panel



Road Type Panel



Road Type Panel

- Generally recommended to select all road types in RunSpec
  - RoadTypeDistribution table in CDM can be used to allocate VMT to the various road types
- Off-network road type captures start, hotelling, and resting evaporative emissions
  - Running evaporative emissions occur on the normal road types
- Some pollutant-process selections automatically select certain road types
- A restricted road type must be selected for the Ramp Fraction tab to appear in the CDM

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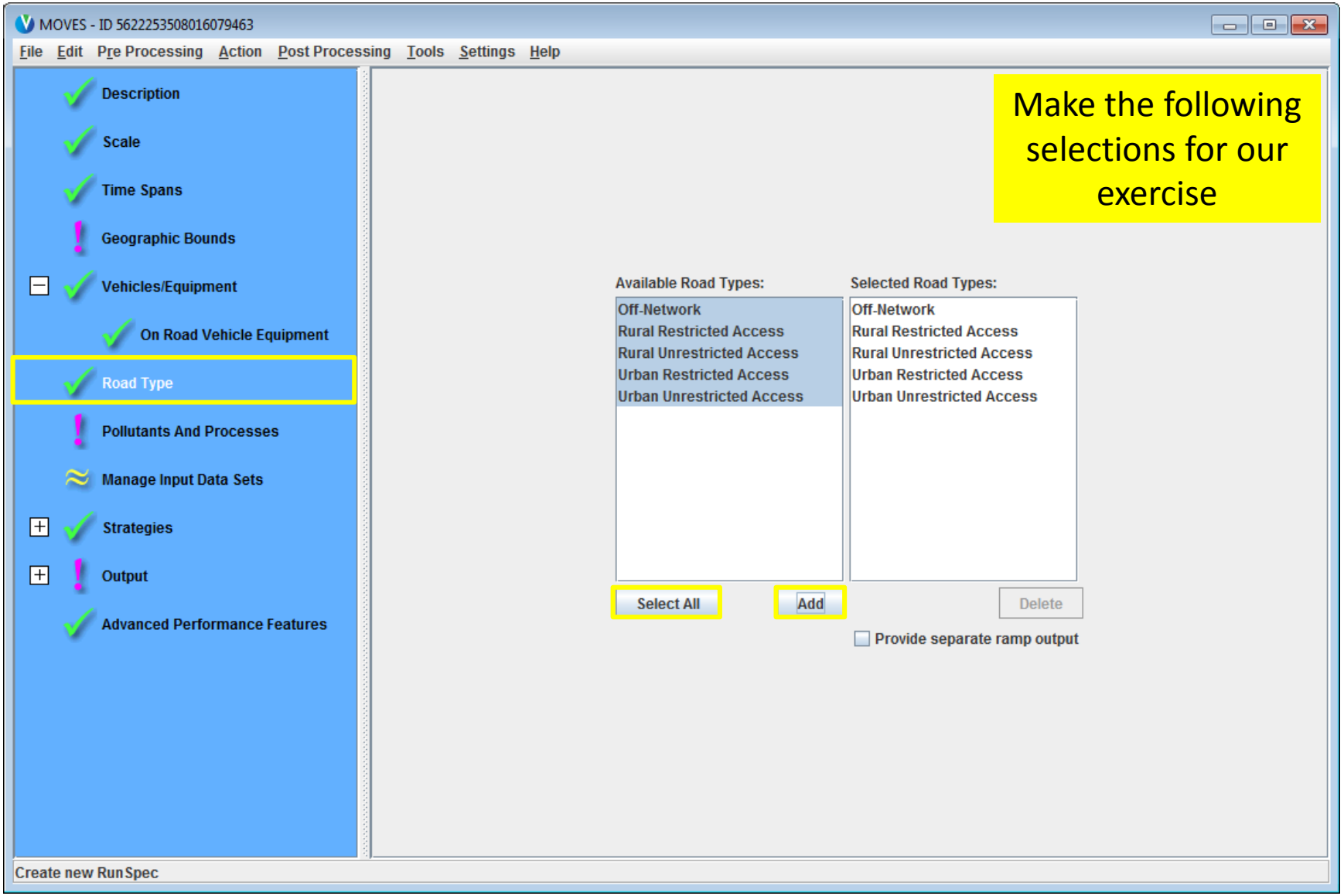
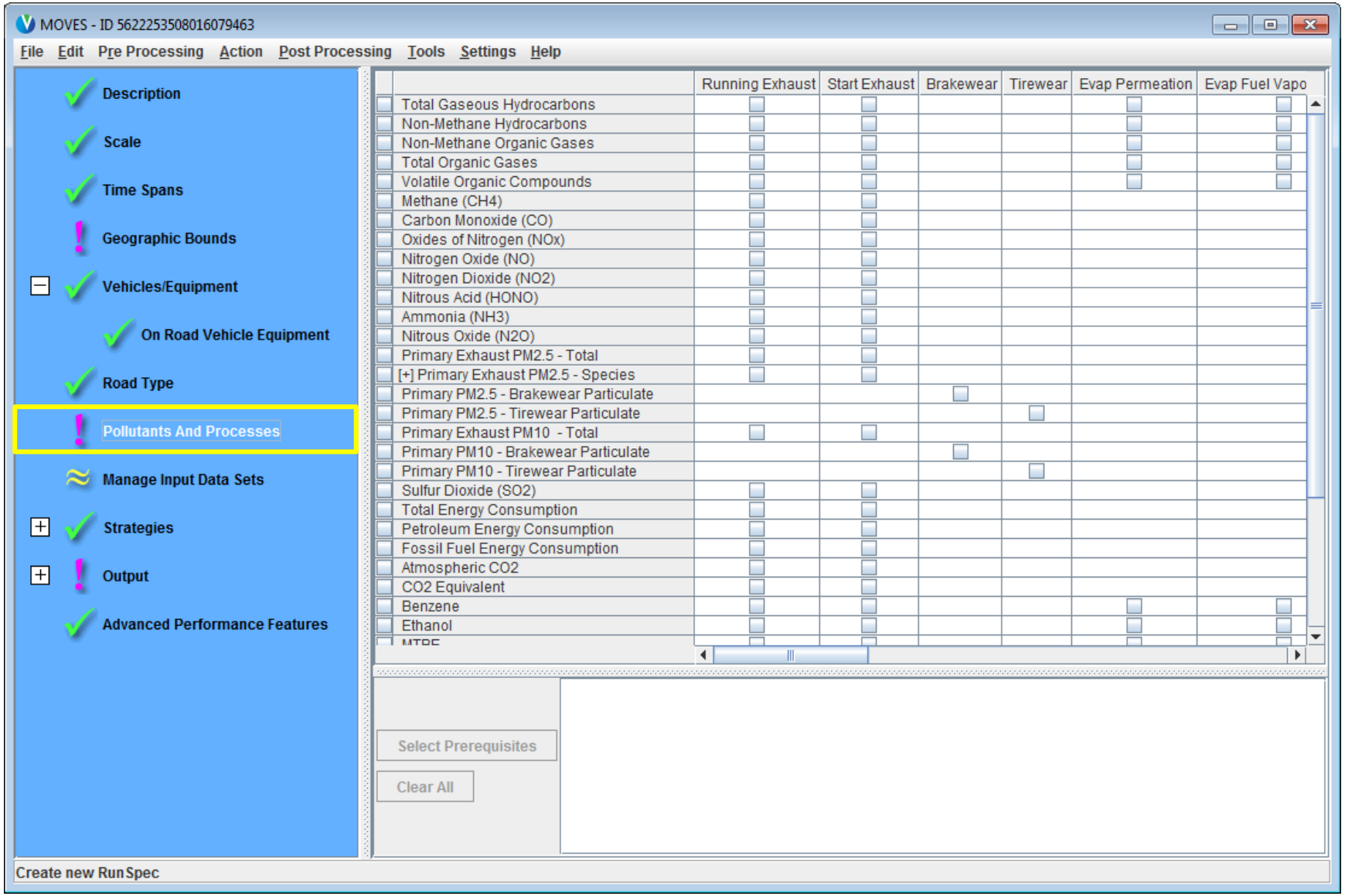
Road Type Panel



Pollutants and Processes Panel



Pollutants and Processes Panel

- Consult the MOVES Technical Guidance to determine the pollutants and processes that should be modeled
  - Varies based on purpose of modeling (e.g., What public health standard has been violated? What demonstration is being made?)
  - For SIP/conformity analyses, select all processes associated with a given pollutant
  - Extra pollutants/processes will increase run-time

- Box to the left of the pollutant name has two uses
  - Selects all processes for a pollutant if no processes have been selected for that pollutant; or
  - Unselects all processes for a pollutant if any processes have been selected for that pollutant.

- Some pollutants and processes are “chained”

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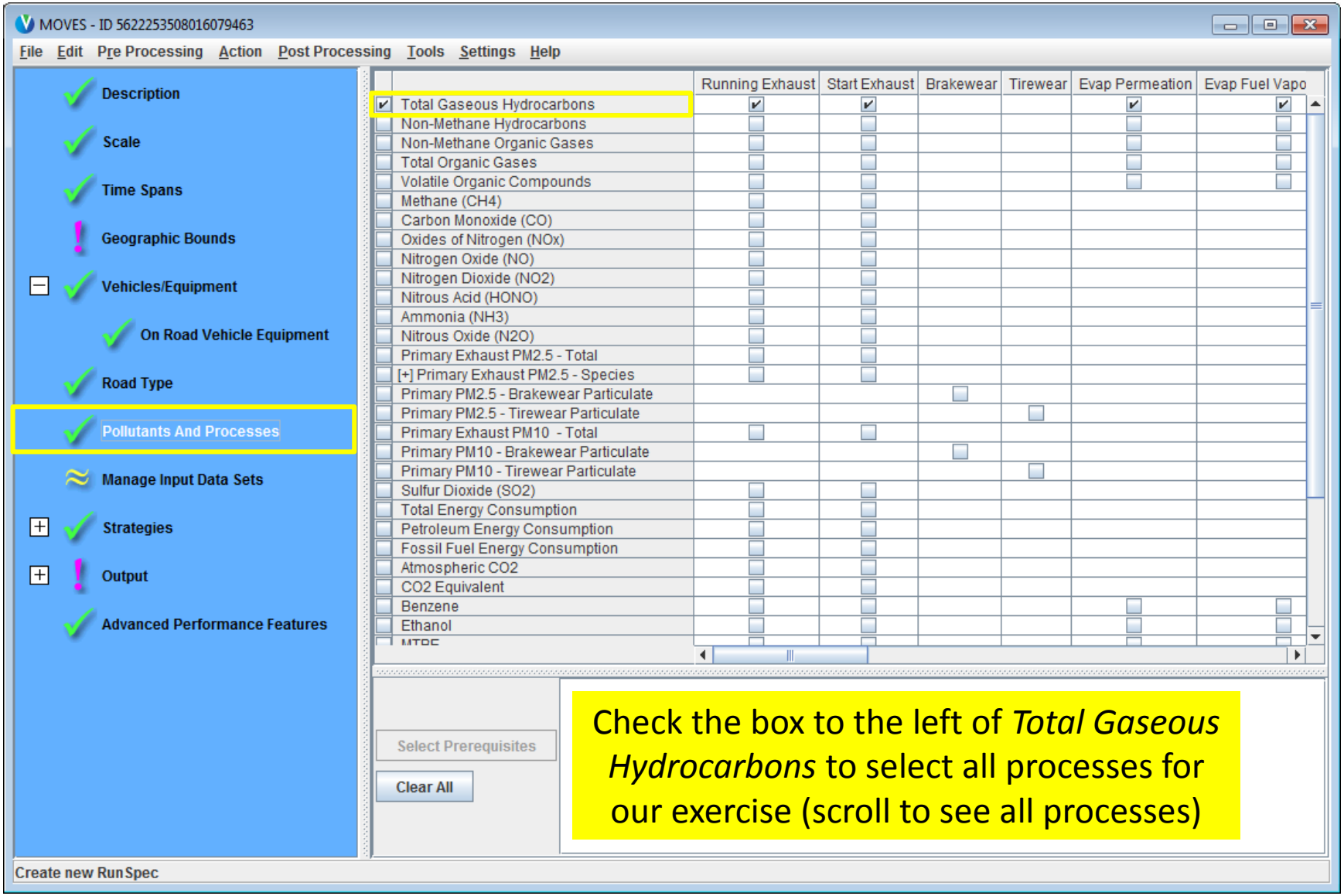
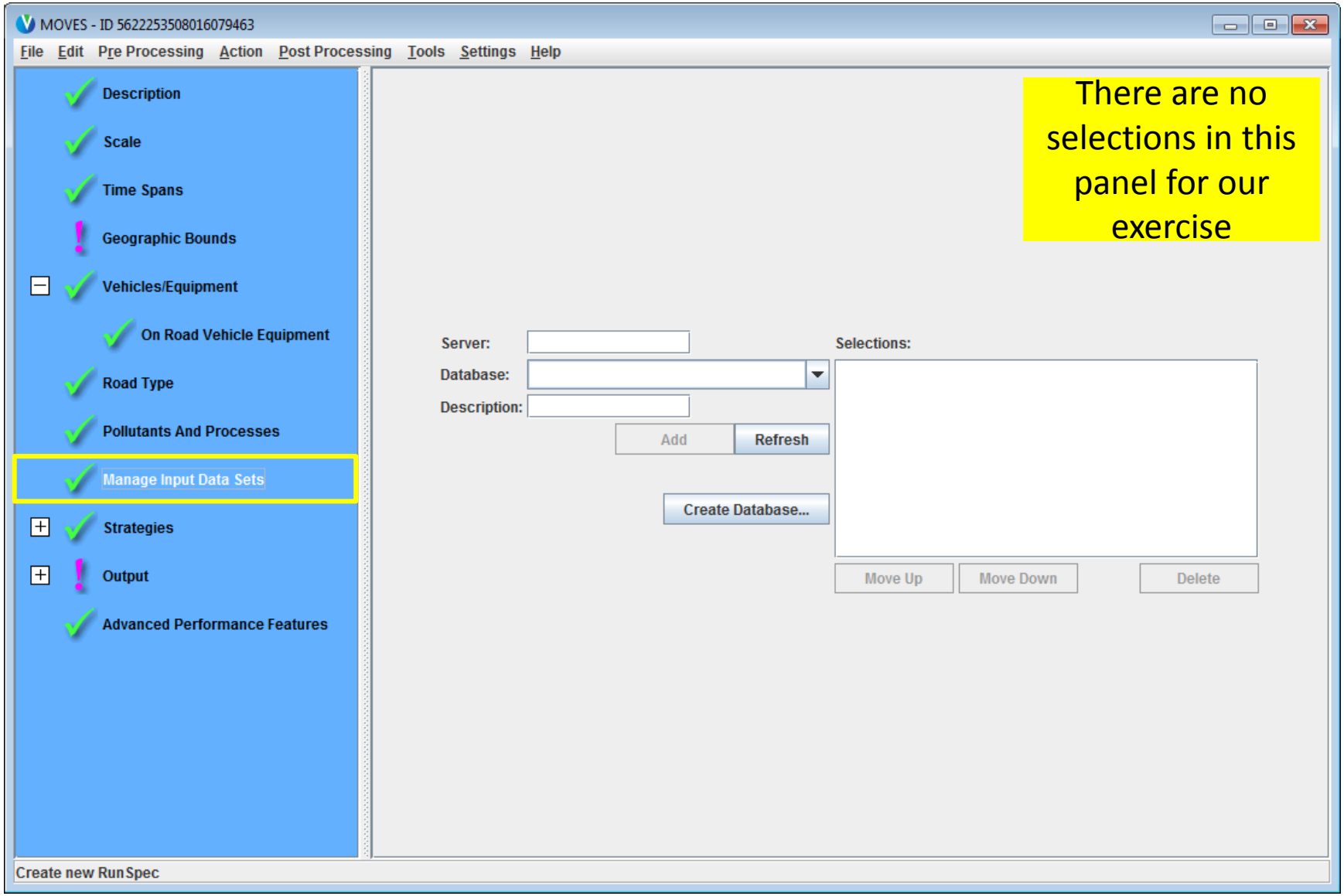
Pollutants and Processes Panel



Manage Input Data Sets Panel

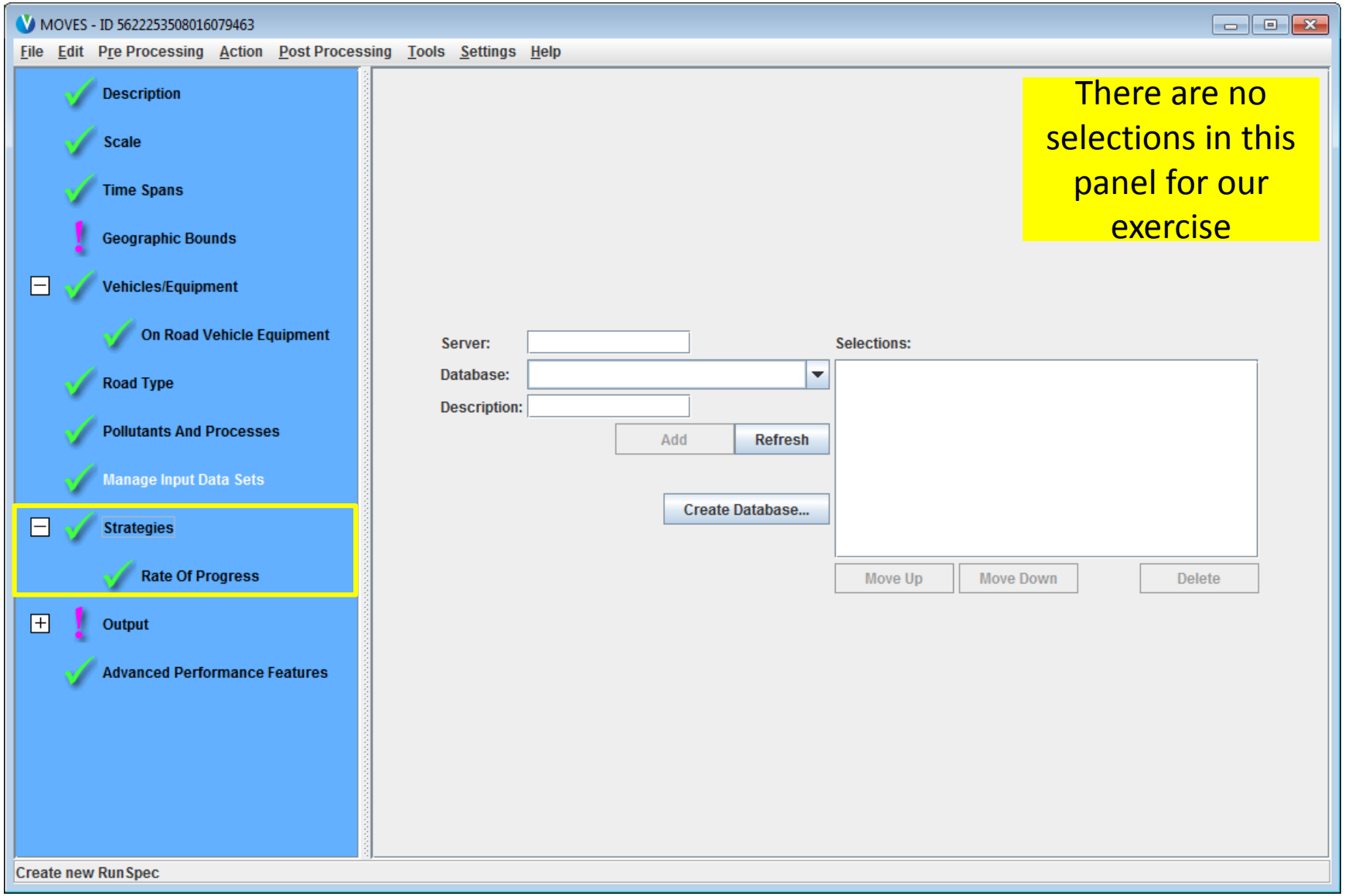


Strategies Panel (Rate Of Progress)

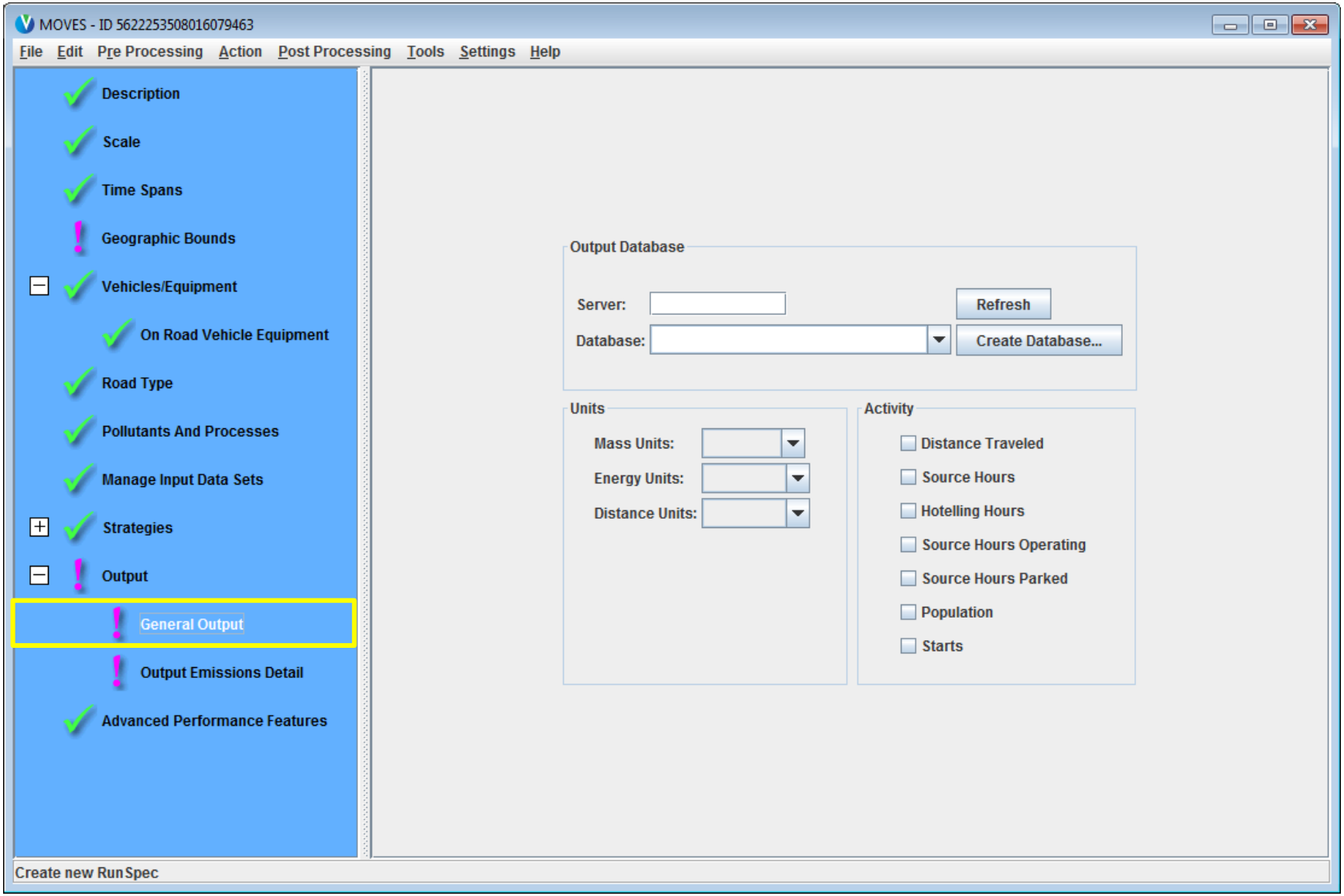
- The Rate of Progress panel (ROP) allows users to identify the RunSpec as an "rate of progress run", which will estimate emissions using the assumption that the 1990 Clean Air Act Amendments had not been implemented

- Note: Earlier versions of MOVES included panels here called Alternative Vehicle and Fuels Technology (AVFT) and Retrofit Data. These inputs have been moves into the CDM.

Strategies Panel (Rate Of Progress)



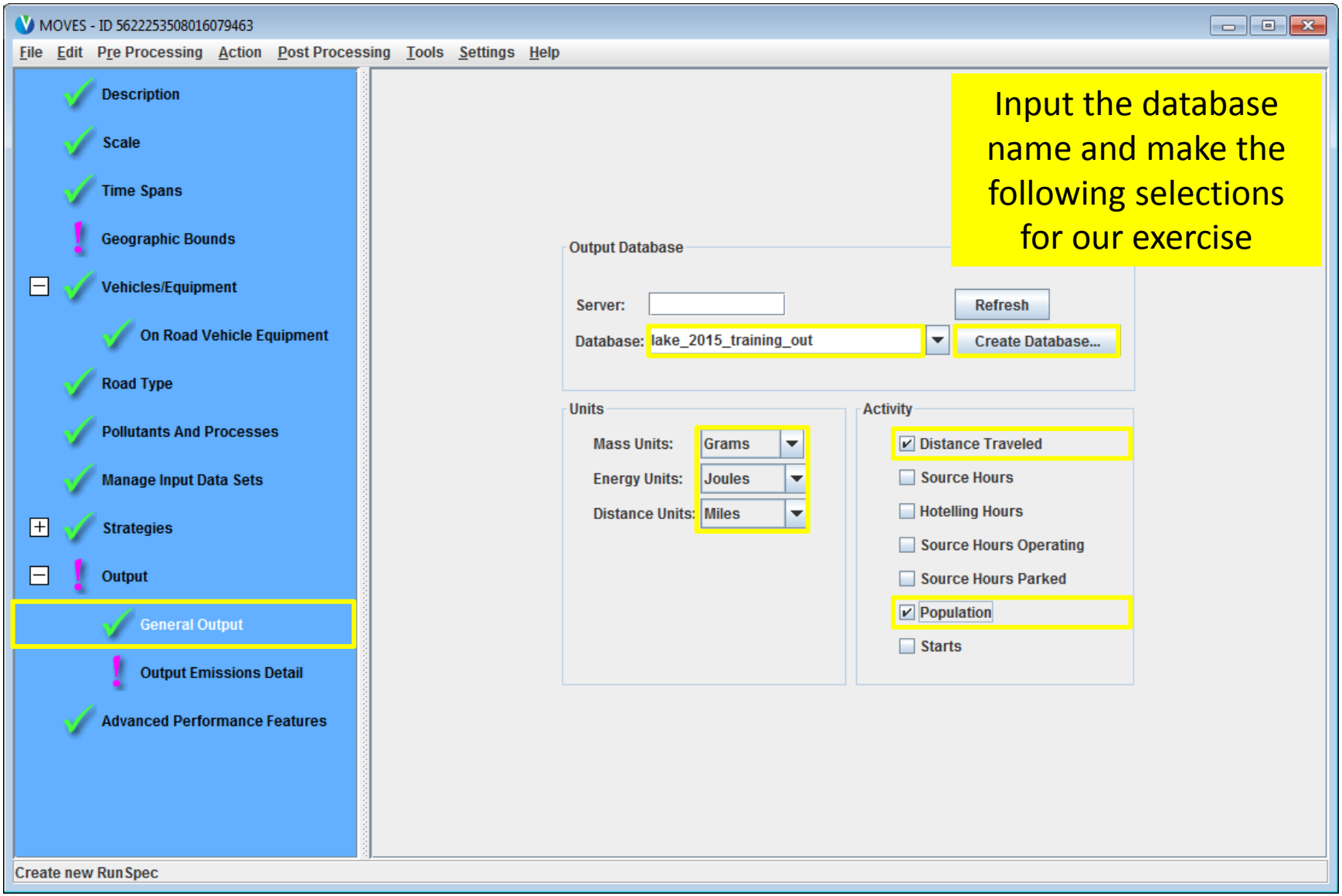
Output Panel (General Output)



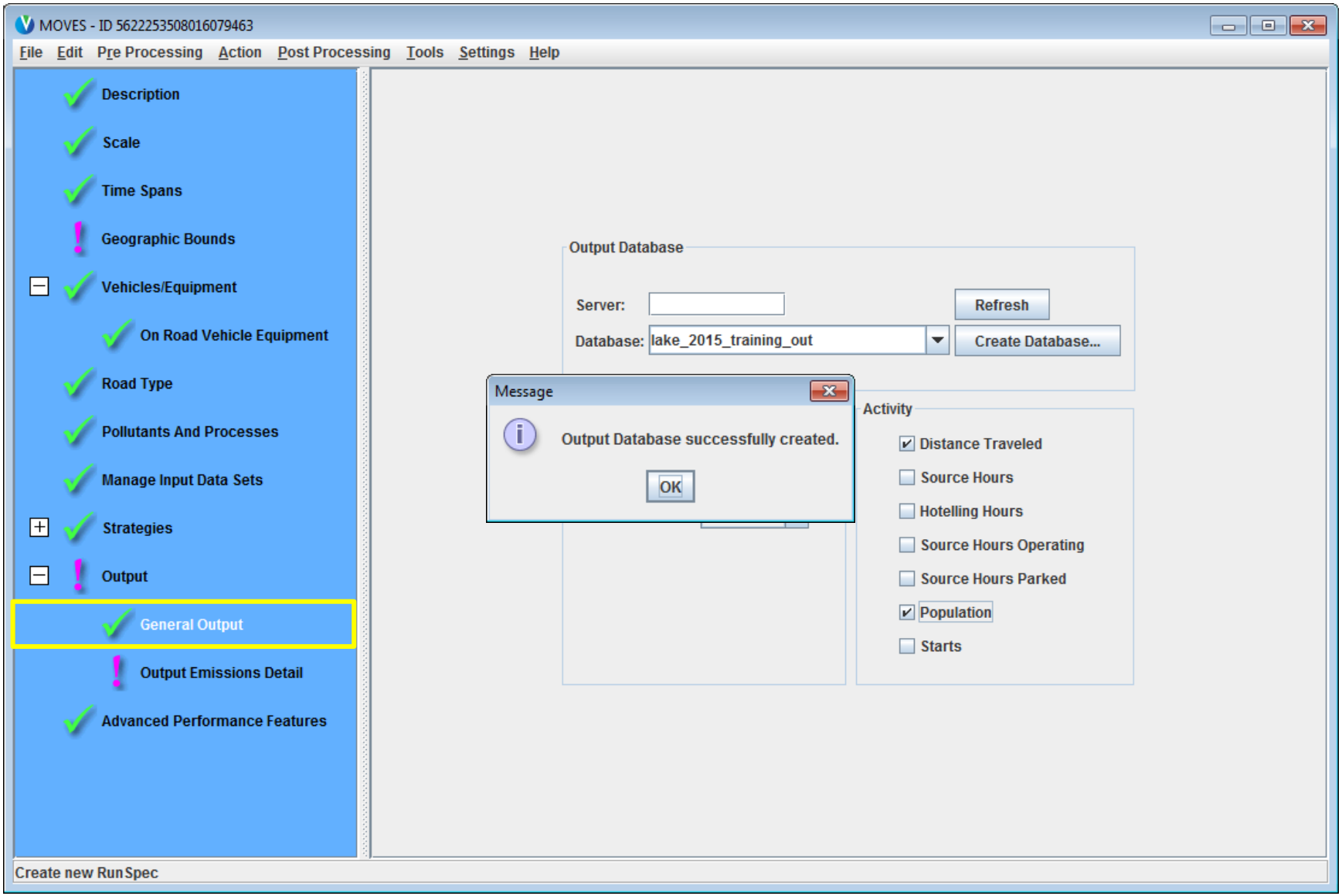
Output Panel (General Output)

- User must identify the output database
  - Best practice is to name output databases ending with "_out"
  - Manually create the database if it doesn't already exist
  - Multiple RunSpecs can be stored in the same database
    - Different RunSpecs will be identified by different MOVESrunID's
    - Generally, there should be a reason to have multiple RunSpecs in the same output database (e.g., each run is a county in a nonattainment area and the results will later be summed)
- Units must be selected
- Activity output selections are optional
  - Selecting "Distance Traveled" and "Population" is recommended
  - Selecting any of the other options is entirely up to the user

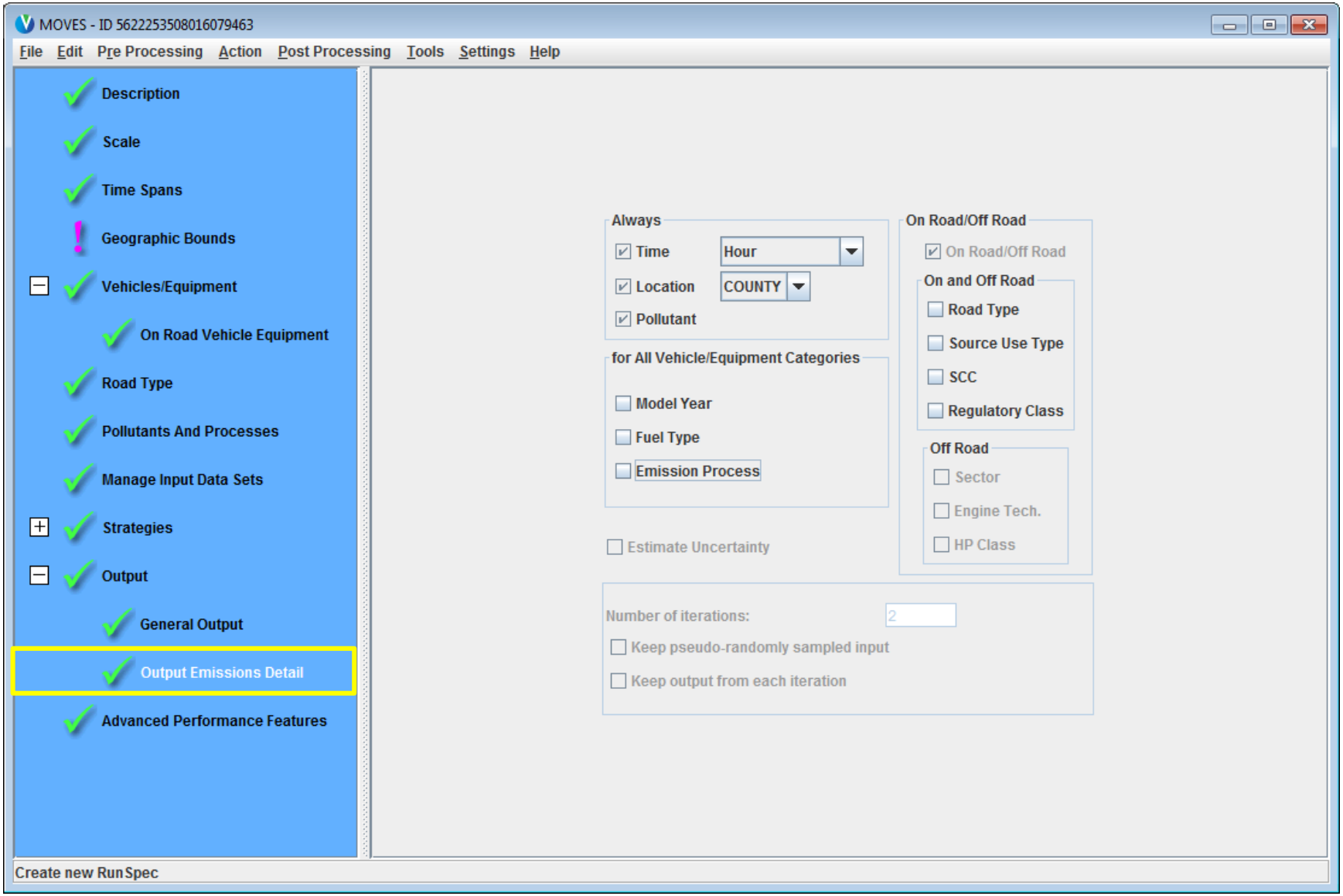
Output Panel (General Output)



Output Panel (General Output)



Output Panel (Output Emission Detail)



Output Panel (Output Emission Detail)

- The aggregation of the Time level is up to the user
  - Generally *Hour* or *24-Hour Day* are recommended, but if *24-Hour Day* is selected detail at the Hour level will be lost
  - If *Hour* or *24-Hour Day* are selected, results must be properly weighted if emissions for longer timeframes are estimated
- At County Scale, selecting Location of *County* is recommended
- The 'for All Vehicle/Equipment Categories' and 'On Road' selections depend on the detail desired by the user
  - More selections means more detail
  - Differentiation by Source (vehicle) Type is likely most useful

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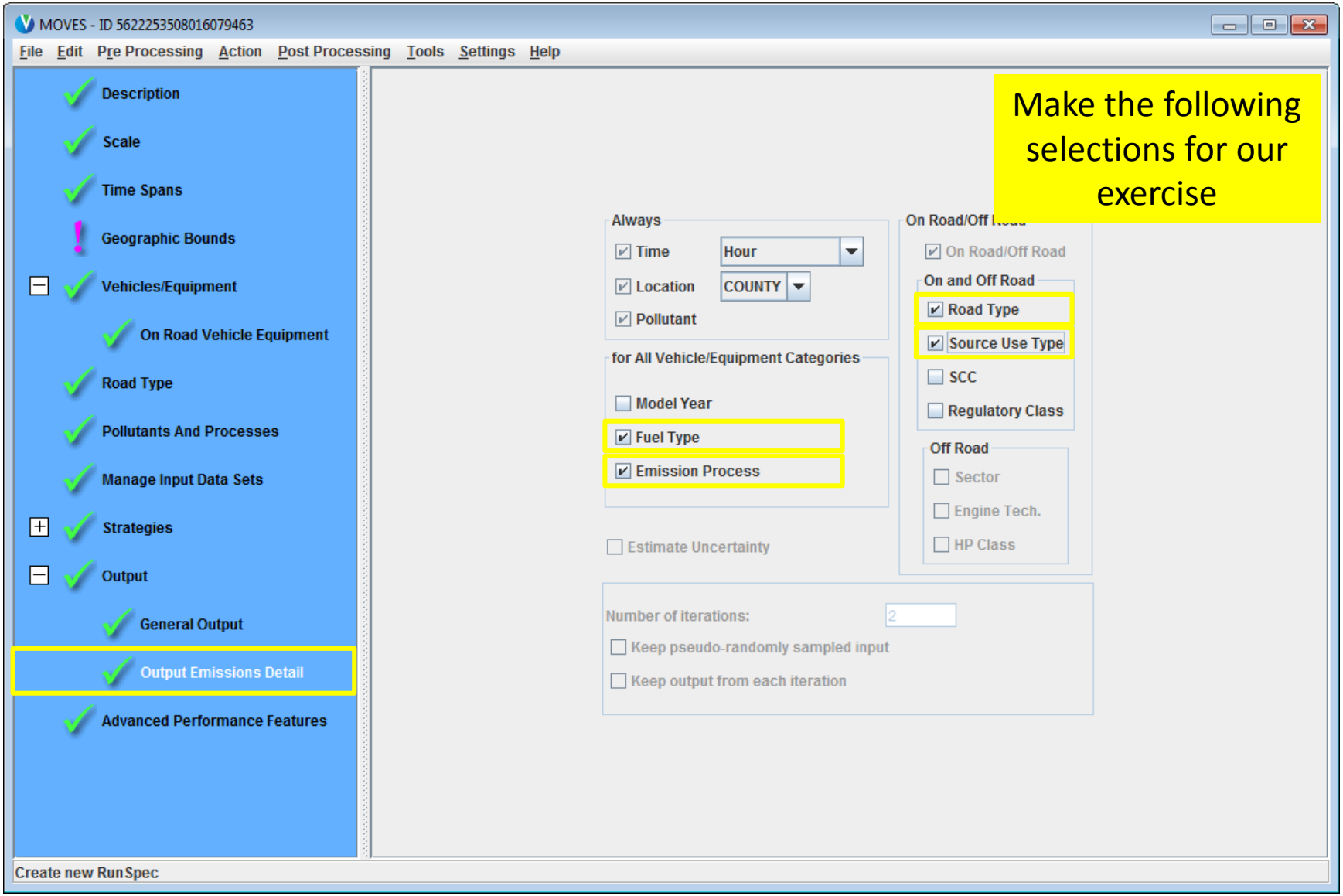
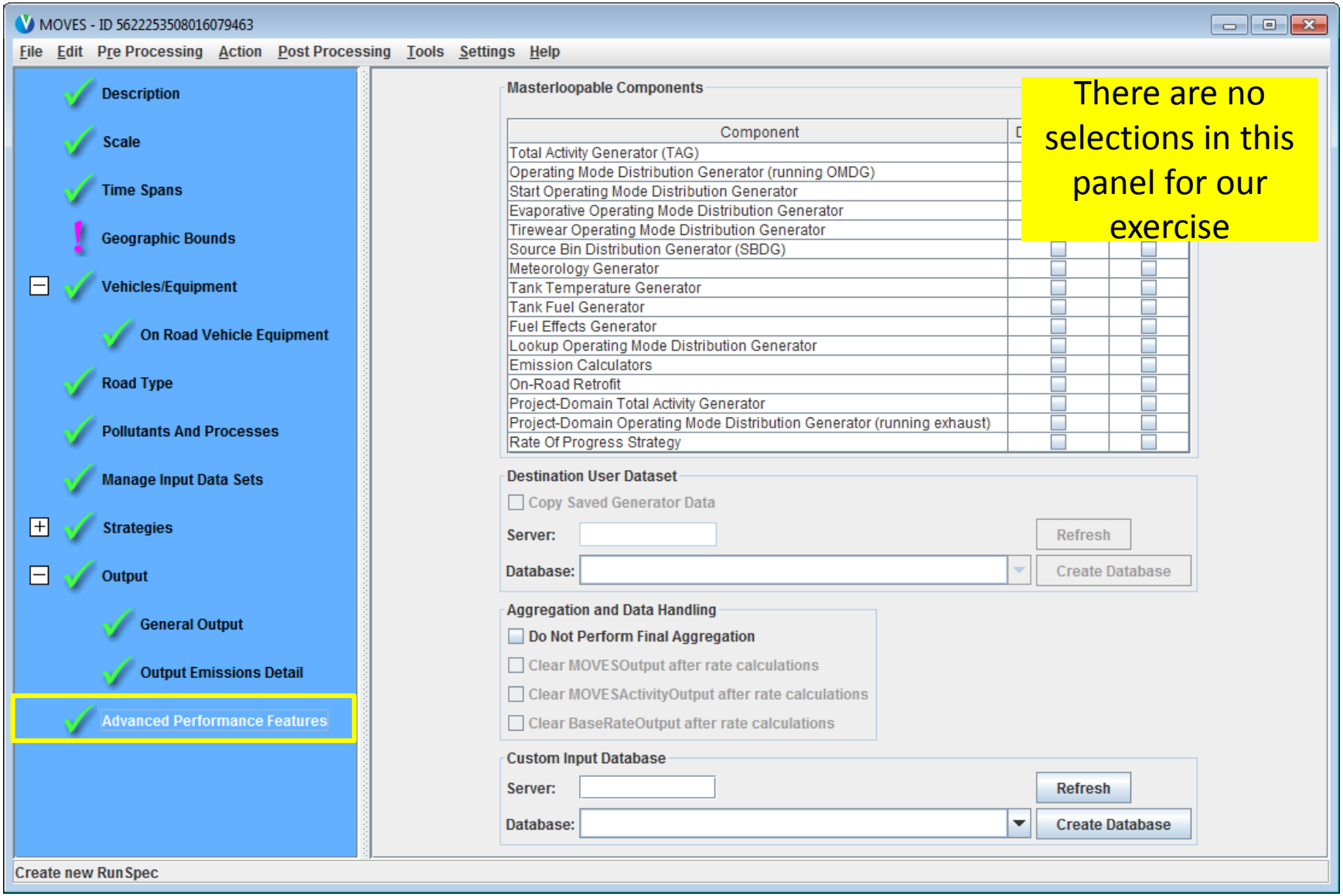
Output Panel (Output Emission Detail)



Advanced Performance Features Panel



Saving the RunSpec

- We've completed our RunSpec selections for this run. We want to save this before proceeding with the CDM

- Instructions for Developing a County-scale RunSpec:
  - Save as "lake_2015_inventory.mrs" in the "MOVES2014 RunSpecs" folder you created earlier

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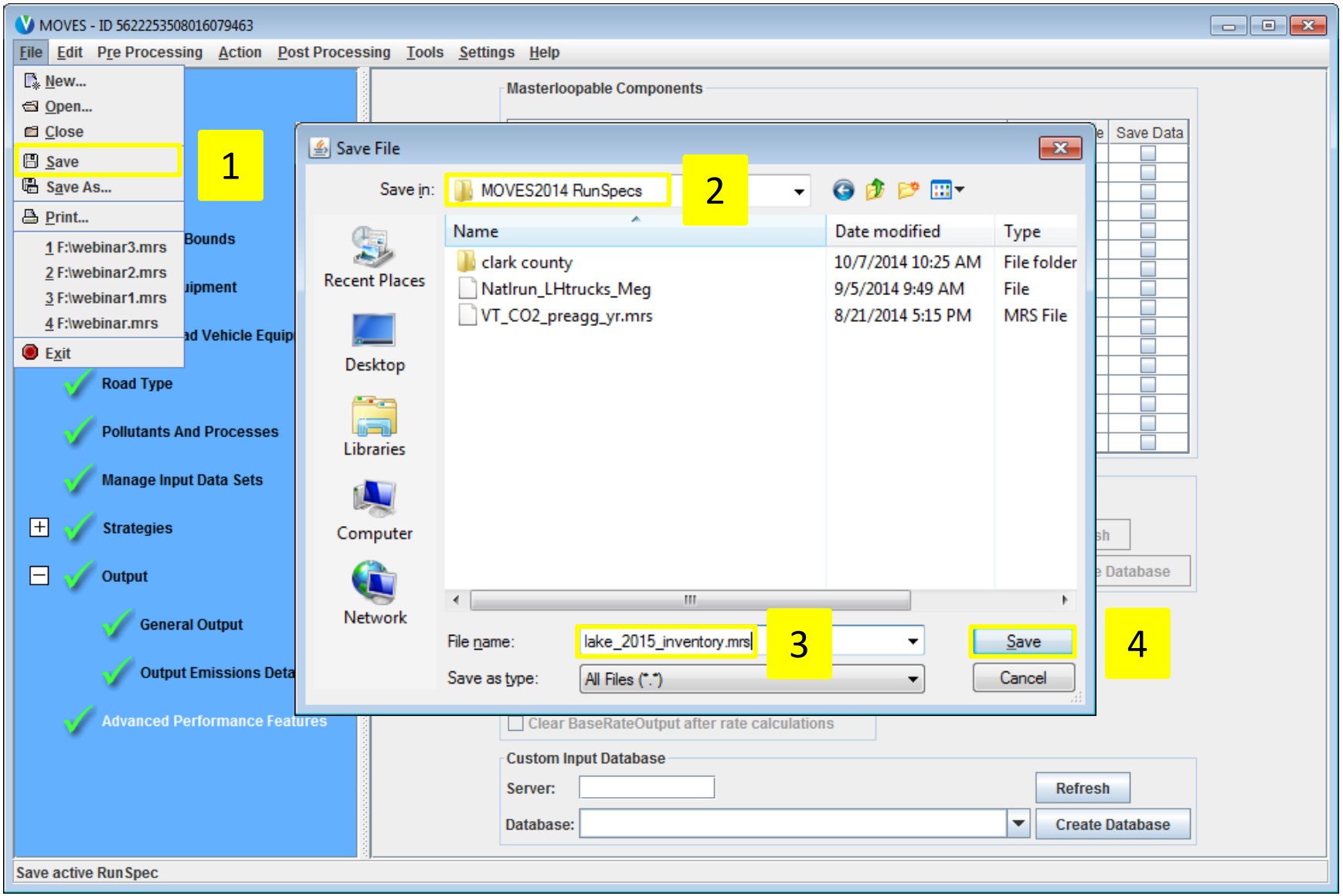
Saving the RunSpec



Entering Data Using the County Data Manager

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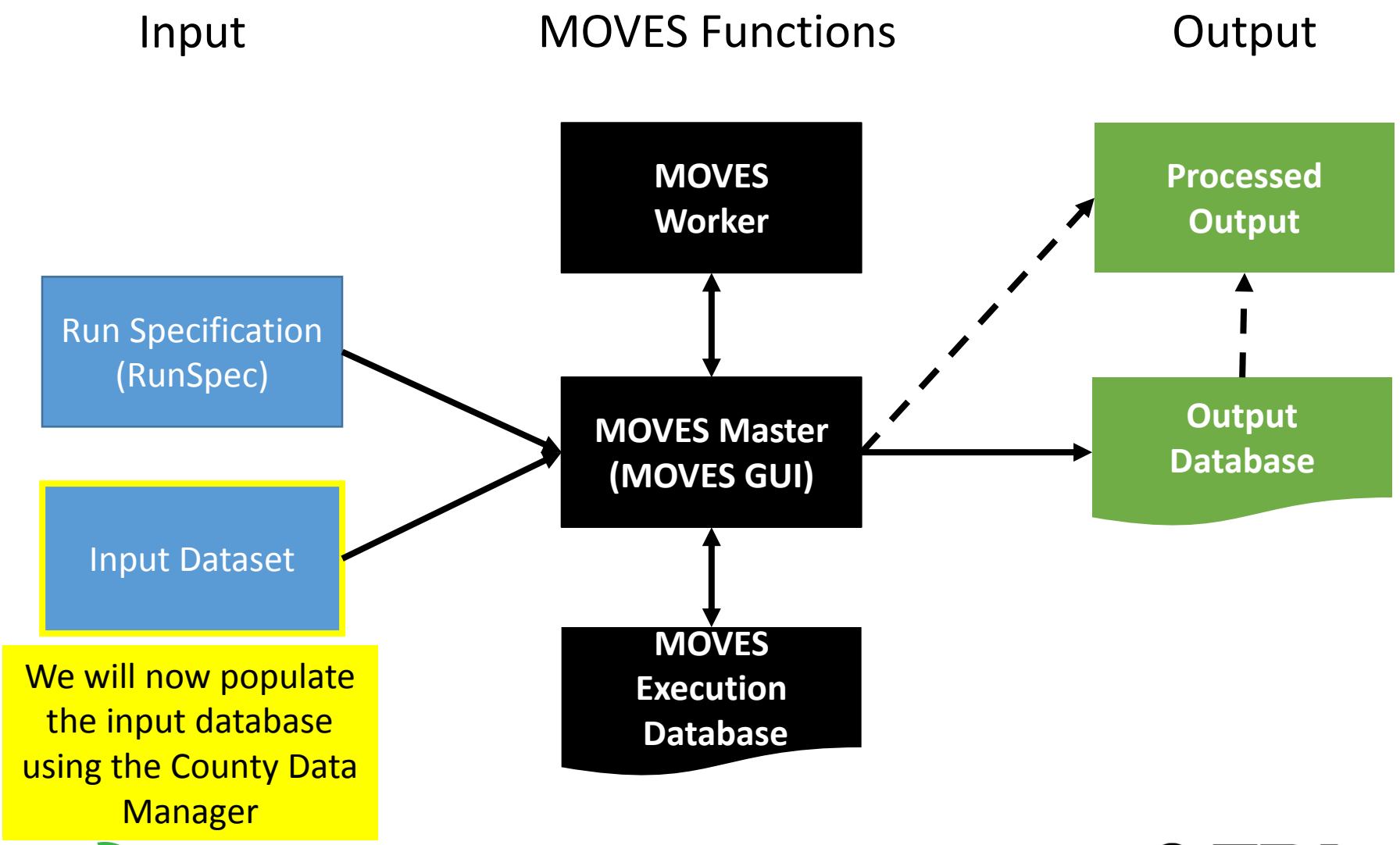
Using MOVES: Where Are We?



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What is the County Data Manager?

- The County Data Manager (CDM) is a tool that facilitates the process of entering data into a county input database
  - The data in the input database is used by MOVES when executing the run

- CDM takes the form of a separate Graphical User Interface (GUI) that is used in conjunction with the MOVES Master GUI
  - When the CDM is open, the MOVES Master GUI is frozen and no changes can be made to the RunSpec

- Users manipulate data in Excel, then "Import" worksheets into the CDM
  - Data is not entered directly in the CDM

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County Data Manager Functions

- Use the CDM to
  - Create templates,
  - Export default data (when available), or
  - Export previously imported data

- Using the CDM ensures input tables are properly formatted, which is important

- When exporting default data: review default data for accuracy before conducting a MOVES run
  - At the County scale, MOVES requires users to export and re-import default data (when available) so that users examine each input and the most up-to-date information can be used in modeling

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More CDM Functions

- The CDM imports (enters) the data into the county input database
  - Add descriptions of data being imported
  - Descriptions are useful for documentation of data sources

- Imported data can be cleared for each tab or the entire database can be emptied
  - Should always clear previously-imported data before importing new data for the same input; prevents execution errors

Opening the County Data Manager

- Two ways to open the CDM:
  - "Enter/Edit Data" button on the Geographic Bounds panel; or
  - Use the "Pre Processing" pull-down menu

- If the input database you want to use already exists, it can be selected in the Domain Input Database drop-down list; otherwise, new input database can be created in CDM

- Advanced Tip: If the user plans on utilizing the batch import process, the user should not exit the CDM until all data has been imported
  - The XML script written using the CDM Tools tab will only contain the names of the files that were imported during the active CDM session

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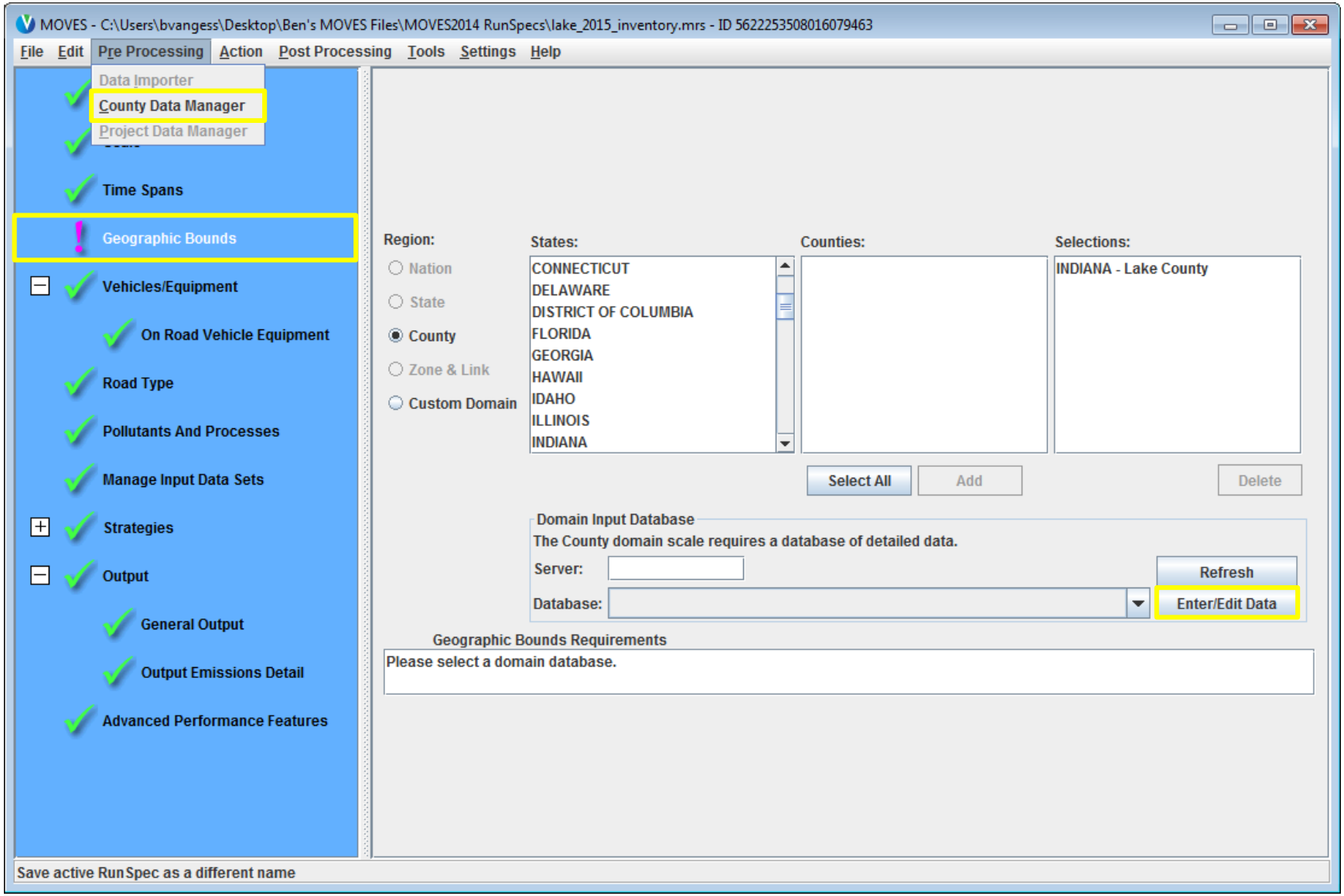
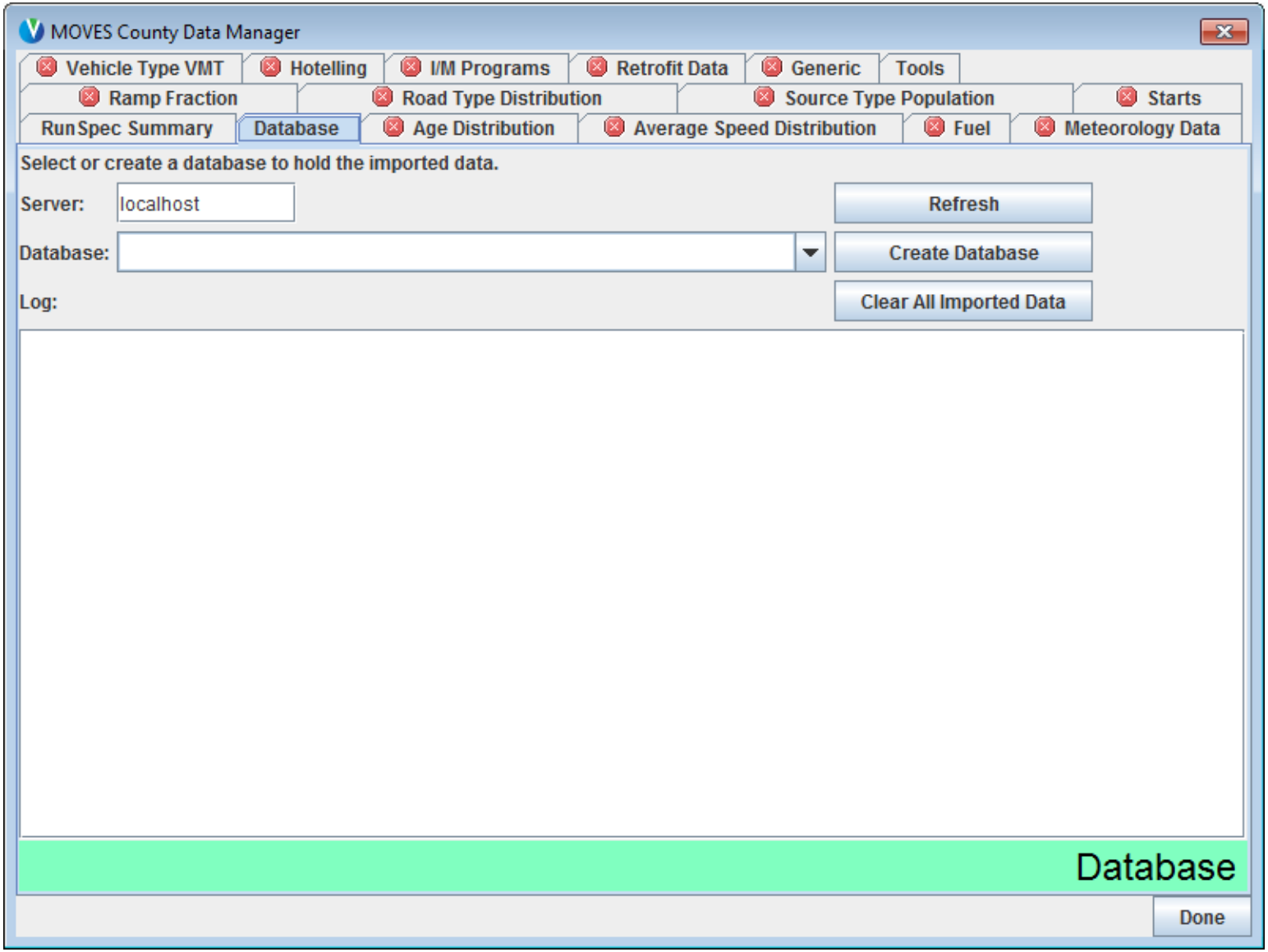
Opening the County Data Manager



A Newly Opened CDM



Using the CDM: General Info

- and symbols for each tab are determined by the relationship between the selections made in the RunSpec and the data provided by the user
  - appears when the user has provided data that is sufficient and passes error checks for all parameters in the RunSpec; note that several tabs begin with a green check (optional inputs)
  - appears if the user has not provided enough information or if there is an error with the data provided
  - Nothing done in the CDM will affect the selections in the RunSpec

- "RunSpec Summary" tab restates selections made in the RunSpec
  - Helpful reference while using CDM – see next slide

- "Tools" tab (not covered in this course)
  - Used to automate data import process and for batch operation

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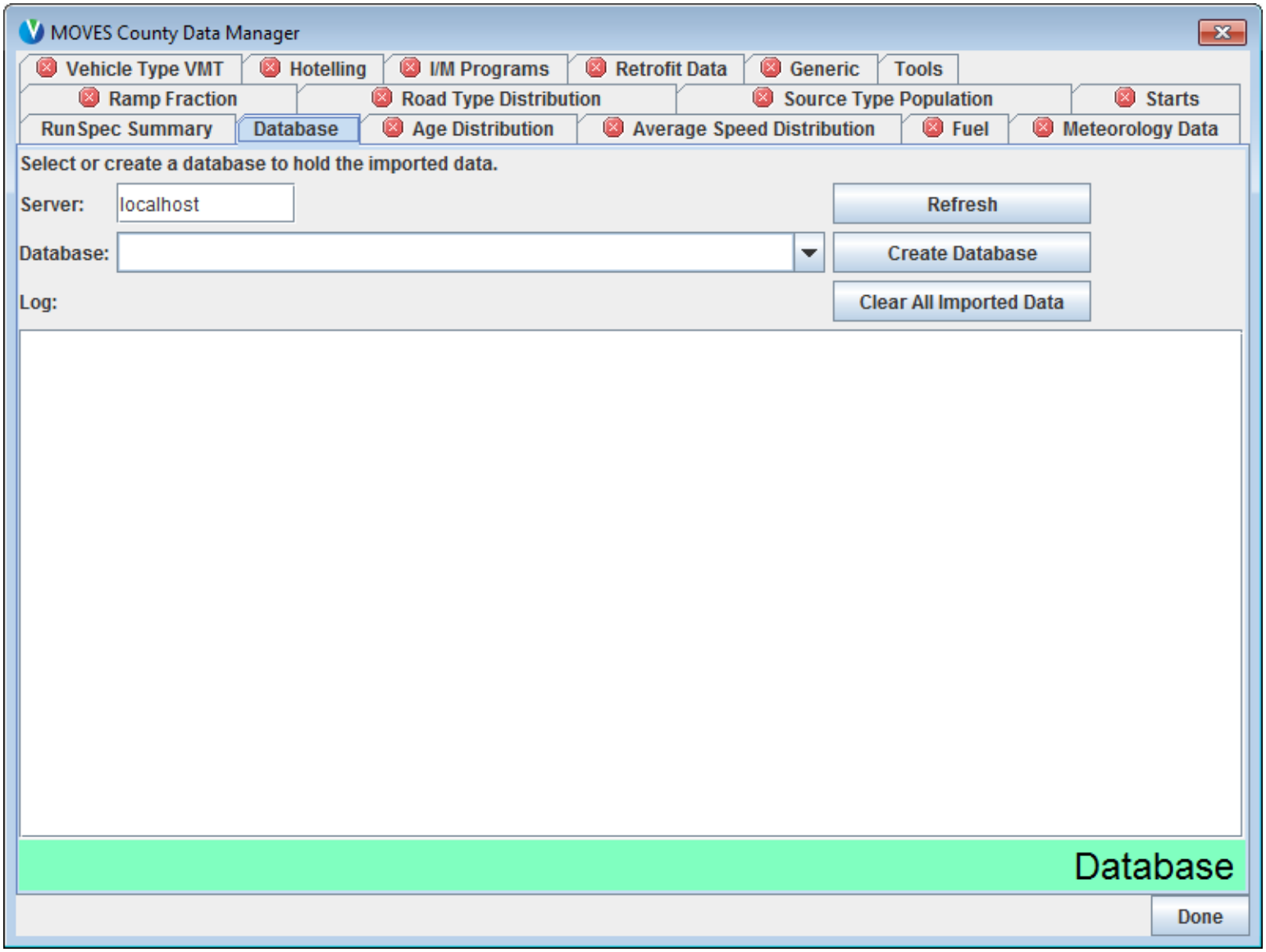
Using the CDM: CDM Database Tab



Using the CDM: CDM Database Tab

- County input database is selected or created here
- Existing county input databases can be selected from the drop-down menu
- Once a county input database has been created or selected, the tables within it can be edited with the other CDM tabs
  - All the tables in the database can be cleared of data with the "Clear All Imported Data" button
- The tab also displays a log of changes

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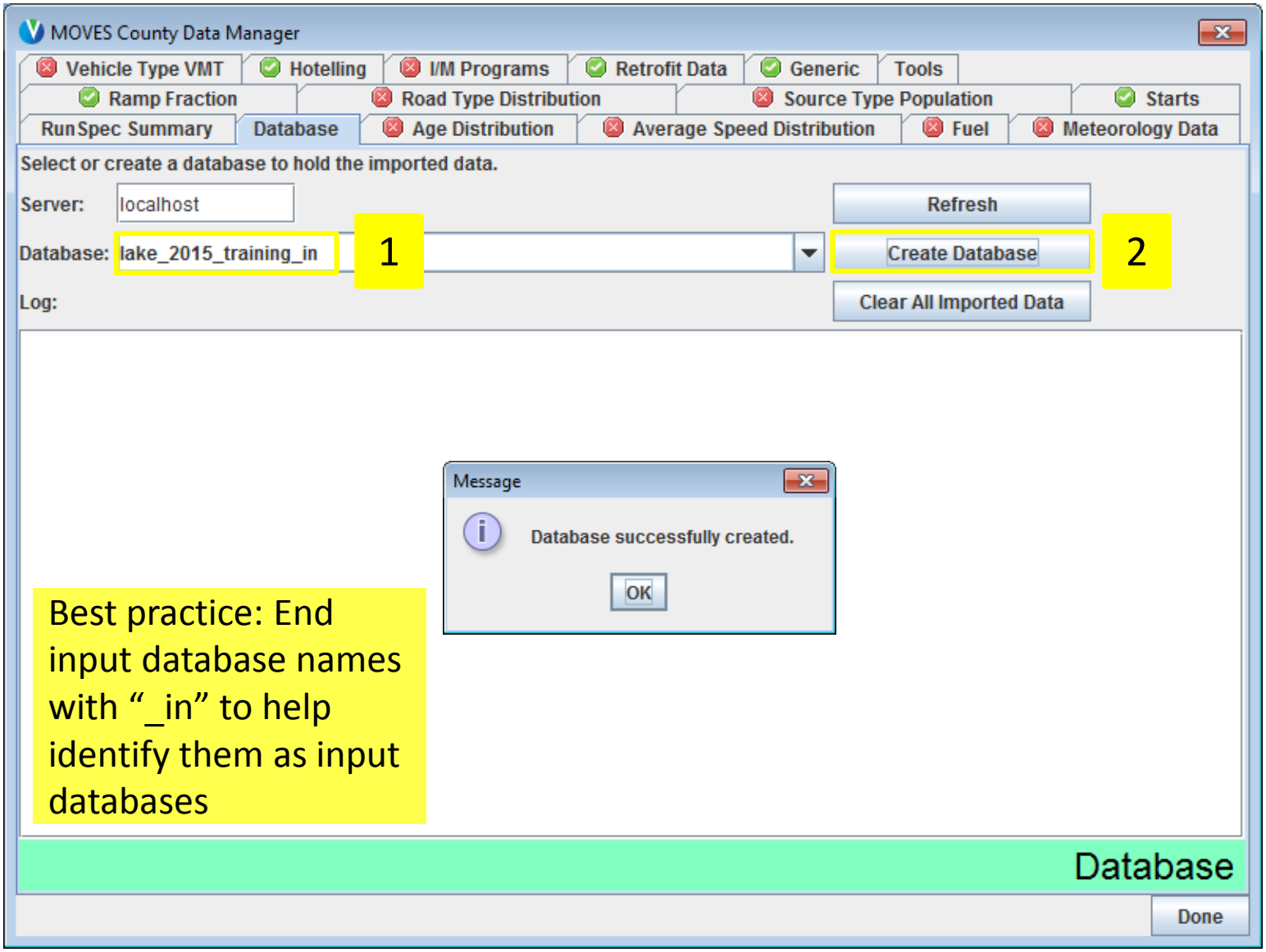
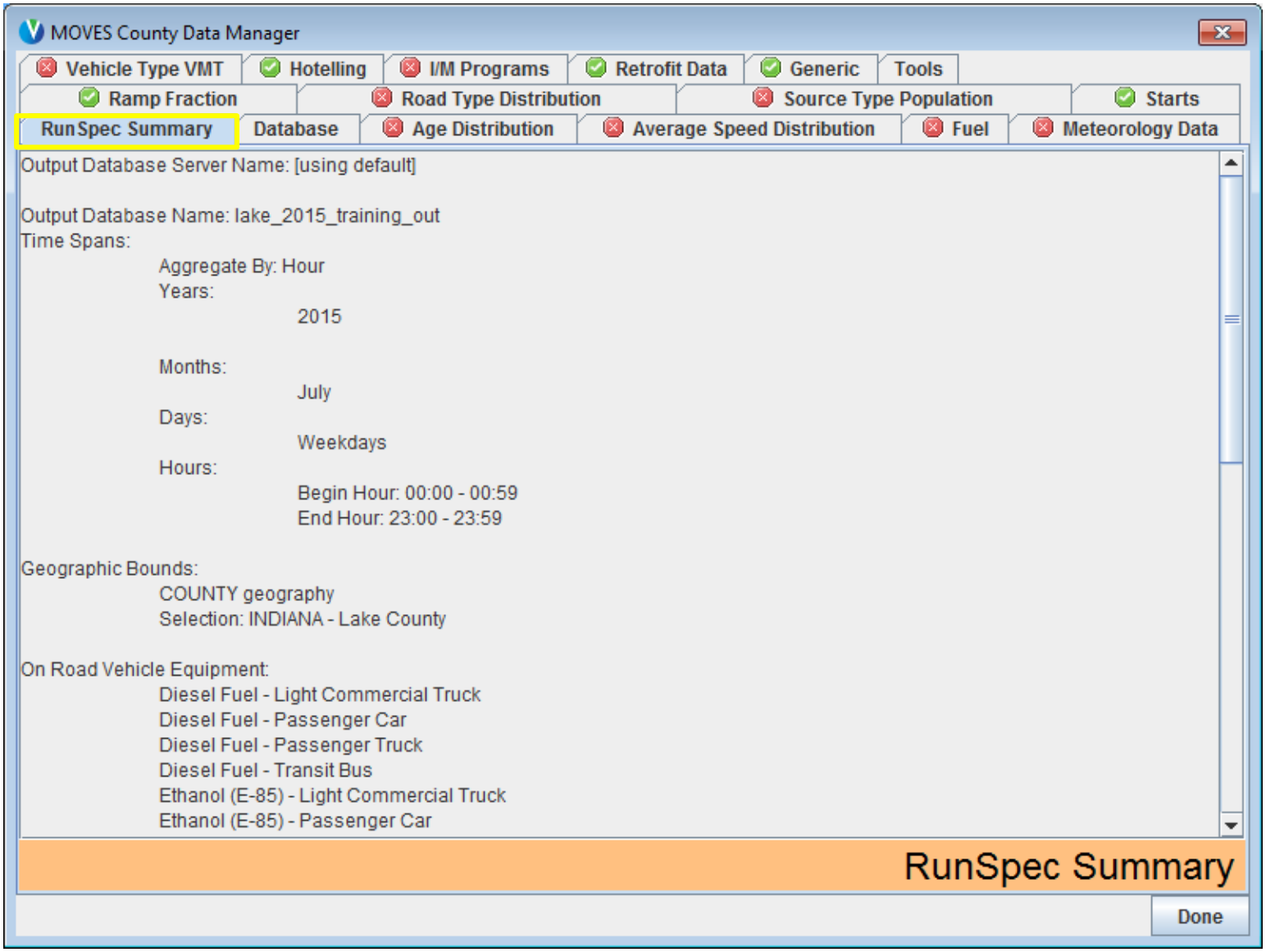
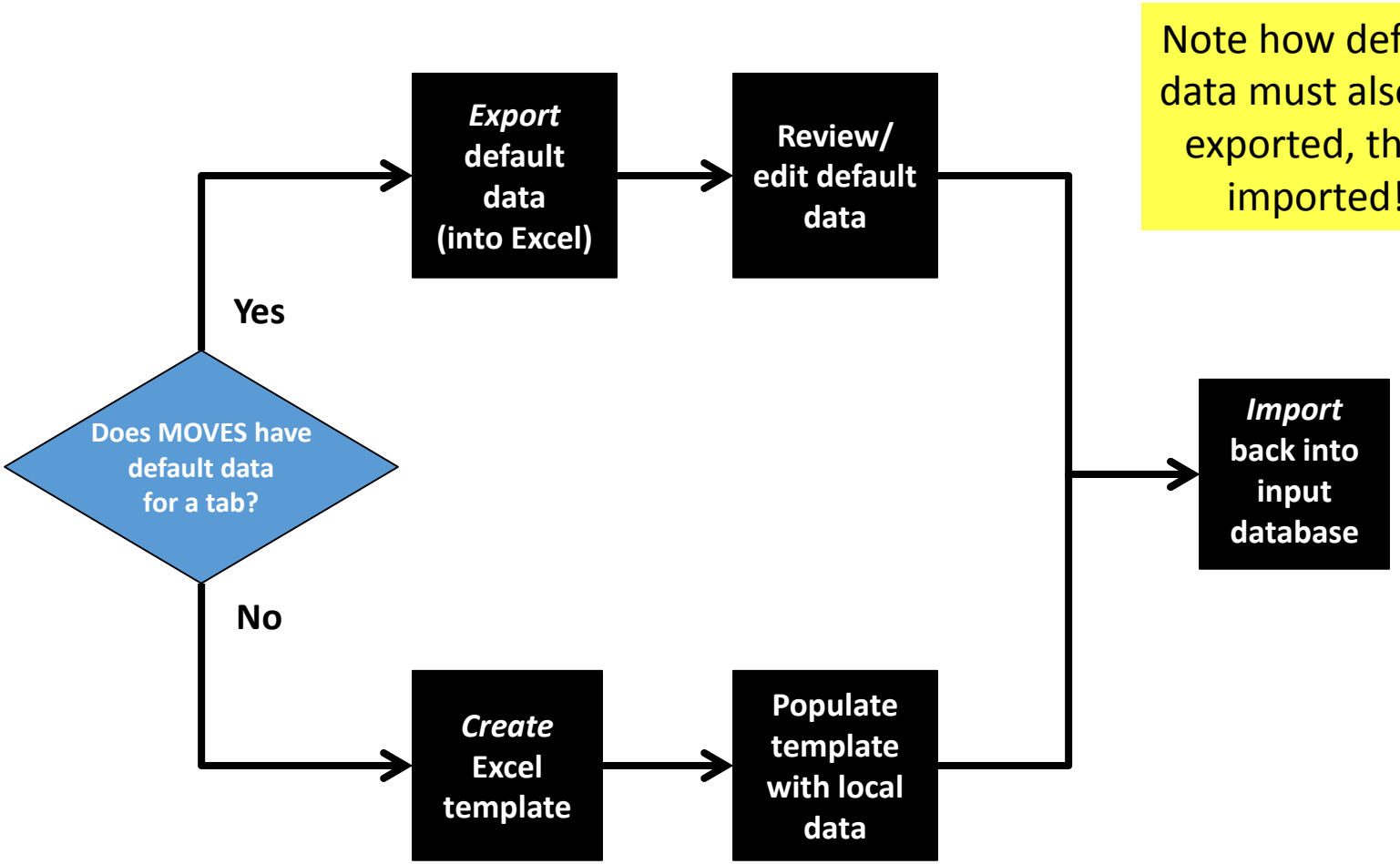
Creating a New County Input Database



Using the CDM: RunSpec Summary Tab



Using the CDM: Options for Entering Data



Note how default data must also be exported, then imported!

Using the CDM: Creating a Template

- All tabs provide the option of creating an Excel template spreadsheet of the appropriate MOVES table
  - Save as.xls extension to get a spreadsheet format
- Templates contain the proper fields/column headings, but have blank cells for user-specified data
- The template will be pre-populated with some data based on entries made in the RunSpec
  - This is why it's recommended to complete all RunSpec panels first!
- Extra worksheets will help you decipher MOVES codes

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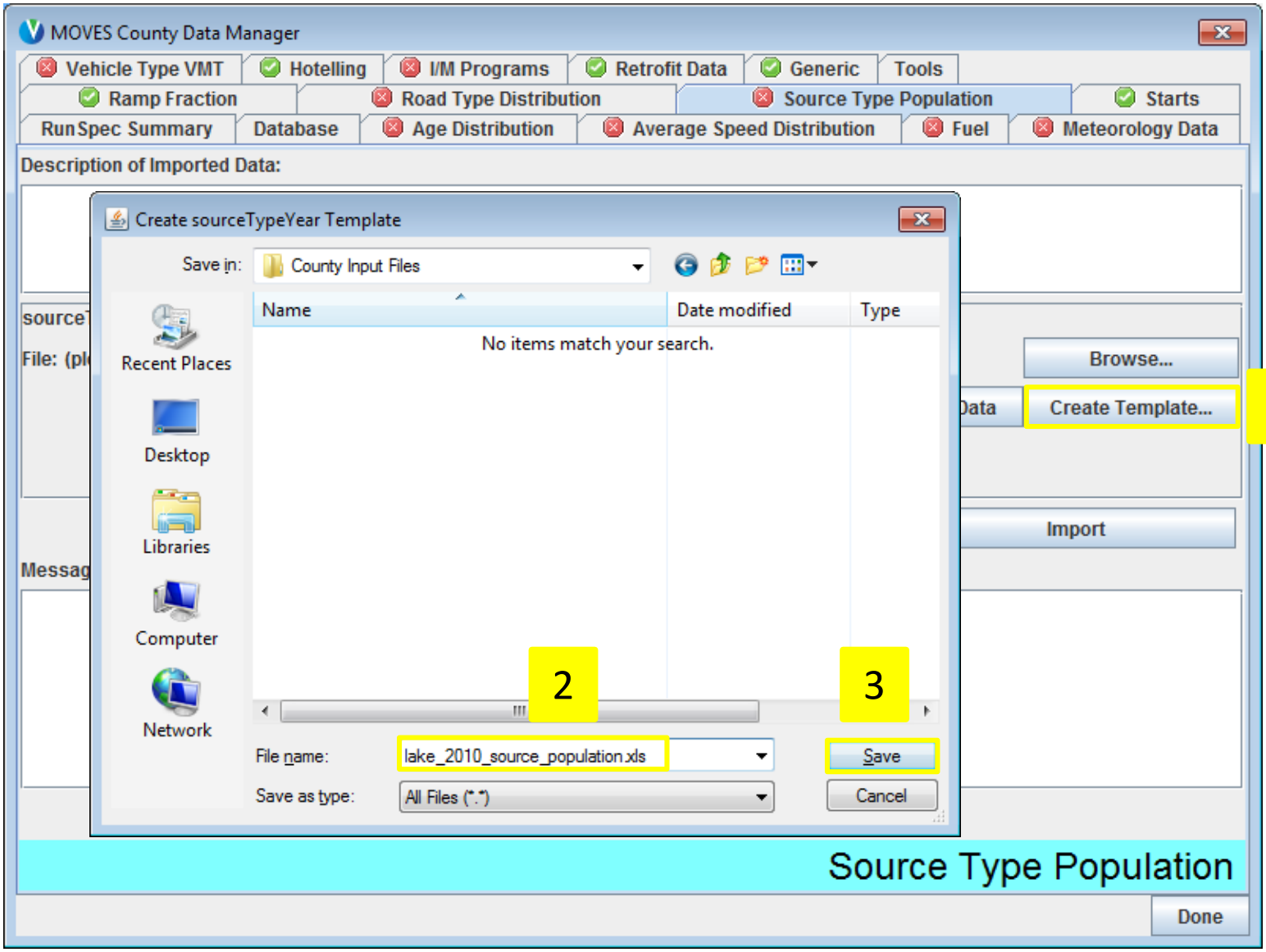
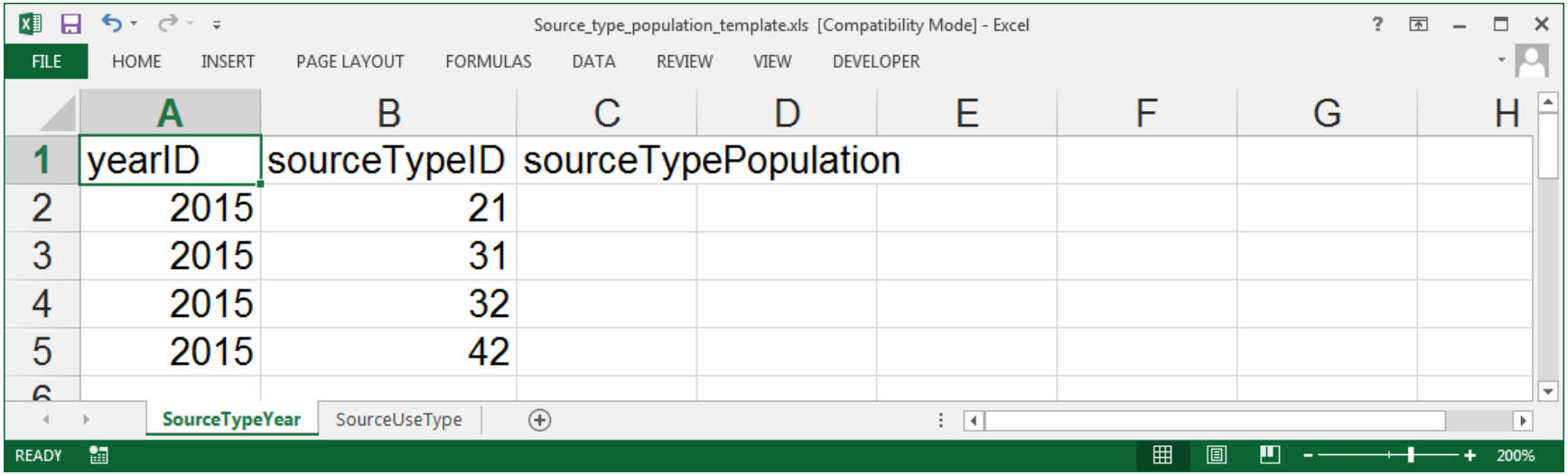
Example: Creating a Template



Example: Creating a Template



- Example template of SourceTypeYear table created from the "Source Type Population" tab of the CDM

- Note that"YearID" and "SourceTypeID" have been pre-populated based on RunSpec selections; "SourceTypePopulation" fields will need to be filled in by the user

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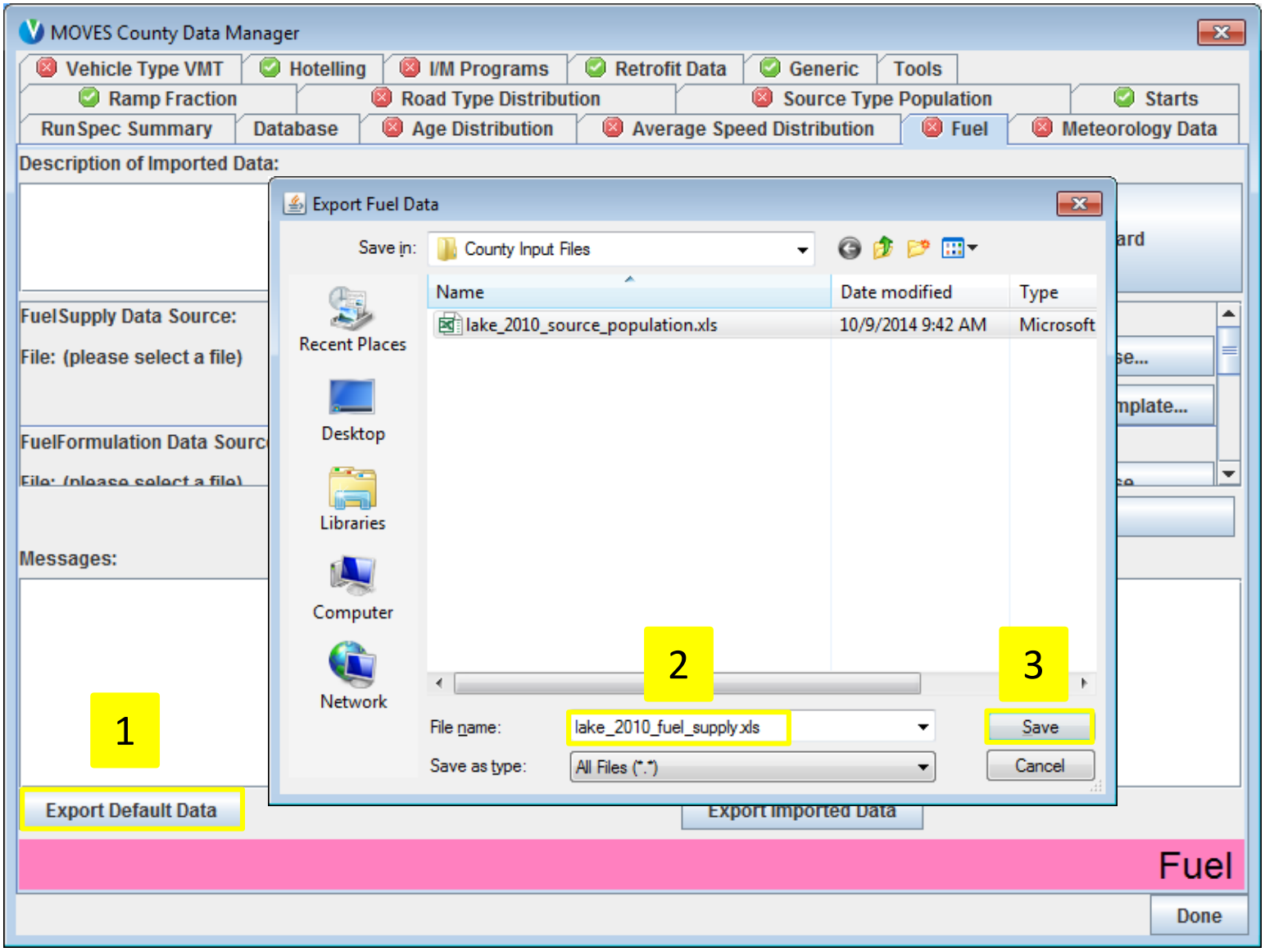
Using the CDM: Exporting Default Data

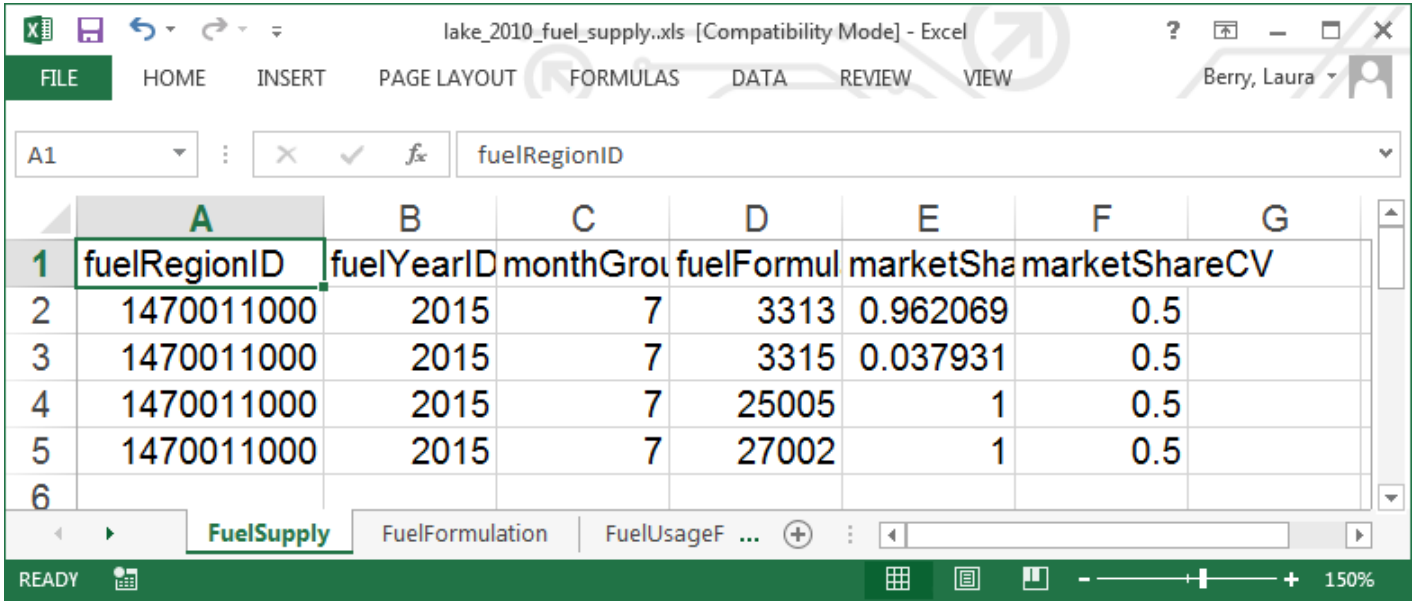
- Some tabs have default data available:
  - Average Speed Distribution
  - Ramp Fraction
  - Fuel (Fuel Supply, Fuel Formulation, Fuel Usage, AVFT)
  - Meteorology Data
  - Vehicle Type VMT (Month, Day, and Hour VMT Fractions)
  - I/M Programs
  - Hotelling

- Tabs with default data will have “Export Default Data” option

Example: Exporting Default Data



Example: Exporting Default Data



	A	B	C	D	E	F	G
1	fuelRegionID	fuelYearID	monthGrou	fuelFormul	marketSha	marketShareCV	
2	1470011000	2015	7	3313	0.962069	0.5	
3	1470011000	2015	7	3315	0.037931	0.5	
4	1470011000	2015	7	25005	1	0.5	
5	1470011000	2015	7	27002	1	0.5	
6							

- Example of exported default data for FuelSupply table created from the “Fuel” tab of the CDM

- Per MOVES Technical Guidance, user would check default data to ensure applicability and make any changes

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Using the CDM: Importing Data

- Data must be imported back into the CDM from Excel for each tab (even when using default data for a tab)

- Imported data is read from a Excel worksheet that has been properly formatted with the correct columns

- General steps:
  1) Recommended: Add a description of the data you are about to import (e.g., the file location or data source)
  2) Browse to find the correct Excel file
  3) Select the Excel file
  4) Select the appropriate worksheet (name should match Data Source in the CDM tab)
  5) Click the “Import” button

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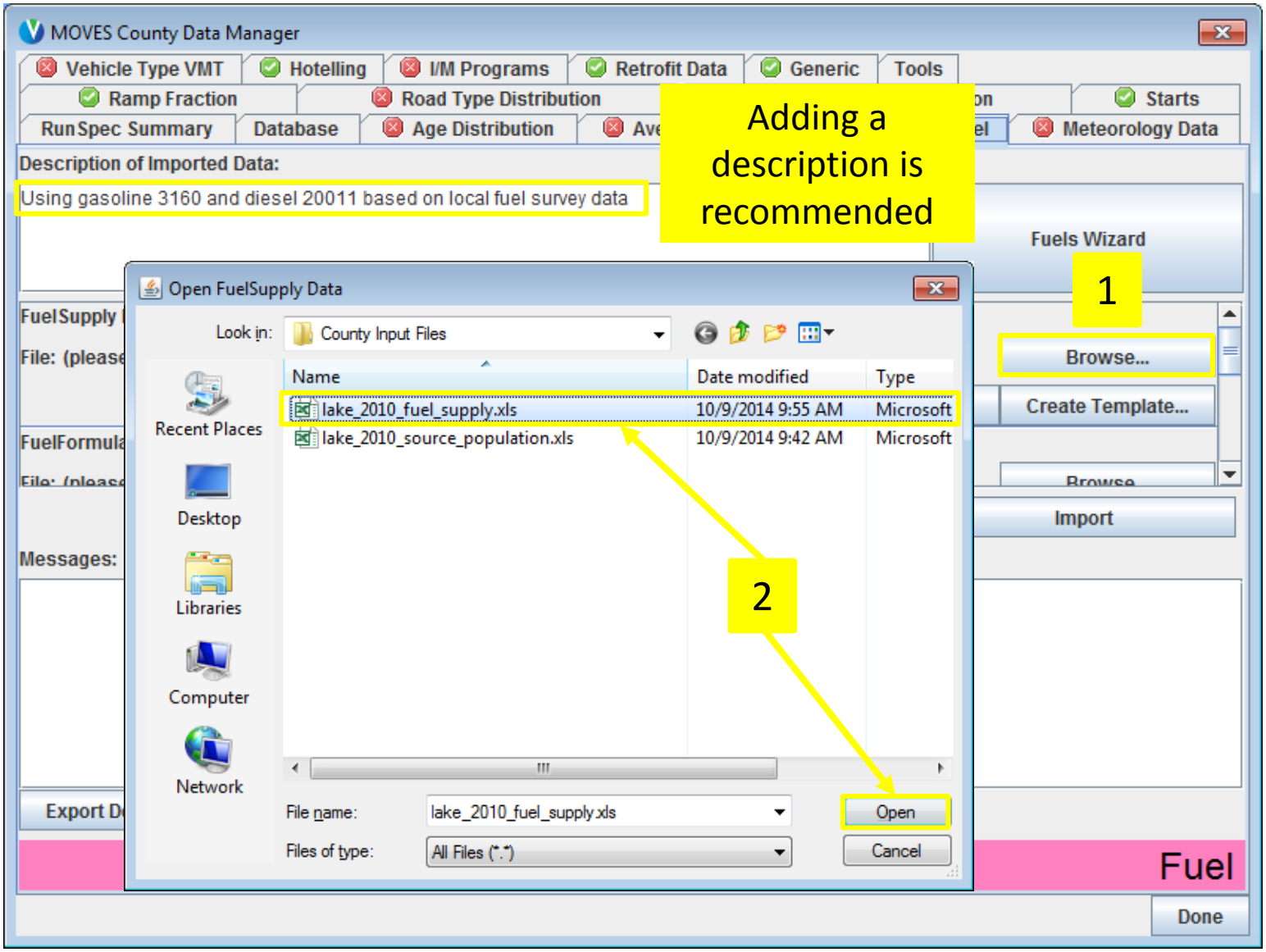
Using the CDM: Importing Data

- Check to see if you get an “Import Complete” message

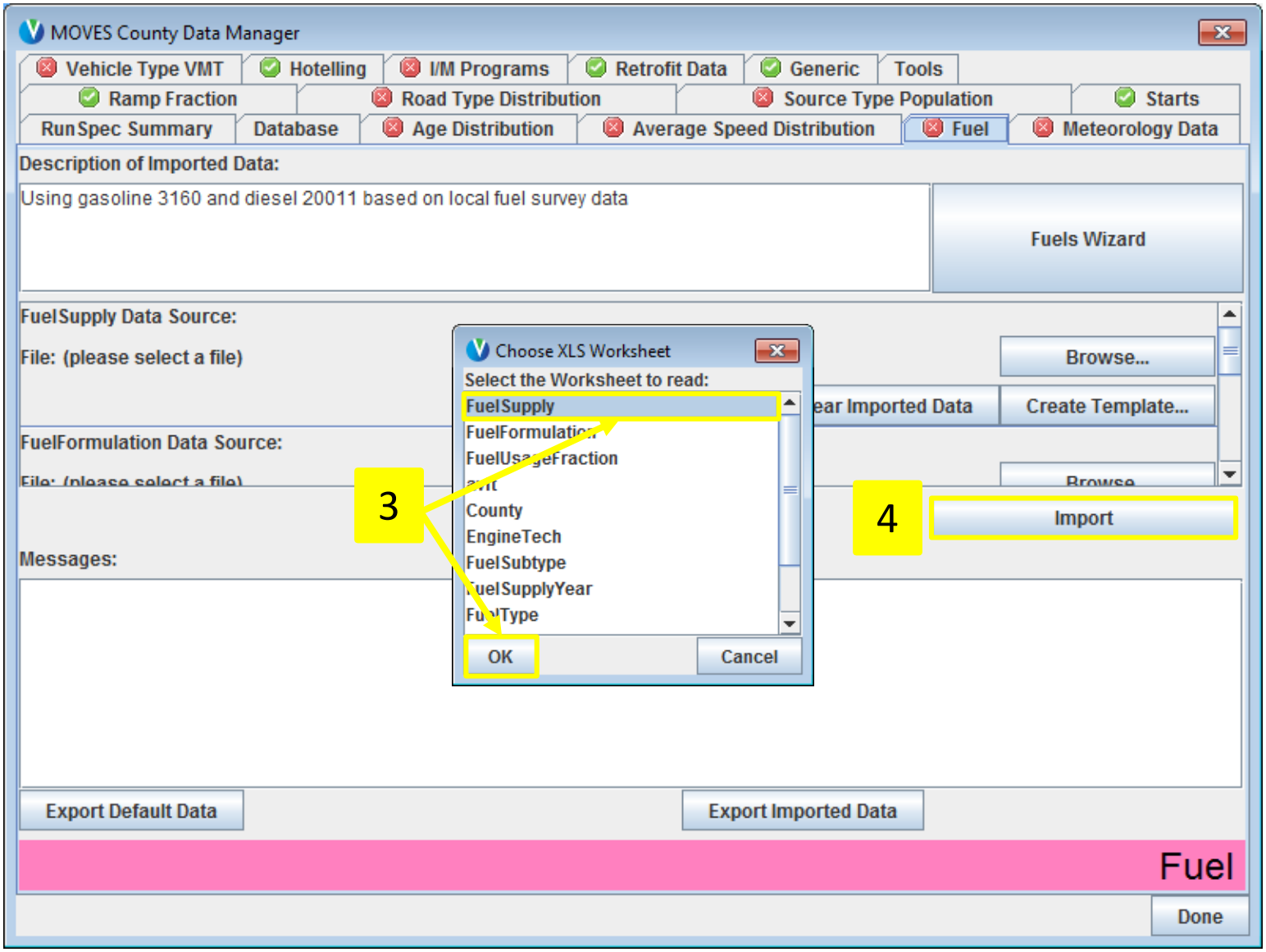
- When the import is successfully completed the will change to a on the County Data Manager tab
  - If message says, “Import Complete” but remains, that means more data is required (e.g., data was not provided for all source types selected in the RunSpec)
  - For many tables, unused data can be imported (e.g., extra months, hours, source types, etc.) with no adverse impacts; however, data for additional counties and years should NOT be imported as this can cause errors when attempting to execute the RunSpec

- The description you entered will appear in the log, which can be viewed on the Database tab

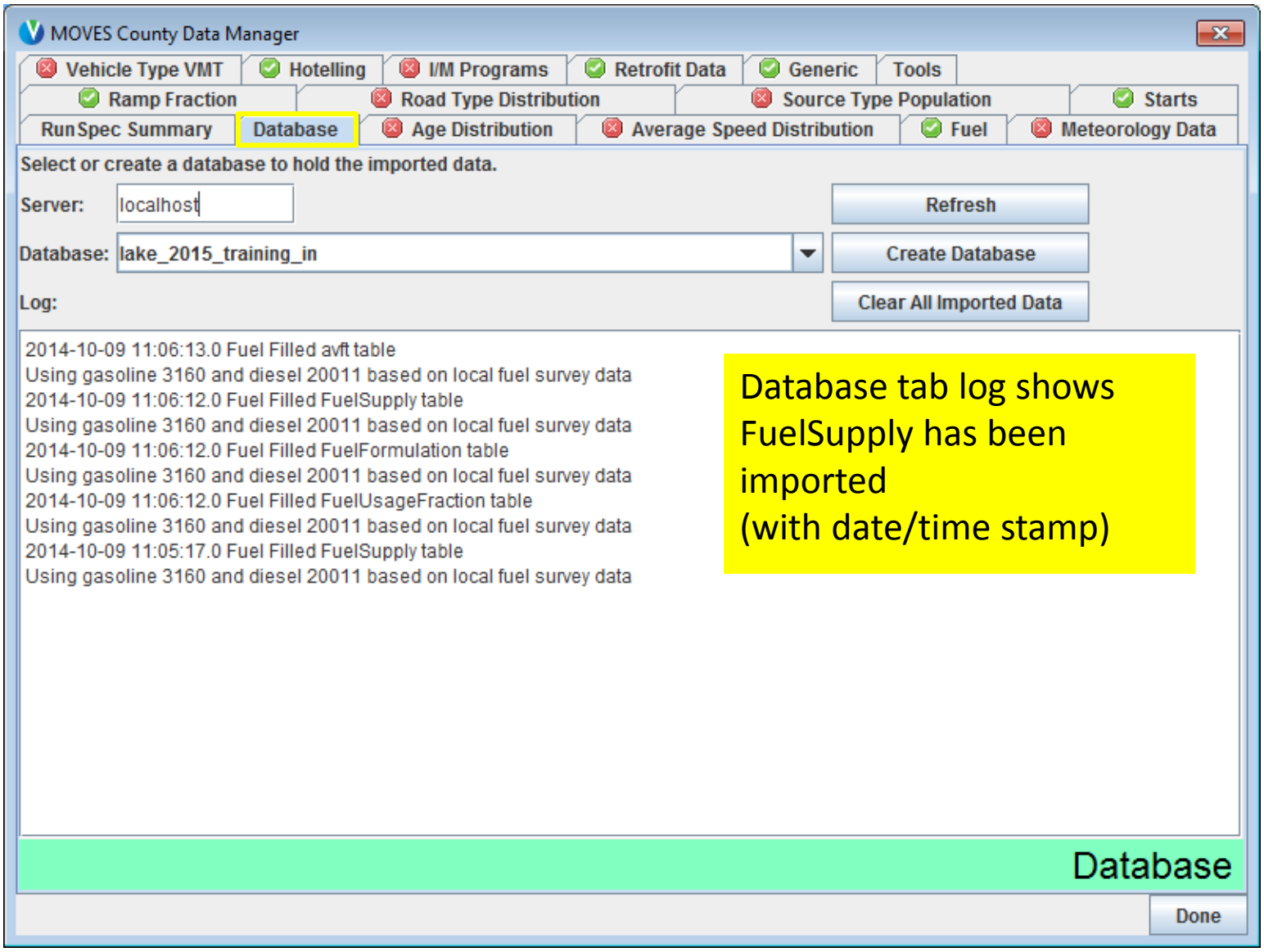
Example: Importing Data



Example: Importing Data



Example: Importing Data (Con't)



Database tab log shows FuelSupply has been imported (with date/time stamp)

CDM: Entering Local Data

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Entering Data Using the CDM: Overview

- We will go through each data input (MOVES table) that can be accessed through each CDM tab

- We will look at the fields in each input table and go over EPA's MOVES Technical Guidance for that input

- After discussing each input, we will enter the appropriate data for our county-level inventory exercise for Lake County
  - Exercise files can be found in the "County Level Inventory" folder

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Summary of Data Inputs

Vehicle Type VMT

- Total annual VMT by HPMS vehicle type
- Also month, day and hour VMT fractions
- MOVES table: HPMSVTypeYear (and others)

Hotelling

- Information on Hotelling activity
- MOVES tables: HotellingActivityDistribution and HotellingHours

I/M Programs

- Data on I/M program(s), if any
- MOVES table: IMCoverage

Retrofit Data

- Defines retrofit programs
- MOVES table: onRoadRetrofit

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Summary of Data Inputs

Ramp Fraction tab

- Fraction of freeway VHT occurring on ramps
- MOVES table: RoadType

Road Type Distribution

- Fraction of source type VMT on different road types
- MOVES table: RoadTypeDistribution

Source Type Population

- Number (i.e., population) of local vehicles operating in the area
- Important for start and evaporative emissions
- MOVES table: SourceTypeYear

Starts

- Provides information on vehicle starts
- MOVES table: Starts (and others)

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Summary of Data Inputs

Age Distribution

- Age fractions of fleet by age and source type
- MOVES table: SourceTypeAgeDistribution

Average Speed Distribution

- Speed distribution by road type, hour and source (vehicle) type
- MOVES table: AvgSpeedDistribution

Fuel

- Market share and composition of fuel blends
- Defaults available by county
- MOVES tables: FuelSupply, FuelFormulation, FuelUsage, and AVFT

Meteorology Data tab

- Temperature and humidity inputs
- MOVES table: ZoneMonthHour

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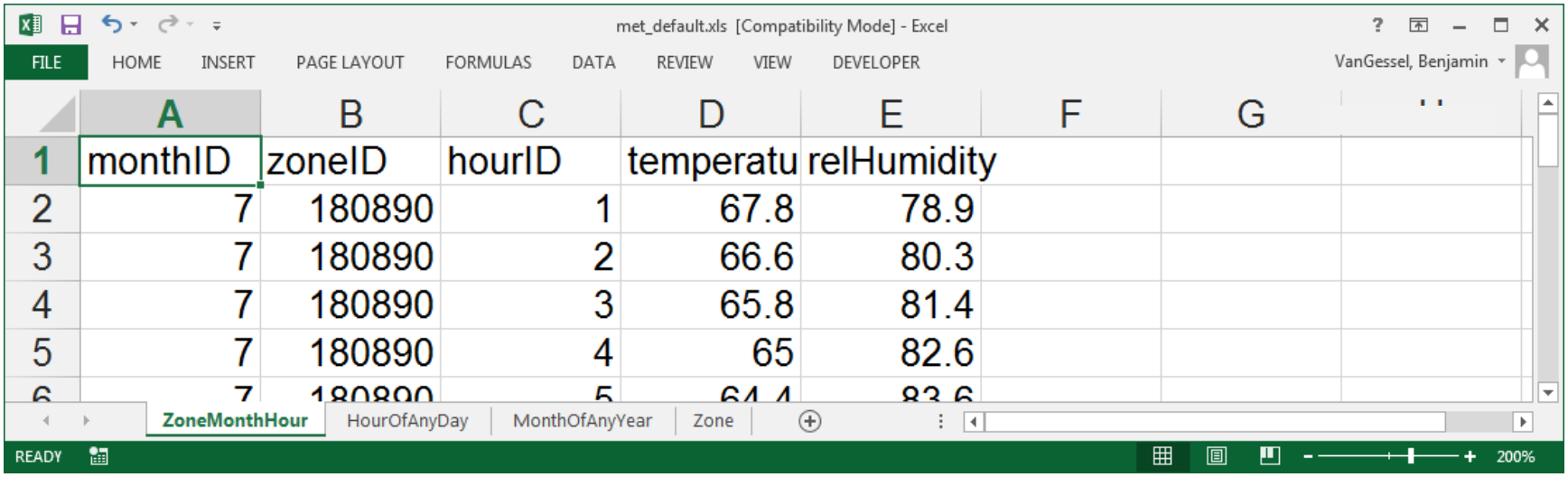
Summary of Data Inputs (Custom Domain Only)

- Zone Road Activity tab
  - Contains 3 tables to capture activity occurring within each zone
  - MOVES table: Zone
  - MOVES table: ZoneRoadType
  - MOVES table: SCCRoadDistributionData

Meteorology Data

- Meteorology data should be entered for every month and hour selected in the RunSpec
- Temperatures are in degrees Fahrenheit
- Relative humidity must be between 0 and 100
- ZoneID is simply the countyID + a zero



	A	B	C	D	E	F	G
1	monthID	zoneID	hourID	temperatu	relHumidity		
2	7	180890	1	67.8	78.9		
3	7	180890	2	66.6	80.3		
4	7	180890	3	65.8	81.4		
5	7	180890	4	65	82.6		
6	7	180890	5	64.4	83.6		

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Meteorology Data: Guidance

- Section 4.2 of MOVES Technical Guidance

- Local temperature and humidity data are required inputs for SIP and regional conformity analysis with MOVES

- Default data based on 10 year averages – these may not be appropriate for all types of analysis

- Temperatures for conformity analysis must be consistent with temperatures used to develop SIP emissions budgets

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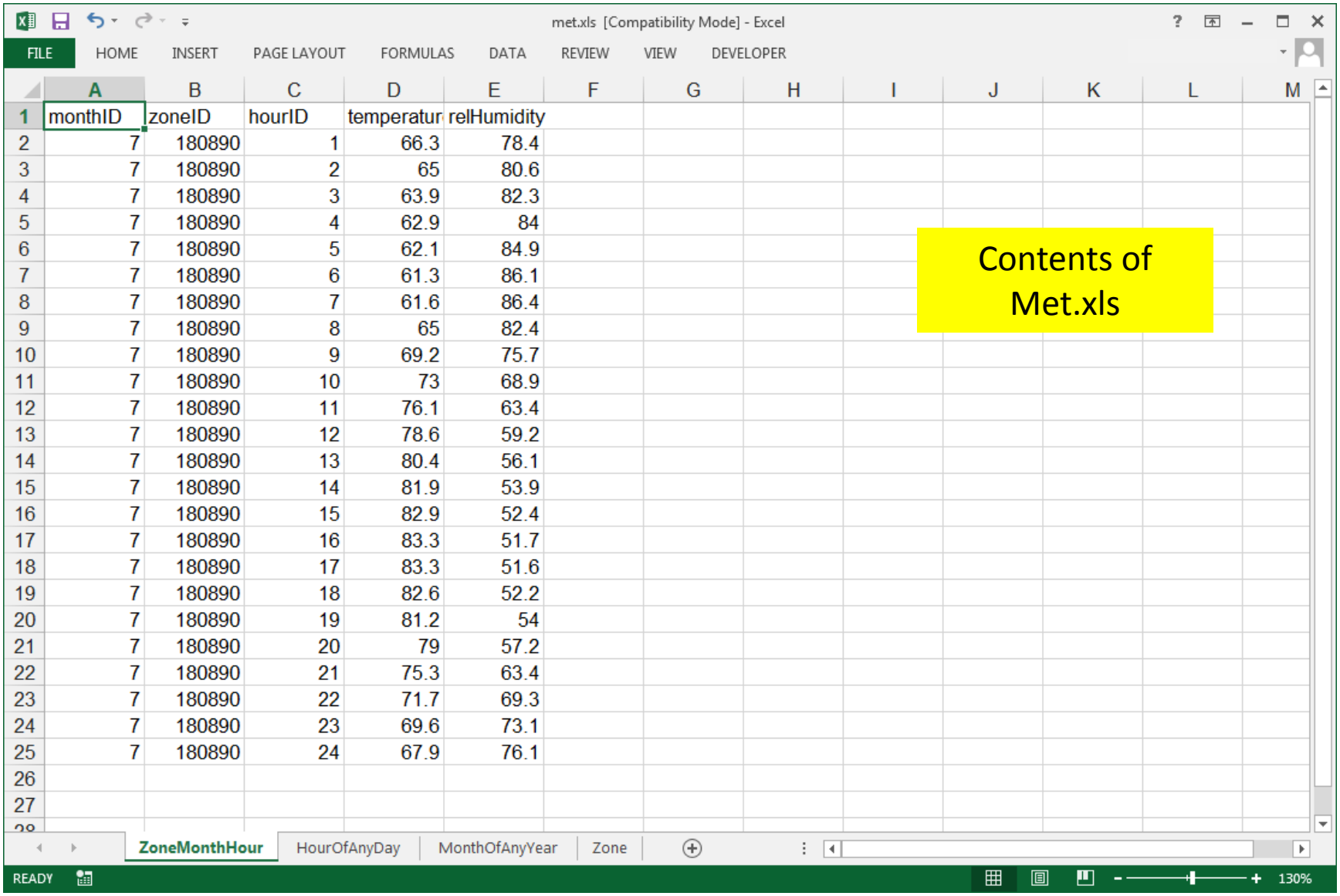
Meteorology Data: Exercise

- Let's enter meteorology data into the CDM for our county-level exercise

- The template has already been filled out with our met data and is available as file: *met.xls*

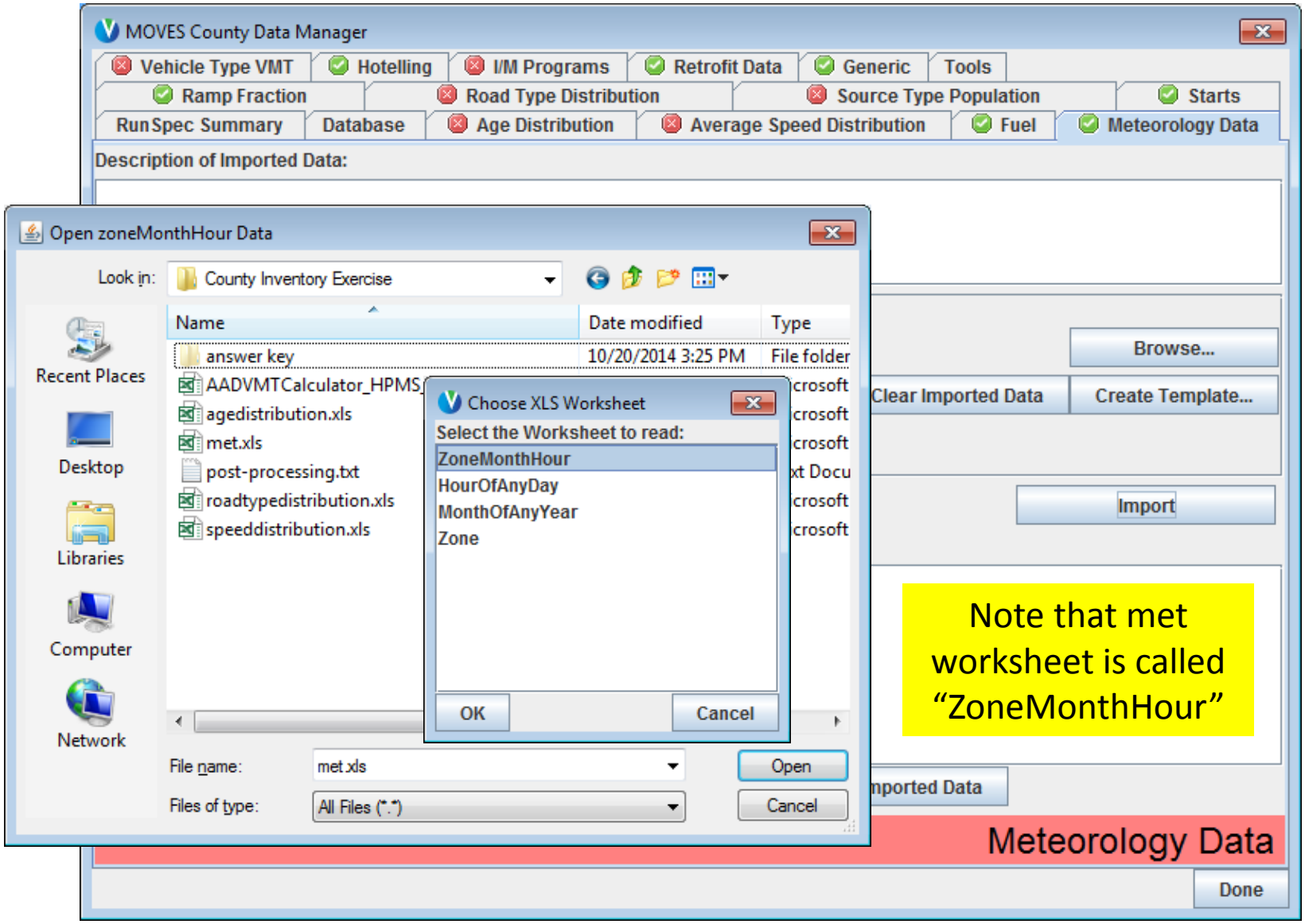
- Instructions for Developing a County-scale RunSpec:
  - Open *met.xls*, review the data, and import the table into the Meteorology tab

County Inventory Exercise: Entering Meteorology Data



	A	B	C	D	E
1	monthID	zoneID	hourID	temperatur	relHumidity
2	7	180890	1	66.3	78.4
3	7	180890	2	65	80.6
4	7	180890	3	63.9	82.3
5	7	180890	4	62.9	84
6	7	180890	5	62.1	84.9
7	7	180890	6	61.3	86.1
8	7	180890	7	61.6	86.4
9	7	180890	8	65	82.4
10	7	180890	9	69.2	75.7
11	7	180890	10	73	68.9
12	7	180890	11	76.1	63.4
13	7	180890	12	78.6	59.2
14	7	180890	13	80.4	56.1
15	7	180890	14	81.9	53.9
16	7	180890	15	82.9	52.4
17	7	180890	16	83.3	51.7
18	7	180890	17	83.3	51.6
19	7	180890	18	82.6	52.2
20	7	180890	19	81.2	54
21	7	180890	20	79	57.2
22	7	180890	21	75.3	63.4
23	7	180890	22	71.7	69.3
24	7	180890	23	69.6	73.1
25	7	180890	24	67.9	76.1
26					
27					

County Inventory Exercise: Entering Meteorology Data



Age Distribution

- Age Distribution is entered according to MOVES source types and calendar year
  - AgeFraction must sum to "1" within these fields
- Age Distribution covers new (0) to 30+ year old vehicles
- MOVES does not vary age distribution by month with one run
- EPA has age distribution converters on web, if needed.

agedistribution.xls [Compatibility Mode]...

FILE HOME INSERT PAGE L FORM DATA REVIE VIEW

	A	B	C	D	E	F	G
1	SourceTypeID	YearID	AgeID	AgeFraction			
2	21	2015	0				
3	21	2015	1				
4	21	2015	2				
5	21	2015	3				
6	21	2015	4				
7	21	2015	5				
8	21	2015	6				
9	21	2015	7				
10	21	2015	8				
11	21	2015	9				
12	21	2015	10				
13	21	2015	11				
14	21	2015	12				
15	21	2015	13				
16	21	2015	14				
17	21	2015	15				
18	21	2015	16				
19	21	2015	17				
20	21	2015	18				
21	21	2015	19				
22	21	2015	20				
23	21	2015	21				
24	21	2015	22				
25	21	2015	23				
26	21	2015	24				
27	21	2015	25				
28	21	2015	26				
29	21	2015	27				
30	21	2015	28				
31	21	2015	29				
32	21	2015	30				
33	31	2015	0				
34	31	2015	1				
35	31	2015	2				
36	31	2015	3				

sourceTypeAgeDistributi ...

READY 100%

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Age Distribution: Guidance

- Section 4.4 of MOVES Technical Guidance

- Critical input: emissions are sensitive to age and age distributions vary considerably by locality

- Using local age distribution data is therefore recommended
  - Can be based on registration or I/M data, for instance

- Needed for 31 age groups (0-29 years, 30 years and older), and each of 13 MOVES source types (vehicle types)
  - Age is based on model year relative to calendar year

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Age Distribution: Guidance

- If data not available for individual source types, can use data for similar HPMS classes

- Default distributions can be used in some cases
  - If local data not representative of operating fleet (e.g., combination long-haul truck, intercity bus), no MOBILE6 inputs available, or local data is out of date
  - Default age distributions also on EPA MOVES tools website: http://www.epa.gov/otaq/models/moves/tools/

- When modeling a future year, the EPA Age Distribution Projection Tool can be used to adjust base year age distributions
  - The tool accounts for the recession's impact on vehicle sales for a future year
  - The Age Distribution Projection Tool is available on EPA MOVES tools website: http://www.epa.gov/otaq/models/moves/tools/

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Age Distribution: Exercise

- Let's enter age distribution data into the CDM for our county-level exercise

- We have obtained age distribution data for the passenger cars and trucks from local registration data

- The age of diesel buses is known by the fleet operator
  - 50% are new (<1 year old)
  - 50% are one year old

- The template has already been filled out with our local age distribution and is available as file: *agedistribution.xls*

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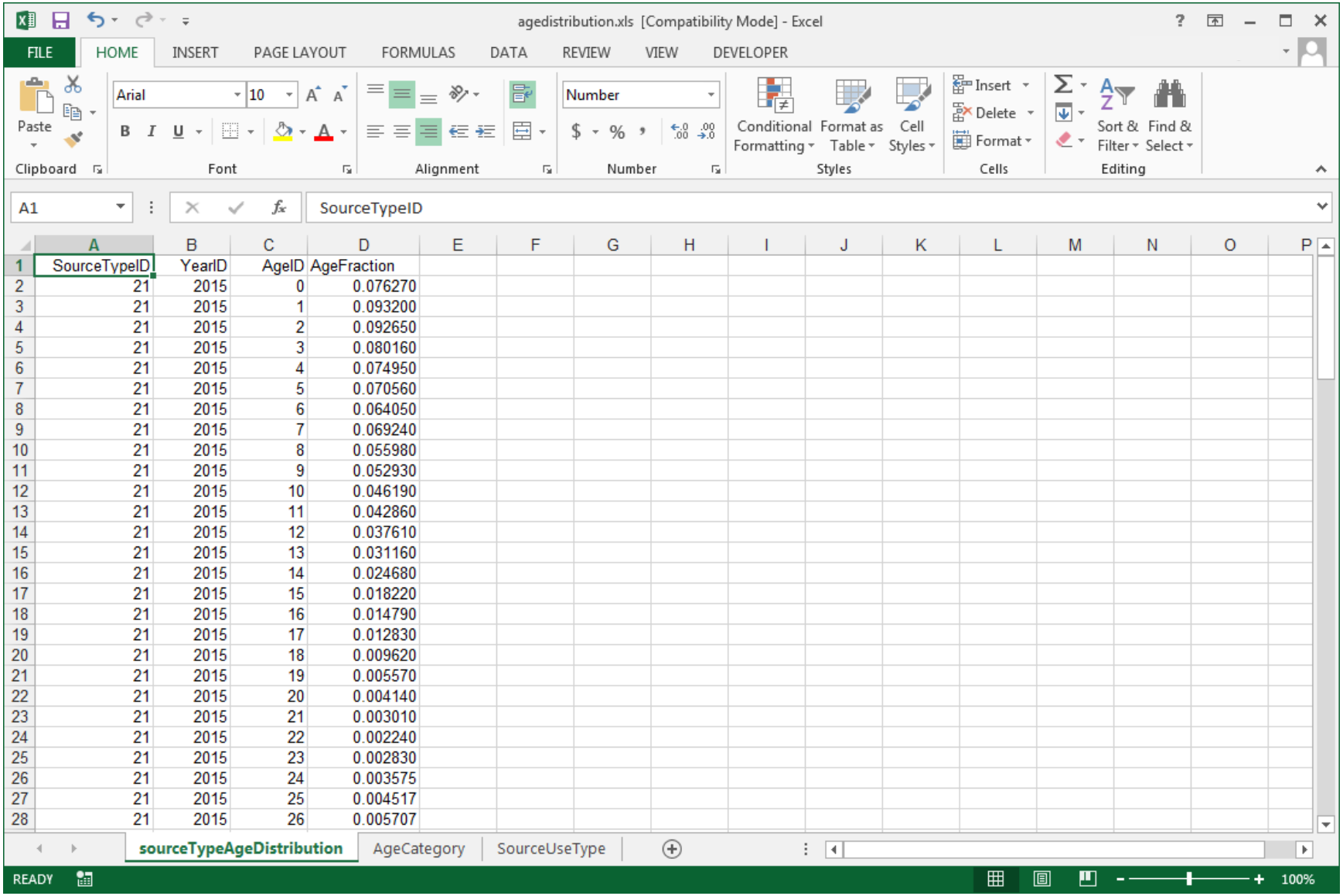
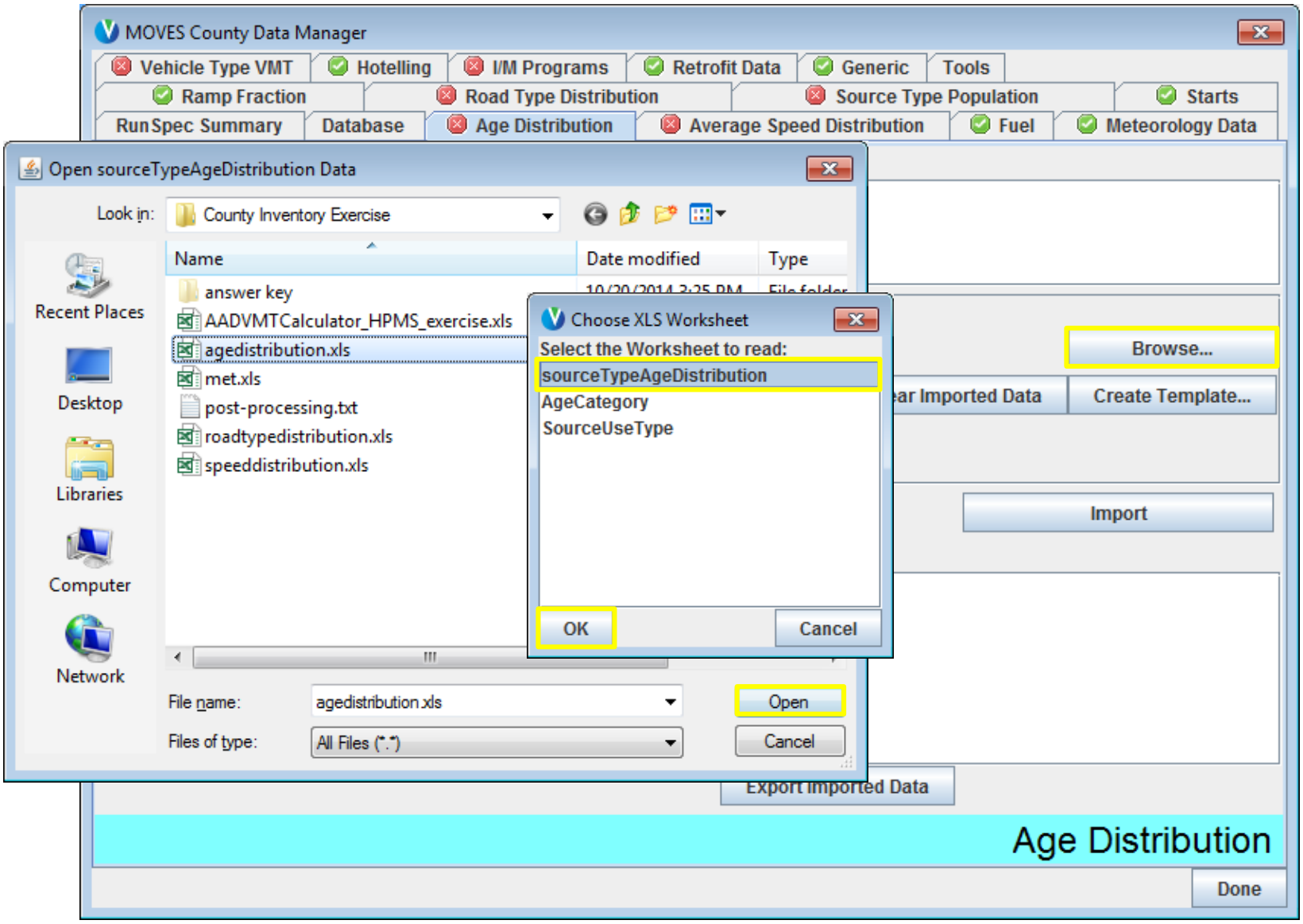
Age Distribution: Exercise



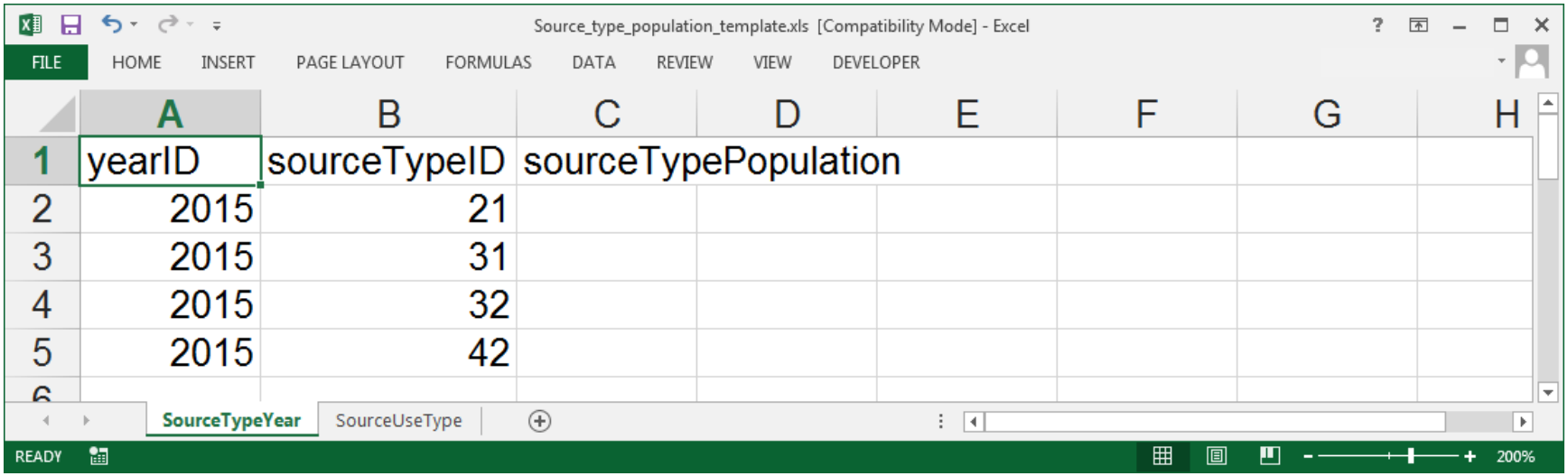
	A	B	C	D
1	SourceTypeID	YearID	AgeID	AgeFraction
2	21	2015	0	0.076270
3	21	2015	1	0.093200
4	21	2015	2	0.092650
5	21	2015	3	0.080160
6	21	2015	4	0.074950
7	21	2015	5	0.070560
8	21	2015	6	0.064050
9	21	2015	7	0.069240
10	21	2015	8	0.055980
11	21	2015	9	0.052930
12	21	2015	10	0.046190
13	21	2015	11	0.042860
14	21	2015	12	0.037610
15	21	2015	13	0.031160
16	21	2015	14	0.024680
17	21	2015	15	0.018220
18	21	2015	16	0.014790
19	21	2015	17	0.012830
20	21	2015	18	0.009620
21	21	2015	19	0.005570
22	21	2015	20	0.004140
23	21	2015	21	0.003010
24	21	2015	22	0.002240
25	21	2015	23	0.002830
26	21	2015	24	0.003575
27	21	2015	25	0.004517
28	21	2015	26	0.005707

County Inventory Exercise: Entering Age Distribution Data



Source Type Population

- Source Type Population is the actual number of vehicles of each "source type" (vehicle type) in the county being modeled



Source Type Population: Guidance

- Section 4.3 of MOVES Technical Guidance

- Start and evaporative emissions depend upon vehicle population

- Local population data is again recommended
  - Based on registration or I/M data, for instance

- Vehicle population growth must be handled outside the model since MOVES at the county scale only runs one year
  - Vehicle population for future years can be scaled in proportion to VMT or human population growth

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Source Type Population: Guidance

- Only local vehicles need to be included in population
  - Local vehicles are those that have a significant portion of their starts and parked hours in the county
  - Pass-through vehicles do not have to be included in population, but their VMT must be included in the Vehicle Type VMT tab

- Sources of population data
  - Use local registration data for motorcycles, passenger cars and light trucks
  - Use data from transit agencies, school districts, refuse haulers for buses and refuse trucks
  - If information is not available for other vehicle classes, their local population can be estimated by using the ratio of MOVES default population to MOVES default VMT and then applying that same ratio to local VMT.

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Source Type Population: Exercise

- Let's enter source type population data into the CDM for our county-level exercise

- We have passenger car and truck populations from local registration data
  - 50,000 passenger cars
  - 25,000 passenger trucks
  - 25,000 light commercial trucks

- The number of diesel buses is known by the fleet operator
  - 200 buses

- Instructions for Developing a County-scale RunSpec:
  - Export the template, enter population data, and import the table into the Source Type Population tab

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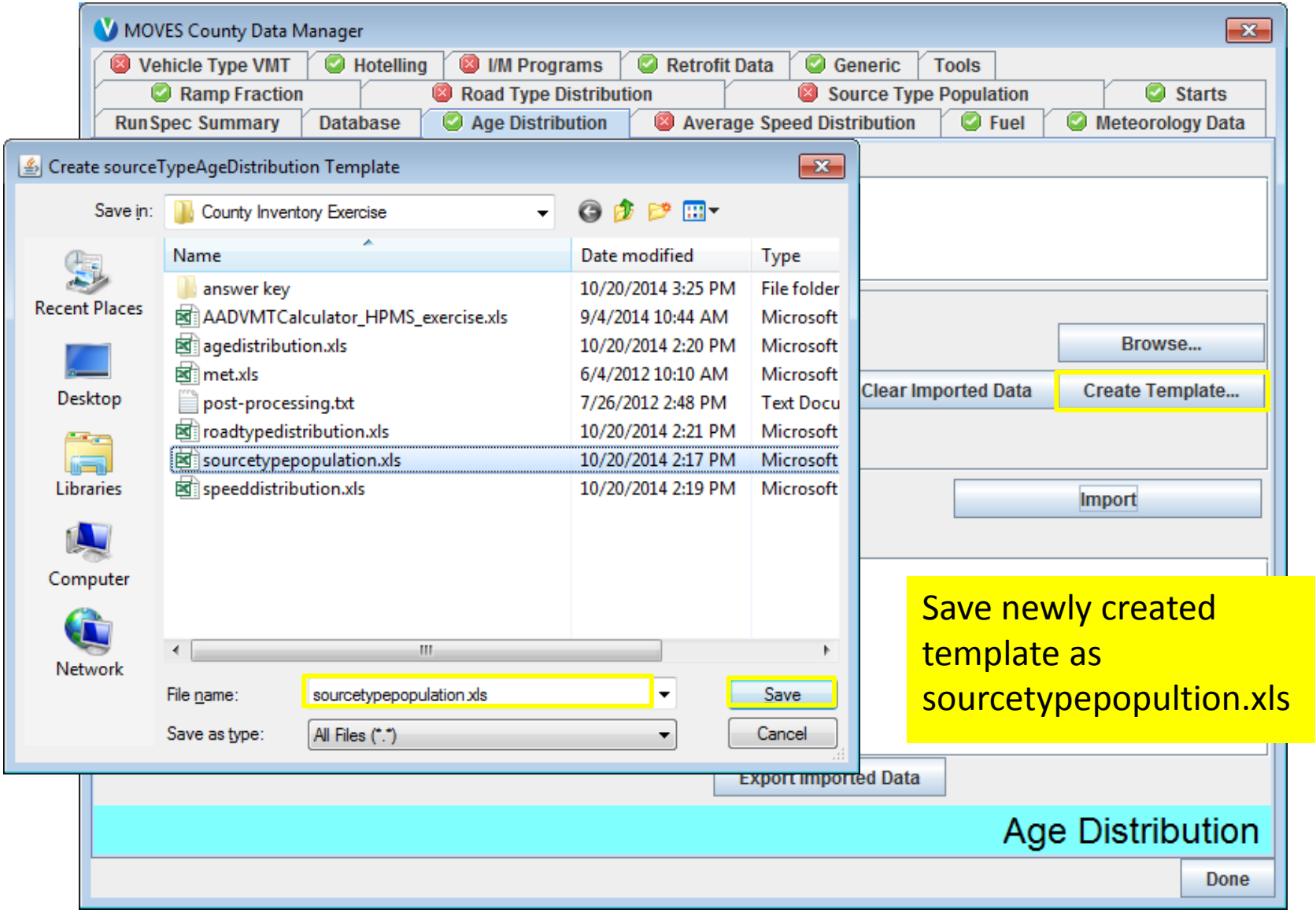
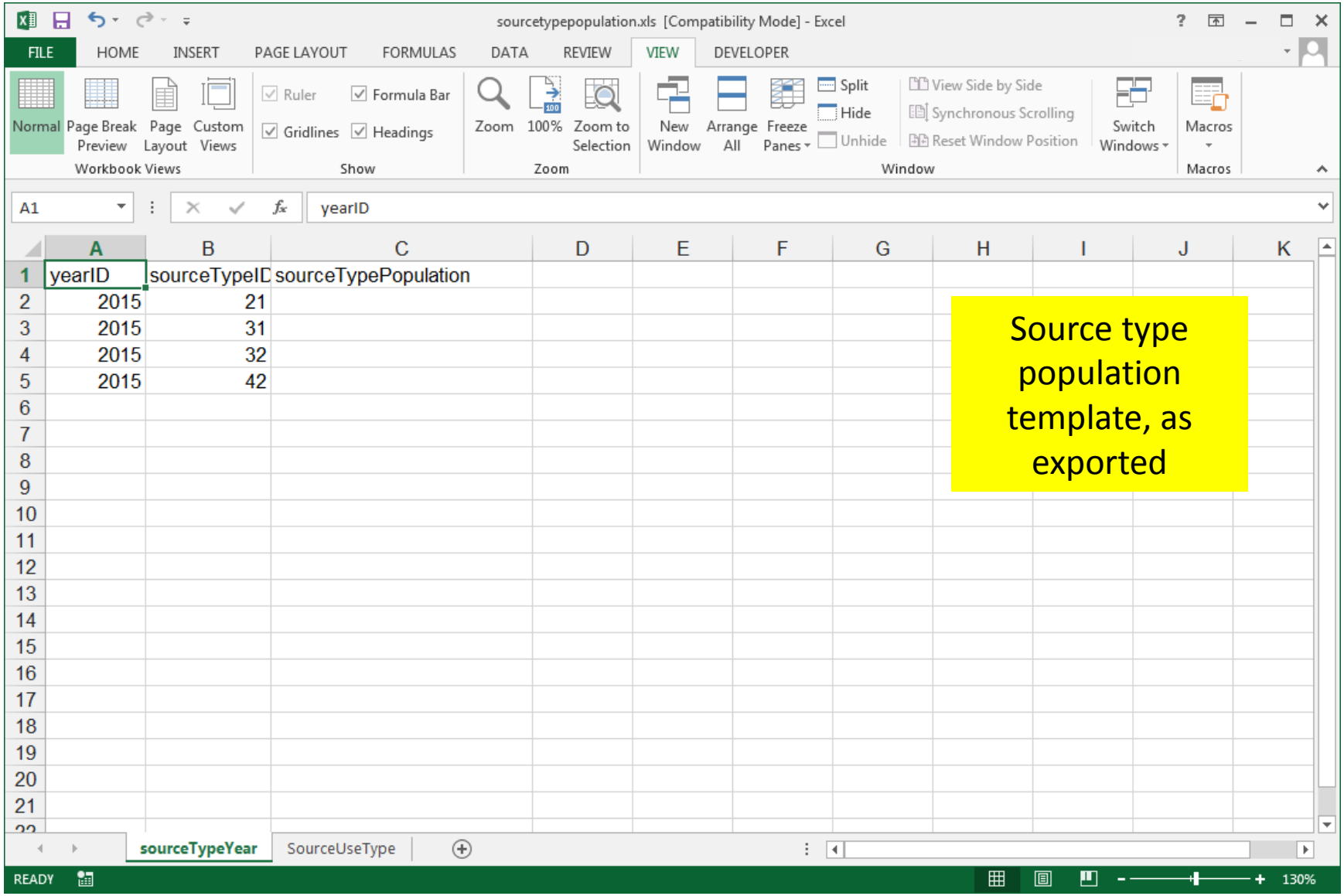
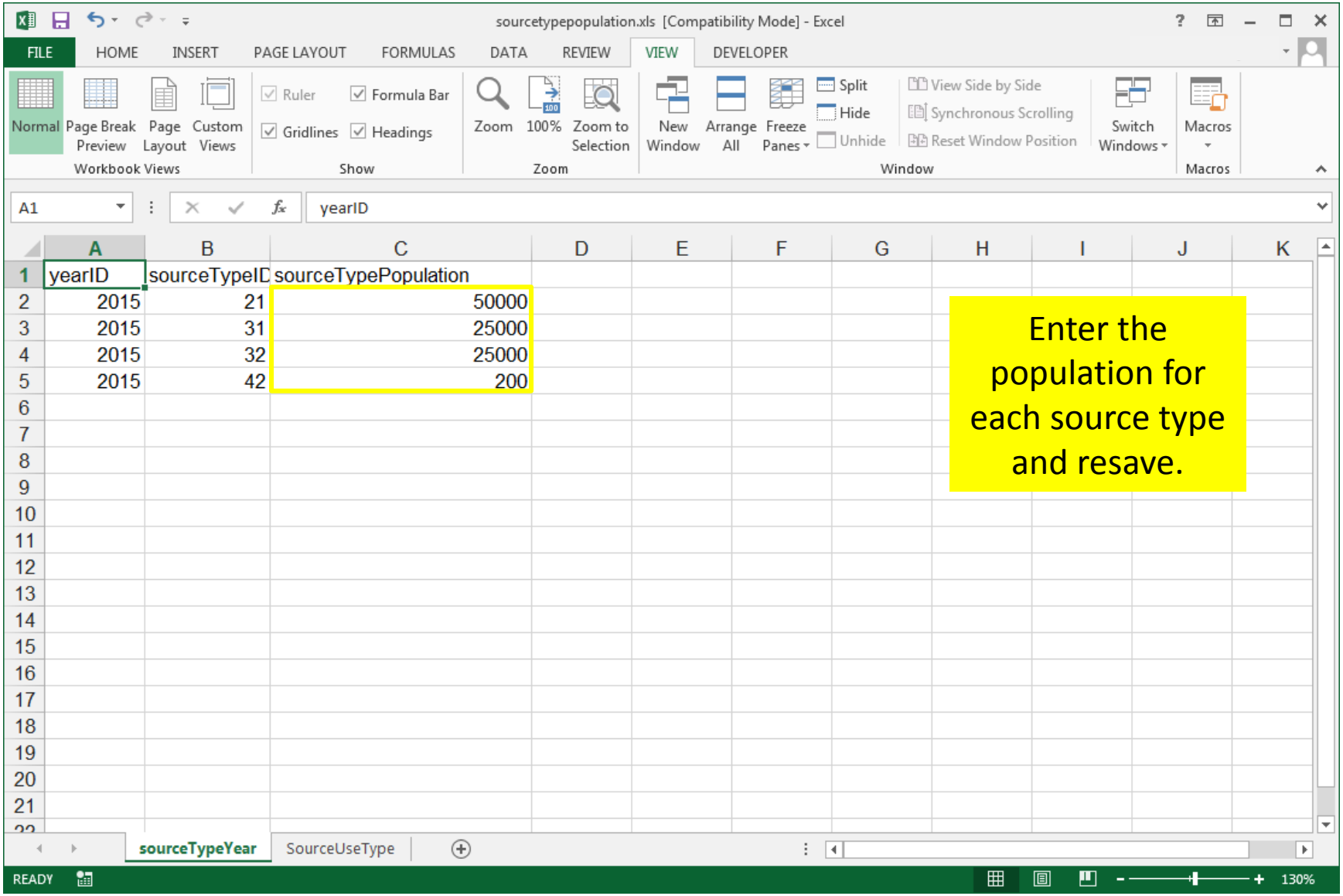
County Inventory Exercise: Entering Source Type Population Data



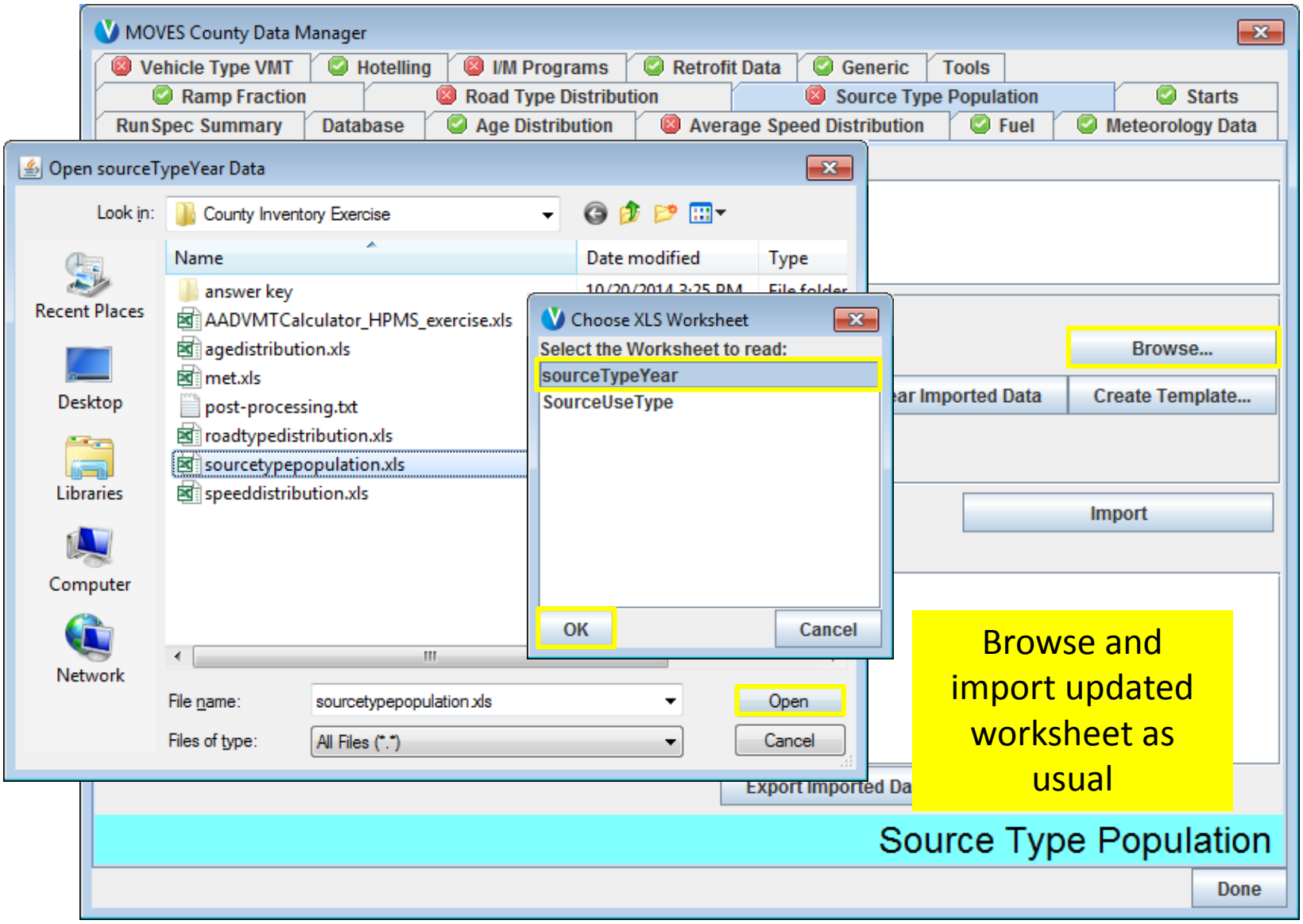
County Inventory Exercise: Entering Source Type Population Data



County Inventory Exercise: Entering Source Type Population Data

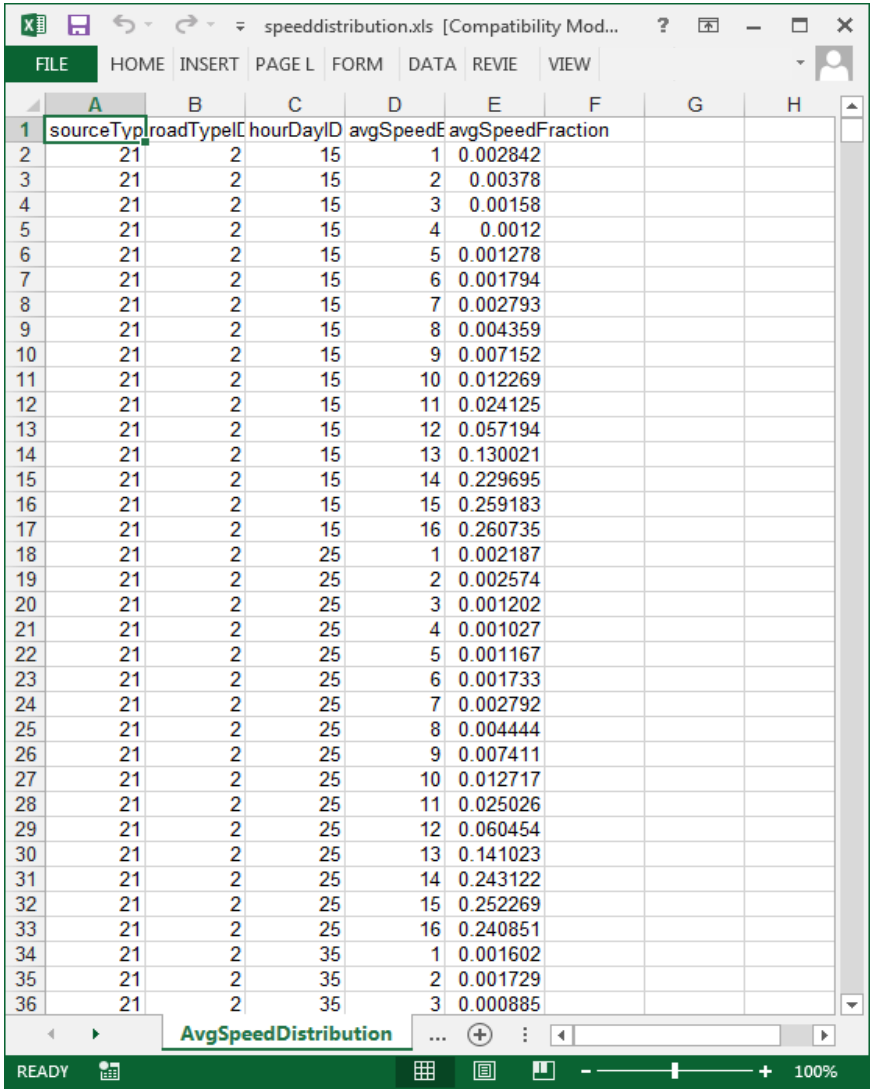


County Inventory Exercise: Entering Source Type Population Data



Average Speed Distribution

- Avg. Speed Distribution entered according to source type, road type, and hour-day
  - AvgSpeedFraction should sum to 1 within these fields
- MOVES has 16 speed bins ranging from 2.5 to 75+ mph



	A	B	C	D	E
1	sourceTyp	roadTypeID	hourDayID	avgSpeedB	avgSpeedFraction
2	21	2	15	1	0.002842
3	21	2	15	2	0.00378
4	21	2	15	3	0.00158
5	21	2	15	4	0.0012
6	21	2	15	5	0.001278
7	21	2	15	6	0.001794
8	21	2	15	7	0.002793
9	21	2	15	8	0.004359
10	21	2	15	9	0.007152
11	21	2	15	10	0.012269
12	21	2	15	11	0.024125
13	21	2	15	12	0.057194
14	21	2	15	13	0.130021
15	21	2	15	14	0.229695
16	21	2	15	15	0.259183
17	21	2	15	16	0.260735
18	21	2	25	1	0.002187
19	21	2	25	2	0.002574
20	21	2	25	3	0.001202
21	21	2	25	4	0.001027
22	21	2	25	5	0.001167
23	21	2	25	6	0.001733
24	21	2	25	7	0.002792
25	21	2	25	8	0.004444
26	21	2	25	9	0.007411
27	21	2	25	10	0.012717
28	21	2	25	11	0.025026
29	21	2	25	12	0.060454
30	21	2	25	13	0.141023
31	21	2	25	14	0.243122
32	21	2	25	15	0.252269
33	21	2	25	16	0.240851
34	21	2	35	1	0.001602
35	21	2	35	2	0.001729
36	21	2	35	3	0.000885

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Average Speed Distribution: Speed Bins

avgSpeedBinID	avgSpeedBinDesc
1	Speed < 2.5mph
2	2.5mph <= speed < 7.5mph
3	7.5mph <= speed < 12.5mph
4	12.5mph <= speed < 17.5mph
5	17.5mph <= speed < 22.5mph
6	22.5mph <= speed < 27.5mph
7	27.5mph <= speed < 32.5mph
8	32.5mph <= speed < 37.5mph
9	37.5mph <= speed < 42.5mph
10	42.5mph <= speed < 47.5mph
11	47.5mph <= speed < 52.5mph
12	52.5mph <= speed < 57.5mph
13	57.5mph <= speed < 62.5mph
14	62.5mph <= speed < 67.5mph
15	67.5mph <= speed < 72.5mph
16	72.5 <= speed

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Average Speed Distribution

- Avg. Speed Distribution is in terms of time, not distance (i.e. fraction of VHT, not VMT, in each speed bin)

- AvgSpeedDistribution table can be very long (~50,000+ rows) if RunSpec covers all source types, road types, day types, and hours
  - Consult MOVES User Guide for info about "wildcards" to provide identical speed inputs for multiple fields (e.g., HPMS classes, both types of day, etc.)

Average Speed Distribution: Guidance

- Section 4.6 of MOVES Technical Guidance

- Local speed distribution data is recommended
  - The more detail that can be obtained, the better
  - Speed distribution data can be applied to all source types within an HPMS class (e.g., same distribution for 31 and 32) or for more general categories (e.g., same distribution for all light-duty vehicles) if more detailed information is not available
  - For temporal aspects, speed distribution data can be entered at the hourly level, but varying the speed distribution for peak and off-peak hours is also acceptable
  - Freeway speeds should reflect mainline freeway speeds (not ramps)

Average Speed Distribution: Guidance

- MOVES has four road types which are affected by the speed distribution
  - Urban restricted and rural restricted road types are generally interstates and highways
  - Urban unrestricted and rural unrestricted road types are generally arterials, collectors, and local roads

- If separate speed distributions are known for arterials, collectors, and local roads, either:
  - Calculate a weighted speed distribution that applies to all urban or rural unrestricted roads, or
  - Do multiple MOVES runs using the appropriate speed and VMT information for arterials, collectors, and local roads separately and combine the results

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Average Speed Distribution: Working with Travel Model Data

- MPO travel demand forecasting (TDF) models typically produce link-level output that can be used to develop speed distributions, road type distributions and ramp fractions

- Depending on model capabilities, speeds may need to be post-processed

- Output will need to be "mapped" to MOVES format
  - Map TDF model road types to MOVES road types
  - Map TDF model time periods to MOVES hours
  - If different vehicle types are modeled, map vehicle types to MOVES source types
  - If different geographic areas modeled (e.g., CBD, urban, suburban, etc.), map to MOVES urban and rural groups

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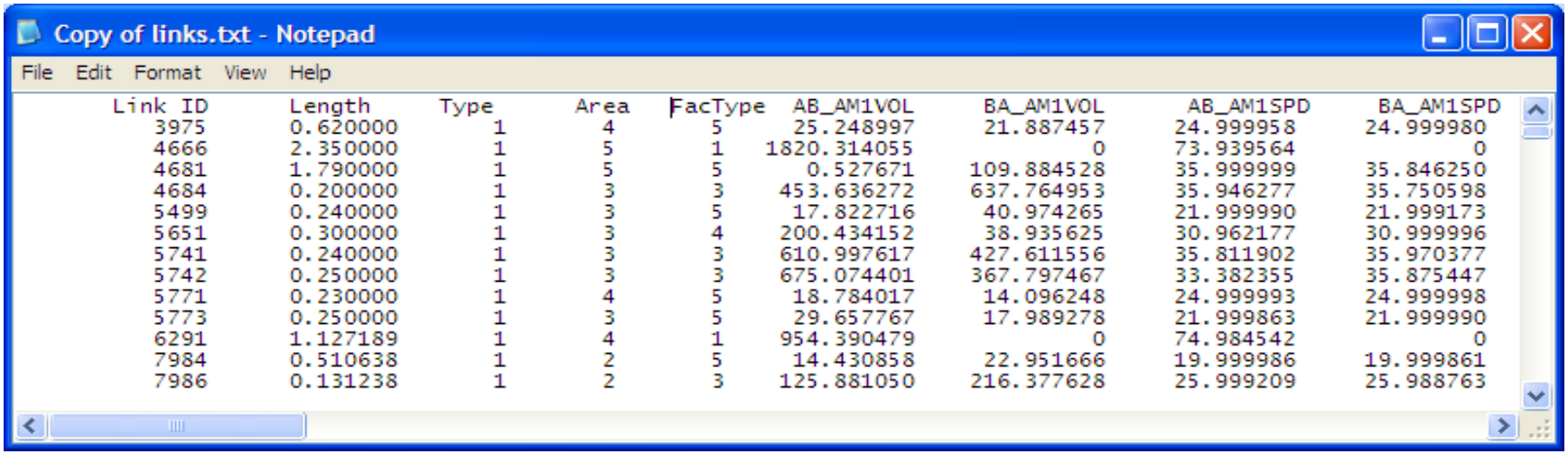
Average Speed Distribution: Example Travel Model Output

- Type = link type (highway, transit, etc.)
- Area = area type (CBD, urban, suburban, etc.)
- Factype = roadway type (freeway, major arterial, etc.)
- AB_AM1VOL = traffic volume in the A to B direction during the first a.m. time period (BA_AM1VOL = volume in the B to A direction)
- AB_AM1SPD = speed in the A to B direction during the first a.m. time period (BA_AM1SPD = speed in the B to A direction)
- This example continues for 9 more time periods and ~ 19,000 more links



Link ID	Length	Type	Area	FacType	AB_AM1VOL	BA_AM1VOL	AB_AM1SPD	BA_AM1SPD
3975	0.620000	1	4	5	25.248997	21.887457	24.999958	24.999980
4666	2.350000	1	5	1	1820.314055	0	73.939564	0
4681	1.790000	1	5	5	0.527671	109.884528	35.999999	35.846250
4684	0.200000	1	3	3	453.636272	637.764953	35.946277	35.750598
5499	0.240000	1	3	5	17.822716	40.974265	21.999990	21.999173
5651	0.300000	1	3	4	200.434152	38.935625	30.962177	30.999996
5741	0.240000	1	3	3	610.997617	427.611556	35.811902	35.970377
5742	0.250000	1	3	3	675.074401	367.797467	33.382355	35.875447
5771	0.230000	1	4	5	18.784017	14.096248	24.999993	24.999998
5773	0.250000	1	3	5	29.657767	17.989278	21.999863	21.999990
6291	1.127189	1	4	1	954.390479	0	74.984542	0
7984	0.510638	1	2	5	14.430858	22.951666	19.999986	19.999861
7986	0.131238	1	2	3	125.881050	216.377628	25.999209	25.988763

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Average Speed Distribution: Steps in Developing Speed Inputs

- Map to the four relevant MOVES road types
  - No VMT or VHT on roadtypeid = 1 (“off-network”)
  - Use only roadway links, not rail, bike, walk links
- Sort by speed bin
- Calculate VHT by speed bin and road type (link length times volume divided by speed = VHT)
  - If ramps coded separately, use only freeway mainline segments in VHT calculations, but still need to reflect ramp VMT in VMT inputs
- Sum total VHT by road type and then calculate bin fractions

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Average Speed Distribution: Steps in Developing Speed Inputs

- Repeat for each time period; map to MOVES hours

- If multiple vehicle types modeled, repeat for each vehicle group and map to MOVES source type
  - Some areas do separate traffic assignment for cars, trucks, and other classes
  - If bus transit links modeled separately, calculate speeds separately and use these speeds for the transit bus source type)

- If multiple area types, then map to rural and urban
  - Can also handle as individual “zones”

Average Speed Distribution: Exercise

- Let's enter average speed distribution data into the CDM for our county-level exercise

- In this case, we have the same speed distribution for all vehicle types

- The template has been filled out and is available as file: *SpeedDistribution.xls*

Instructions for Developing a County-scale RunSpec:

- Review *SpeedDistribution.xls* and import into the Average Speed Distribution tab

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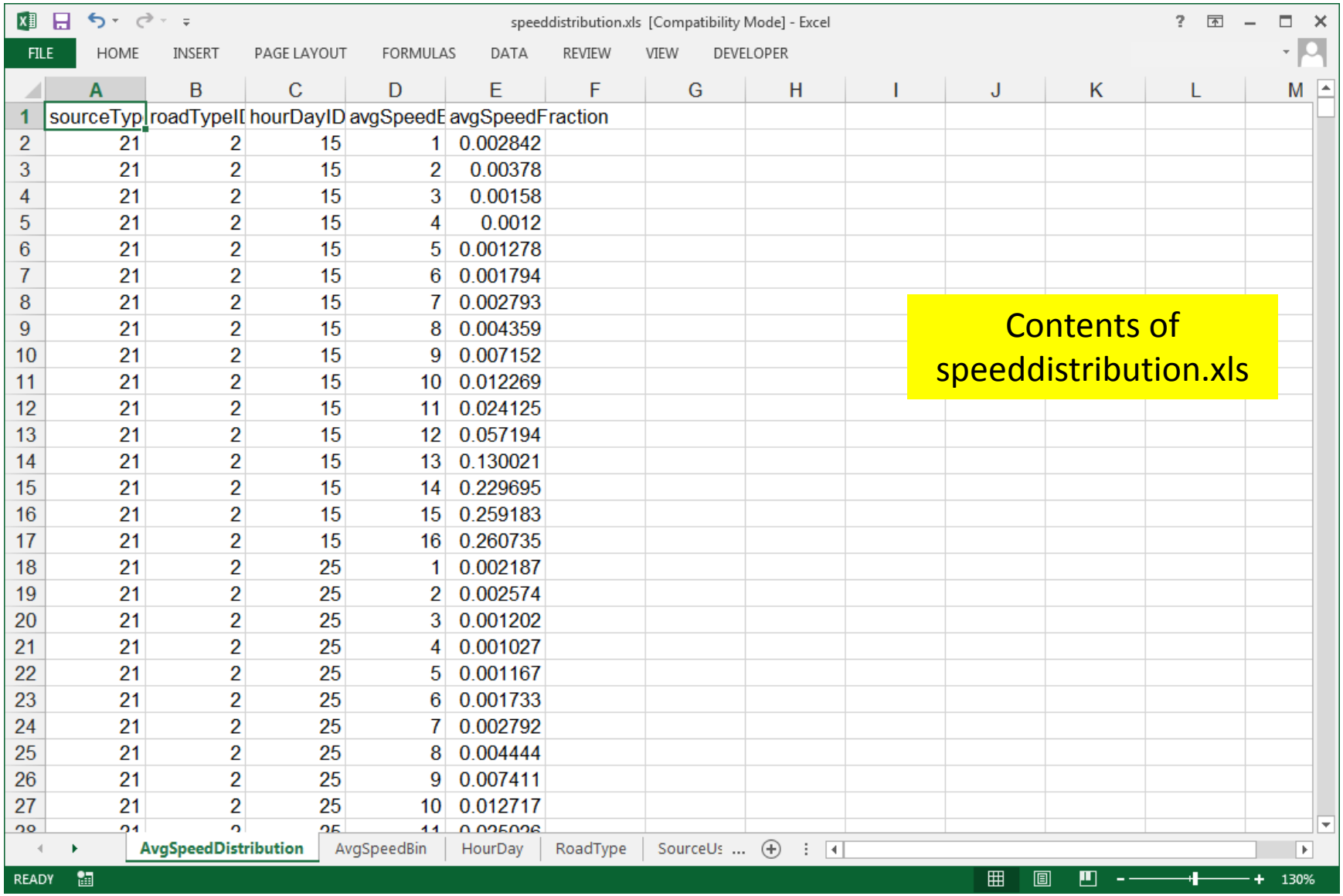
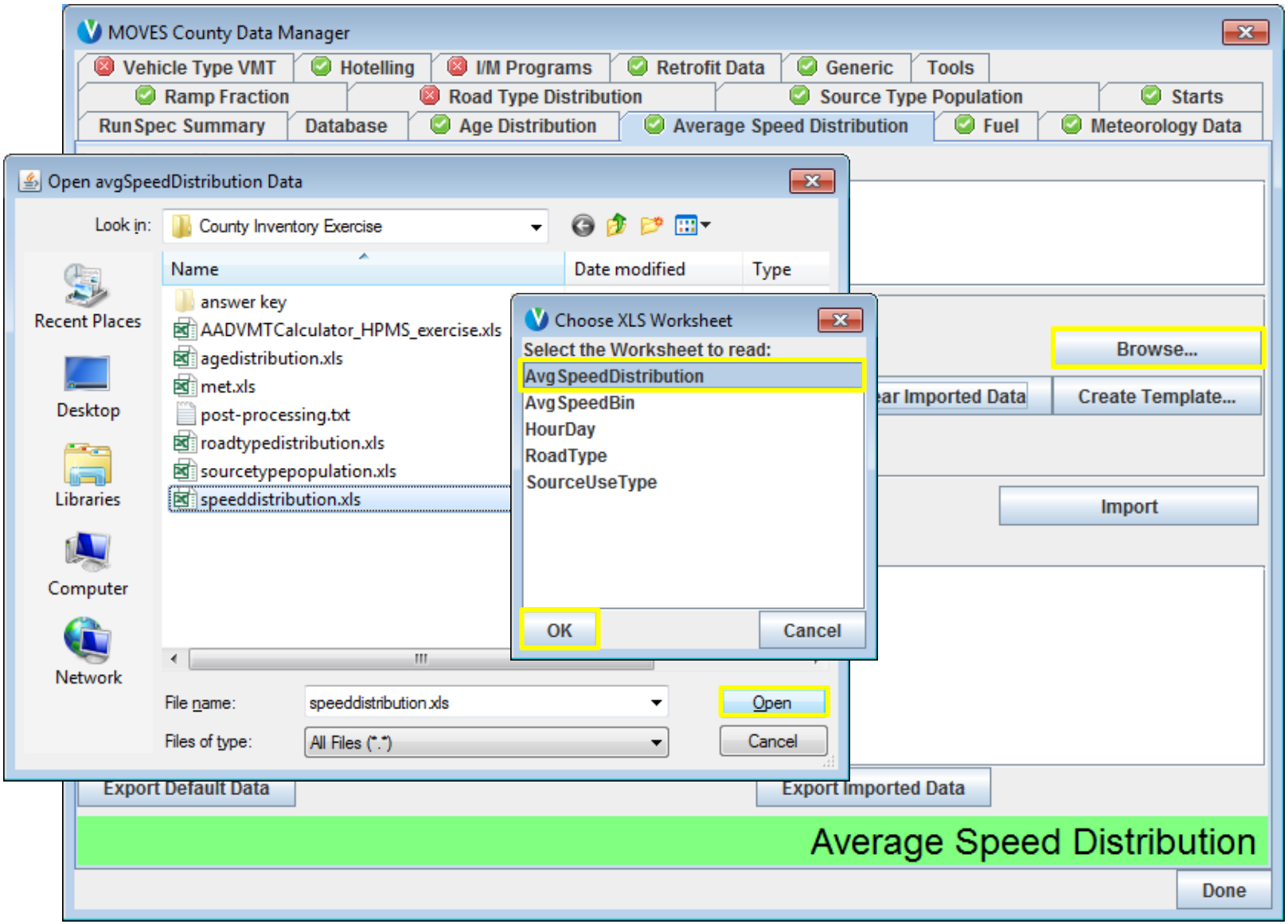
County Inventory Exercise:
Entering Average Speed Distribution Data



	A	B	C	D	E
1	sourceTyp	roadTypeI	hourDayID	avgSpeedB	avgSpeedFraction
2	21	2	15	1	0.002842
3	21	2	15	2	0.00378
4	21	2	15	3	0.00158
5	21	2	15	4	0.0012
6	21	2	15	5	0.001278
7	21	2	15	6	0.001794
8	21	2	15	7	0.002793
9	21	2	15	8	0.004359
10	21	2	15	9	0.007152
11	21	2	15	10	0.012269
12	21	2	15	11	0.024125
13	21	2	15	12	0.057194
14	21	2	15	13	0.130021
15	21	2	15	14	0.229695
16	21	2	15	15	0.259183
17	21	2	15	16	0.260735
18	21	2	25	1	0.002187
19	21	2	25	2	0.002574
20	21	2	25	3	0.001202
21	21	2	25	4	0.001027
22	21	2	25	5	0.001167
23	21	2	25	6	0.001733
24	21	2	25	7	0.002792
25	21	2	25	8	0.004444
26	21	2	25	9	0.007411
27	21	2	25	10	0.012717

Contents of speeddistribution.xls

County Inventory Exercise:
Entering Average Speed Distribution Data



Vehicle Type VMT

- MOVES needs annual VMT and month, day, and hour fractions
- Annual VMT is entered based on HPMS vehicle class, while distribution factors are based on MOVES source type
- Month VMT fractions - Fraction of annual VMT (per source type) occurring per month.
- Day VMT fractions - Fraction of annual VMT (per source type) occurring on one of two day types (weekday or weekend).
- Hour VMT fractions - Fraction of annual VMT (per source type) occurring per hour.

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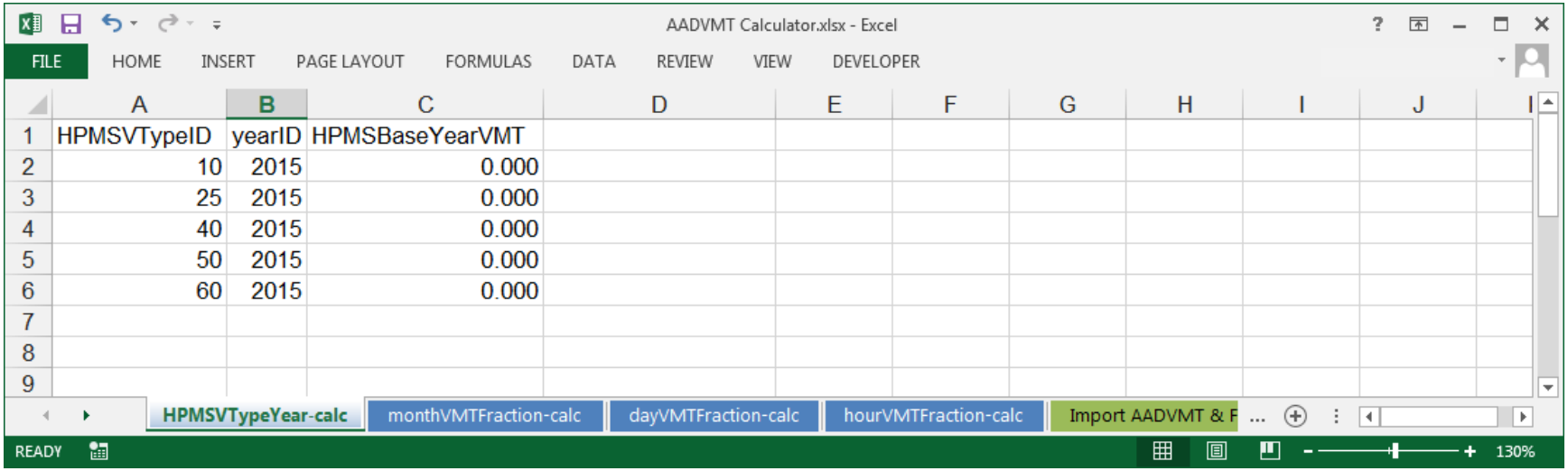
Vehicle Type VMT

- VMT is entered for each HPMS vehicle class in terms of annual VMT



	A	B	C
1	HPMSVTypeID	yearID	HPMSBaseYearVMT
2	10	2015	0.000
3	25	2015	0.000
4	40	2015	0.000
5	50	2015	0.000
6	60	2015	0.000
7			
8			
9			

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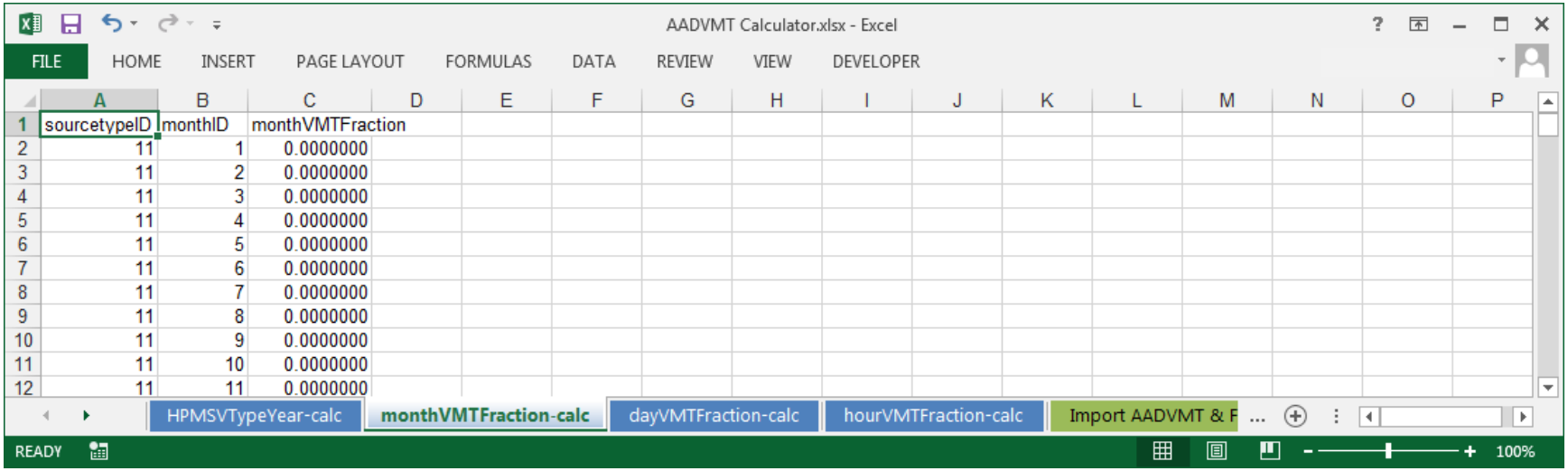
Vehicle Type VMT: Month VMT Fraction

- MonthVMTFraction must sum to 1 within each source type over a 12-month period

- If only one month is being modeled, fractions summing to less than one are acceptable



	A	B	C
1	sourcetypeID	monthID	monthVMTFraction
2	11	1	0.0000000
3	11	2	0.0000000
4	11	3	0.0000000
5	11	4	0.0000000
6	11	5	0.0000000
7	11	6	0.0000000
8	11	7	0.0000000
9	11	8	0.0000000
10	11	9	0.0000000
11	11	10	0.0000000
12	11	11	0.0000000

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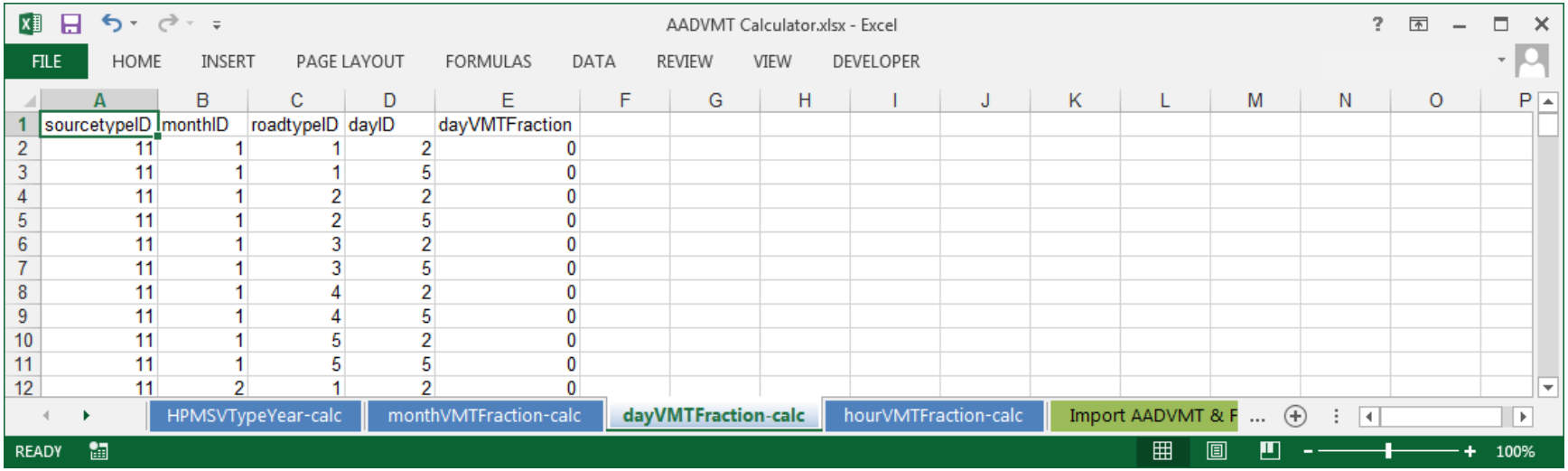
Vehicle Type VMT: Day VMT Fraction

- DayVMTFraction must sum to 1 within each source type, month, road type combination

- DayVMTFraction is the fraction of VMT occurring on each day, by type, throughout a month (i.e., ≈22 weekdays + ≈ 9 weekend days in a 31 day month; 22/31 = 0.71, similar to default values)



	A	B	C	D	E
1	sourcetypeID	monthID	roadtypeID	dayID	dayVMTFraction
2	11	1	1	2	0
3	11	1	1	5	0
4	11	1	2	2	0
5	11	1	2	5	0
6	11	1	3	2	0
7	11	1	3	5	0
8	11	1	4	2	0
9	11	1	4	5	0
10	11	1	5	2	0
11	11	1	5	5	0
12	11	2	1	2	0

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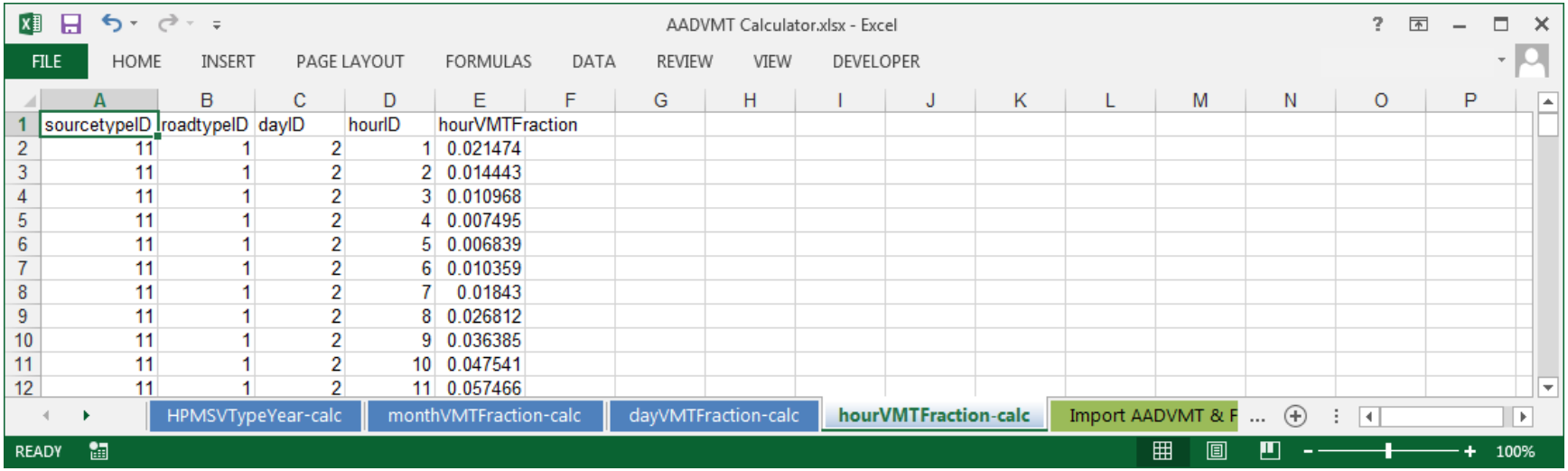
Vehicle Type VMT: Hour VMT Fraction

- HourVMTFraction must sum to 1 within each source type, road type, type of day combination

- HourVMTFraction is applied to all months
  - If data varies for different months, you must run different RunSpecs for each



	A	B	C	D	E
1	sourcetypeID	roadtypeID	dayID	hourID	hourVMTFraction
2	11	1	2	1	0.021474
3	11	1	2	2	0.014443
4	11	1	2	3	0.010968
5	11	1	2	4	0.007495
6	11	1	2	5	0.006839
7	11	1	2	6	0.010359
8	11	1	2	7	0.01843
9	11	1	2	8	0.026812
10	11	1	2	9	0.036385
11	11	1	2	10	0.047541
12	11	1	2	11	0.057466

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Annual VMT & VMT Fractions: Guidance

- Section 4.5 of MOVES Technical Guidance
- Total local VMT data are necessary
- Local VMT month, day, and hour fractions should be used if data are available; otherwise, defaults are acceptable
- Entering annual VMT and the correct month and daily VMT fractions for the entire year allows the same files to be used to model any month or day
  - If VMT is calculated for just a specific month or day (and the monthVMTFraction and dayVMTFraction tables are populated accordingly), this database can only be used with RunSpecs for that month and type of day

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CDM: Using the Average Annual Daily Vehicle Miles Traveled (AADVMT) Converter

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AADVMT Converter

- EPA has developed a spreadsheet based converter to scale up more readily available daily VMT to annual VMT

- Users can enter daily VMT entered using true annual average daily VMT or average weekday VMT
  - Modifying Monthly and Weekend-day Adjustment Factors provide user flexibility to determine the amount of VMT for any HPMS class, in any month, for either type of day

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AADVMT Converter

- Recommended approach is to enter adjustment factors for all HPMS classes, months and days
  - That allows resulting tables to be used for analysis covering any mix of vehicles and time periods

- This converter uses MOVES inputs (not MOBILE), so it can be used with VMT data gathered according to MOVES (or FHWA) vehicle types

- We will use this converter to get VMT inputs for our county inventory exercise

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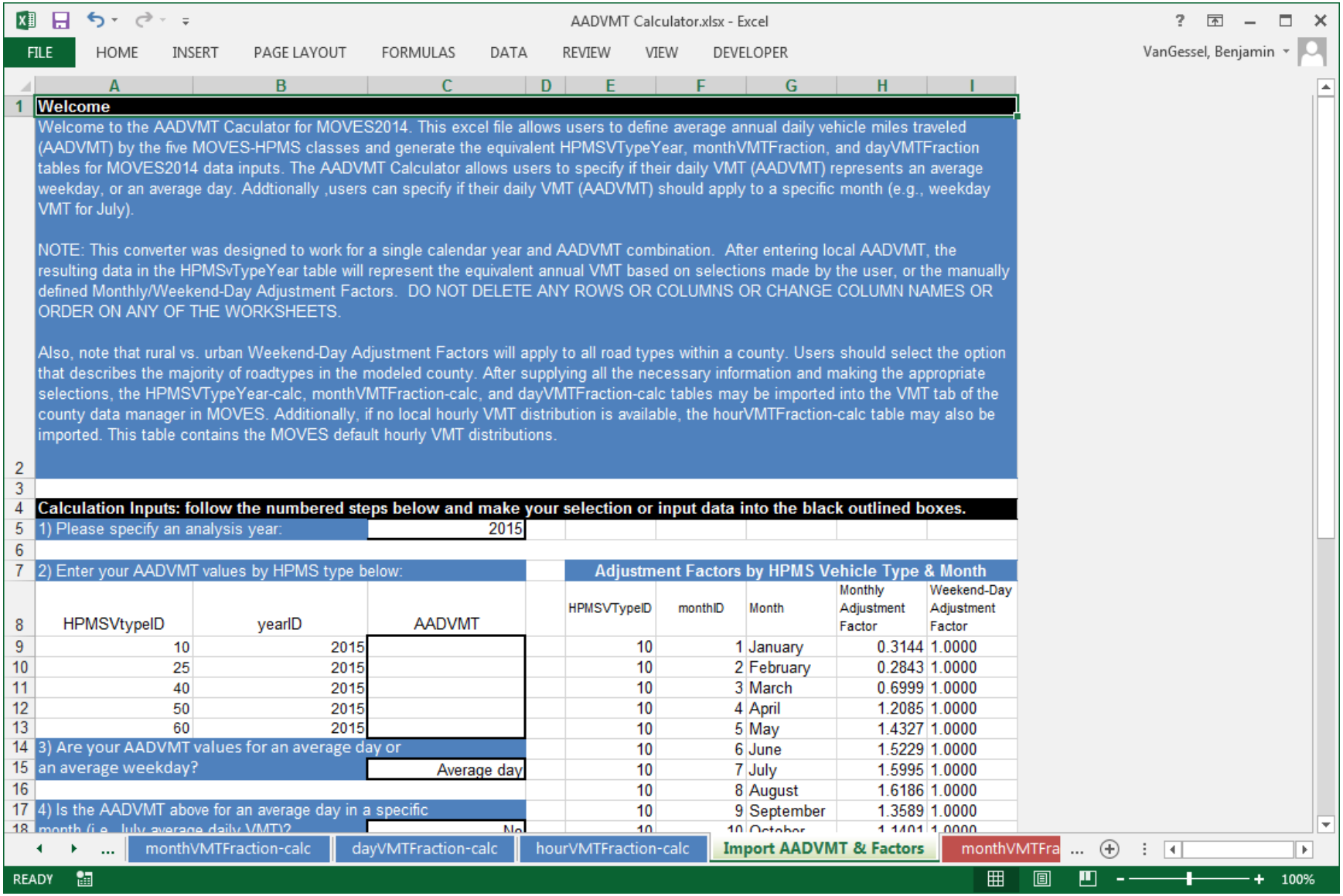
AADVMT Converter



AADVMT Converter

- When daily VMT is entered in VMT converter, annual VMT is generated in **HPMSVTypeYear** table
  - Can be directly imported into the MOVES CDM

- Appropriate Monthly and Weekend Day Adjustment factors should be entered to generate **monthVMTFraction** and **dayVMTFraction** tables that correspond to the calculated annual VMT

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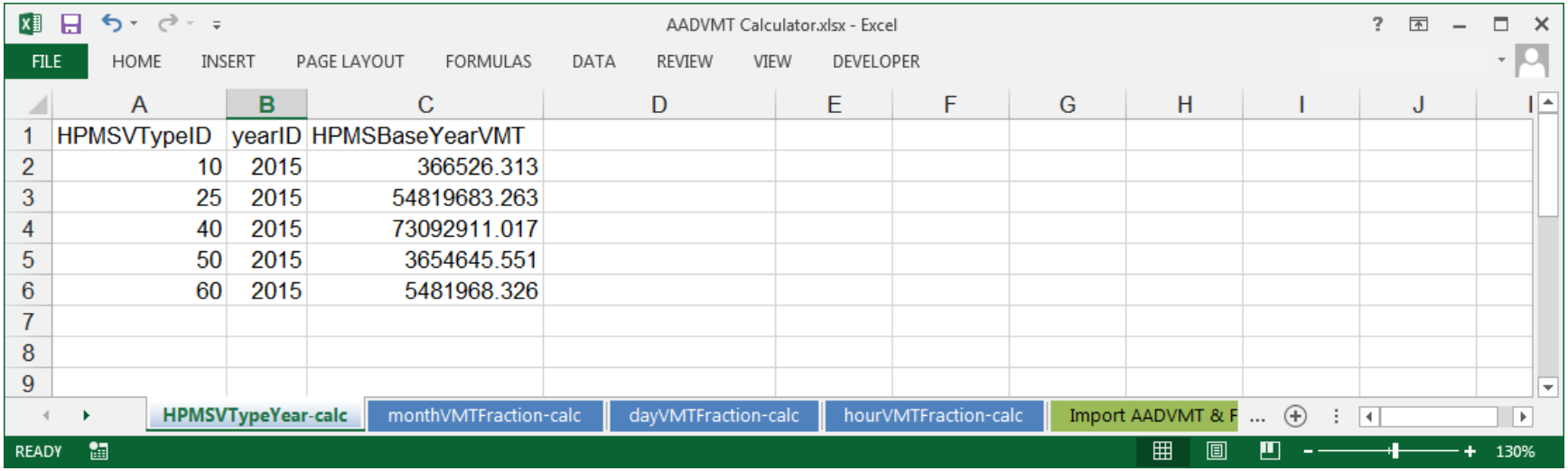
AADVMT - Input Table: HPMSVTypeYear



	A	B	C	D	E	F	G	H	I	J
1	HPMSVTypeID	yearID	HPMSBaseYearVMT							
2	10	2015	366526.313							
3	25	2015	54819683.263							
4	40	2015	73092911.017							
5	50	2015	3654645.551							
6	60	2015	5481968.326							
7										
8										
9										

- HPMSBaseYearVMT is calculated from daily VMT based on month and weekend adjustment factors
- If VMT for an HPMS class was not entered, this table should report a zero for the HPMSBaseYearVMT

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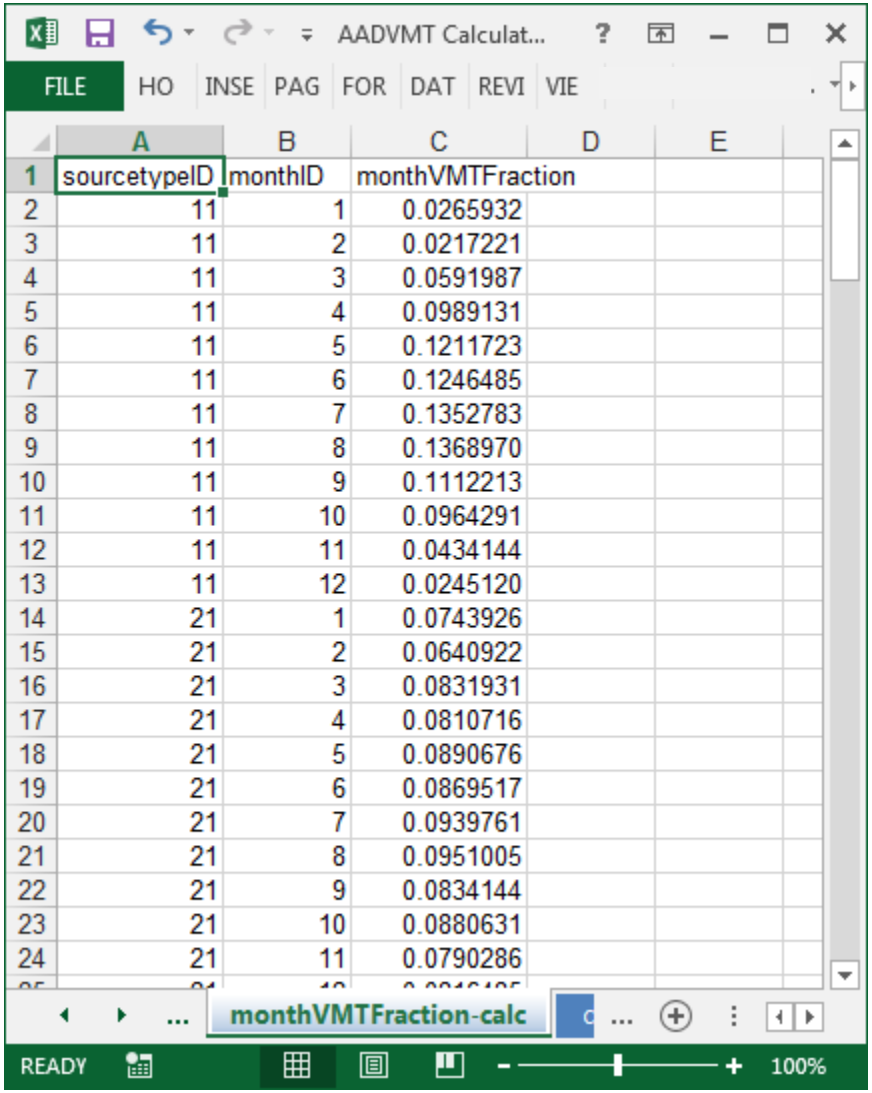
AADVMT - Input Table: MonthVMTFraction

- MonthVMTFraction values are calculated based on adjustment factors provided by the user and number of days in the month
  - Sum of MonthVMTFraction will always total 1 for each source type



	A	B	C	D	E
1	sourcetypeID	monthID	monthVMTFraction		
2	11	1	0.0265932		
3	11	2	0.0217221		
4	11	3	0.0591987		
5	11	4	0.0989131		
6	11	5	0.1211723		
7	11	6	0.1246485		
8	11	7	0.1352783		
9	11	8	0.1368970		
10	11	9	0.1112213		
11	11	10	0.0964291		
12	11	11	0.0434144		
13	11	12	0.0245120		
14	21	1	0.0743926		
15	21	2	0.0640922		
16	21	3	0.0831931		
17	21	4	0.0810716		
18	21	5	0.0890676		
19	21	6	0.0869517		
20	21	7	0.0939761		
21	21	8	0.0951005		
22	21	9	0.0834144		
23	21	10	0.0880631		
24	21	11	0.0790286		

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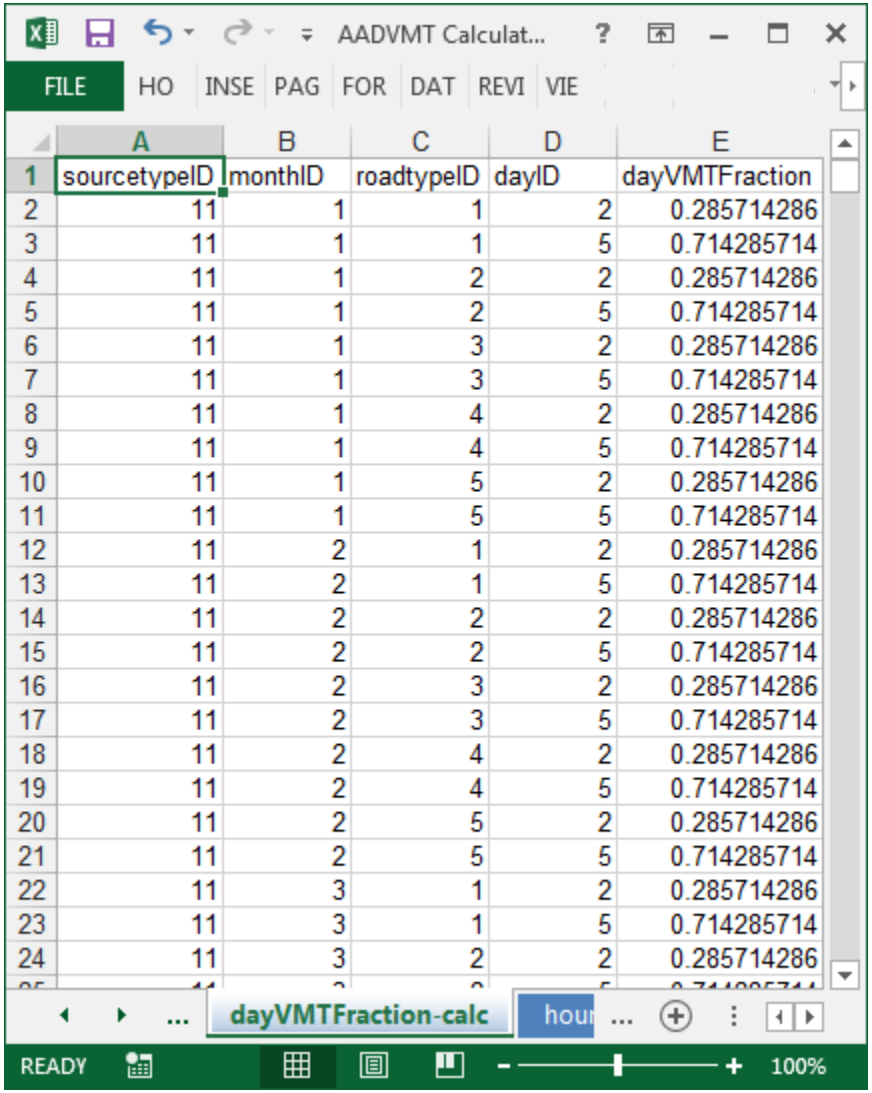
AADVMT - Input Table: DayVMTFraction

- DayVMTFraction values are calculated based on adjustment factors provided by the user
  - Sum of DayVMTFraction will always total 1 for each source type, month, road type combination
- DayVMTFraction values will be the same for all road types, but can vary by month



	A	B	C	D	E
1	sourcetypeID	monthID	roadtypeID	dayID	dayVMTFraction
2	11	1	1	2	0.285714286
3	11	1	1	5	0.714285714
4	11	1	2	2	0.285714286
5	11	1	2	5	0.714285714
6	11	1	3	2	0.285714286
7	11	1	3	5	0.714285714
8	11	1	4	2	0.285714286
9	11	1	4	5	0.714285714
10	11	1	5	2	0.285714286
11	11	1	5	5	0.714285714
12	11	2	1	2	0.285714286
13	11	2	1	5	0.714285714
14	11	2	2	2	0.285714286
15	11	2	2	5	0.714285714
16	11	2	3	2	0.285714286
17	11	2	3	5	0.714285714
18	11	2	4	2	0.285714286
19	11	2	4	5	0.714285714
20	11	2	5	2	0.285714286
21	11	2	5	5	0.714285714
22	11	3	1	2	0.285714286
23	11	3	1	5	0.714285714
24	11	3	2	2	0.285714286

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AADVMT Converter: Exercise

- Let's enter our VMT and VMT fractions data into the CDM for our county-level exercise

- For this example, we don't know annual VMT but we do know daily VMT as follows:
  - Passenger vehicles = 3,000,000
  - Transit buses = 10,000

- Use the Average Annual Daily Vehicle Miles Traveled (AADVMT) converter to generate the annual/ month/day/hour VMT tables for the Vehicle Type VMT tab

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AADVMT Converter: Exercise

Instructions for entering information into the AADVMT Converter:

1) Specify *2015* for the analysis year

2) Enter our known daily VMT for each HPMS vehicle type:

   Passenger vehicles (HPMSVtypeID 25) = 3,000,000

   Transit buses (HPMSVtypeID 40) = 10,000

   Enter 0 for all other HPMSVtypeIDs (no VMT for these types)

3) For step 3 in the AADVMT Calculator, select *Average weekday*.

4) For step 4 in the AADVMT Calculator, select *Yes* to set a monthly adjustment factor (column H) of 1.0 indicating the VMT is from a particular month (e.g., July).

5) Skip to step 6.

   For question 6a, select *Yes*.

   For question 6b, select *Urban* to use the MOVES urban default Weekend-Day Adjustment Factor (column I) of 0.7793. This indicates that weekend traffic is 77.93% of weekday traffic.

6) For step 7, select *Yes* to use default hourVMTFraction values.

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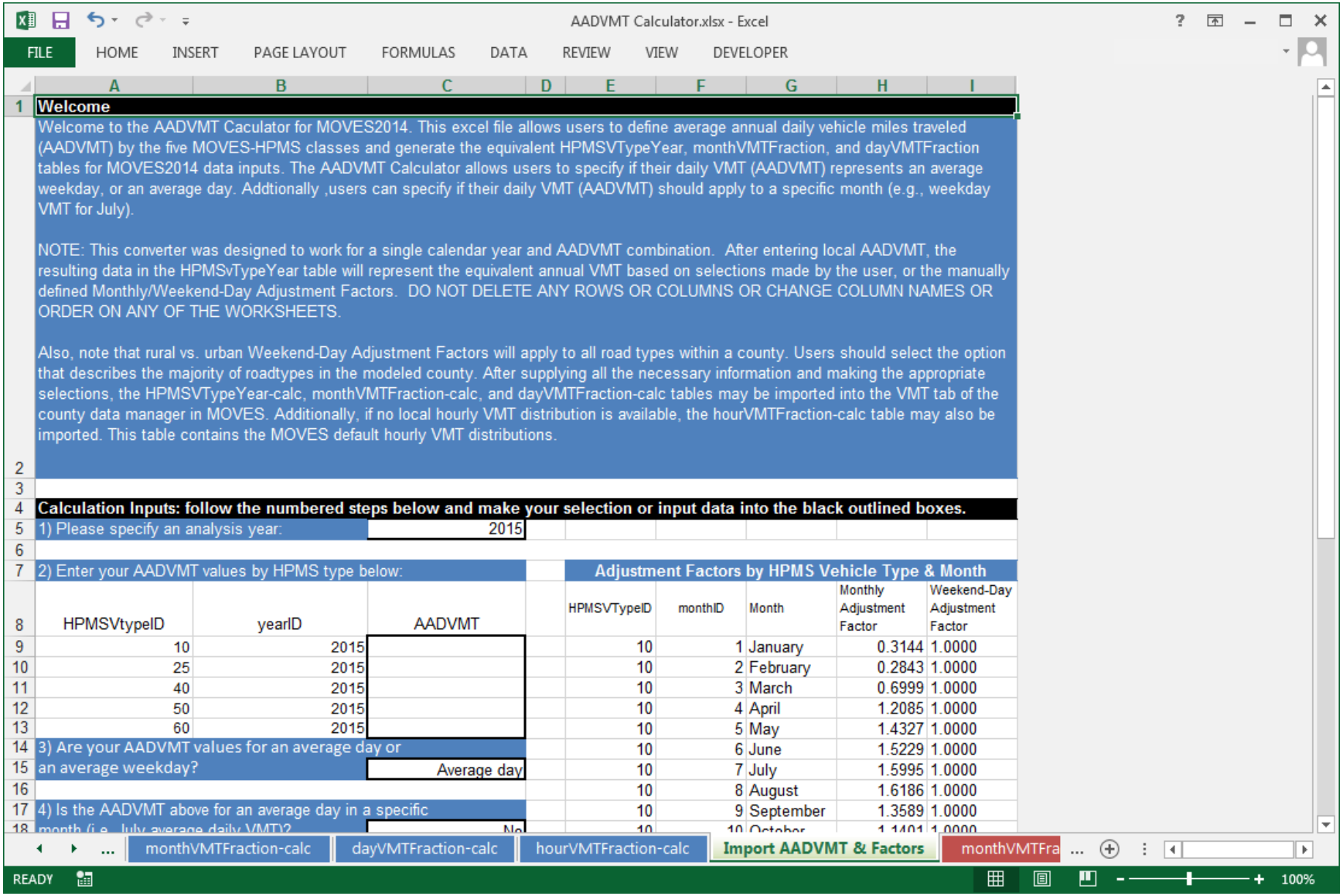
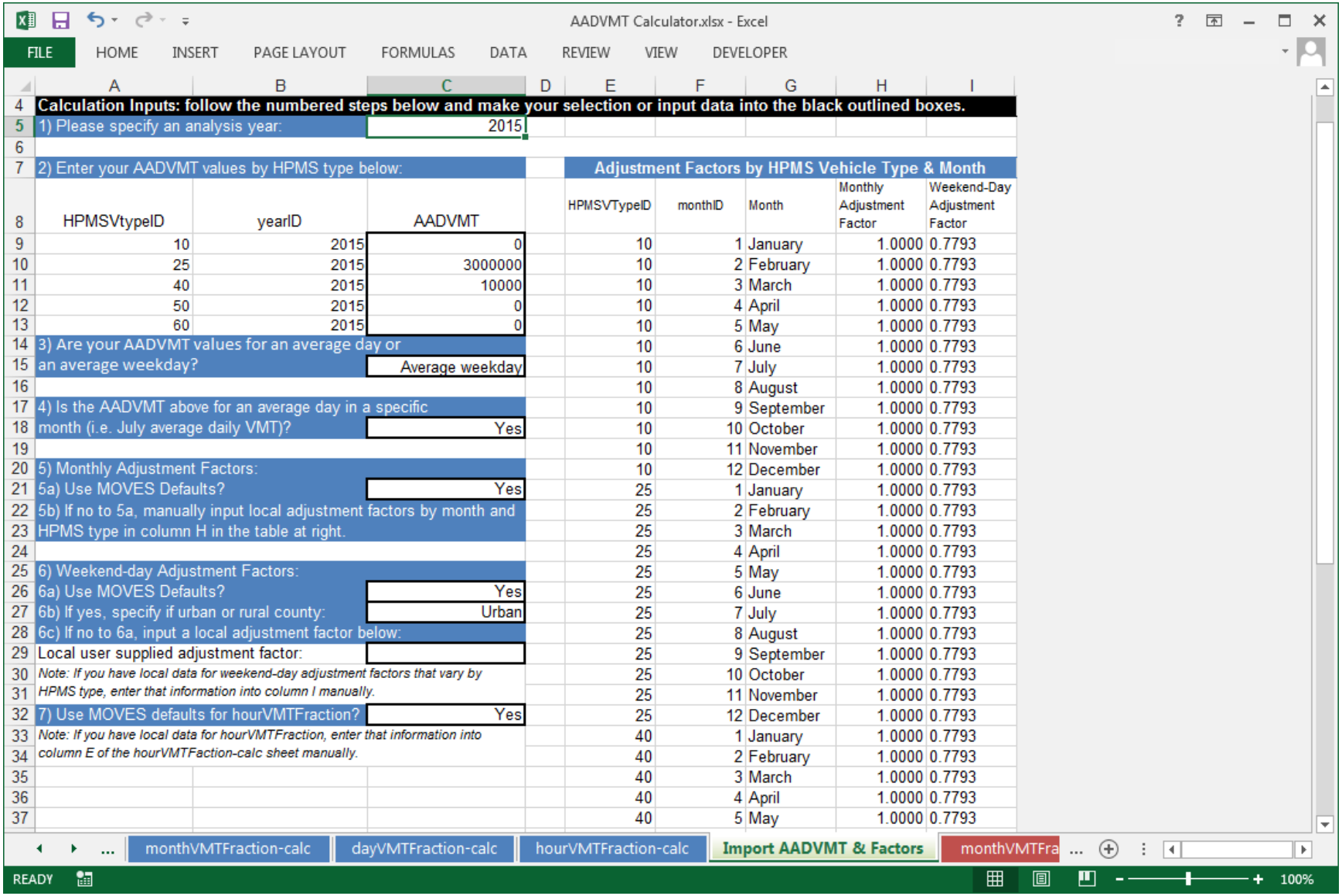
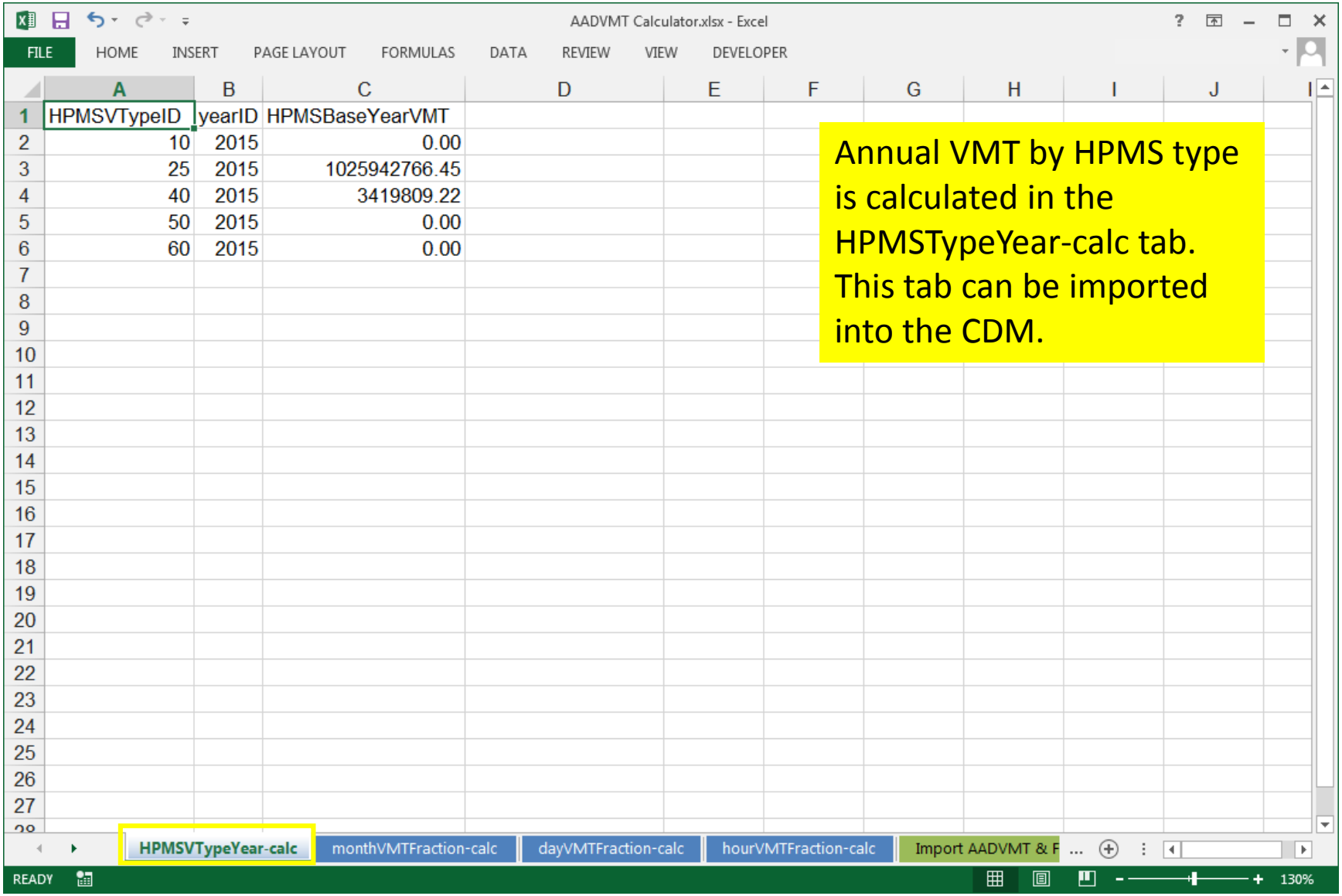
AADVMT Converter: Exercise



AADVMT Converter: Exercise



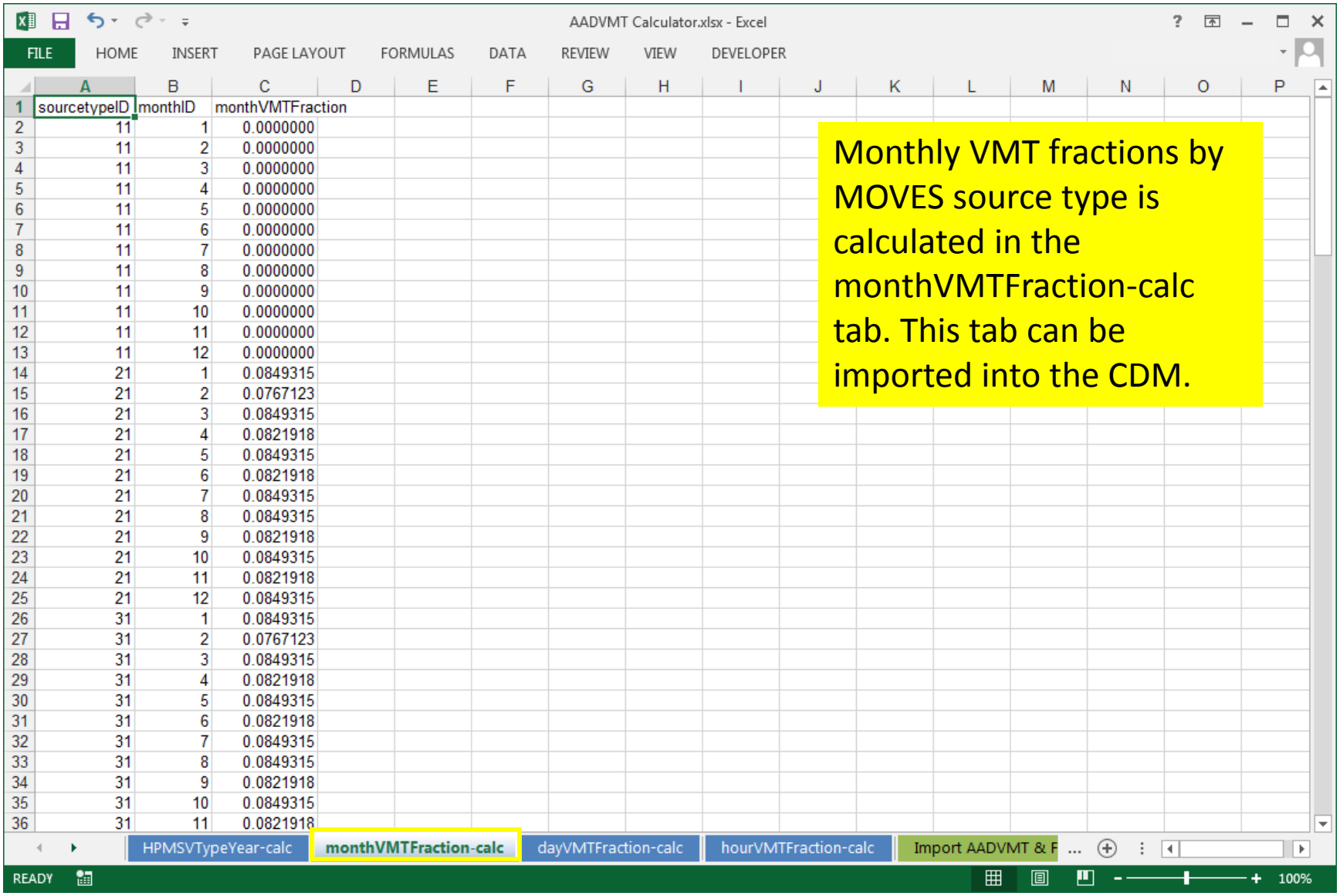
HPMSVtypeYear-calc Tab



	A	B	C
1	HPMSVTypeID	yearID	HPMSBaseYearVMT
2	10	2015	0.00
3	25	2015	1025942766.45
4	40	2015	3419809.22
5	50	2015	0.00
6	60	2015	0.00

Annual VMT by HPMS type is calculated in the HPMSTypeYear-calc tab. This tab can be imported into the CDM.

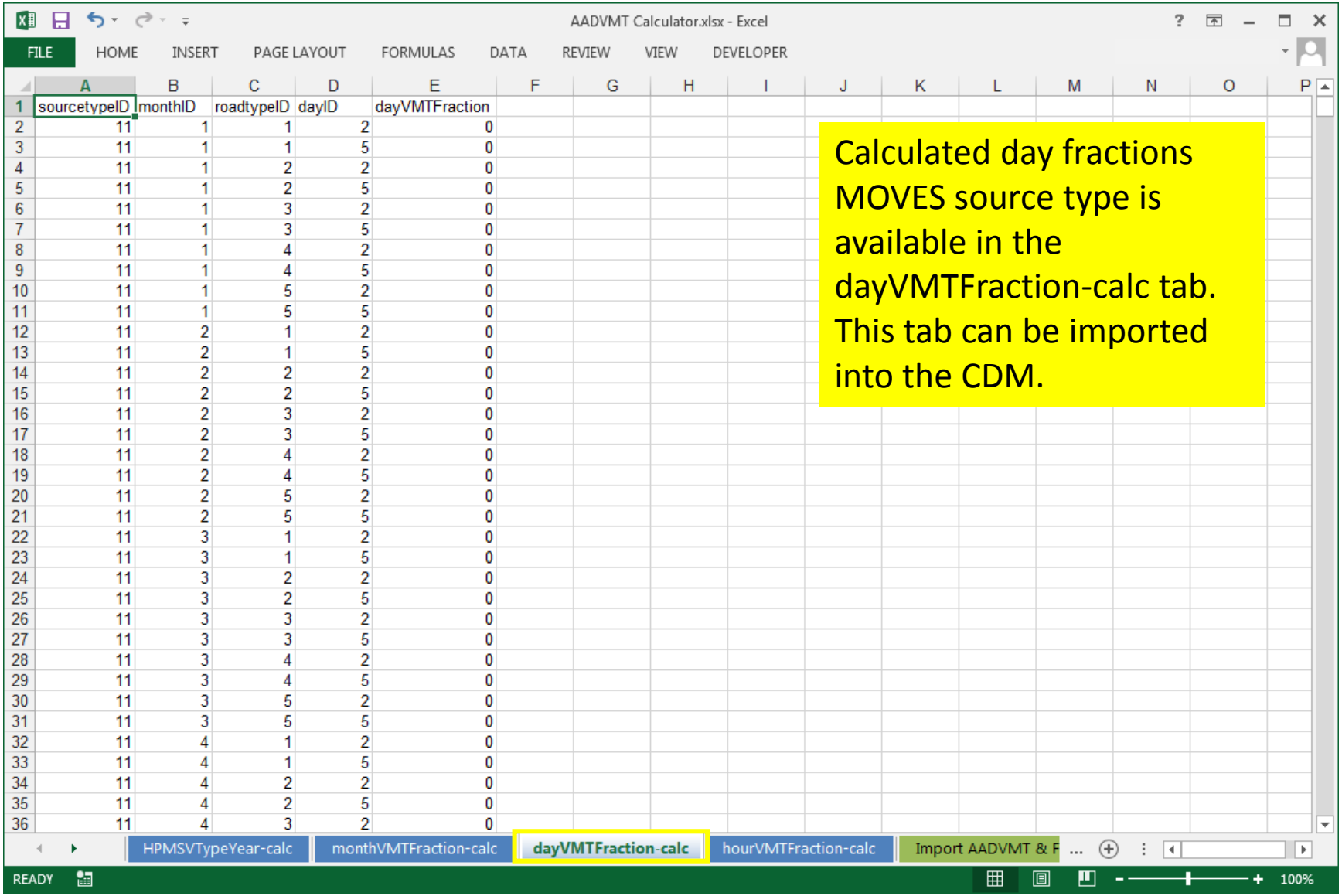
MonthVMTFraction-calc Tab



sourcetypeID	monthID	monthVMTFraction
11	1	0.0000000
11	2	0.0000000
11	3	0.0000000
11	4	0.0000000
11	5	0.0000000
11	6	0.0000000
11	7	0.0000000
11	8	0.0000000
11	9	0.0000000
11	10	0.0000000
11	11	0.0000000
11	12	0.0000000
21	1	0.0849315
21	2	0.0767123
21	3	0.0849315
21	4	0.0821918
21	5	0.0849315
21	6	0.0821918
21	7	0.0849315
21	8	0.0849315
21	9	0.0821918
21	10	0.0849315
21	11	0.0821918
21	12	0.0849315
31	1	0.0849315
31	2	0.0767123
31	3	0.0849315
31	4	0.0821918
31	5	0.0849315
31	6	0.0821918
31	7	0.0849315
31	8	0.0849315
31	9	0.0821918
31	10	0.0849315
31	11	0.0821918

Monthly VMT fractions by MOVES source type is calculated in the monthVMTFraction-calc tab. This tab can be imported into the CDM.

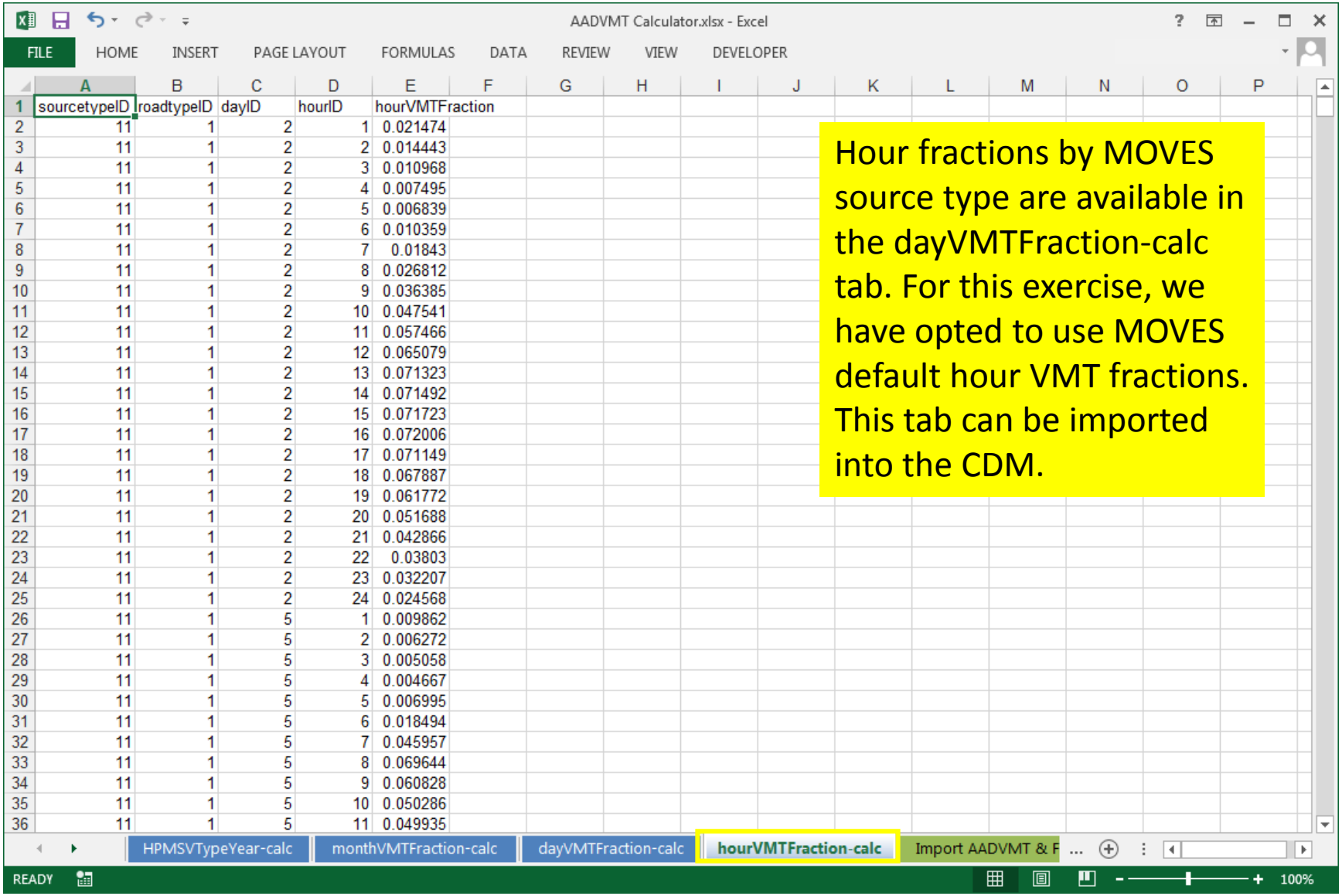
DayVMTFraction-calc Tab



sourcetypeID	monthID	roadtypeID	dayID	dayVMTFraction
11	1	1	2	0
11	1	1	5	0
11	1	2	2	0
11	1	2	5	0
11	1	3	2	0
11	1	3	5	0
11	1	4	2	0
11	1	4	5	0
11	1	5	2	0
11	1	5	5	0
11	2	1	2	0
11	2	1	5	0
11	2	2	2	0
11	2	2	5	0
11	2	3	2	0
11	2	3	5	0
11	2	4	2	0
11	2	4	5	0
11	2	5	2	0
11	2	5	5	0
11	3	1	2	0
11	3	1	5	0
11	3	2	2	0
11	3	2	5	0
11	3	3	2	0
11	3	3	5	0
11	3	4	2	0
11	3	4	5	0
11	3	5	2	0
11	3	5	5	0
11	4	1	2	0
11	4	1	5	0
11	4	2	2	0
11	4	2	5	0
11	4	3	2	0

Calculated day fractions MOVES source type is available in the dayVMTFraction-calc tab. This tab can be imported into the CDM.

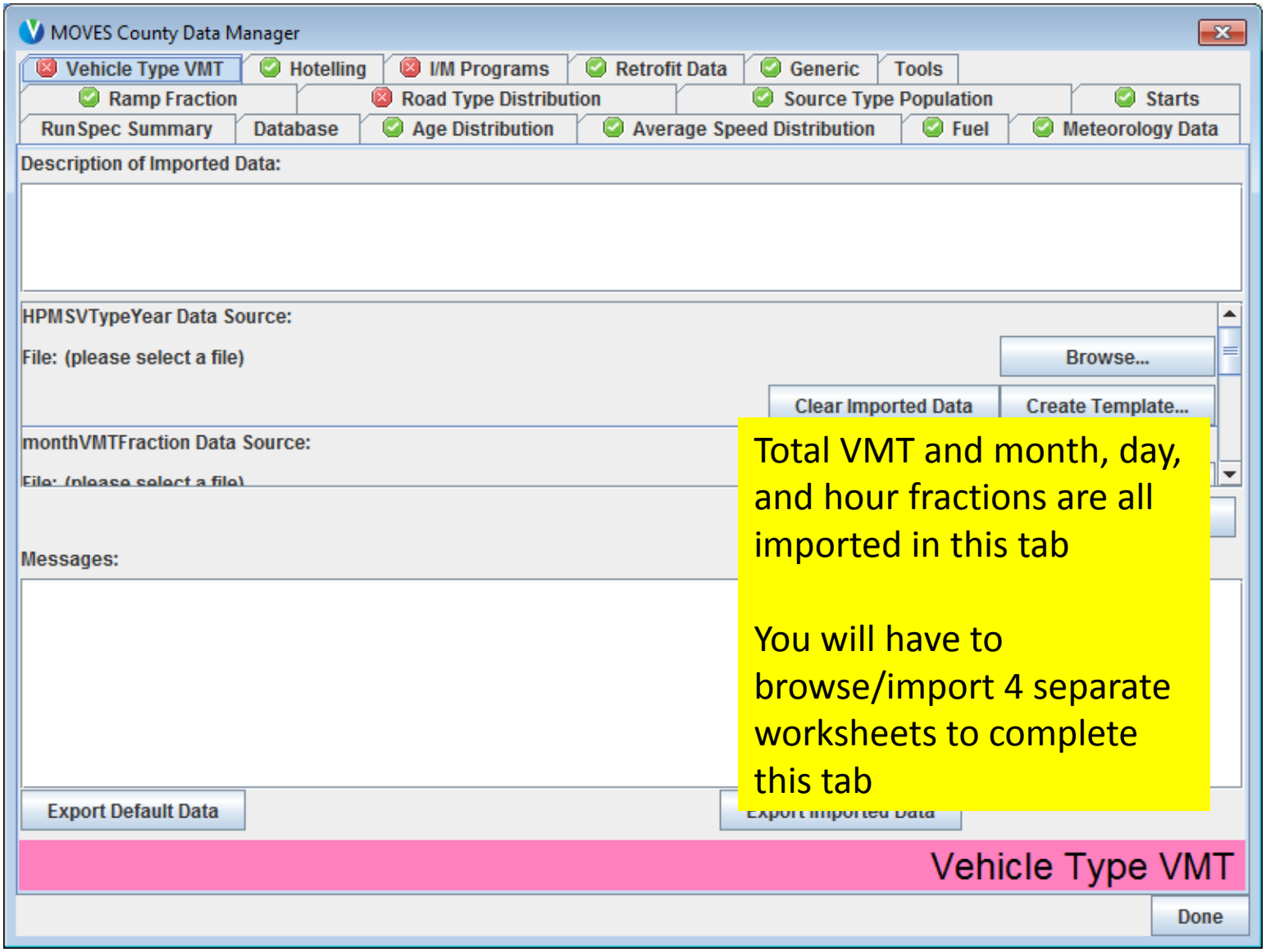
Default hour fractions – located in HourVMTFraction-default tab



sourcetypeID	roadtypeID	dayID	hourID	hourVMTFraction
11	1	2	1	0.021474
11	1	2	2	0.014443
11	1	2	3	0.010968
11	1	2	4	0.007495
11	1	2	5	0.006839
11	1	2	6	0.010359
11	1	2	7	0.01843
11	1	2	8	0.026812
11	1	2	9	0.036385
11	1	2	10	0.047541
11	1	2	11	0.057466
11	1	2	12	0.065079
11	1	2	13	0.071323
11	1	2	14	0.071492
11	1	2	15	0.071723
11	1	2	16	0.072006
11	1	2	17	0.071149
11	1	2	18	0.067887
11	1	2	19	0.061772
11	1	2	20	0.051688
11	1	2	21	0.042866
11	1	2	22	0.03803
11	1	2	23	0.032207
11	1	2	24	0.024568
11	1	5	1	0.009862
11	1	5	2	0.006272
11	1	5	3	0.005058
11	1	5	4	0.004667
11	1	5	5	0.006995
11	1	5	6	0.018494
11	1	5	7	0.045957
11	1	5	8	0.069644
11	1	5	9	0.060828
11	1	5	10	0.050286
11	1	5	11	0.049935

Hour fractions by MOVES source type are available in the dayVMTFraction-calc tab. For this exercise, we have opted to use MOVES default hour VMT fractions. This tab can be imported into the CDM.

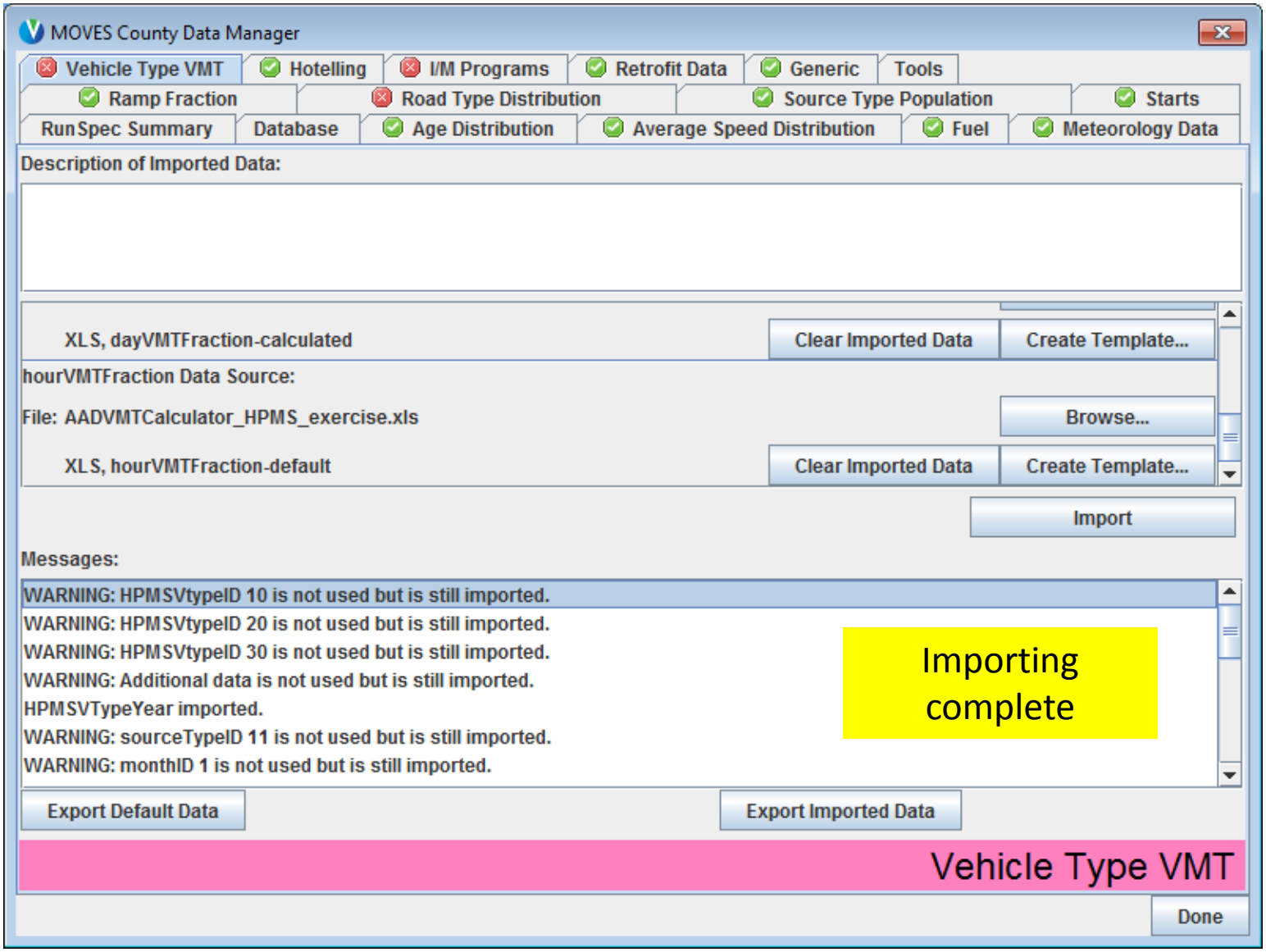
County Inventory Exercise: Entering Vehicle Type VMT



Total VMT and month, day, and hour fractions are all imported in this tab

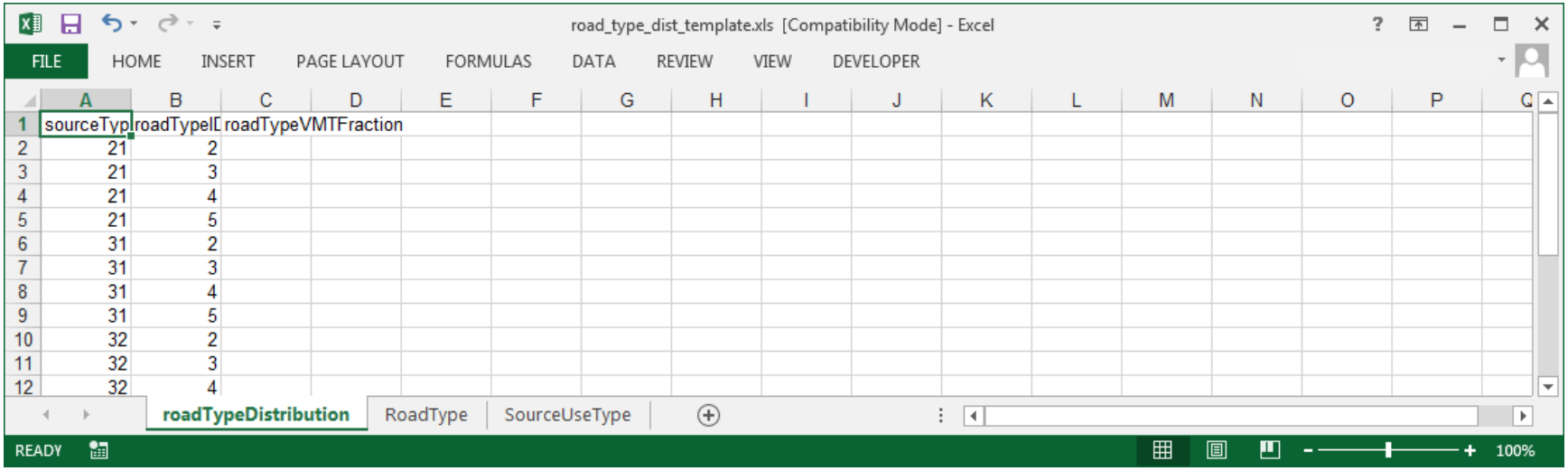
You will have to browse/import 4 separate worksheets to complete this tab

County Inventory Exercise: Entering Vehicle Type VMT Data



Road Type Distribution

- RoadTypeVMTFraction is the fraction of VMT (distance, not time) on each road type by a source type



Road Type Distribution

- Fractions should sum to 1 within each source type

- All road types appear in the template even if they were not selected in the RunSpec
  - Any VMT assigned to a road type not selected in the RunSpec will not be accounted for in MOVES output
  - This could lead to misleading or incorrect results
  - Safest approach is to always include all road types in RunSpec

Road Type Distribution: Guidance

- Section 4.7 of MOVES Technical Guidance

- Users should develop road type distribution data based on local information

- If data are not available, the same road type distribution can be used for all source types in the same HPMS class
  - However, in many cases, road type distributions vary for source types in the same HPMS class (e.g., transit bus vs. intercity bus), so source type specific information is encouraged

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Road Type Distribution: Using Travel Model Outputs

- Travel model link volumes can be used to develop road type distribution fractions
- Map links to MOVES road types
  - If ramps are coded separately, ramps are included as part of restricted access road
- Calculate VMT by link (length x volume)
- Sum by link and road type across all time periods (MOVES inputs do not vary by hour)
- Calculate fractions that sum to one
- Repeat for each vehicle group, as needed

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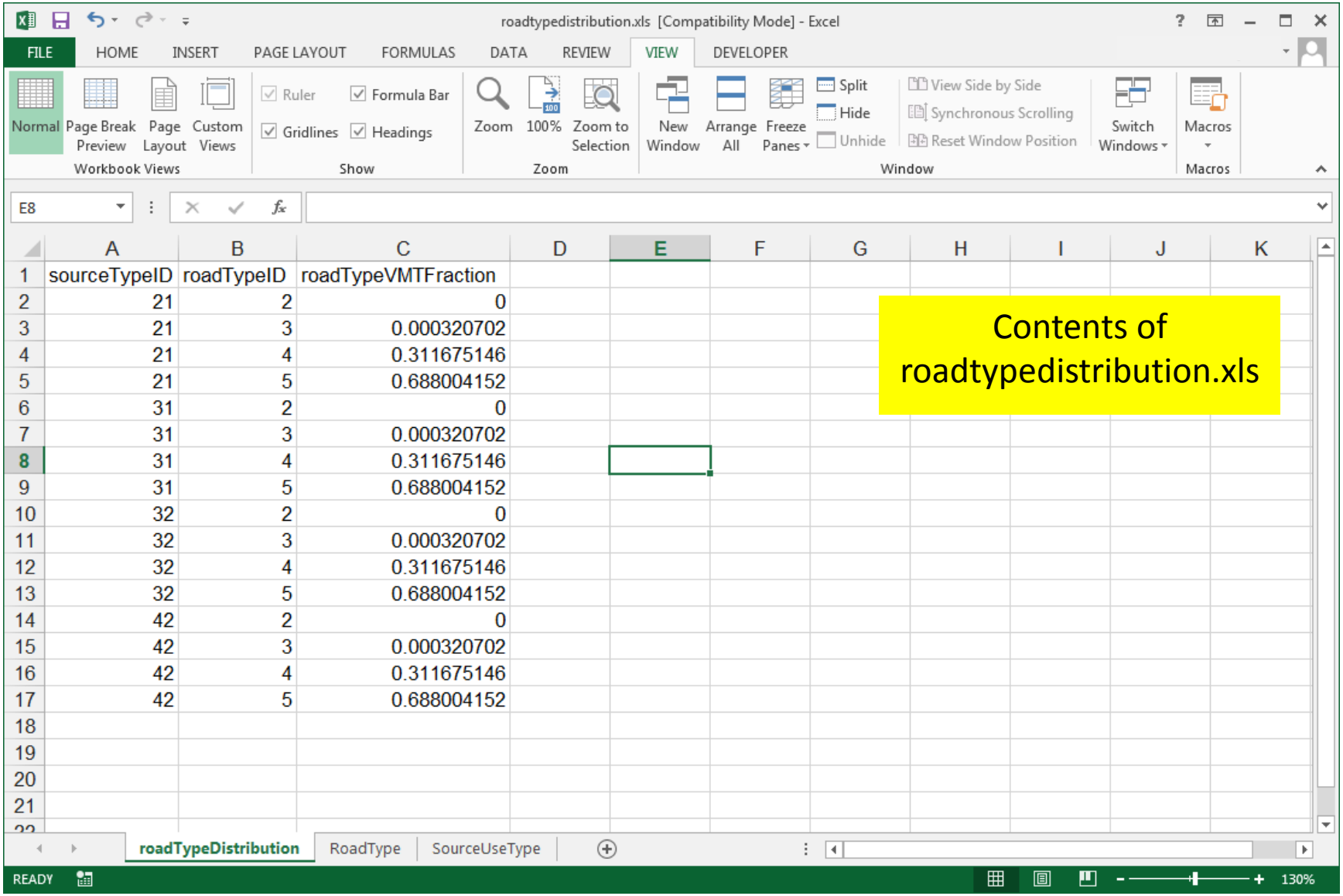
Road Type Distribution: Exercise

- Let's enter our road type distribution data into the CDM for our county-level exercise

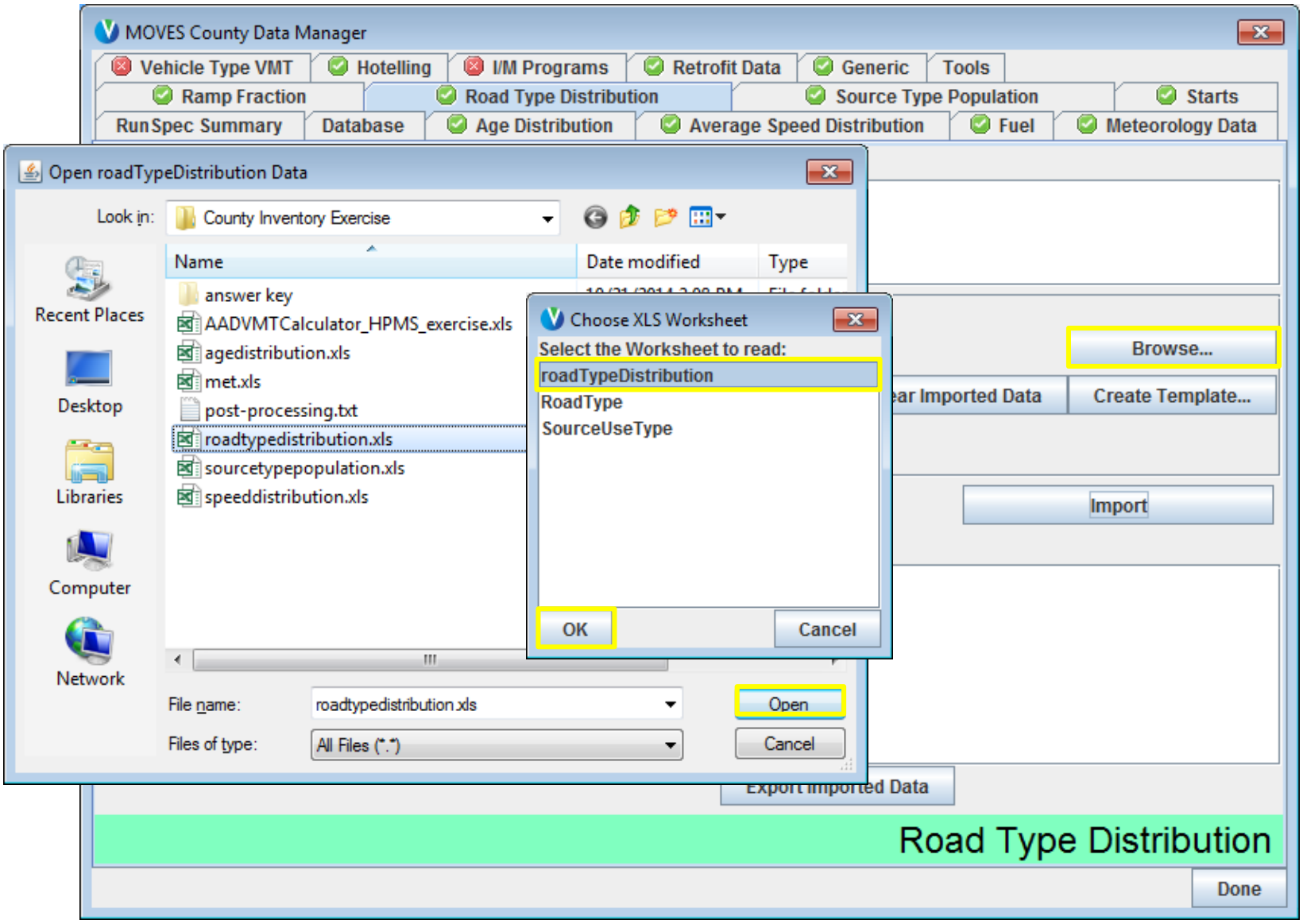
- The template has been filled out with our local road type distribution and is available as file: *RoadTypeDistribution.xls*

- Instructions for Developing a County-scale RunSpec:
  - Review *RoadTypeDistribution.xls* and import into the Road Type Distribution tab

County Inventory Exercise: Entering Road Type Distribution Data



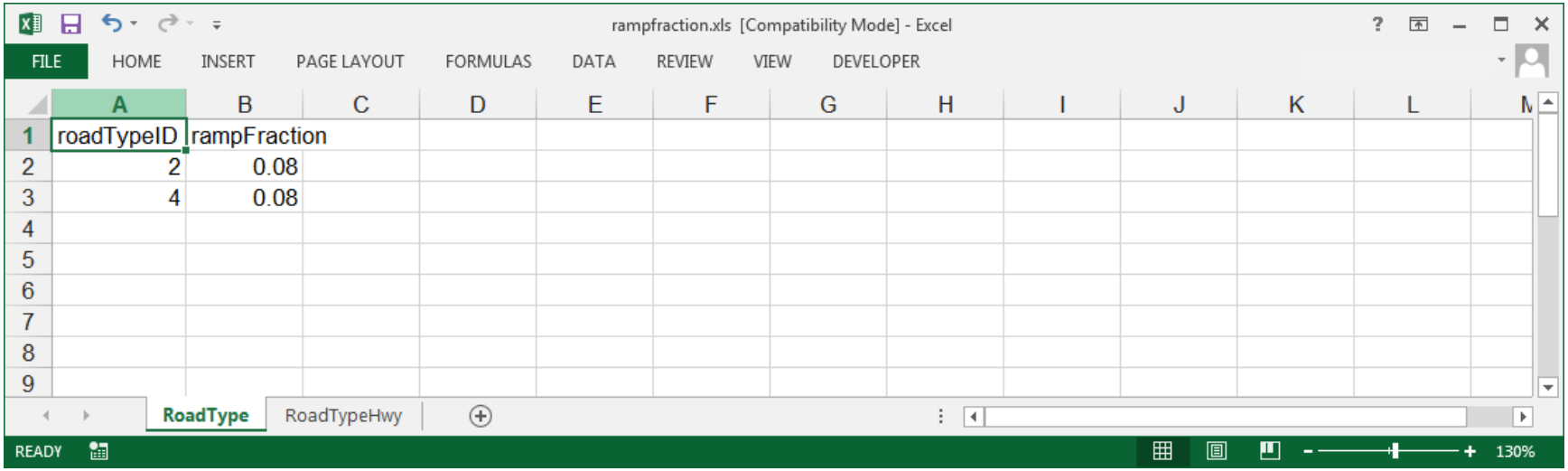
County Inventory Exercise: Entering Road Type Distribution Data



Ramp Fraction

- RampFraction is the fraction of *time* (daily VHT) – *not* distance – spent on ramps as compared to the total time on restricted roadways and ramps
  - A restricted road type must have been selected in the Road Type panel to be able to import Ramp Fraction data

- This tab starts with a green check. Default ramp fraction of 0.08 (8%) is applied if this fraction is not changed



Ramp Fraction: Guidance

- Section 4.8 of MOVES Technical Guidance

- Local data on ramp activity is commonly available from TDM modeling

- Generally it is not acceptable to use the default fractions, as ramp activity has a large impact on emissions - EPA recommends that local data be used

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Ramp Fraction: Using Travel Model Outputs

- If ramps coded separately, ramp fraction can be calculated from travel model link volumes and speeds
- Calculate freeway, ramp, and total freeway + ramp VHT (does not vary by hour or source type)
- Calculate ramp fraction
- Separate calculation for urban and rural

Ramp Fraction: Exercise

- Let's enter our ramp fraction data into the CDM for our county-level exercise

- Our local ramp fractions for rural and urban unrestricted road types are 12%

- The MOVES ramp fraction default (8%) must therefore be changed

- Instructions for Developing a County-scale RunSpec:
  - Export the default data, change the fractions to 12%, and import the table into the Ramp Fraction tab

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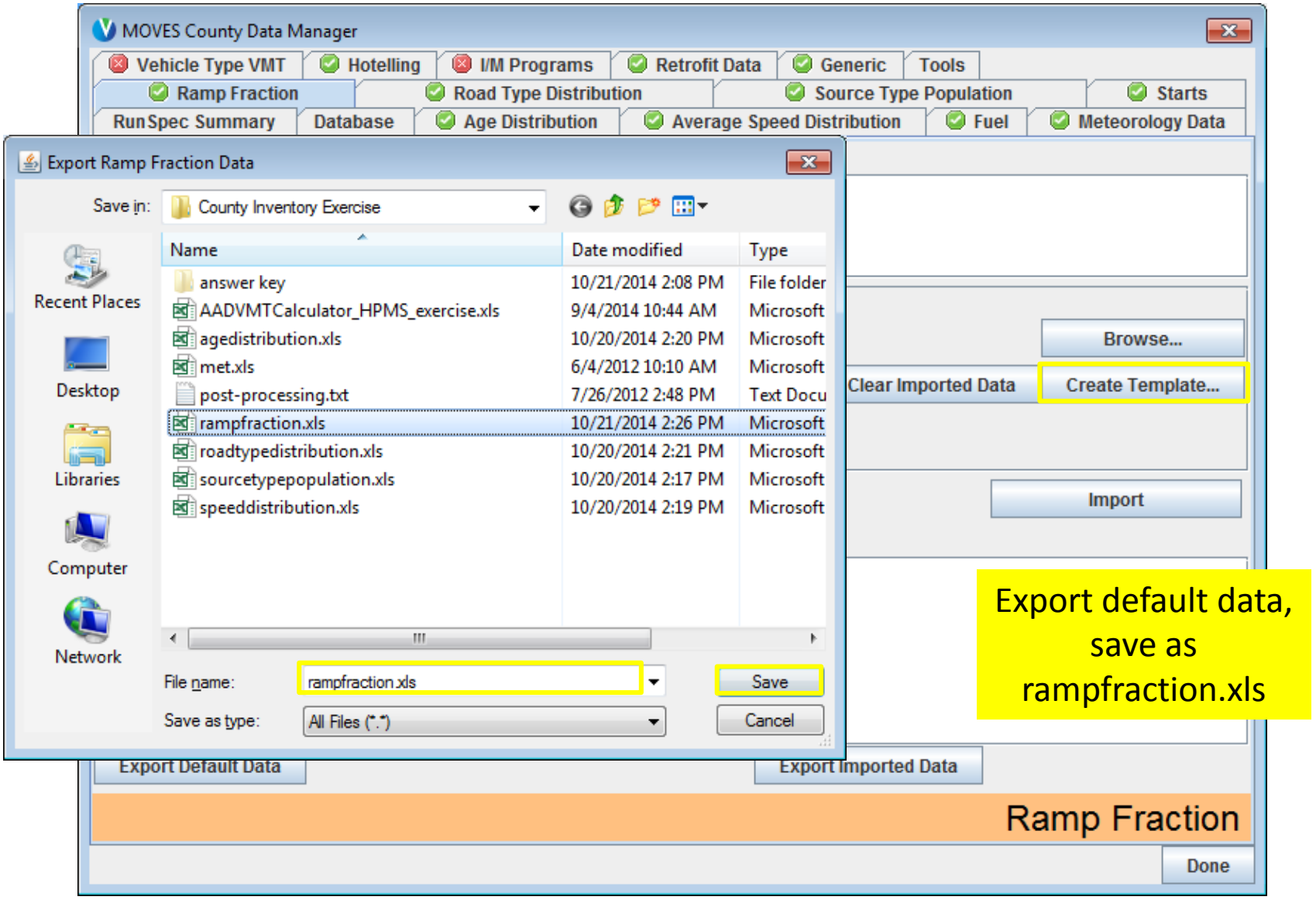
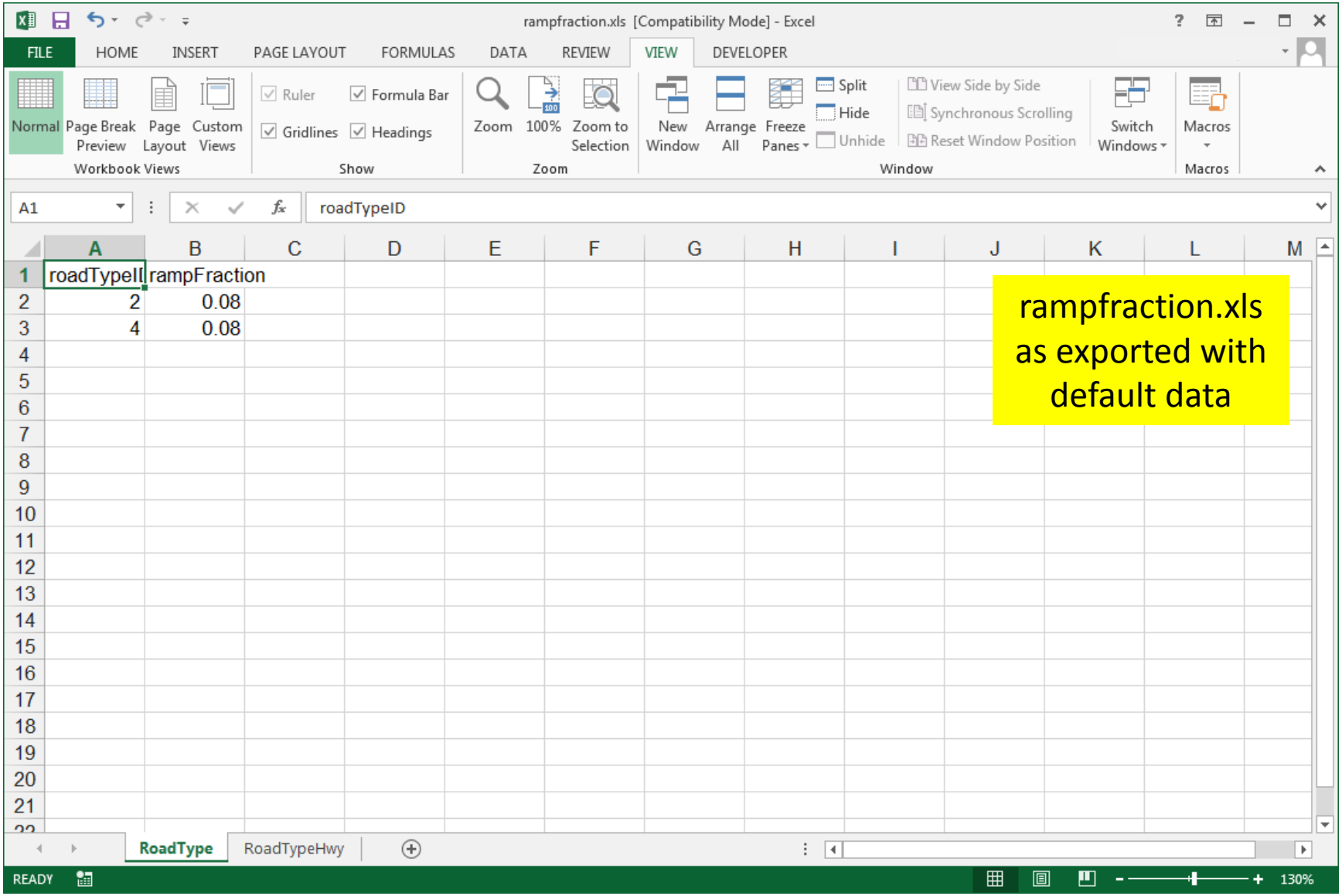
County Inventory Exercise: Entering Ramp Fraction Data

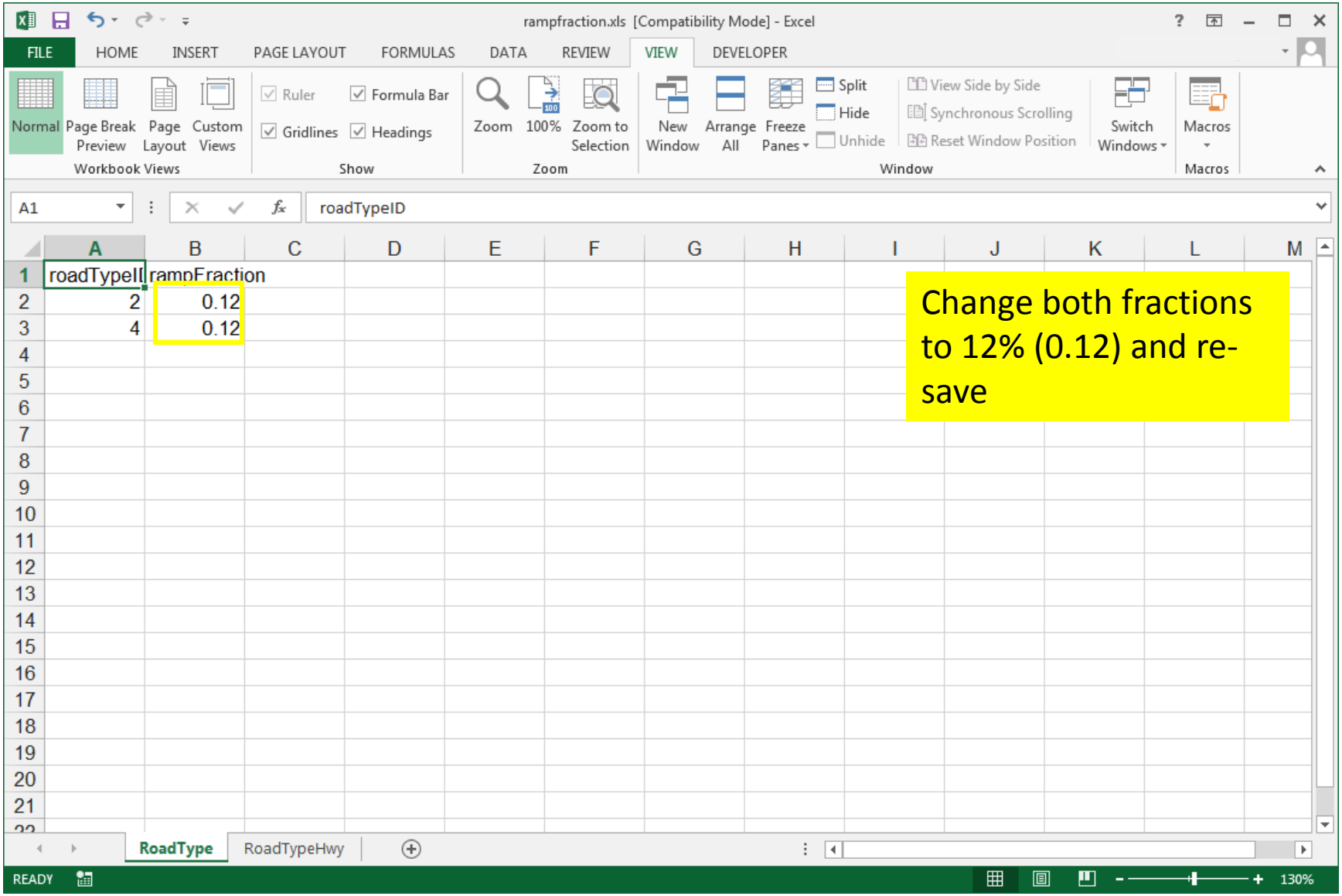


County Inventory Exercise: Entering Ramp Fraction Data

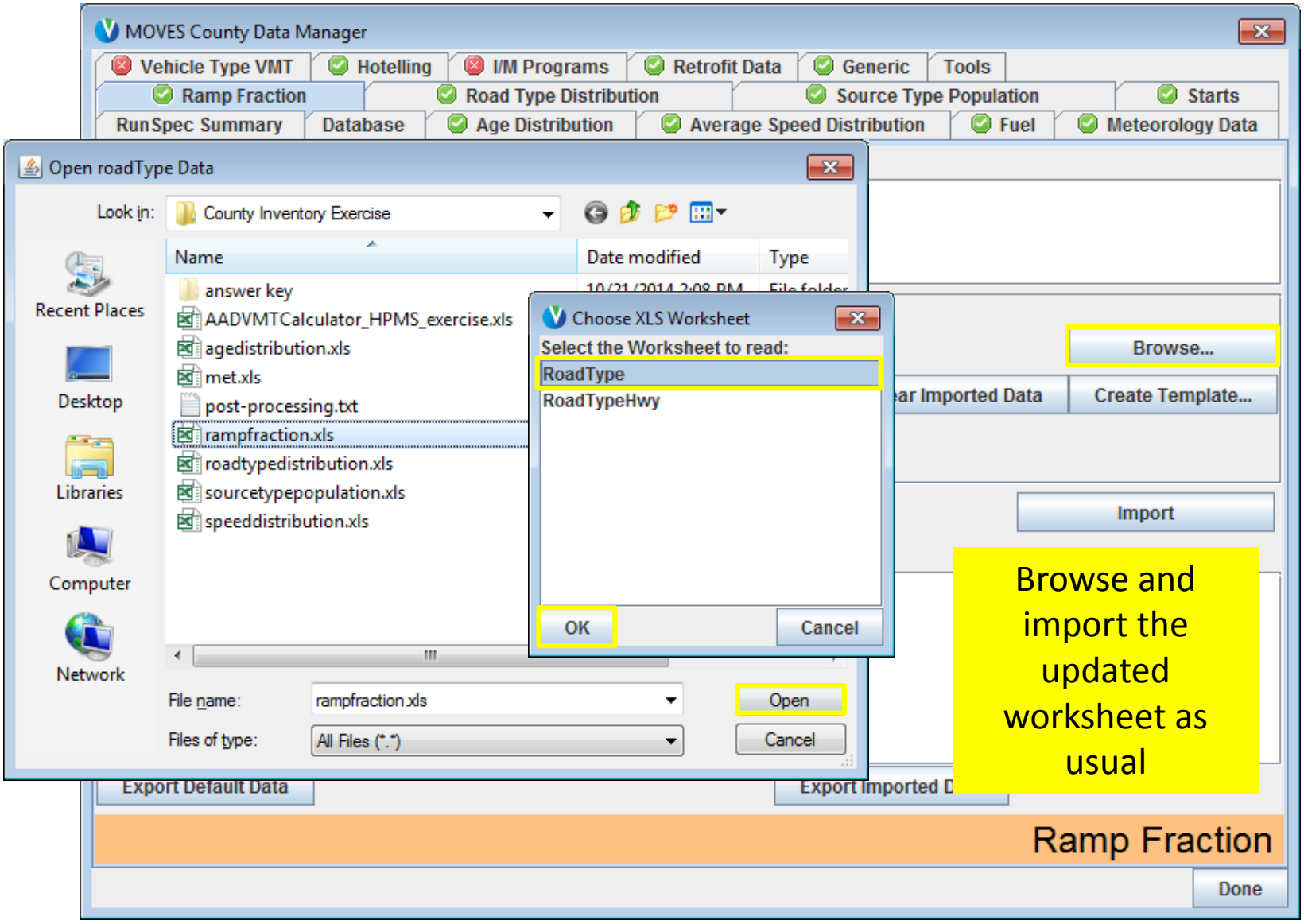


rampfraction.xls as exported with default data

County Inventory Exercise: Entering Ramp Fraction Data



County Inventory Exercise: Entering Ramp Fraction Data



Fuel

- The Fuel tab contains four data tables
  - Fuel Supply
  - Fuel Formulation
  - Fuel Usage Fraction
  - AVFT

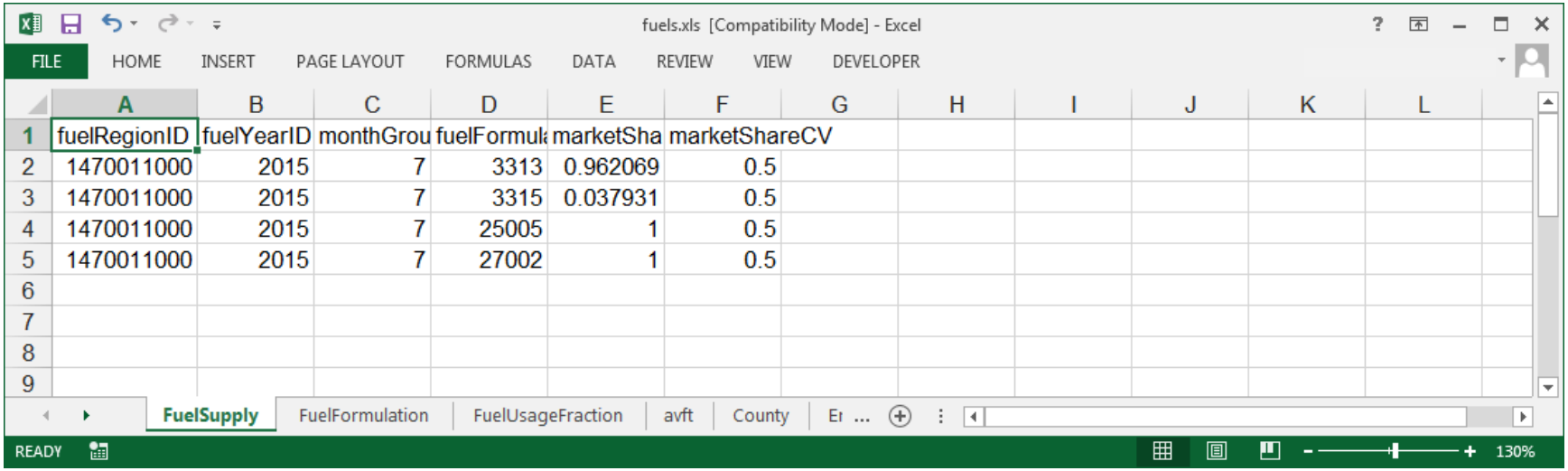
- Data must be selected/entered for each table

- Notes about MOVES versions
  - In MOVES2010, these tables were separate tabs; they are combined under one “Fuel” tab in MOVES2010b and MOVES2014

Fuel: Fuel Supply Data

- Fuel Supply entered by county, year, month, fuel type
  - marketShare (column E) must sum to 1 within these fields
  - marketShare CV (column F) is inactive; ignore any values

- If defaults are exported, they will contain gasoline, diesel, ethanol (E-85), and CNG formulations
  - Users should add entries for alt. fuels if selected in RunSpec

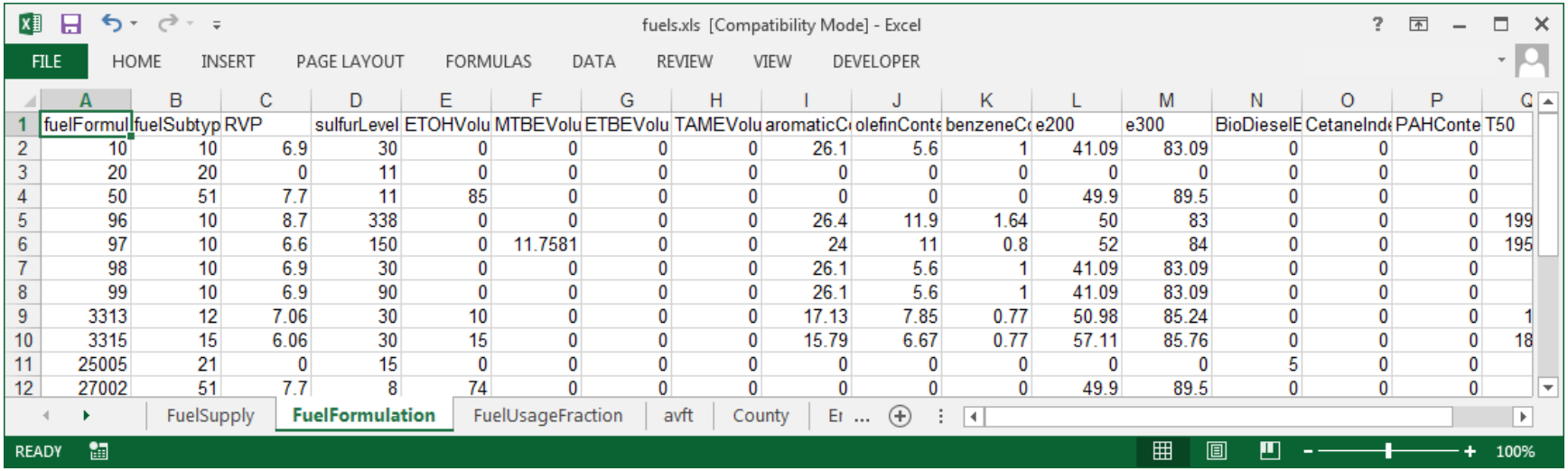


	A	B	C	D	E	F	G	H	I	J	K	L
1	fuelRegionID	fuelYearID	monthGrou	fuelFormul	marketSha	marketShareCV						
2	1470011000	2015	7	3313	0.962069	0.5						
3	1470011000	2015	7	3315	0.037931	0.5						
4	1470011000	2015	7	25005	1	0.5						
5	1470011000	2015	7	27002	1	0.5						
6												
7												
8												
9												

Fuel: Fuel Formulation Data

- Use only existing FuelFormulationID's with the appropriate FuelSubTypeID for the fuel properties being entered
  - However, properties can be changed for existing formulations
  - Gasoline FuelFormulationIDs are 500-9419; diesel 20011-20491

- Consult MOVES Technical Guidance for information about the requirements for populating each field



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	fuelFormul	fuelSubtyp	RVP	sulfurLevel	ETOHVolu	MTBEVolu	ETBEVolu	TAMEVolu	aromaticC	olefinConte	benzeneC	e200	e300	BioDieselE	CetaneInde	PAHConte	T50
2	10	10	6.9	30	0	0	0	0	26.1	5.6	1	41.09	83.09	0	0	0	
3	20	20	0	11	0	0	0	0	0	0	0	0	0	0	0	0	
4	50	51	7.7	11	85	0	0	0	0	0	0	49.9	89.5	0	0	0	
5	96	10	8.7	338	0	0	0	0	26.4	11.9	1.64	50	83	0	0	0	199
6	97	10	6.6	150	0	11.7581	0	0	24	11	0.8	52	84	0	0	0	195
7	98	10	6.9	30	0	0	0	0	26.1	5.6	1	41.09	83.09	0	0	0	
8	99	10	6.9	90	0	0	0	0	26.1	5.6	1	41.09	83.09	0	0	0	
9	3313	12	7.06	30	10	0	0	0	17.13	7.85	0.77	50.98	85.24	0	0	0	1
10	3315	15	6.06	30	15	0	0	0	15.79	6.67	0.77	57.11	85.76	0	0	0	18
11	25005	21	0	15	0	0	0	0	0	0	0	0	0	5	0	0	
12	27002	51	7.7	8	74	0	0	0	0	0	0	49.9	89.5	0	0	0	

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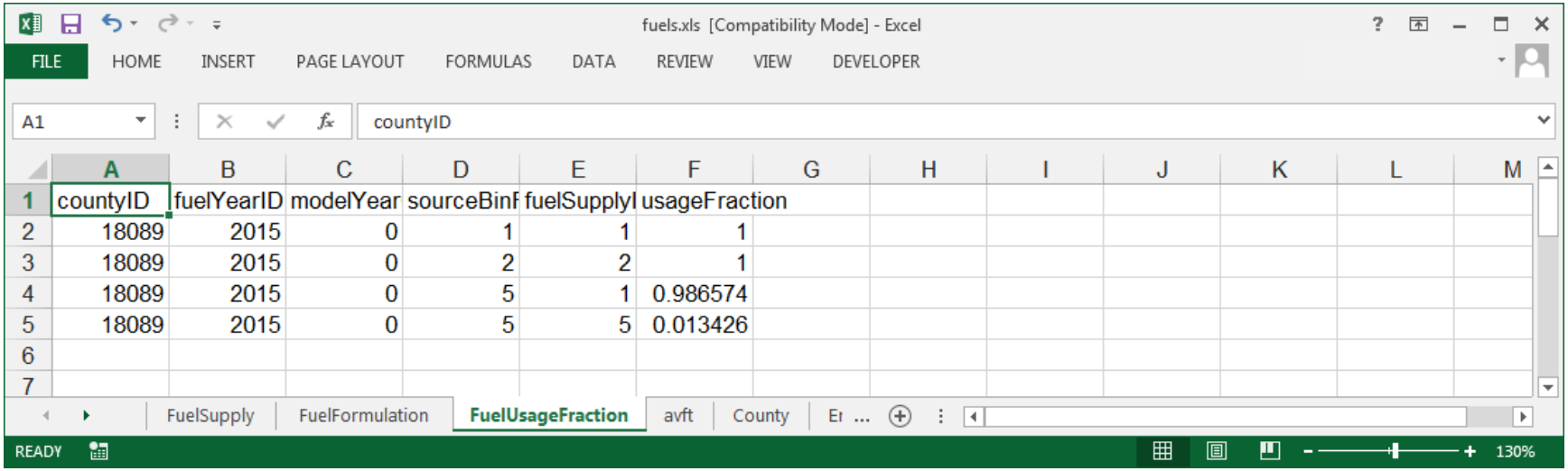
Fuel: Fuel Usage Fraction

- Fuelusagefraction is a new required input that specifies the fraction of E-85 capable (flex-fuel) vehicles that use E-85 (sourcebinfueltypeid 5) vs. conventional gasoline
- The table below shows that 98.7% of E-85 capable vehicles use conventional gasoline and 1.3% use E-85 for Lake County, IN
- Fractions of 1 are required for sourcebinfueltypeID 1, 2, and 3 (gas, diesel, and CNG fuel types)



	A	B	C	D	E	F
1	countyID	fuelYearID	modelYear	sourceBinF	fuelSupplyI	usageFraction
2	18089	2015	0	1	1	1
3	18089	2015	0	2	2	1
4	18089	2015	0	5	1	0.986574
5	18089	2015	0	5	5	0.013426
6						
7						

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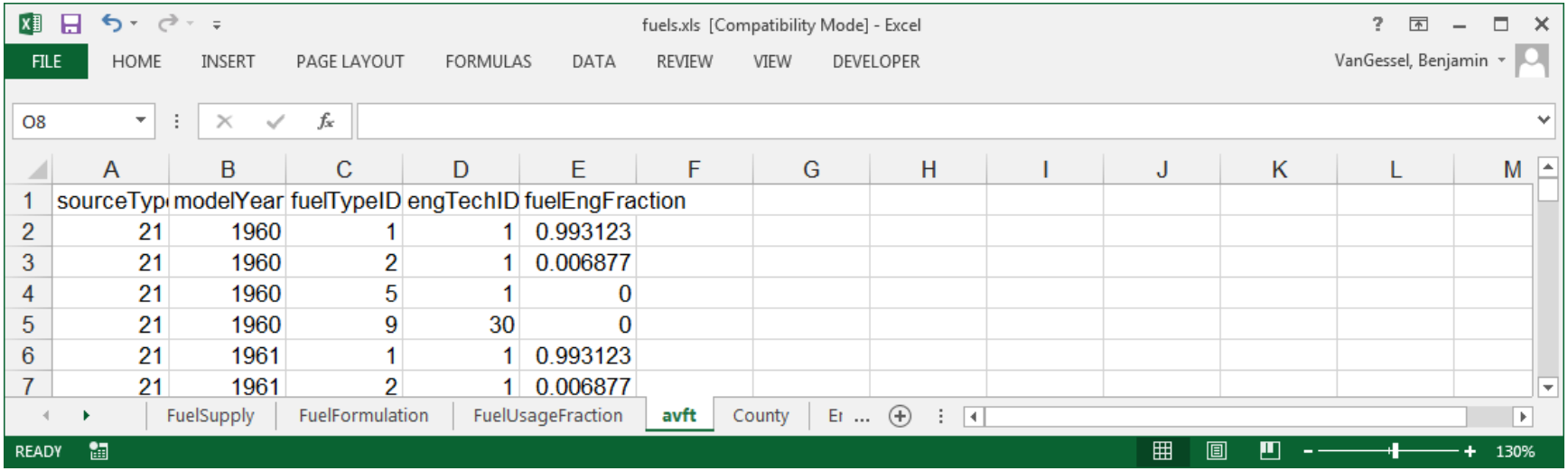
Fuel: AVFT

- The Alternate Vehicle and Fuel Technology (AVFT) input allows users to define the split between diesel, gasoline, CNG, and electricity, for each vehicle source type and model year.

- Combinations of sourceTypeID and modelyearID must sum to 1.



	A	B	C	D	E
1	sourceTyp	modelYear	fuelTypeID	engTechID	fuelEngFraction
2	21	1960	1	1	0.993123
3	21	1960	2	1	0.006877
4	21	1960	5	1	0
5	21	1960	9	30	0
6	21	1961	1	1	0.993123
7	21	1961	2	1	0.006877

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Fuel: Guidance

- Section 4.9 of MOVES Technical Guidance

- Review default data and only make changes when local volumetric fuel property information is available
  - Recommended approach is to modify existing fuel formulations and assign each the appropriate market share
  - Another acceptable approach is to calculate a weighted average of the fuel properties, but this will result in differences from the first approach where non-linear relationships exist
  - Straight averages should NEVER be used

- If only certain properties are known (e.g., RVP, sulfur, ethanol), but others are not (e.g., olefins), then
  - Defaults can be used for the other parameters or
  - Fuels in the same fuel PADD can be used if they have the desired composition for the known properties

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Fuel: Guidance

- RVP should always be reviewed by the user
  - In some cases, the 1 psi ethanol waiver was not taken into account; in other years, the RVP was interpolated in default database
  - Therefore, assumptions were made to populate the database that should be corrected by the user
  - The RVP should be set to the regulatory limit applicable in the area, making sure RVP reflects whether the 1 psi ethanol waiver is present for 10% ethanol blends

- RFG fuel property data is available on the EPA website at: http://www.epa.gov/otaq/fuels/gasolinefuels/rfg/

- When adjusting individual fuel properties, the Fuel Wizard should be used (accessed in the Fuels tab of the CDM)
  - Appropriately adjusts other fuel properties based on know fuel properties (e.g., RVP)

Fuel: Exercise

- Let's enter fuel data into the CDM for our county-level exercise

- There is only one gasoline, one ethanol (E-85), and one diesel fuel formulation in our area.

- Instructions for Developing a County-scale RunSpec:
  - Export the default fuel information MOVES has for Lake County, check the values, adjust AVFT to reflect a 100% diesel transit bus fleet, then import into the Fuel tab

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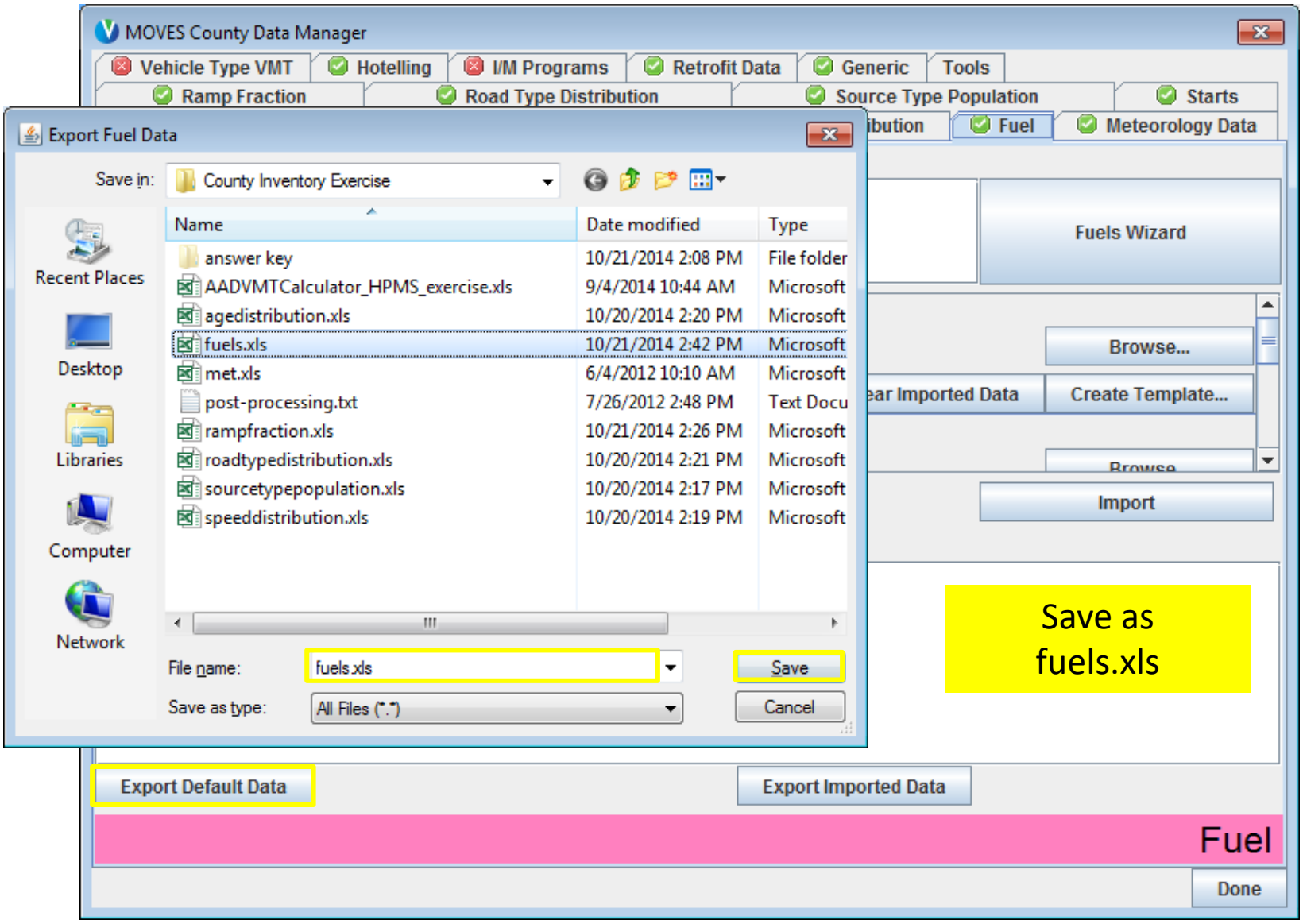
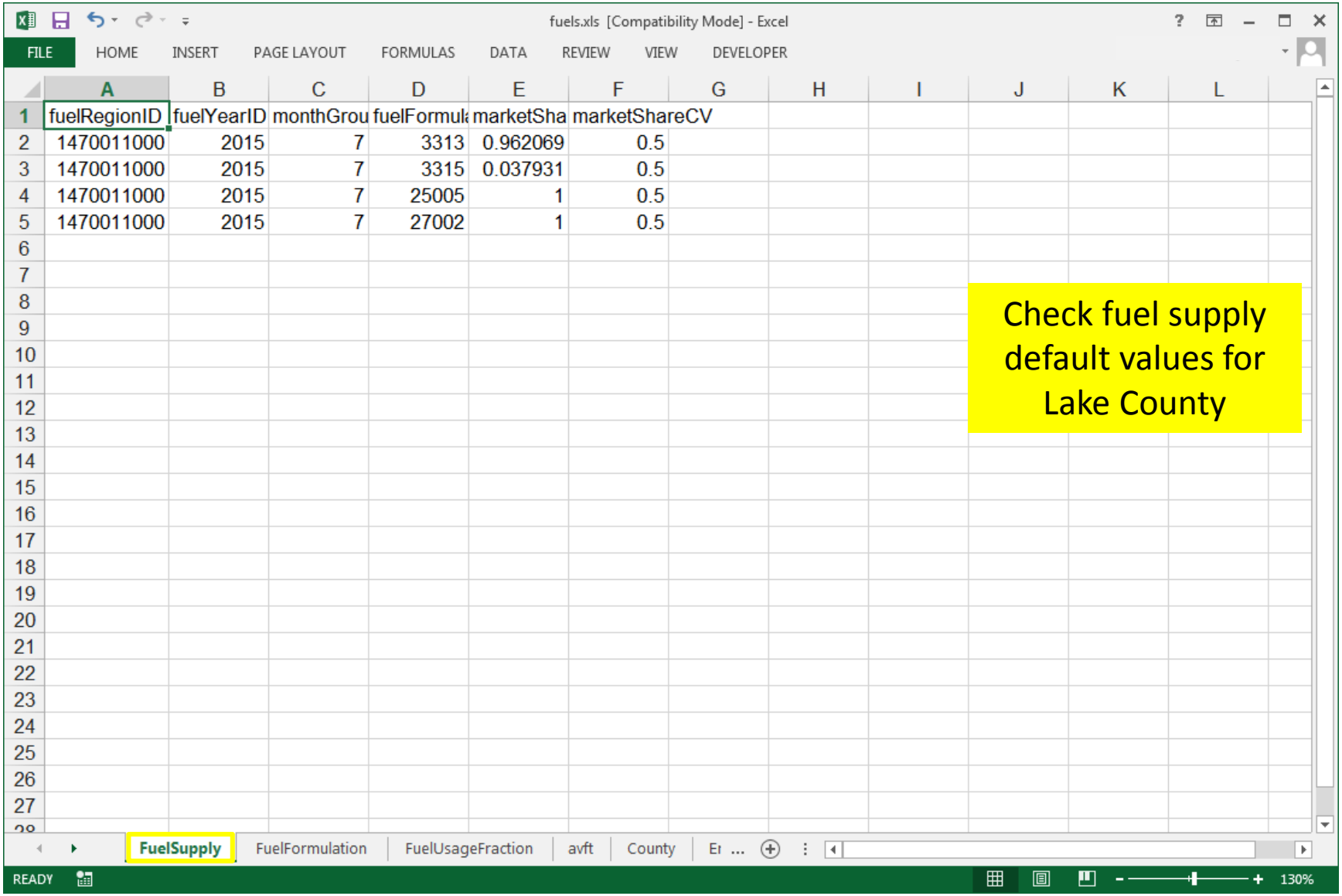
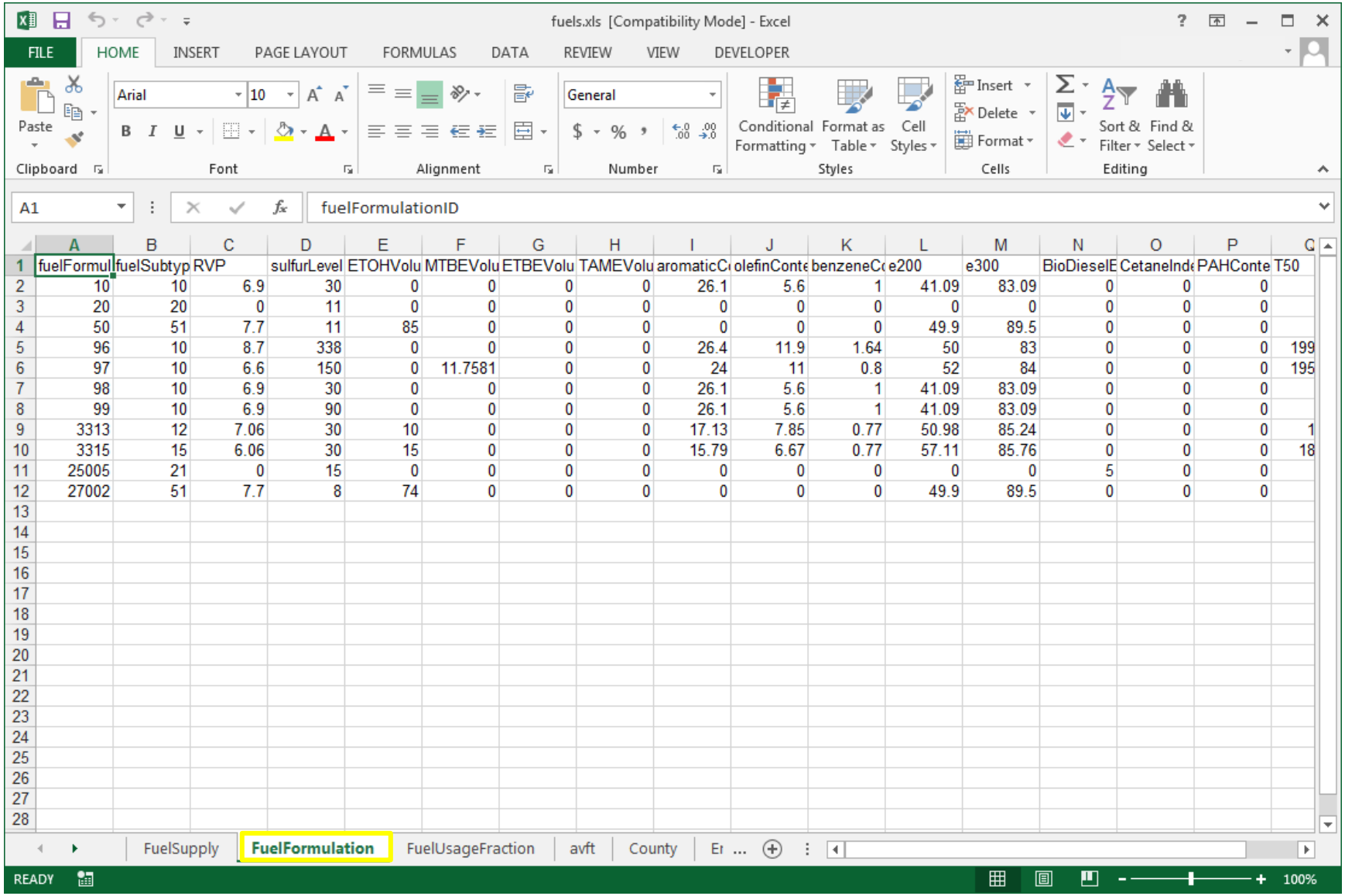
County Inventory Exercise: Entering Fuel Data



County Inventory Exercise: Checking Default Data



County Inventory Exercise: Checking Default Data



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	fuelFormul	fuelSubtyp	RVP	sulfurLevel	ETOHVolu	MTBEVolu	ETBEVolu	TAMEVolu	aromaticC	olefinConte	benzeneC	e200	e300	BioDieselE	CetaneInde	PAHConte	T50
2	10	10	6.9	30	0	0	0	0	26.1	5.6	1	41.09	83.09	0	0	0	
3	20	20	0	11	0	0	0	0	0	0	0	0	0	0	0	0	
4	50	51	7.7	11	85	0	0	0	0	0	0	49.9	89.5	0	0	0	
5	96	10	8.7	338	0	0	0	0	26.4	11.9	1.64	50	83	0	0	0	199
6	97	10	6.6	150	0	11.7581	0	0	24	11	0.8	52	84	0	0	0	195
7	98	10	6.9	30	0	0	0	0	26.1	5.6	1	41.09	83.09	0	0	0	
8	99	10	6.9	90	0	0	0	0	26.1	5.6	1	41.09	83.09	0	0	0	
9	3313	12	7.06	30	10	0	0	0	17.13	7.85	0.77	50.98	85.24	0	0	0	1
10	3315	15	6.06	30	15	0	0	0	15.79	6.67	0.77	57.11	85.76	0	0	0	18
11	25005	21	0	15	0	0	0	0	0	0	0	0	0	5	0	0	
12	27002	51	7.7	8	74	0	0	0	0	0	0	49.9	89.5	0	0	0	
13																	
14																	
15																	
16																	
17																	
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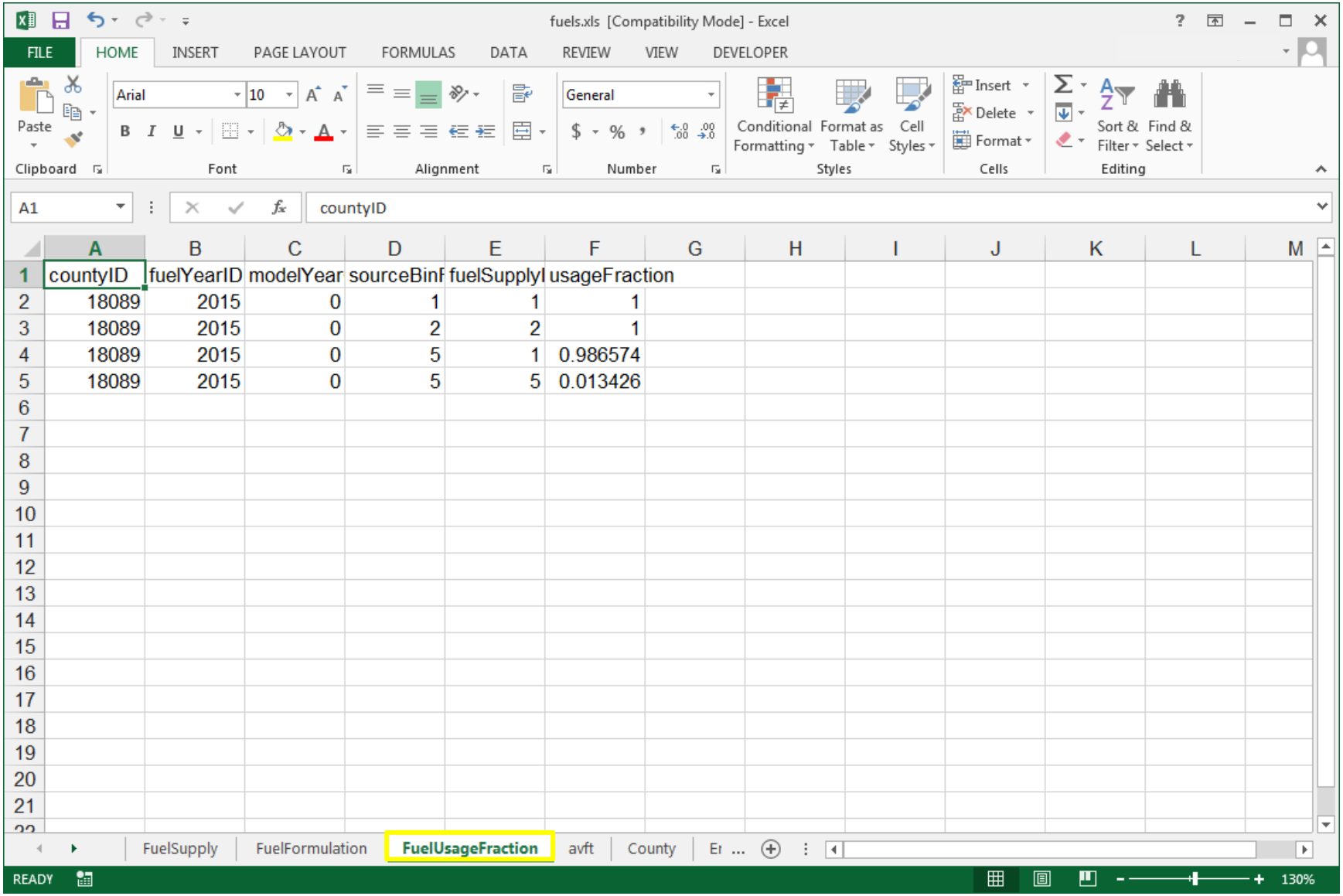
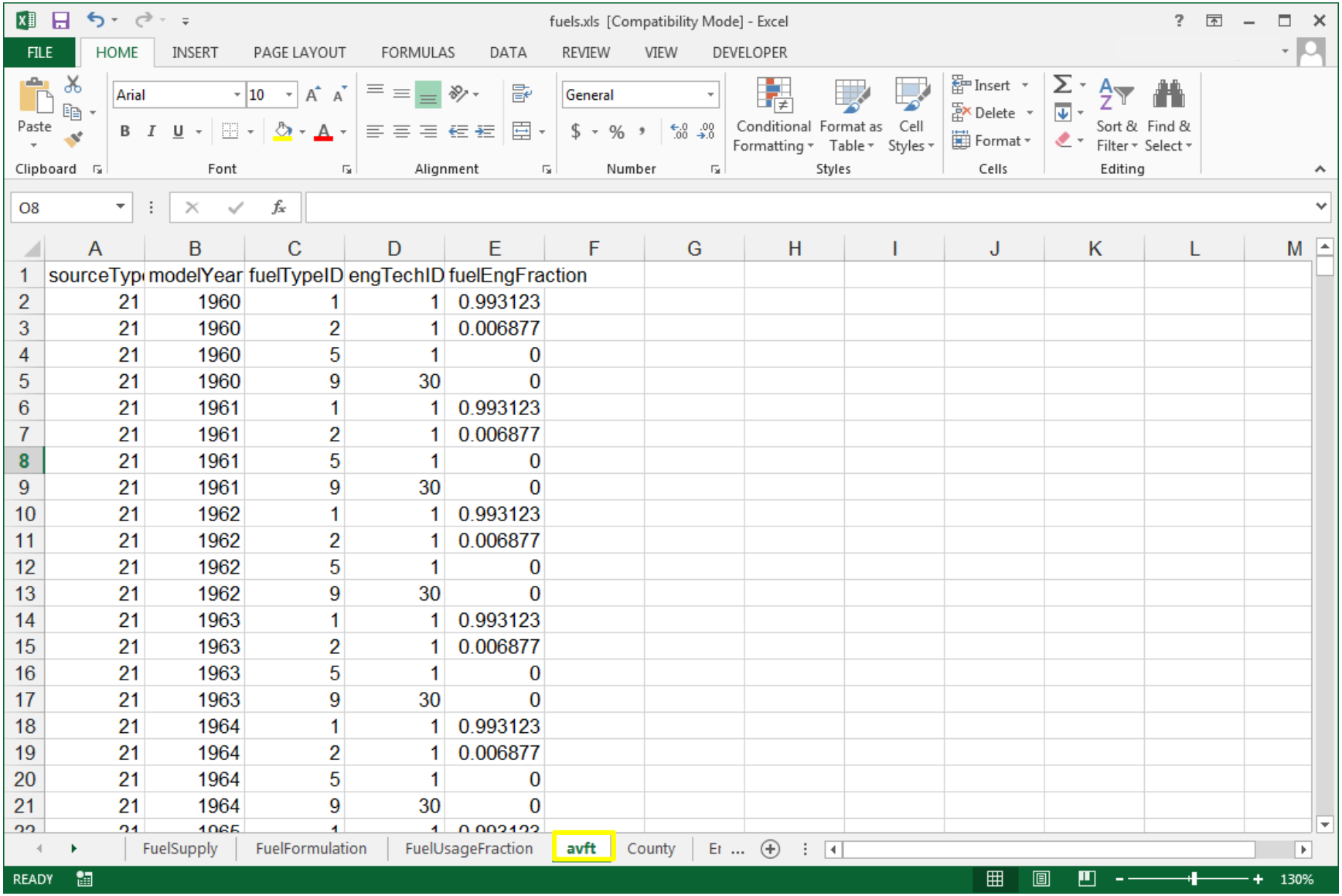
County Inventory Exercise: Checking Default Data



countyID	fuelYearID	modelYear	sourceBinF	fuelSupplyI	usageFraction
18089	2015	0	1	1	1
18089	2015	0	2	2	1
18089	2015	0	5	1	0.986574
18089	2015	0	5	5	0.013426

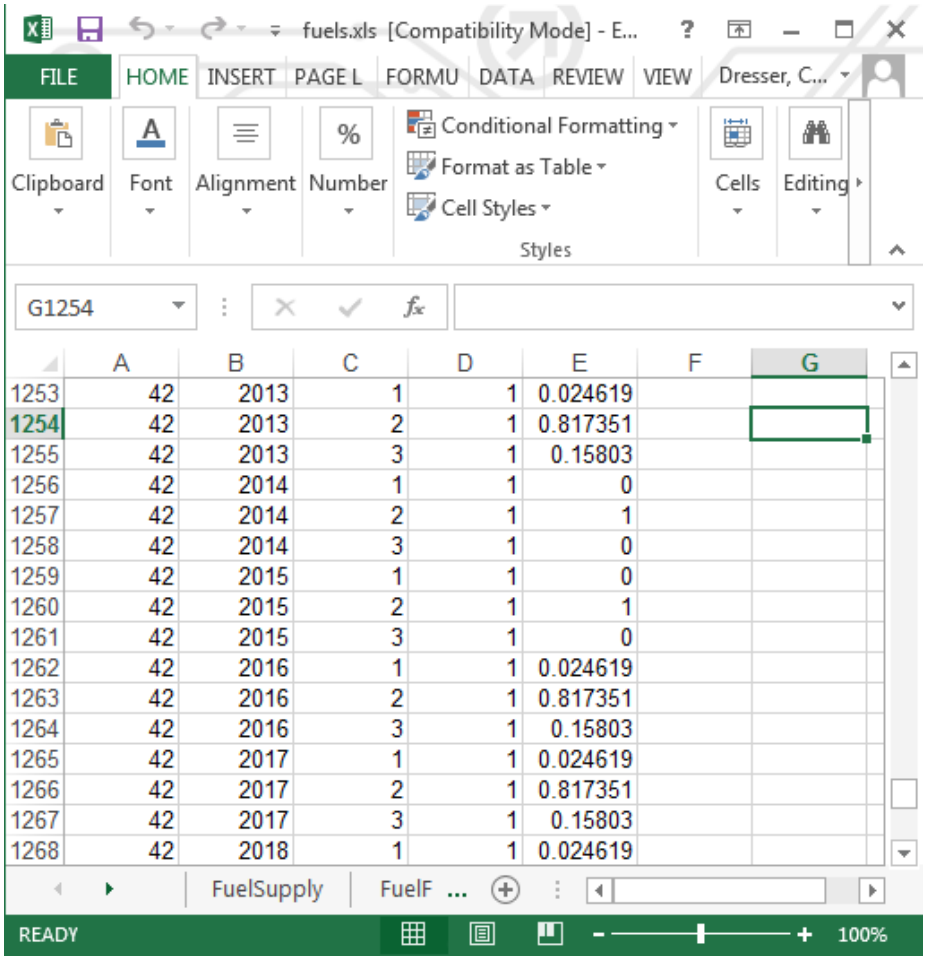
County Inventory Exercise: Checking Default Data



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	sourceTyp	modelYear	fuelTypeID	engTechID	fuelEngFraction								
2	21	1960	1	1	0.993123								
3	21	1960	2	1	0.006877								
4	21	1960	5	1	0								
5	21	1960	9	30	0								
6	21	1961	1	1	0.993123								
7	21	1961	2	1	0.006877								
8	21	1961	5	1	0								
9	21	1961	9	30	0								
10	21	1962	1	1	0.993123								
11	21	1962	2	1	0.006877								
12	21	1962	5	1	0								
13	21	1962	9	30	0								
14	21	1963	1	1	0.993123								
15	21	1963	2	1	0.006877								
16	21	1963	5	1	0								
17	21	1963	9	30	0								
18	21	1964	1	1	0.993123								
19	21	1964	2	1	0.006877								
20	21	1964	5	1	0								
21	21	1964	9	30	0								

Fuel: AVFT Exercise

- Input fractions of 1.0 for FueltypeID 2 and SourceTypeID 42 (years 2014 and 2015 only)
- Indicates a 100% diesel fueled transit bus fleet



	A	B	C	D	E	F	G
1253	42	2013	1	1	0.024619		
1254	42	2013	2	1	0.817351		
1255	42	2013	3	1	0.15803		
1256	42	2014	1	1	0		
1257	42	2014	2	1	1		
1258	42	2014	3	1	0		
1259	42	2015	1	1	0		
1260	42	2015	2	1	1		
1261	42	2015	3	1	0		
1262	42	2016	1	1	0.024619		
1263	42	2016	2	1	0.817351		
1264	42	2016	3	1	0.15803		
1265	42	2017	1	1	0.024619		
1266	42	2017	2	1	0.817351		
1267	42	2017	3	1	0.15803		
1268	42	2018	1	1	0.024619		

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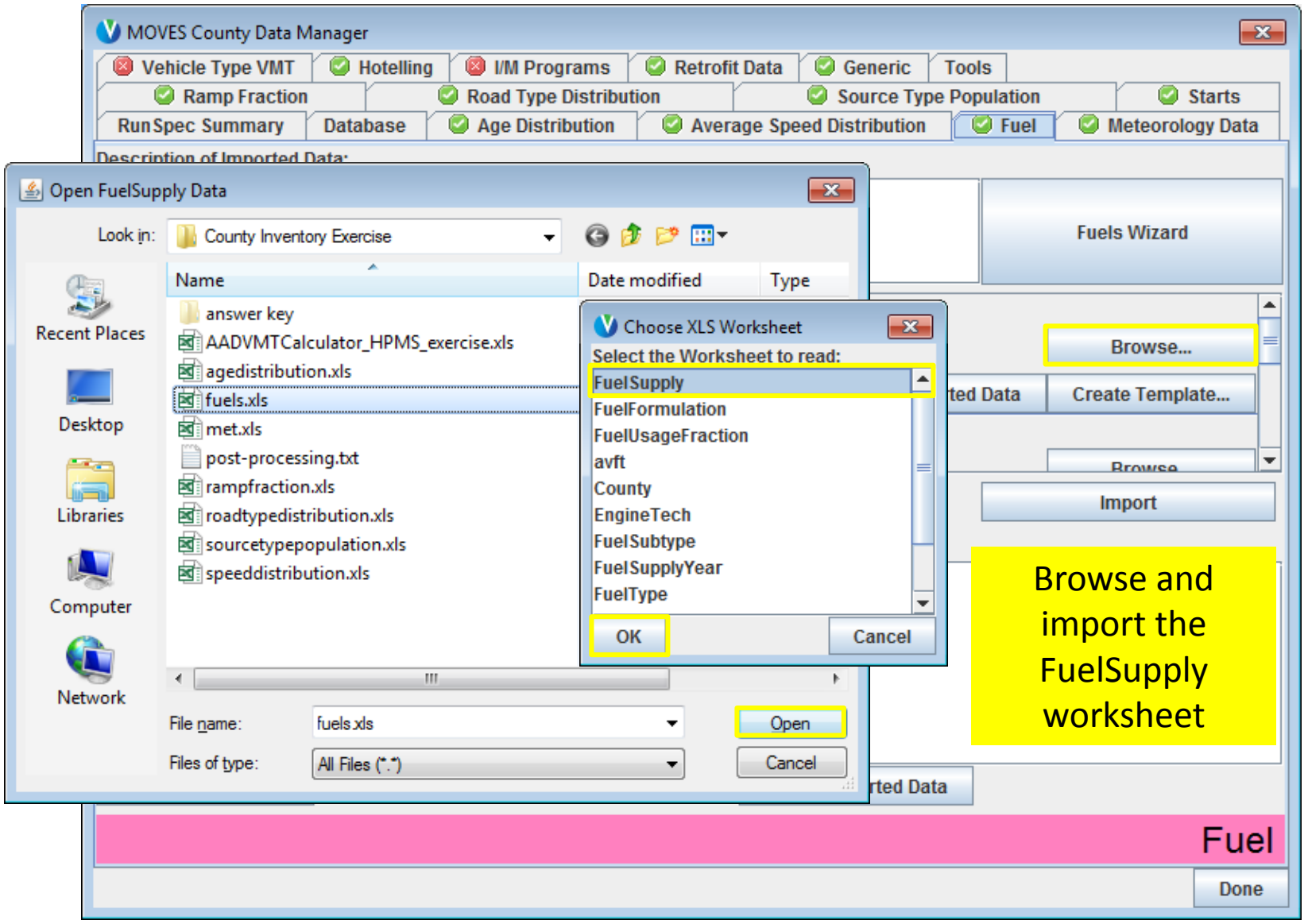
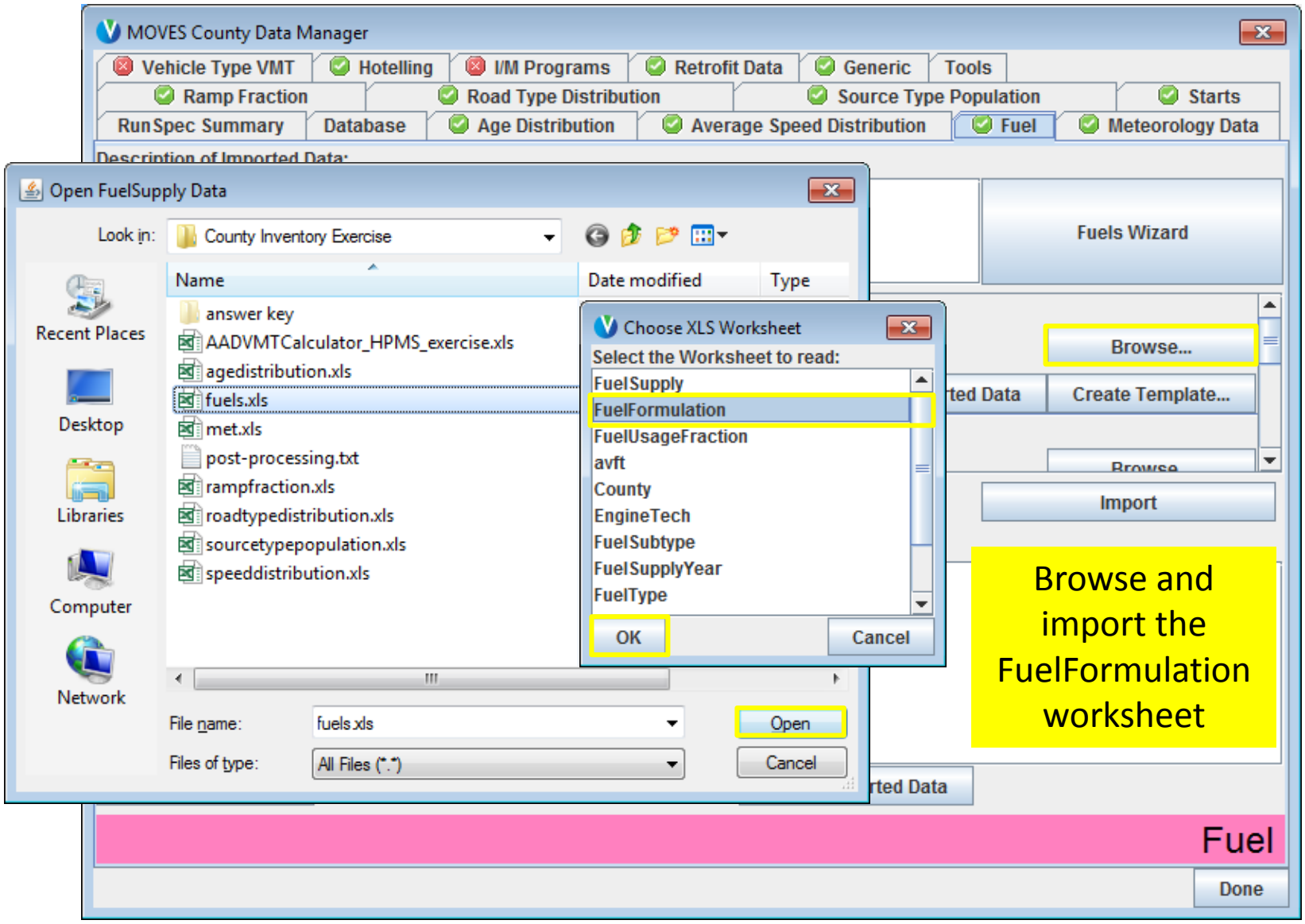
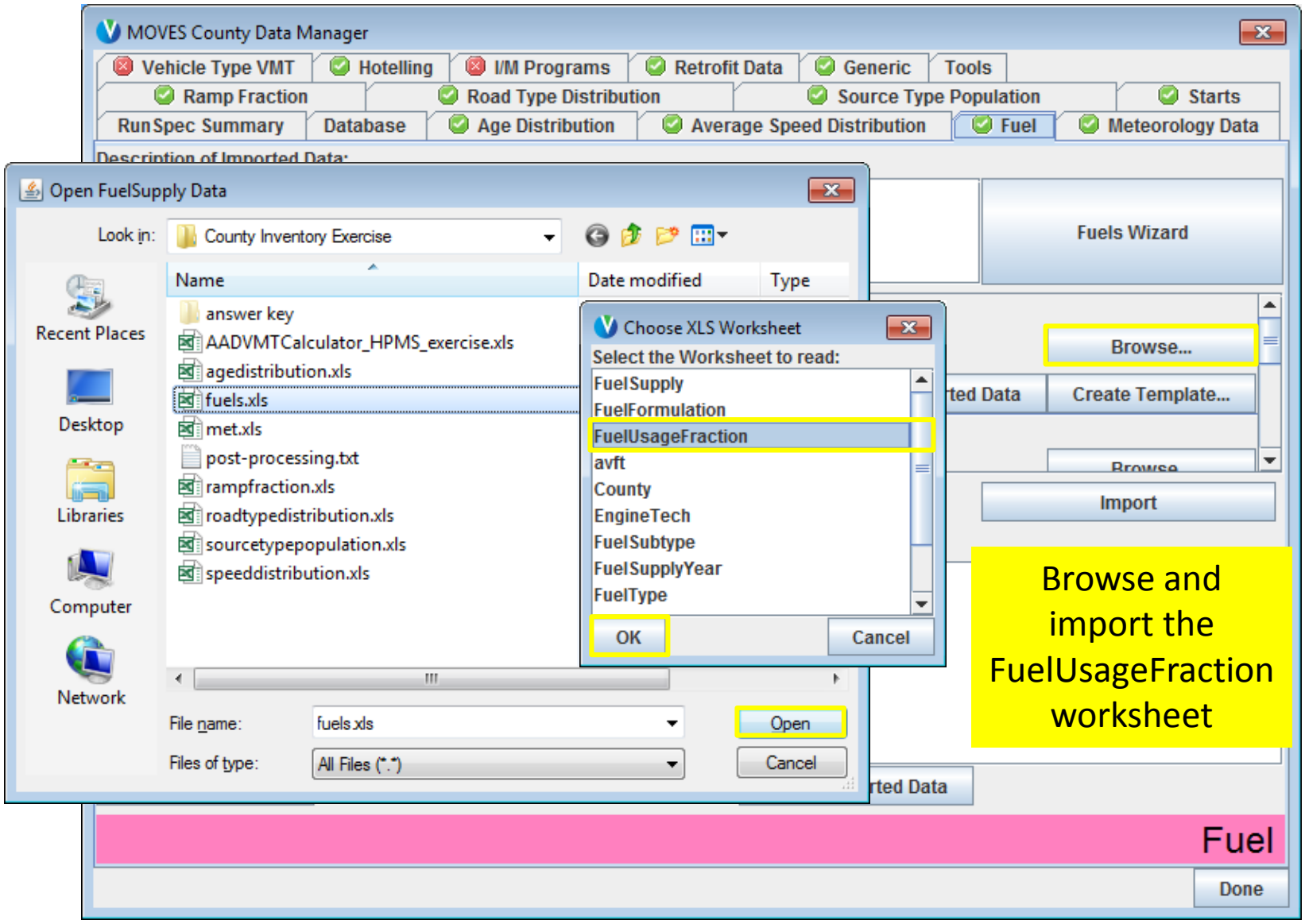
County Inventory Exercise: Entering Fuel Supply Data



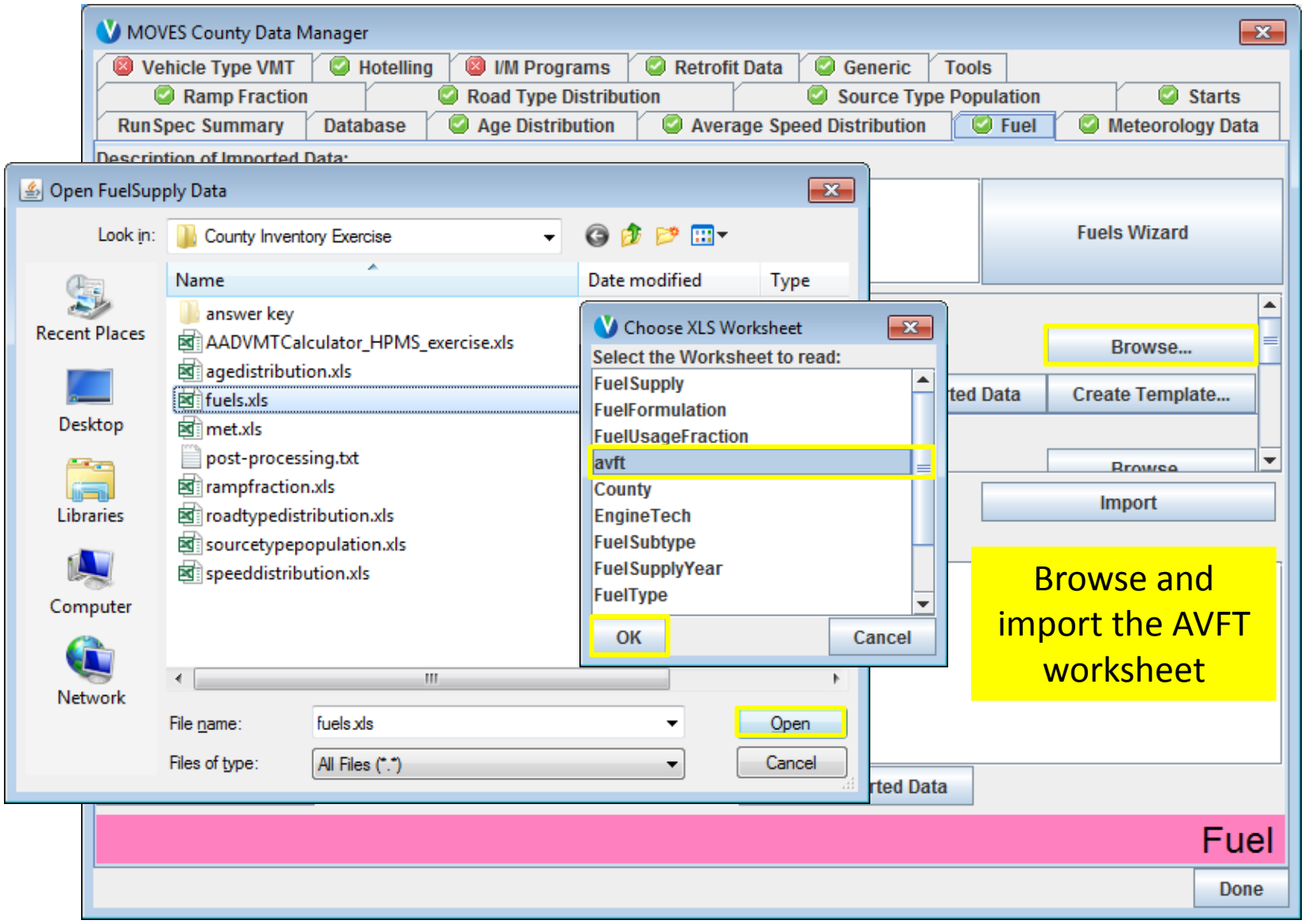
County Inventory Exercise: Entering Fuel Formulation Data



County Inventory Exercise: Entering Fuel Usage Fraction



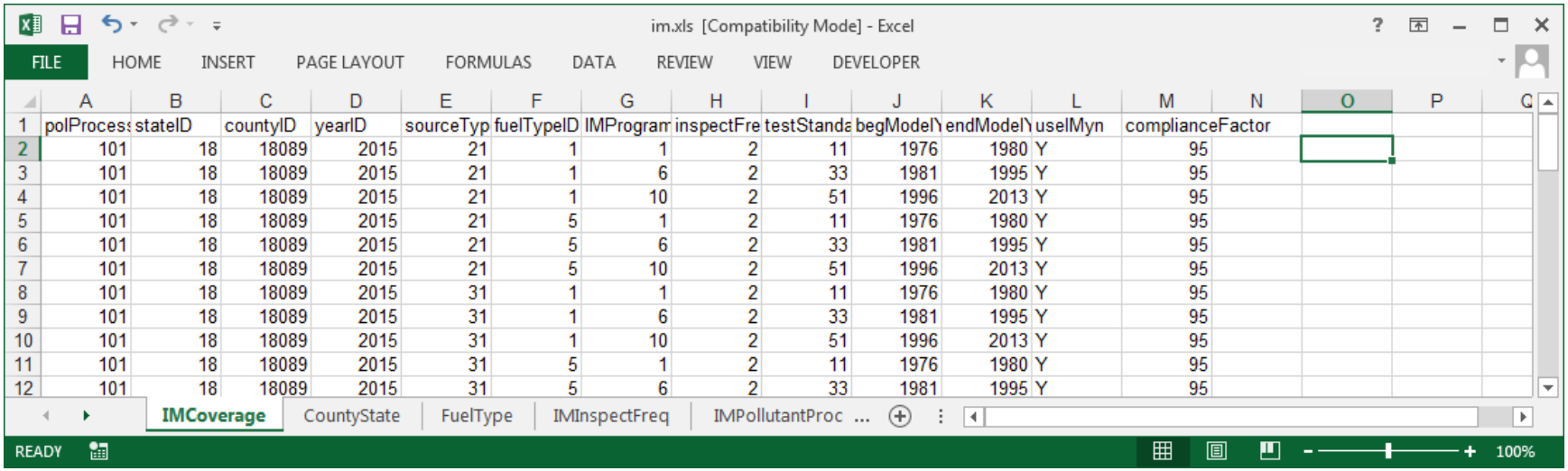
County Inventory Exercise: Entering Fuel Formulation Data



Inspection & Maintenance (I/M) Programs

- Only one I/M program can be applied to each pollutant-process, source type, fuel type, model year combination

- IMProgramID is arbitrary number but must be unique for each fuel type, inspection frequency, test standard combination



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	polProcess	stateID	countyID	yearID	sourceTyp	fuelTypeID	IMProgram	inspectFre	testStanda	begModelY	endModelY	useIMyn	complianceFactor				
2	101	18	18089	2015	21	1	1	2	11	1976	1980	Y	95				
3	101	18	18089	2015	21	1	6	2	33	1981	1995	Y	95				
4	101	18	18089	2015	21	1	10	2	51	1996	2013	Y	95				
5	101	18	18089	2015	21	5	1	2	11	1976	1980	Y	95				
6	101	18	18089	2015	21	5	6	2	33	1981	1995	Y	95				
7	101	18	18089	2015	21	5	10	2	51	1996	2013	Y	95				
8	101	18	18089	2015	31	1	1	2	11	1976	1980	Y	95				
9	101	18	18089	2015	31	1	6	2	33	1981	1995	Y	95				
10	101	18	18089	2015	31	1	10	2	51	1996	2013	Y	95				
11	101	18	18089	2015	31	5	1	2	11	1976	1980	Y	95				
12	101	18	18089	2015	31	5	6	2	33	1981	1995	Y	95				

I/M Programs: Guidance

- Section 4.11 of MOVES Technical Guidance

- MOVES uses a single "compliance factor" (compliance rate). The general equation for finding compliance factor is:

Compliance Factor = % Compliance Rate X (100% - waiver rate) X Regulatory class coverage adjustment

- Regulatory class coverage adjustment is used to account for I/M programs which may not cover an entire source type because the program only applies to certain weight classes

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I/M Programs: Guidance

- If separate I/M programs apply to different weight classes within the same source type, the two programs cannot be accounted for in a single RunSpec
  - If such a situation exists, assume the I/M program that covers a larger amount of the VMT within the source type applies to all weight classes for which there is an I/M program

- Consult MOVES Technical Guidance (Section 4.11) and User Guide for detailed instructions on how to construct I/M inputs (Section 2.3.3.4.16)

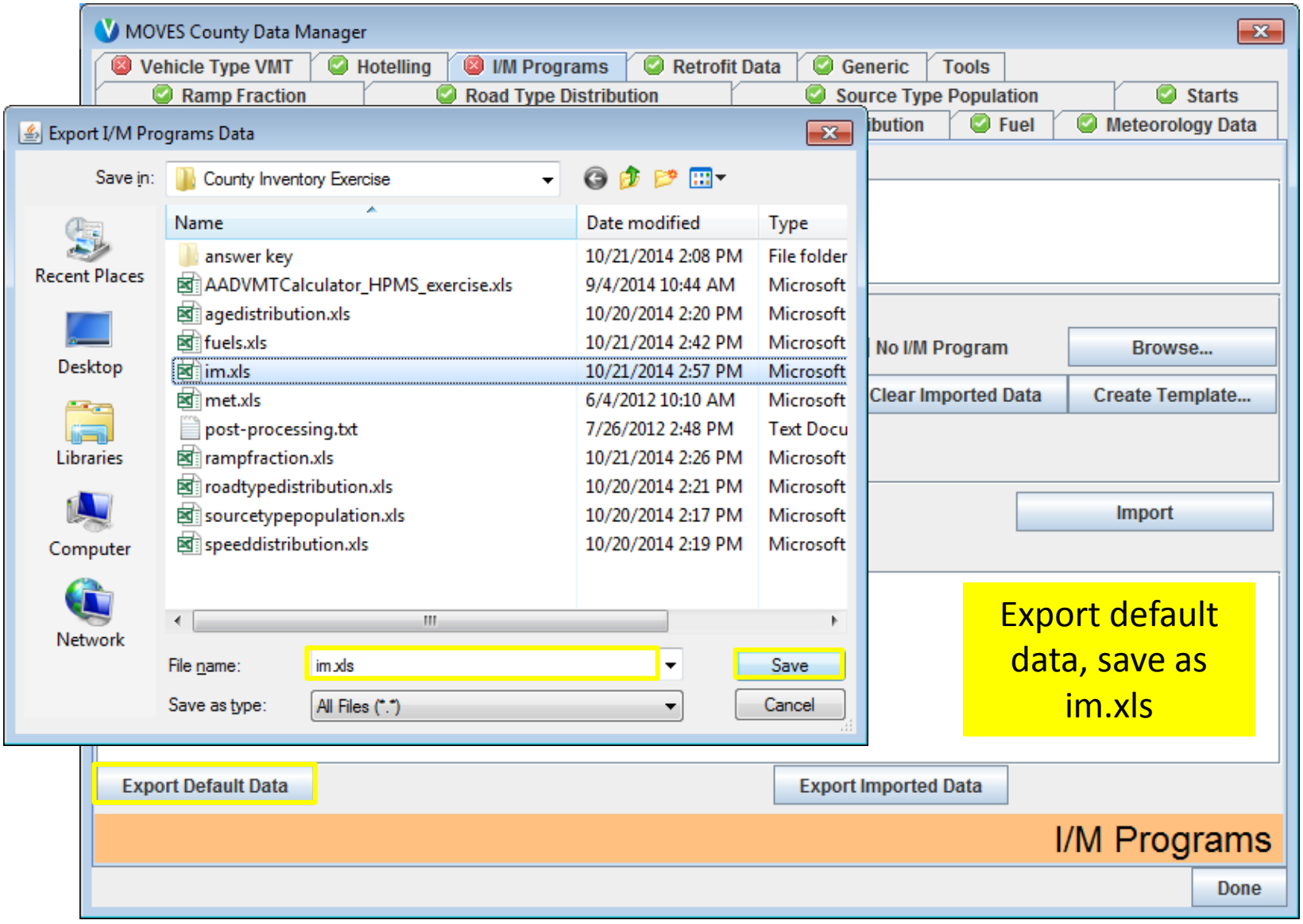
I/M Programs: Exercise

- Let's enter our I/M data into the CDM for our county-level exercise

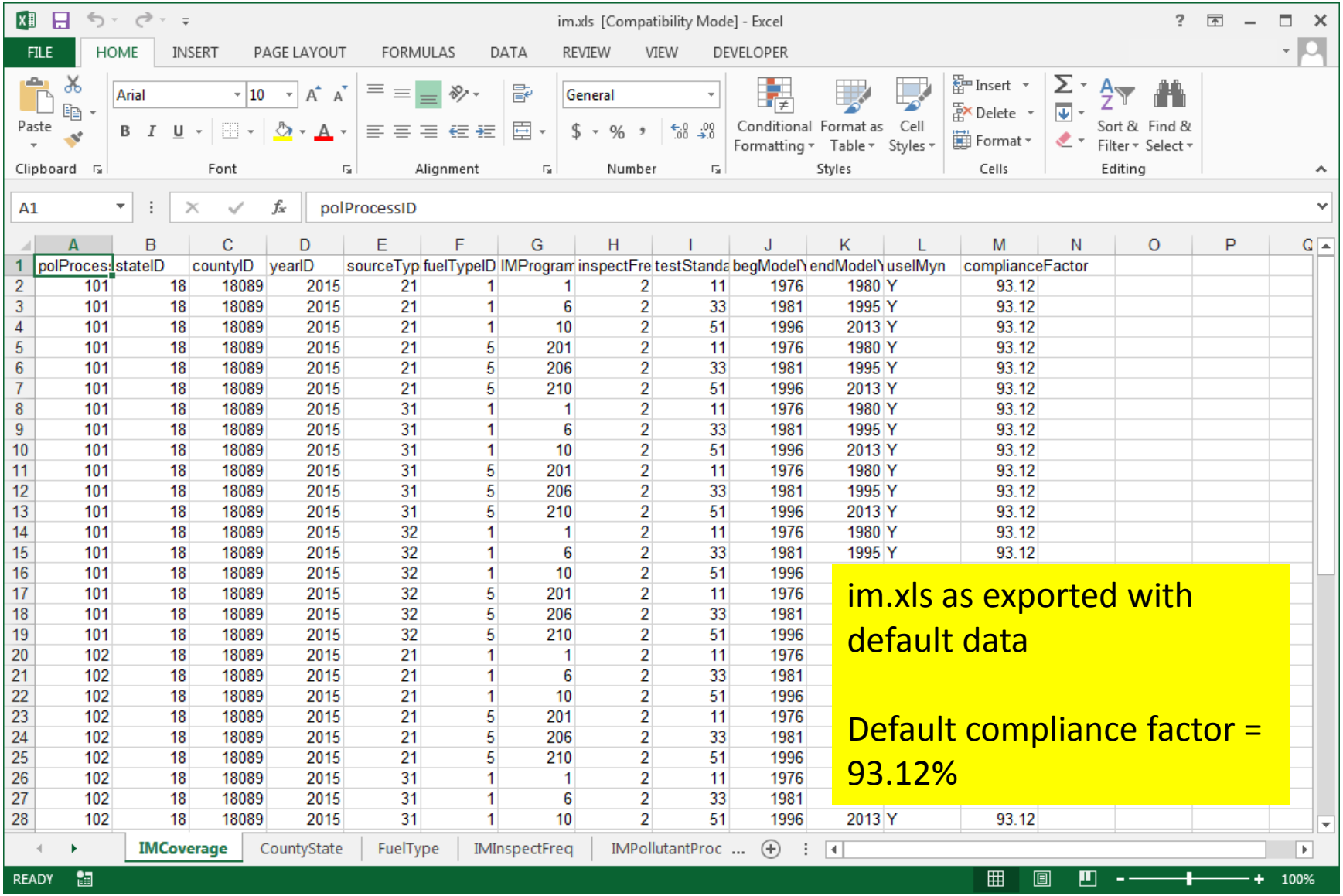
- MOVES will have default data for our county I/M program. However, we need to update the compliance factor to 95%

- Instructions for Developing a County-scale RunSpec:
  - Export the default I/M data for Lake County, change the compliance factors to 95%, and import the table into the I/M Programs tab

County Inventory Exercise: Entering I/M Programs Data



County Inventory Exercise: Entering I/M Programs Data

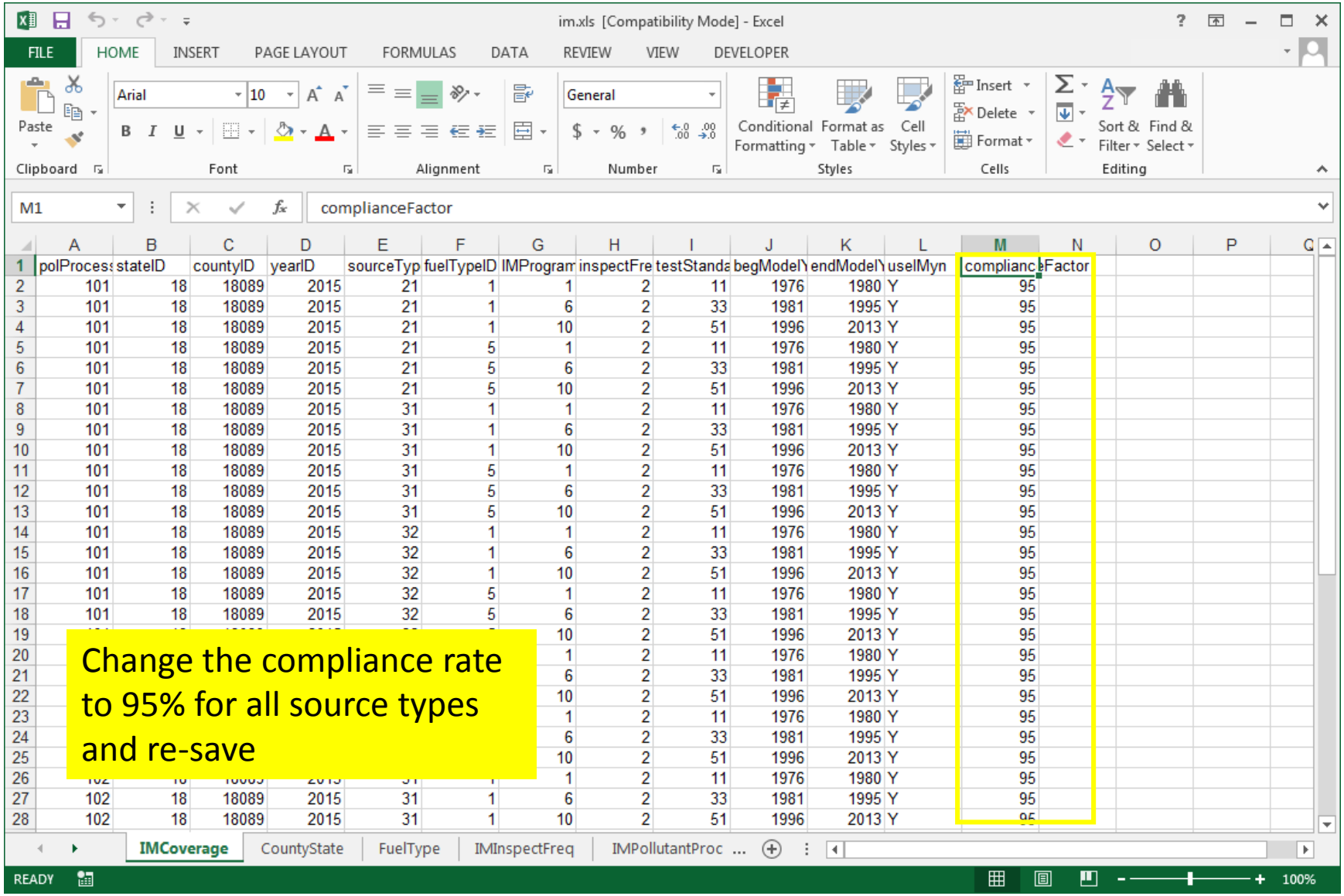


	polProces	stateID	countyID	yearID	sourceTyp	fuelTypeID	IMProgram	inspectFre	testStanda	begModelY	endModelY	useIMyn	complianceFactor
2	101	18	18089	2015	21	1	1	2	11	1976	1980	Y	93.12
3	101	18	18089	2015	21	1	6	2	33	1981	1995	Y	93.12
4	101	18	18089	2015	21	1	10	2	51	1996	2013	Y	93.12
5	101	18	18089	2015	21	5	201	2	11	1976	1980	Y	93.12
6	101	18	18089	2015	21	5	206	2	33	1981	1995	Y	93.12
7	101	18	18089	2015	21	5	210	2	51	1996	2013	Y	93.12
8	101	18	18089	2015	31	1	1	2	11	1976	1980	Y	93.12
9	101	18	18089	2015	31	1	6	2	33	1981	1995	Y	93.12
10	101	18	18089	2015	31	1	10	2	51	1996	2013	Y	93.12
11	101	18	18089	2015	31	5	201	2	11	1976	1980	Y	93.12
12	101	18	18089	2015	31	5	206	2	33	1981	1995	Y	93.12
13	101	18	18089	2015	31	5	210	2	51	1996	2013	Y	93.12
14	101	18	18089	2015	32	1	1	2	11	1976	1980	Y	93.12
15	101	18	18089	2015	32	1	6	2	33	1981	1995	Y	93.12
16	101	18	18089	2015	32	1	10	2	51	1996			
17	101	18	18089	2015	32	5	201	2	11	1976			
18	101	18	18089	2015	32	5	206	2	33	1981			
19	101	18	18089	2015	32	5	210	2	51	1996			
20	102	18	18089	2015	21	1	1	2	11	1976			
21	102	18	18089	2015	21	1	6	2	33	1981			
22	102	18	18089	2015	21	1	10	2	51	1996			
23	102	18	18089	2015	21	5	201	2	11	1976			
24	102	18	18089	2015	21	5	206	2	33	1981			
25	102	18	18089	2015	21	5	210	2	51	1996			
26	102	18	18089	2015	31	1	1	2	11	1976			
27	102	18	18089	2015	31	1	6	2	33	1981			
28	102	18	18089	2015	31	1	10	2	51	1996	2013	Y	93.12

im.xls as exported with default data

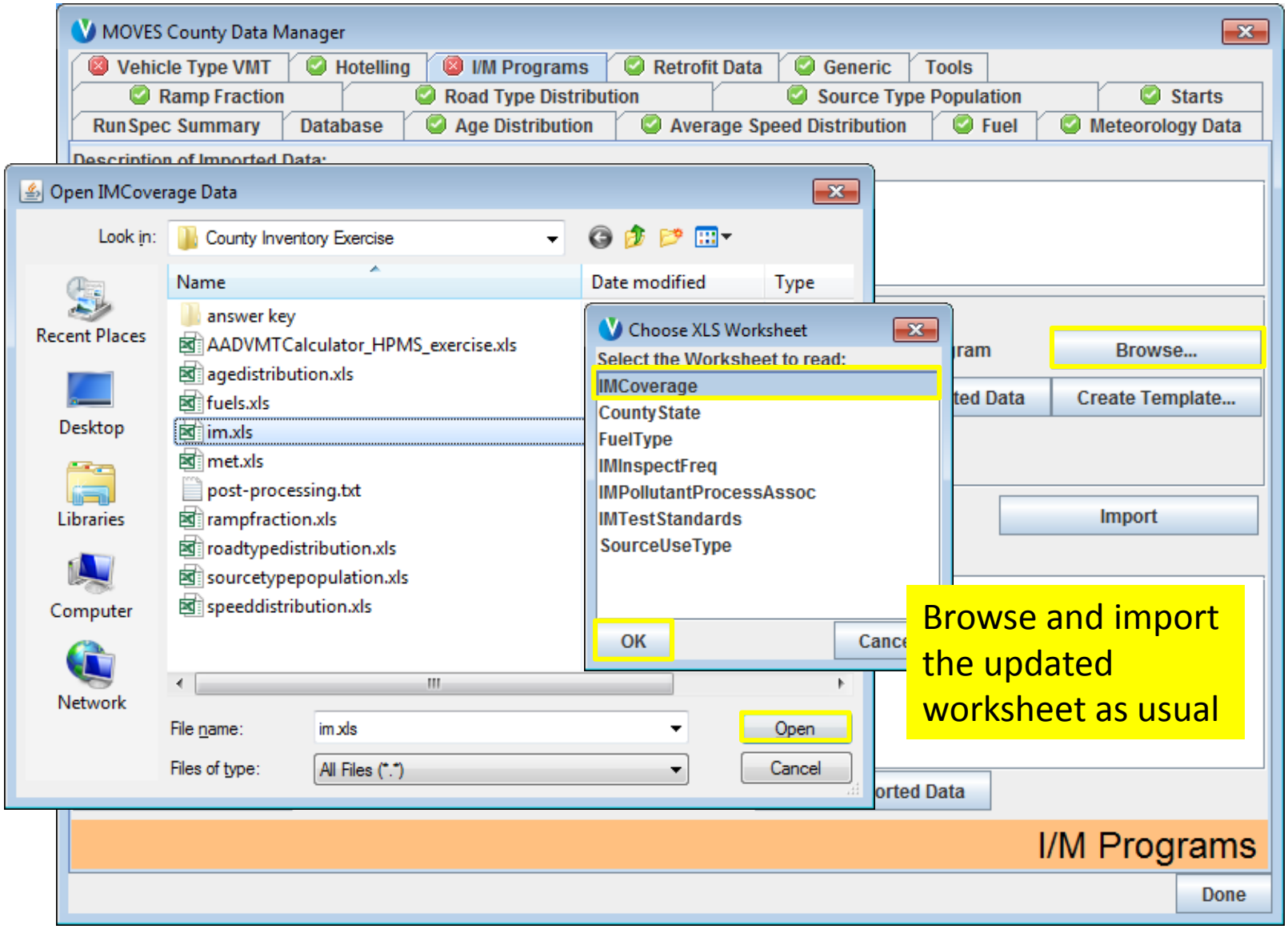
Default compliance factor = 93.12%

County Inventory Exercise: Entering I/M Programs Data

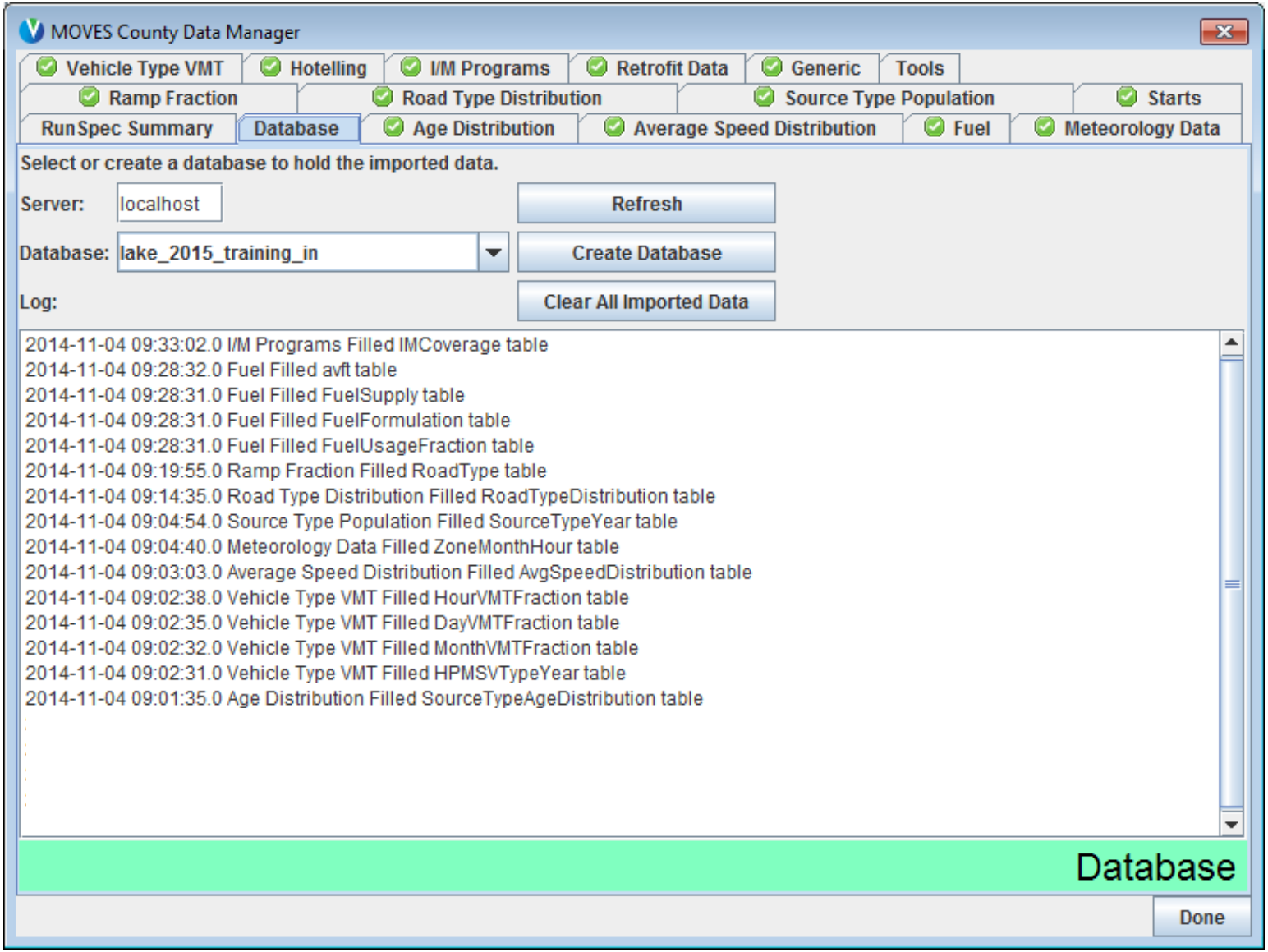


	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	polProcess	stateID	countyID	yearID	sourceTyp	fuelTypeID	IMProgram	inspectFre	testStanda	begModelY	endModelY	useIMyn	complianceFactor	
2	101	18	18089	2015	21	1	1	2	11	1976	1980	Y	95	
3	101	18	18089	2015	21	1	6	2	33	1981	1995	Y	95	
4	101	18	18089	2015	21	1	10	2	51	1996	2013	Y	95	
5	101	18	18089	2015	21	5	1	2	11	1976	1980	Y	95	
6	101	18	18089	2015	21	5	6	2	33	1981	1995	Y	95	
7	101	18	18089	2015	21	5	10	2	51	1996	2013	Y	95	
8	101	18	18089	2015	31	1	1	2	11	1976	1980	Y	95	
9	101	18	18089	2015	31	1	6	2	33	1981	1995	Y	95	
10	101	18	18089	2015	31	1	10	2	51	1996	2013	Y	95	
11	101	18	18089	2015	31	5	1	2	11	1976	1980	Y	95	
12	101	18	18089	2015	31	5	6	2	33	1981	1995	Y	95	
13	101	18	18089	2015	31	5	10	2	51	1996	2013	Y	95	
14	101	18	18089	2015	32	1	1	2	11	1976	1980	Y	95	
15	101	18	18089	2015	32	1	6	2	33	1981	1995	Y	95	
16	101	18	18089	2015	32	1	10	2	51	1996	2013	Y	95	
17	101	18	18089	2015	32	5	1	2	11	1976	1980	Y	95	
18	101	18	18089	2015	32	5	6	2	33	1981	1995	Y	95	
19							10	2	51	1996	2013	Y	95	
20							1	2	11	1976	1980	Y	95	
21							6	2	33	1981	1995	Y	95	
22							10	2	51	1996	2013	Y	95	
23							1	2	11	1976	1980	Y	95	
24							6	2	33	1981	1995	Y	95	
25							10	2	51	1996	2013	Y	95	
26							1	2	11	1976	1980	Y	95	
27	102	18	18089	2015	31	1	6	2	33	1981	1995	Y	95	
28	102	18	18089	2015	31	1	10	2	51	1996	2013	Y	95	

County Inventory Exercise: Entering I/M Programs Data



County Inventory Exercise: All Data Imported

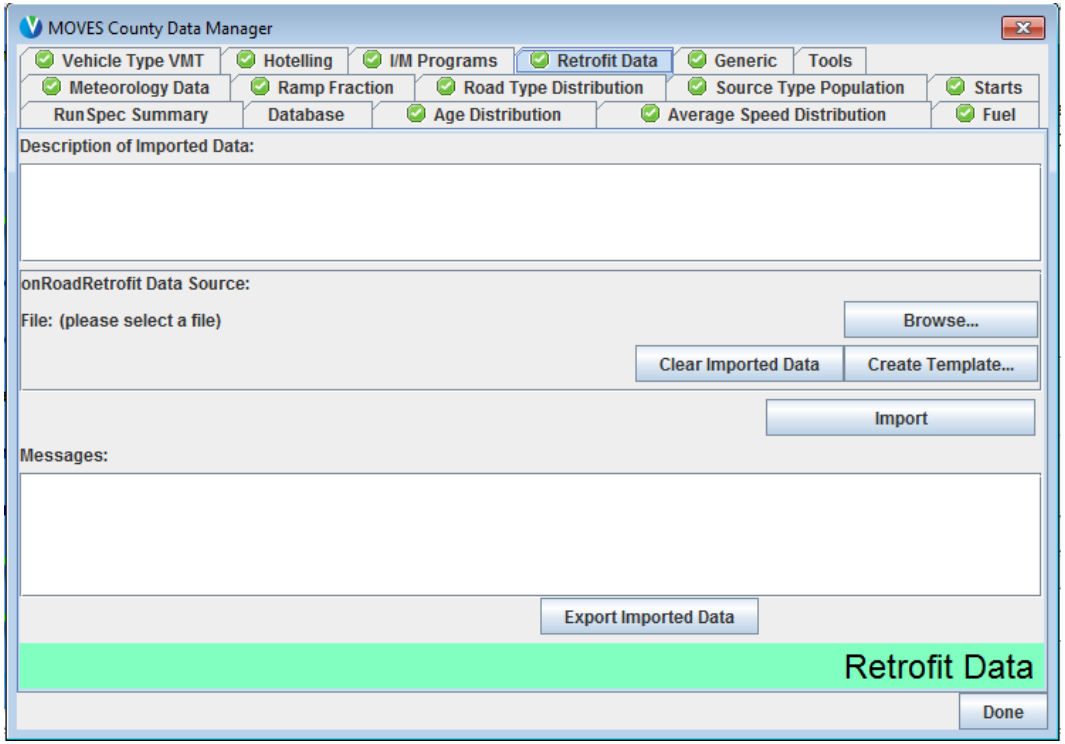


Other CDM Tabs: Generic

- The Generic tab allows advanced users to enter data into the many tables used by MOVES to complete its calculations

- In general, most users will not have a reason to enter data through this tab

Other CDM Tabs: Retrofit



- The retrofit importer (formerly in the runspec of MOVES2010b) is now located in the CDM/PDM
- Use to model diesel retrofit programs
- This is an optional input

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Other CDM Tabs: Retrofit

pollutantID	processID	fuelTypeID	sourceTypeID	retrofitYearID	beginModelYea	endModelYearID	cumFractionRetrofit	retrofitEffectiveFraction
3	1	2	62	2024	2020	2024	0.5	0.3

The example above describes a retrofit program:

- Applying to diesel combination long-haul trucks (sourceTypeID 62)
- Affecting running emissions (process ID 1) of NOx (pollutantID 3)
- For model years 2020 through 2024 (beginModelYearID/endModelYearID)
- Where 50% of all vehicles in that MY range are retrofitted (cumFractionRetrofit 0.5)
- And the retrofit technology reduces emissions 30% (retrofiteffectivefraction 0.3)

- The retrofityearID should always be the analysis year
- Consult EPA guidance material for more information on when to use the Retrofit input

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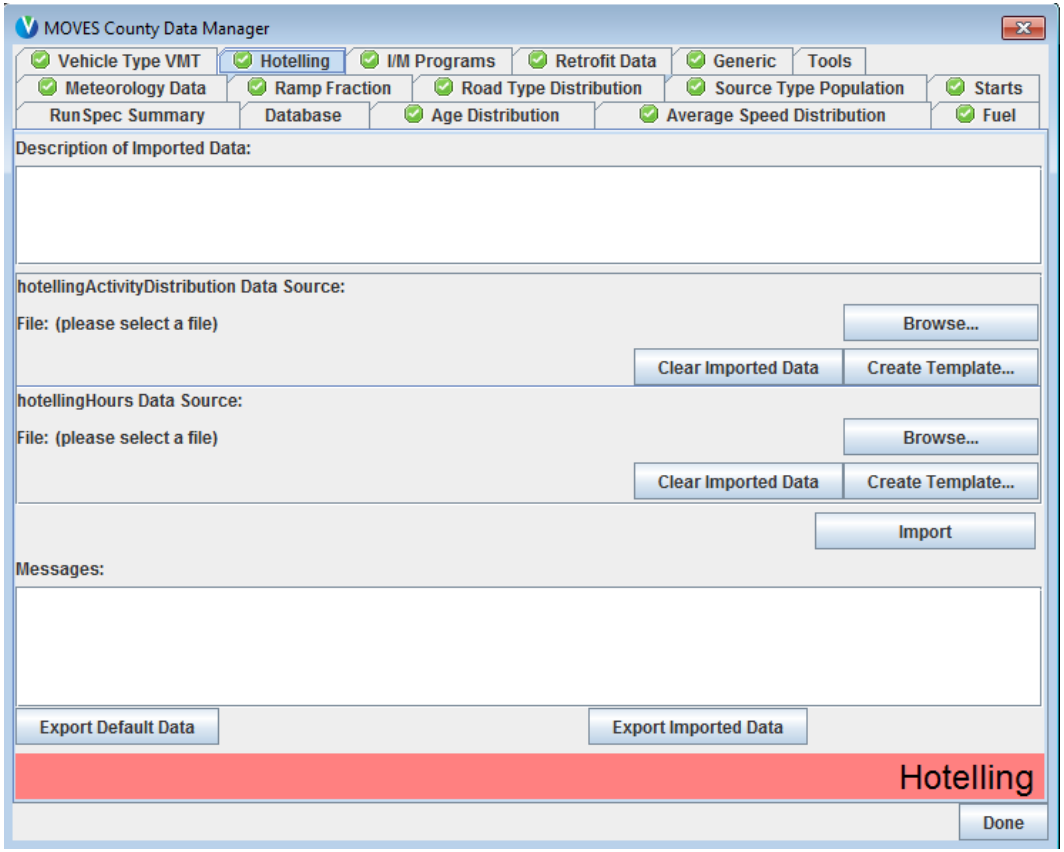
Other CDM Tabs: Hotelling



- The Hotelling input allows users to describe long-haul combination truck hotelling behavior
- The two panels are:
  - **hotellingactivitydistribution** and
  - **hotellinghours**
- Both are optional inputs
- Output in Rates mode is provided in the **ratepervehicle** table, but also in a new **rateperhour** table. ***Only one should be used*** depending on if activity is available in terms of vehicle population or hotelling hours

Other CDM Tabs: Hotelling

- The **hotellingactivitydistribution** table is used to define the fraction of trucks in each of four modes of hotelling activity:
- 200 – Extended Idling
- 201 – Auxiliary Power Units (APUs)
- 203 – Battery Power
- 204 – Engine Off
- The example shows the national default fractions

beginModelYearID	endModelYearID	opModeID	opModeFraction
1960	2009	200	1
1960	2009	201	0
1960	2009	203	0
1960	2009	204	0
2010	2050	200	0.7
2010	2050	201	0.3
2010	2050	203	0
2010	2050	204	0

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Other CDM Tabs: Hotelling

hourDayID	monthID	yearID	ageID	zoneID	sourceTyp	hotellingHo
15	1	2024	30	131210	62	0
15	1	2024	29	131210	62	0
15	1	2024	28	131210	62	0
15	1	2024	27	131210	62	0
15	1	2024	26	131210	62	0
15	1	2024	25	131210	62	0.033932
15	1	2024	24	131210	62	0.146956
15	1	2024	23	131210	62	0.141804
15	1	2024	22	131210	62	0.113281
15	1	2024	21	131210	62	0.129963
15	1	2024	20	131210	62	0.23111
15	1	2024	19	131210	62	0.102025
15	1	2024	18	131210	62	0.409672
15	1	2024	17	131210	62	0.397336
15	1	2024	16	131210	62	0.402312
15	1	2024	15	131210	62	0.737026
15	1	2024	14	131210	62	0.82595
15	1	2024	13	131210	62	1.388
15	1	2024	12	131210	62	1.41376
15	1	2024	11	131210	62	1.52765
15	1	2024	10	131210	62	1.05556
15	1	2024	9	131210	62	2.35206
15	1	2024	8	131210	62	1.73303
15	1	2024	7	131210	62	3.48606
15	1	2024	6	131210	62	1.39675
15	1	2024	5	131210	62	2.19772
15	1	2024	4	131210	62	2.56074
15	1	2024	3	131210	62	5.66776
15	1	2024	2	131210	62	4.5037
15	1	2024	1	131210	62	3.1559
15	1	2024	0	131210	62	3.07248

- The **hotellinghours** table is used to define the total number of hotelling hours in your modeling domain
- In MOVES2014 extended idle hours are allocated to counties based on rural combination truck VMT – in MOVES2010b it was based on long-haul combination truck population
- This input can be used to override the defaults and provide local hotelling hours (if available)
- Note that hotelling hours are by "day-type"
  - day 5 = 5 weekdays
  - day 2 = 2 weekend days

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Other CDM Tabs: Starts

- MOVES2014 offers the option to import local vehicle start information
- Input is optional: if no data are provided, MOVES calculates starts from the user defined source type population input
- Depending on the data available, users can use one or more of the following panels:
- **starts** – use when you have all information: starts by source type, hourdayid, modelyear, monthid. If **starts** table used, no other tables below should be used
- **startsPerDay** – use when you have the number of starts per day
- **startsHourFraction** – use when you know the distribution of starts throughout the day
- **startsSourceTypeFraction** – use when you know how to allocate starts among the different source types
- **startsMonthAdjust** – use to adjust start activity by month

An importer is also available to provide information on vehicle soak time

- **importStartsOpModeDistribution** – defines vehicles soak times

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Other CDM Tabs: Starts

- An entire "**starts**" table can be imported. This will completely replace the MOVES generated default starts profile.
- Note that this input requires all information on starts for all hours, dayIDs, age (model year), and source type selected in the runspec

hourDayID	monthID	yearID	ageID	zoneID	sourceTypeID	starts	startsCV
15	1	2024	0	131210	11		
15	1	2024	0	131210	21		
15	1	2024	0	131210	31		
15	1	2024	0	131210	32		
15	1	2024	0	131210	41		
15	1	2024	0	131210	42		
15	1	2024	0	131210	43		
15	1	2024	0	131210	51		
15	1	2024	0	131210	52		
15	1	2024	0	131210	53		
15	1	2024	0	131210	54		
15	1	2024	0	131210	61		
15	1	2024	0	131210	62		
15	1	2024	1	131210	11		
15	1	2024	1	131210	21		
15	1	2024	1	131210	31		
15	1	2024	1	131210	32		

Other CDM Tabs: Starts

- The startsperday importer is used to provide total starts by day type
- Starts should be entered for all vehicles and all days within the day type (day 5 represents five weekdays, and day 2 represents two weekends)
- This input can be used independently, or in combination with **startsHourFraction, startsSourceTypeFraction, and startsMonthAdjust**

zoneID	dayID	yearID	startsPerDay	
131210	5	2024		

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Other CDM Tabs: Starts

zoneID	dayID	hourID	allocationFraction
131210	5	1	
131210	5	2	
131210	5	3	
131210	5	4	
131210	5	5	
131210	5	6	
131210	5	7	
131210	5	8	
131210	5	9	
131210	5	10	
131210	5	11	
131210	5	12	
131210	5	13	
131210	5	14	
131210	5	15	
131210	5	16	
131210	5	17	
131210	5	18	
131210	5	19	
131210	5	20	

- The **startshourfraction** importer is used to define the distribution of total starts across the day
- Different distributions can be provided for each day type
- This input can be used independently, or in combination with **startsperday**, **startsSourceTypeFraction**, and **startsMonthAdjust**

Other CDM Tabs: Starts

sourceTypeID	allocationFraction
11	
21	
31	
32	
41	
42	
43	
51	
52	
53	
54	
61	
62	

- The **startssourcetypefraction** importer is used to define the distribution of total starts by source type
- This input can be used independently, or in combination with **startsperday**, **startshourfraction**, and **startsMonthAdjust**

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Other CDM Tabs: Starts

monthID	monthAdjustment
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

- The **startsmonthadjust** importer is used to define the distribution of total starts by month
- A fraction of 1 for all months indicates every month has an equal number of starts
- These can be varied to adjust for a scenario where there is greater start activity in the summer months vs. winter months
- This input can be used independently, or in combination with **startsperday**, **startshourfraction**, and **startssourcetypefraction**

Other CDM Tabs: Starts

sourceTyp	hourDayID	linkID	polProcess	opModeID	opModeFraction
11	15	1312101	302	101	
11	15	1312101	302	102	
11	15	1312101	302	103	
11	15	1312101	302	104	
11	15	1312101	302	105	
11	15	1312101	302	106	
11	15	1312101	302	107	
11	15	1312101	302	108	
11	25	1312101	302	101	
11	25	1312101	302	102	
11	25	1312101	302	103	
11	25	1312101	302	104	
11	25	1312101	302	105	
11	25	1312101	302	106	
11	25	1312101	302	107	
11	25	1312101	302	108	
11	35	1312101	302	101	
11	35	1312101	302	102	
11	35	1312101	302	103	
11	35	1312101	302	104	
11	35	1312101	302	105	
11	35	1312101	302	106	
11	35	1312101	302	107	
11	35	1312101	302	108	

- The **startsopmodedistribution** importer is used to define the distribution of soak times by sourcetype, hour, and dayID
- For each combination of sourcetype, hourDayid, and polprocessID, opmodefractions should sum to 1
- The table below shows the available soak times

opModeID	opModeName
101	Soak Time < 6 minutes
102	6 minutes <= Soak Time < 30 minutes
103	30 minutes <= Soak Time < 60 minutes
104	60 minutes <= Soak Time < 90 minutes
105	90 minutes <= Soak Time < 120 minutes
106	120 minutes <= Soak Time < 360 minutes
107	360 minutes <= Soak Time < 720 minutes
108	720 minutes <= Soak Time

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Other CDM Tabs: Starts

- In the General Output panel of the RunSpec, checking output by "Starts" allows you to confirm that MOVES used the correct number of starts

- For Rates runs, two new tables are created called "**startpervehicle**" and "**rateperstart**"
  - The **startpervehicle** table is primarily informational and can be used for diagnostic purposes

    Only one of these tables should be used for developing a starts emissions inventory:
  - The **rateperstart** table can be used as an alternative for the **ratepervehicle** table if start information is available
  - If you have start info: Multiply **rateperstart** rates x [# of vehicle starts]
  - If you don't: Multiply **ratepervehicle** rate x [vehicle population]

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Running MOVES (Executing the RunSpec)

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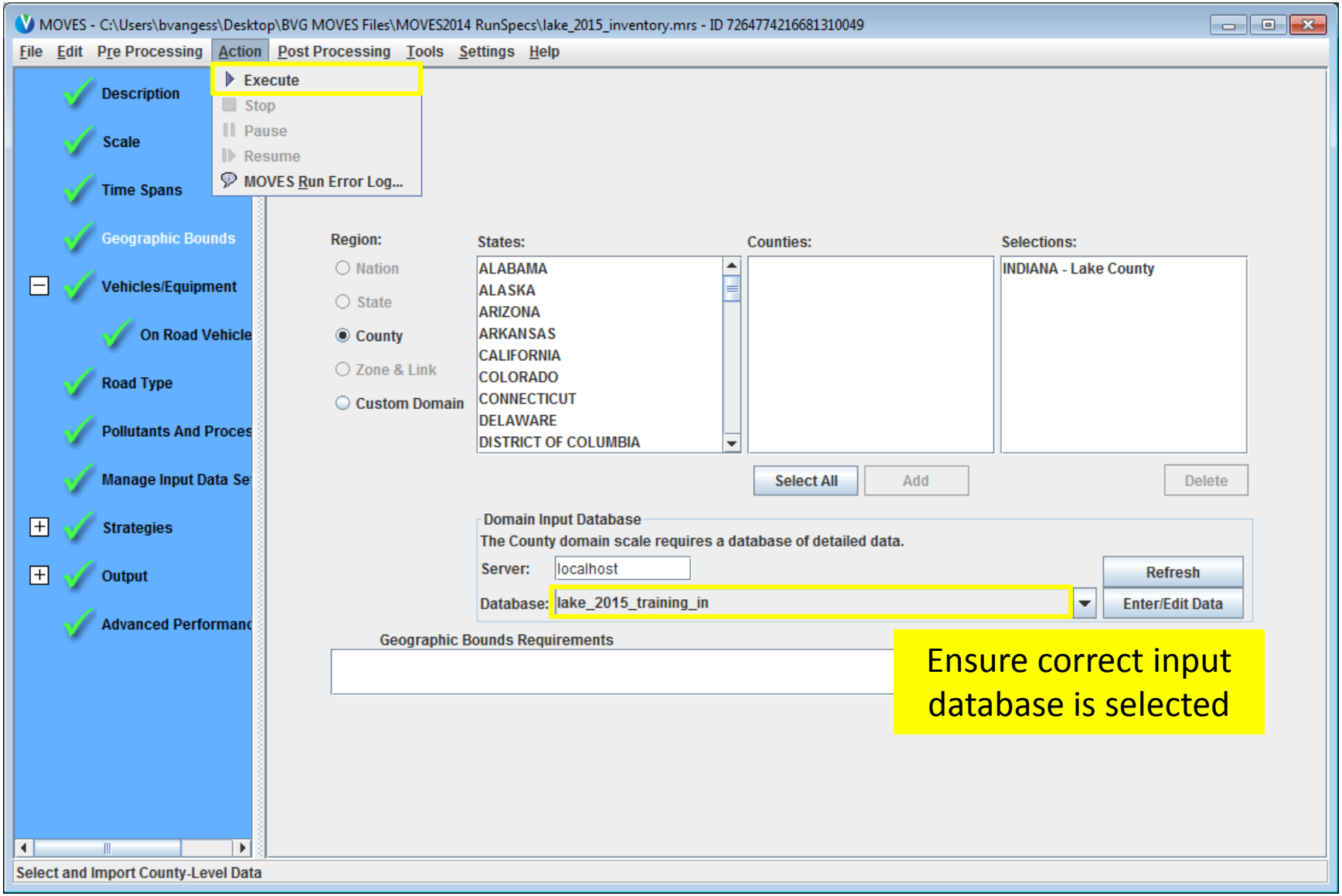
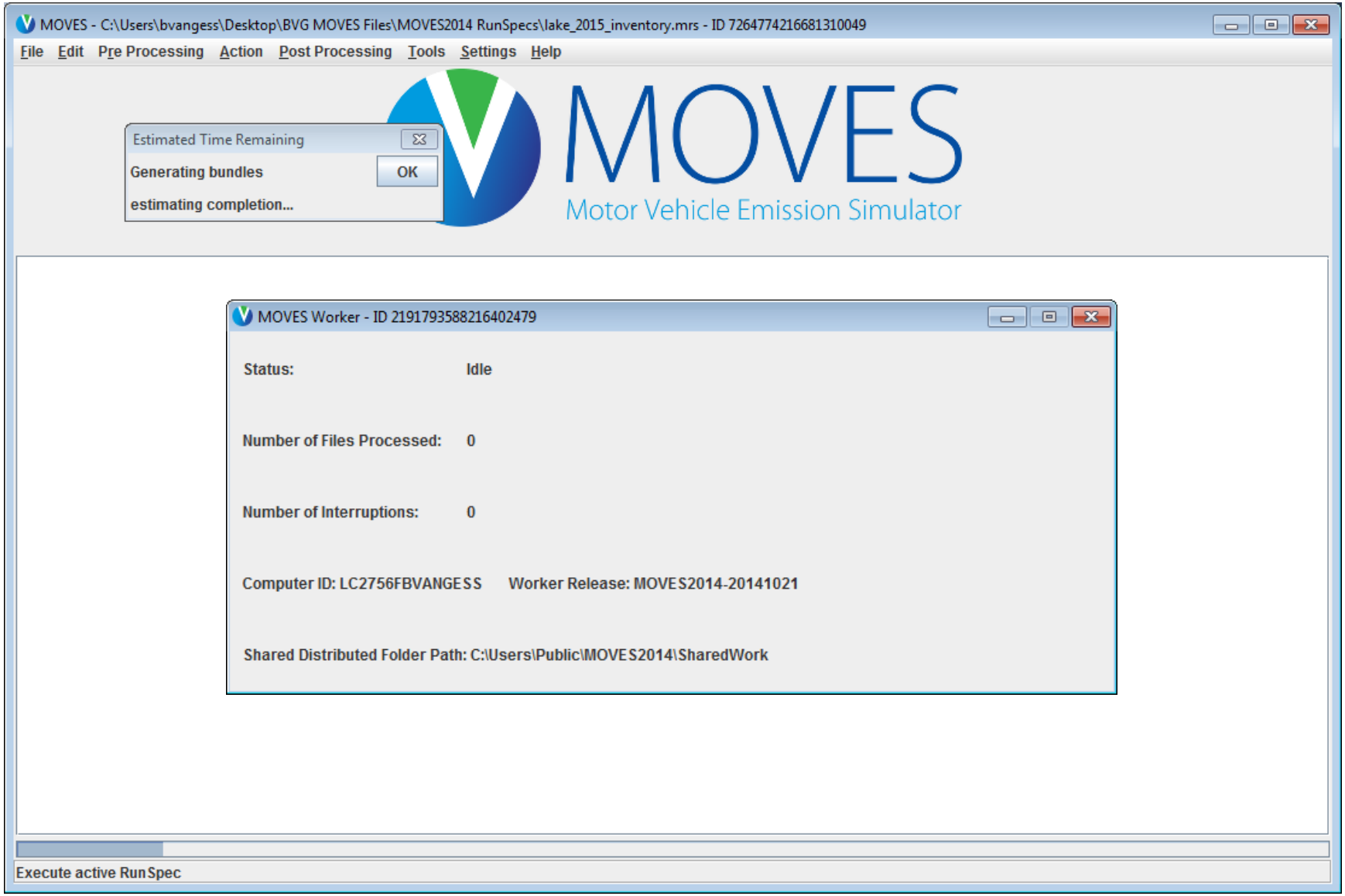
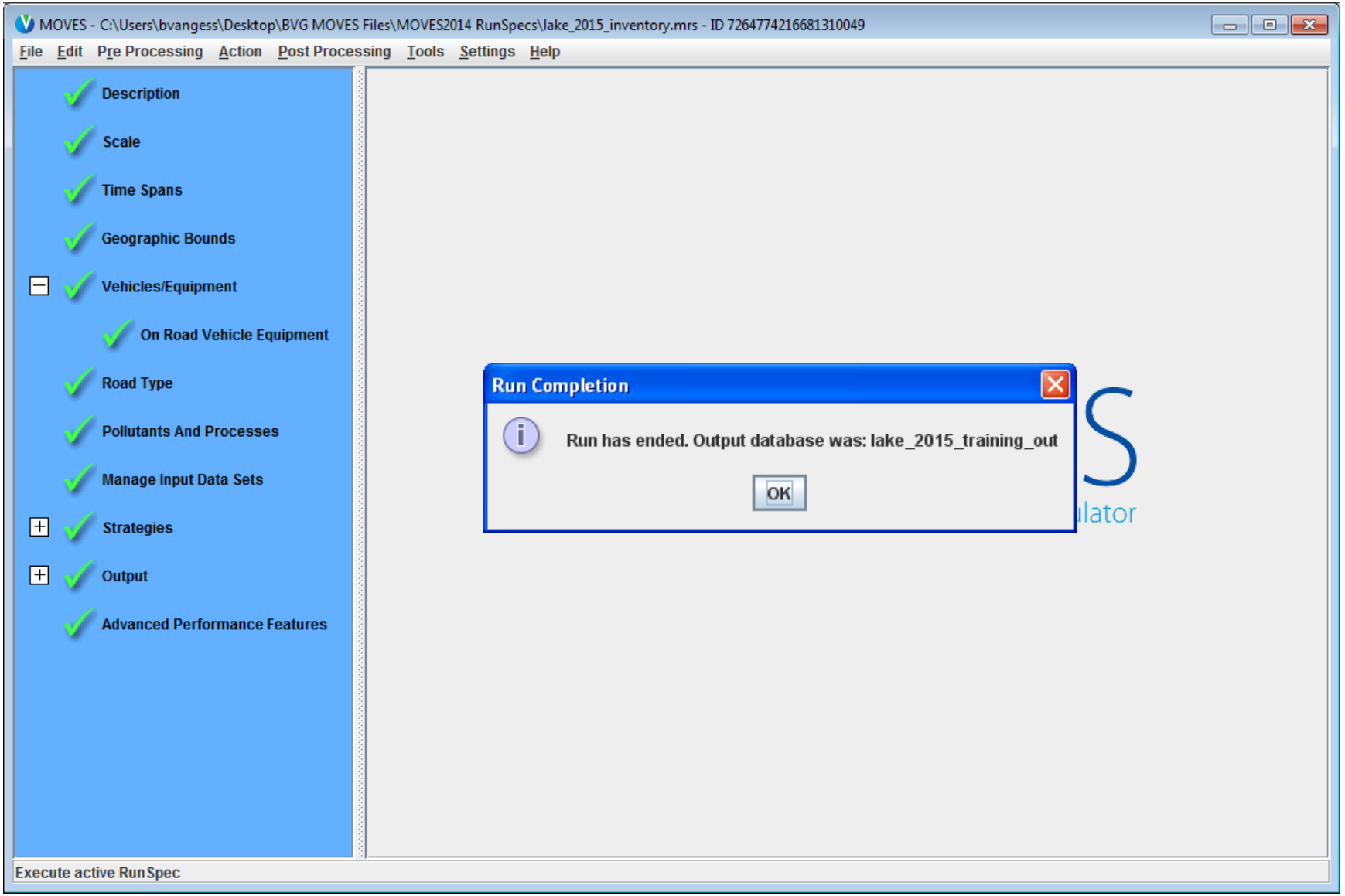
Executing the RunSpec



MOVES Running



Run Complete



Helpful MOVES Tools

- Three new tools available for MOVES2014:
  - AADVMT Converter
  - Age Distribution Projection Tool
  - Default Age Distribution Tool
  - Tools can be found at: www.epa.gov/otaq/models/moves/tools.htm

- Note, the tools website also contains several MOBILE6 to MOVES converters. Generally, these should not be used with MOVES2014

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Questions?

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