Module 7
Emission Rates for County Scale Analyses

Module Overview

- Introduction to rates
- Building a rates lookup table
- Creating a RunSpec for a rates run
- Creating an input database for a rates run
- Class exercise

Introduction to Rates

- Rates can be generated at the National, County (including custom domains), and Project Scales

- Output from an Emission Rates run is a set of emission rates: e.g., rate per mile, per vehicle, per hour, per start

- User must post-process results by multiplying rates by appropriate activity (e.g, miles, vehicles)
  - MOVES does for you when using Inventory mode
  - Because of the post-processing needed, with Emission Rates mode there is greater potential to introduce error

- But, there are some applications where rates are useful…

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Why use rates?

- More flexibility when you need to estimate emissions over a wide range of conditions, e.g., many counties, or a wide range of temperatures
  - for creating SIP or other inventories
  - for modeling specific episodes in a SIP for photochemical modeling

- To create a link-based inventory (e.g., in a travel model post-processor) by applying the specific rates needed on each link

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Other Considerations for Rates vs. Inventory

- Either approach is acceptable for SIP and regional conformity analyses, but we recommend that you:
  - Use the same approach for base and projected inventories
  - Use the same approach for SIP and conformity analyses
  - Use interagency consultation to ensure consistency in methods

- Trade-offs in both approaches; choice depends on the area and purpose
  - In many cases, Inventory is the more appropriate calculation type
    - Shorter run times and less post-processing
  - But, in certain cases, Rates may require fewer runs

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Key Points

- Think carefully about which approach makes the most sense for your situation
  - Do some test runs to get a sense of differences in input requirements, run time, and output file size for each approach
- Be consistent!
  - While you can get the same answer regardless of the approach, it is much easier to avoid problems if you:
    - Use the same approach for base and projection years
    - Use the same approach for SIP and conformity analyses
- Use interagency consultation to make sure everyone agrees on best approach from the start

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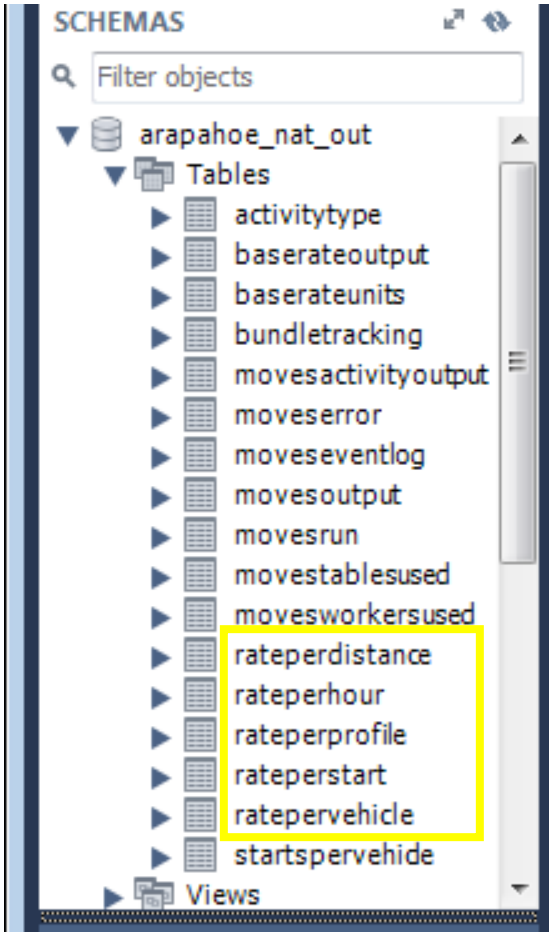
MOVES Rate Tables

MySQL Output for Rates Run



- In Emission Rates mode, MOVES output database includes rate tables that cover all the emissions processes
  - Rateperdistance: Running processes
  - Ratepervehicle: Start, Hotelling, Evap, Refueling processes
    - Rateperstart: Start processes
    - Rateperhour: Hotelling processes
  - Rateperprofile: Evap fuel vapor venting

- To calculate an inventory that captures **all** vehicle activity, you will need to use rates from several rate tables

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Processes Included in Each Rate Table

MOVES Output Table	Process ID and Process:
Rateperdistance	1: Running exhaust 9: Brakewear 10: Tirewear
when running	11: Evap permeation 12: Evap fuel vapor venting 13: Evap fuel leaks
Rateperdistance	15: Crankcase running exhaust 18: Refueling displacement vapor loss 19: Refueling spillage loss
Ratepervehicle	2: Start — *alternative:* use rate from **Rateperstart**
when resting	11: Evap permeation 13: Evap fuel leaks
	16: Crankcase start — *alternative:* use rate from **Rateperstart** 17: Crankcase extended Idle — *alternative:* use rate from **Rateperhour** 18: Refueling displacement 19: Refueling spillage 90: Extended idle — *alternative:* use rate from **Rateperhour** 91: Aux power exhaust — *alternative:* use rate from **Rateperhour**
Rateperprofile	12: Evap fuel vapor venting <- when resting

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When would I use alternative rates?

- Depends on the "activity" information you have

Use rates from:	If you have:	To get emissions for:	Notes:
Rateperstart	Number of vehicle starts	Start (2, 16)	Use these rates ***instead*** of rates from "ratepervehicle"
Rateperhour	Number of hours that trucks are hoteling	APU (90) Extended idle (17, 91)	Use these rates ***instead*** of rates from "ratepervehicle"
Ratepervehicle	Only number of vehicles, and no other info	Start (2, 16) APU (90) Extended idle (17, 91)	Use these rates if you don't have number of starts Use these rates if you don't have hours hoteling

- Regardless, to capture all processes, you will also need to use rates from rateperdistance, ratepervehicle, and rateperprofile

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How Rates Vary: General

- You can obtain rates that vary by:
  - ❑ source use type (vehicle type)
  - ❑ model year
  - ❑ fuel type
- By checking the box on the "Output Emissions Detail" panel in the RunSpec
  - If you don't make these selections, MOVES produces composite emissions rates over that category

- When should you select:
  - ☑ Source use type? Likely *always* (13 source types)
    - You need activity (VMT, population) by source type, to calculate emissions
    - Remainder of module assumes this box is checked
  - ❑ Model year? *ONLY IF* you have different age distributions by county (31 model years)
  - ❑ Fuel type? *ONLY IF* you have activity by fuel type (4 fuel types)

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How Rates Vary

- Running rates vary with:
  - Temperature: you input the range
  - Road type: rates for each of 4 different road types, ids 2 - 5
  - Speed bin: rates for 16 speed bins

- How many rates does the rateperdistance table produce?
  = [up to 9 processes] x [13 source types] x [4 road types] x [16 speed bins] x [# of temps]
  = Up to 7488 rates per temperature, for each pollutant

MOVES 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

Why would running emission rates for the same speed bin differ by road type?

- For example, suppose traffic on each of these road types is averaging 35 mph

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How Rates Vary

- Ratepervehicle rates (9 processes), rateperstart rates (2 processes), and rateperhour rates (3 processes) vary with:
  - Temperature (based on what you enter for a daily "temperature profile" – the temperature over the course of a day)
  - Type of day (weekday vs. weekend day)
  - Hour of day

- How many rates does the ratepervehicle table produce?

  = [up to 9 processes] x [13 source types] x [2 day types] x [24 hours] x [# of temperature profiles]

  = up to 5616 rates for each temperature profile, for each pollutant

  - Similarly, up to 1248 rates per temperature in the rateperstart table
  - And up to 1872 rates per temperature in the rateperhour table

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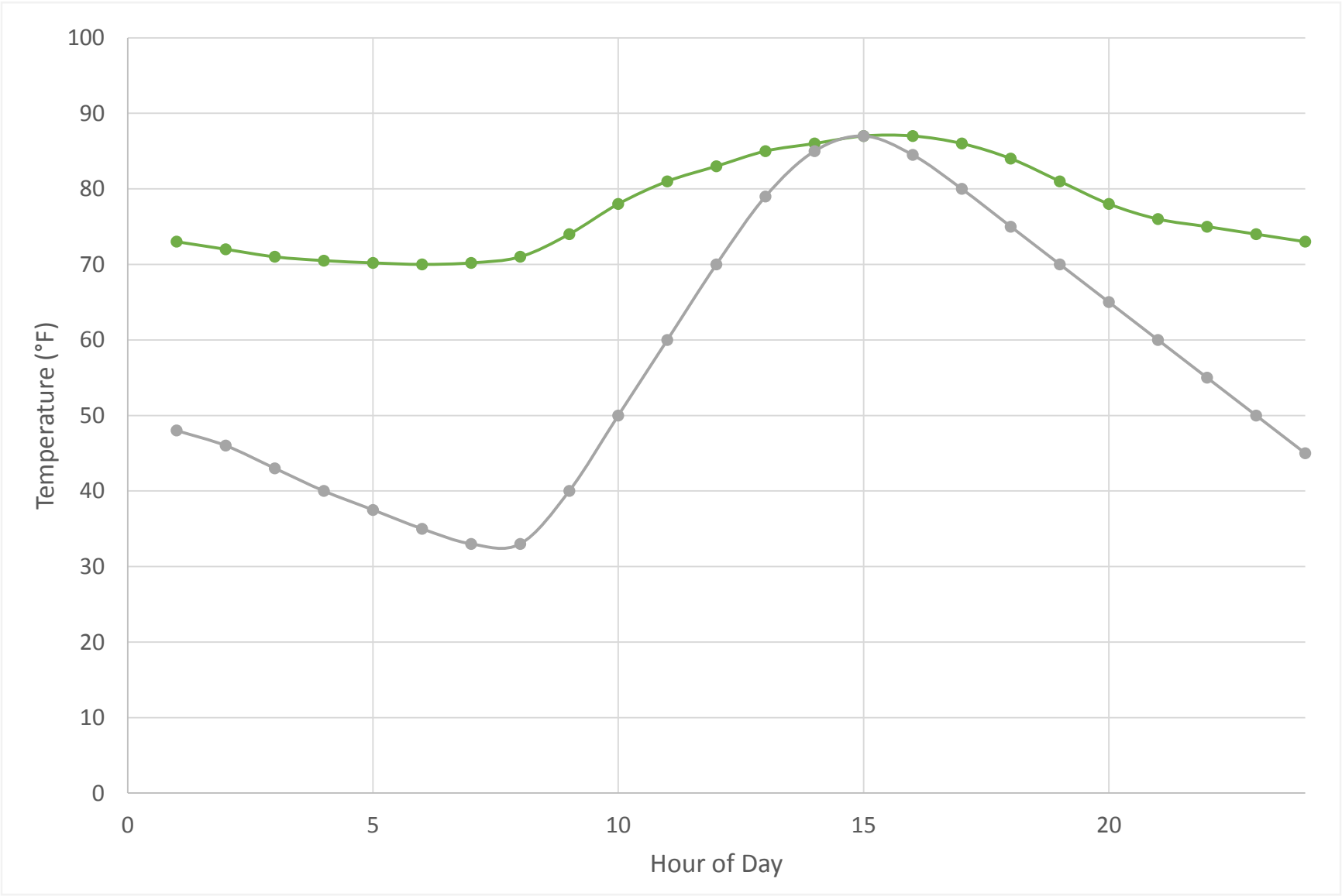
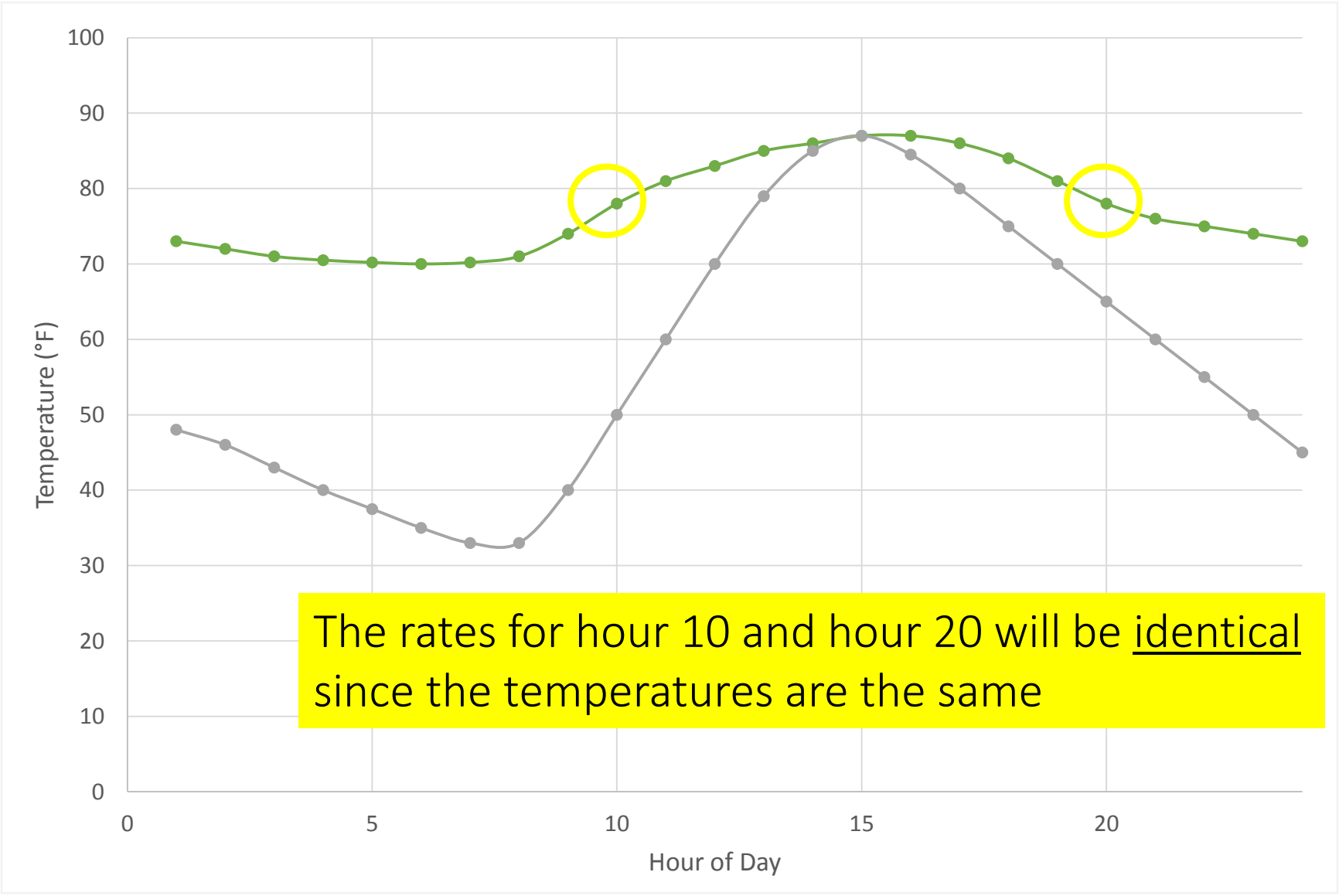
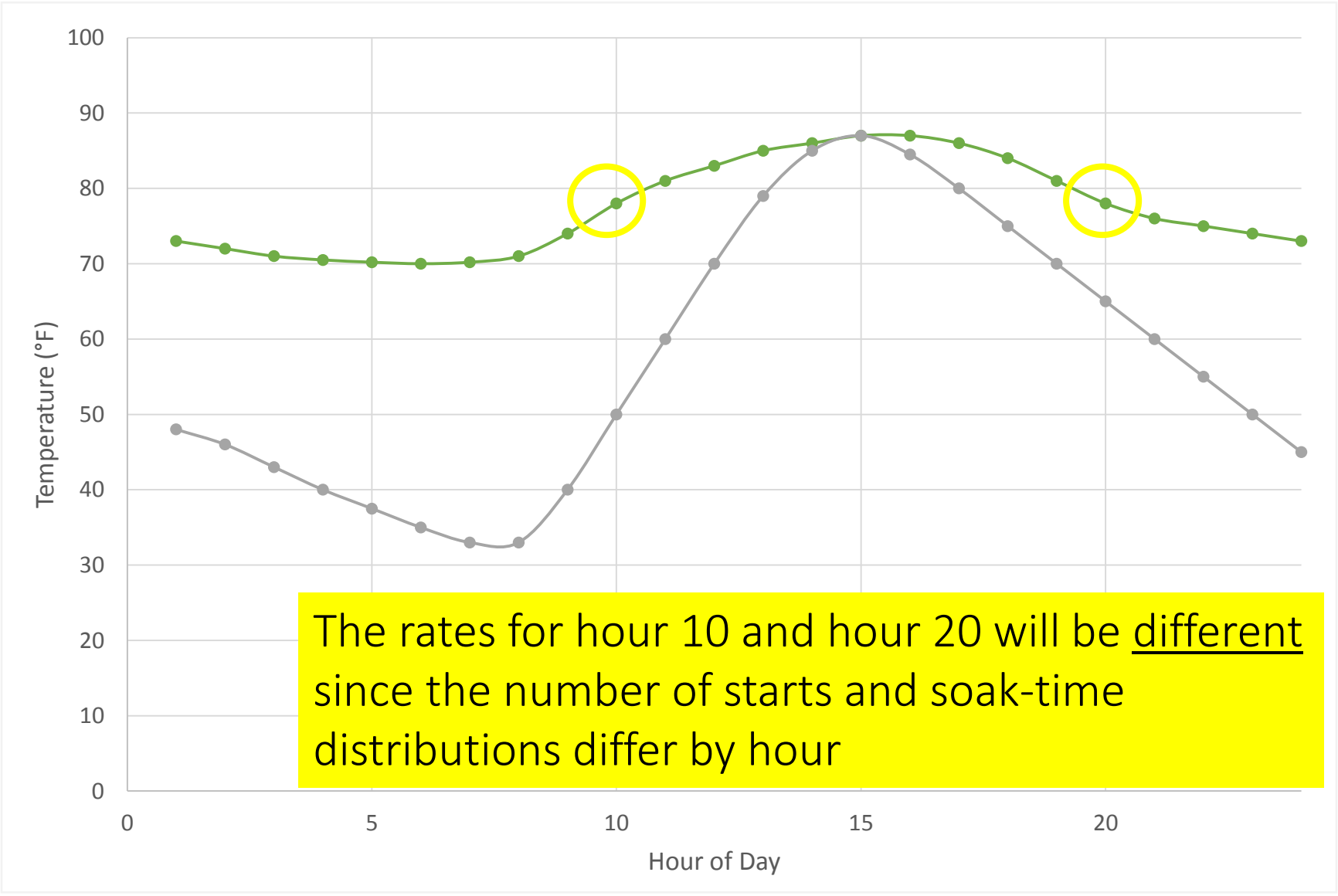
How two temperature profiles affect rates…



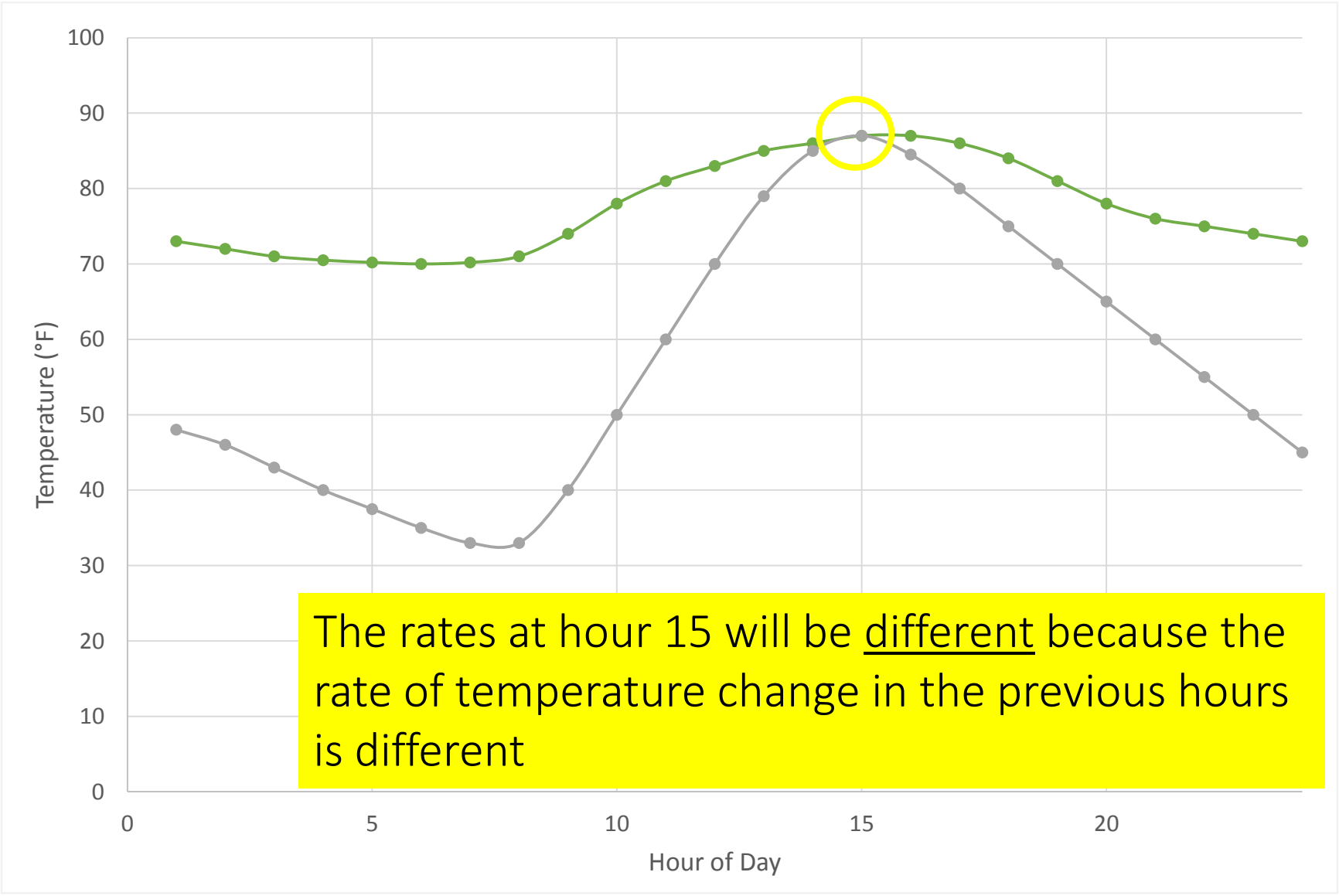
Effect of temperature/hour on running emissions



Effect of temperature/hour on start emissions



Effect of temperature/hour on evaporative emissions



How Rates Vary

- Why would ratepervehicle, rateperstart, and rateperhour rates differ by both temperature and hour of day?

- Why would they differ by type of day?

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How Rates Vary

- Rateperprofile rate (1 process) varies with
  - Temperature (based on what you enter for a daily temperature profile),
  - Temperature in the previous hours
  - Type of day (weekday vs. weekend day)
  - Hour of day

- How many rates does the rateperprofile table produce?
  = [1 process] x [13 source types] x [2 day types] x [24 hours] x [# of temperature profiles]
  = 624 rates for each temperature profile, for each pollutant

- Why would rates differ by both temperature and hour of day?

- Why would they differ by type of day?

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How Rates Vary: Summary

Rates vary with:	Rateperdistance	Ratepervehicle Rateperstart Rateperhour	Rateperprofile
Vehicle type (x 13)	Only if selected	Only if selected	Only if selected
Temperature (x ?)	Yes	Yes – temperature profile	Yes – temperature profile
Road type (x 4)	Yes	--	--
Speed bin (x 16)	Yes	--	--
Type of day (x 2) (Weekday/Wkend)	No	Yes	Yes
Hour of Day (x 24)	No	Yes	Yes
Model year (x 31)	Only if selected	Only if selected	Only if selected
Fuel type (x 4)	Only if selected	Only if selected	Only if selected

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Running Emissions (Rateperdistance Table)

- Total running emissions =

(Running emissions rate) x (VMT)

- Rates given in grams per vehicle-mile
- To get a total running inventory, repeat calculation for each process, vehicle type, road type, and speed bin at the relevant temperature; sum results

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Start Emissions

- Start rates are produced in both:
  - grams per vehicle from the ratepervehicle table, for each hour of day, for each daily temperature profile
    - Calculate inventory by multiplying by vehicle population
  - grams per start from the rateperstart table, for each hour of day, for each daily temperature profile
    - Calculate inventory by multiplying by number of starts
- WARNING: Use one or the other – not both

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Start Emissions

- Calculate total start emissions by multiplying:

  (Start emissions rate from ratepervehicle) x (vehicle population)

OR

- Calculate total start emissions by multiplying:

  (Start emissions rate from rateperstart) x (number of starts)

- To get total daily start emissions, repeat calculation for each vehicle type, start process (2, 16), hour of the day at the relevant temperature; sum results

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Hotelling Emissions: APU, Extended Idle

- Hotelling rates given in both:
  - *grams per vehicle* from the ratepervehicle table, for each temperature and hour of day
    - Calculate inventory by multiplying by vehicle population (i.e, of 62's)
  - *grams per hour* from the rateperhour table, for each temperature and hour of day
    - Calculate inventory by multiplying by number of hoteling hours
- WARNING: Use one or the other – not both
- Be sure to check "Source Use Type" on Output Emissions Detail panel -- if not selected, MOVES will give you a composite rate that applies to all vehicles

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Hotelling Emissions: APU, Extended Idle

- Calculate total extended idle emissions, and total APU emissions by multiplying:

(rate from ratepervehicle) x (number of source type 62s)

OR

(rate from rateperhour) x (number of hoteling hours)

- To get total daily hotelling emissions, repeat calculation for 62's, for each hotelling process (17, 90, 91), hour of the day at the relevant temperature; sum results

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Evaporative Fuel Vapor Venting (Rateperprofile table)

- Rate given in grams per vehicle, for each temperature and hour of day
- Rates are affected by the temperature, and hour of day, as well as the temperature of the *previous hour*
- Inventory is calculated by multiplying the rate by the vehicle population – *not the number of parked hours*

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Evaporative Fuel Vapor Venting (Rateperprofile table)

- Calculate total evaporative emissions by multiplying:

(evaporative Fuel Vapor Venting rate) x (number of vehicles)

- For total daily evaporative fuel vapor venting emissions, repeat calculation for each vehicle type and hour, for the relevant temperature profile; sum results

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Building a Rates Lookup Table

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Building a Rates Lookup Table

- An advanced approach; particularly useful for modeling large geographic areas
- Allows you to generate rates for a wide range of temperatures with a minimal number of runs
- Involves making certain selections in the RunSpec, and using the meteorology tab of the CDM to define temperatures:
  - Each month selected in the RunSpec provides you 24 temperature "slots" (one for each hour of the day)
  - These slots can hold temperatures in 1 degree increments, to get running rates at each specific temperature
  - Or, a month's slots can hold a daily temperature profile, needed for start, hotelling, and evaporative fuel vapor venting rates
  - Determine how many months to select in the RunSpec based on the number of temperature slots needed to represent all the rates you need

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Building a Rates Lookup Table

For running rates (rateperdistance table):

- Determine the temperature range for which you want rates, and how many months are needed in the RunSpec (each month = 24 temperatures)
  - For example, if the temperature range of interest is 50 to 97° F, 48 temperature slots are needed; 2 months can accommodate all of them
  - July Hour 1: 50 degrees
  - July Hour 2: 51 degrees … (and so on, one degree per slot until…)
  - August Hour 24: 97 degrees
- A rate will be produced for each temperature – in this case, the hourID does not impact the results
- MonthID (the month(s) chosen in the RunSpec) affects the fuels MOVES assumes, but otherwise does not affect the rates
  - because you are defining the temperatures

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Building a Rates Lookup Table

- For start and hotelling rates (ratepervehicle table) and evaporative fuel vapor venting (rateperprofile table):
- Determine the number of diurnal profiles you need; each month selected can accommodate one diurnal profile
- Input a realistic diurnal profile for the 24 hours, since both temperature and hour of day impact these emission rates, e.g.:
  - September Hour 1 – 50.1 degrees
  - September Hour 2 – 51.6 degrees
  - September Hour 3 – 54.4 degrees, etc.
- A rate will be produced for each temperature/hourID
- MonthID (the month(s) chosen in the RunSpec) affect the fuels MOVES assumes, but otherwise does not affect the rates
  - because you are defining the temperatures

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Building a Rates Lookup Table

- You can get running rates (rateperdistance table), start and hotelling rates (ratepervehicle table) and resting evaporative rates (rateperprofile table) all in one run:
  - Use some months to define one degree temperature intervals, for running rates
  - Use other months to define daily temperature profiles, for start, extended idle, and resting evaporative rates
  - Use specific months to have MOVES assume the right fuels

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Building a Rates Lookup Table

Example of an annual inventory – Six months selected in RunSpec

Winter rates:

- Use months 12 and 1 to cover the winter temperature range for rateperdistance rates
  - E.g., 10 degrees through 57 degrees in 1 degree intervals
- Use month 2 to define a typical winter daily temperature profile for ratepervehicle and rateperprofile rates

Summer rates:

- Use month 6 and 7 to cover the summer temperature range for rateperdistance rates
  - E.g., 40 degrees through 87 degrees in 1 degree intervals
- Use month 8 to define a typical summer daily temperature profile for ratepervehicle and rateperprofile rates

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Building a Rates Lookup Table

For discussion:

What if you need more temperature slots for summer, but you run out of summer months in the RunSpec?

What if you need more temperature slots, period?

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Building a Rates Lookup Table

For discussion:

What if you need more temperature slots for summer, but you run out of summer months in the RunSpec?

- You can use any of the 12 months – just be sure to apply the summertime fuel formulation to any months where summertime temps are defined (in the fuel tab of the CDM)

What if you need more temperature slots, period?

- You could do multiple runs
- You could choose Custom Domain in the RunSpec, and each Zoneid can then be used to define more temperatures

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Creating a RunSpec for a Rates Run

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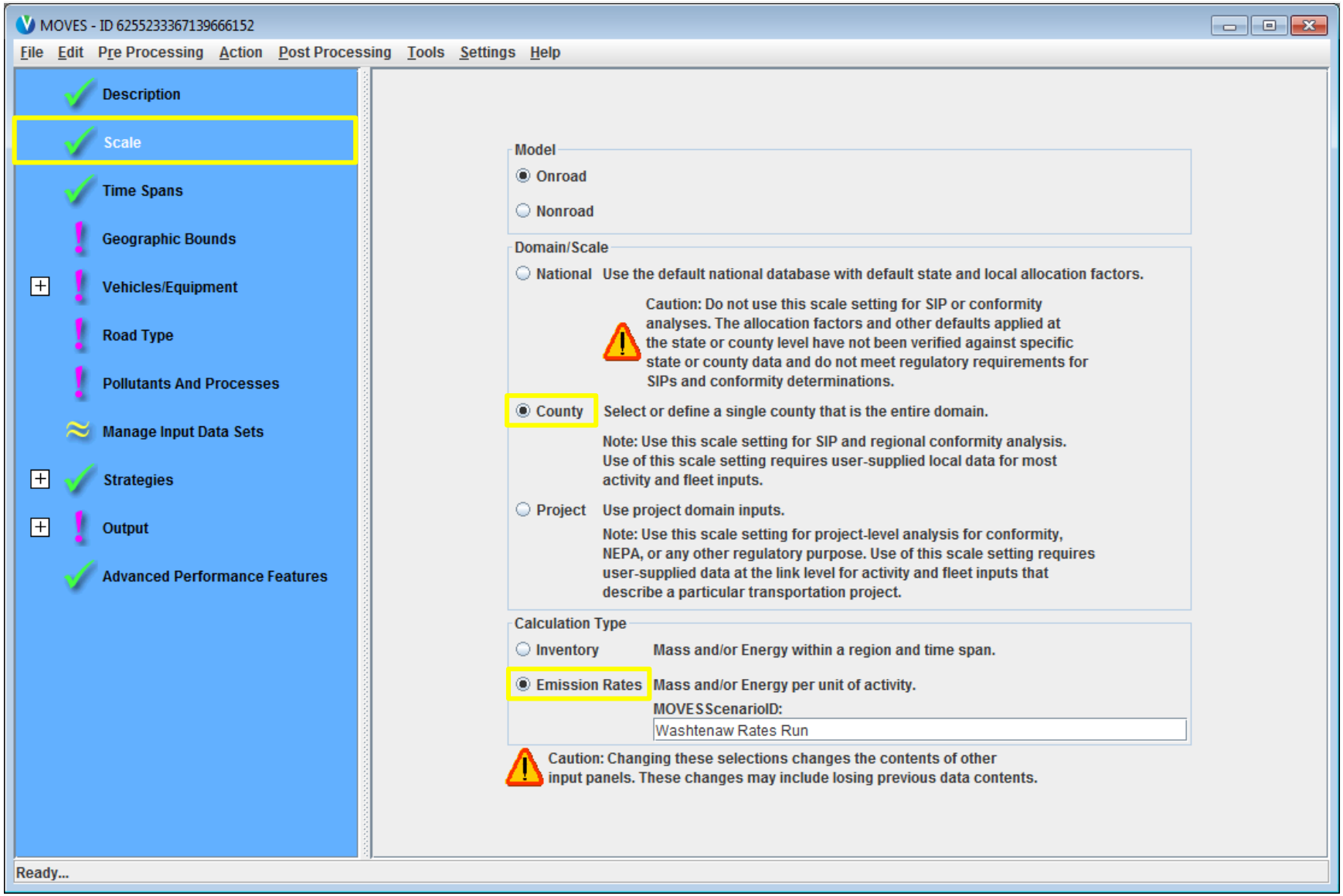
Rates RunSpec Guidance – Scale

- Select *County* in the Domain/Scale
- Select Emission Rates
- MOVESScenarioID is required but will not affect results
  - Used for SMOKE-MOVES
  - If not using SMOKE-MOVES, enter something descriptive

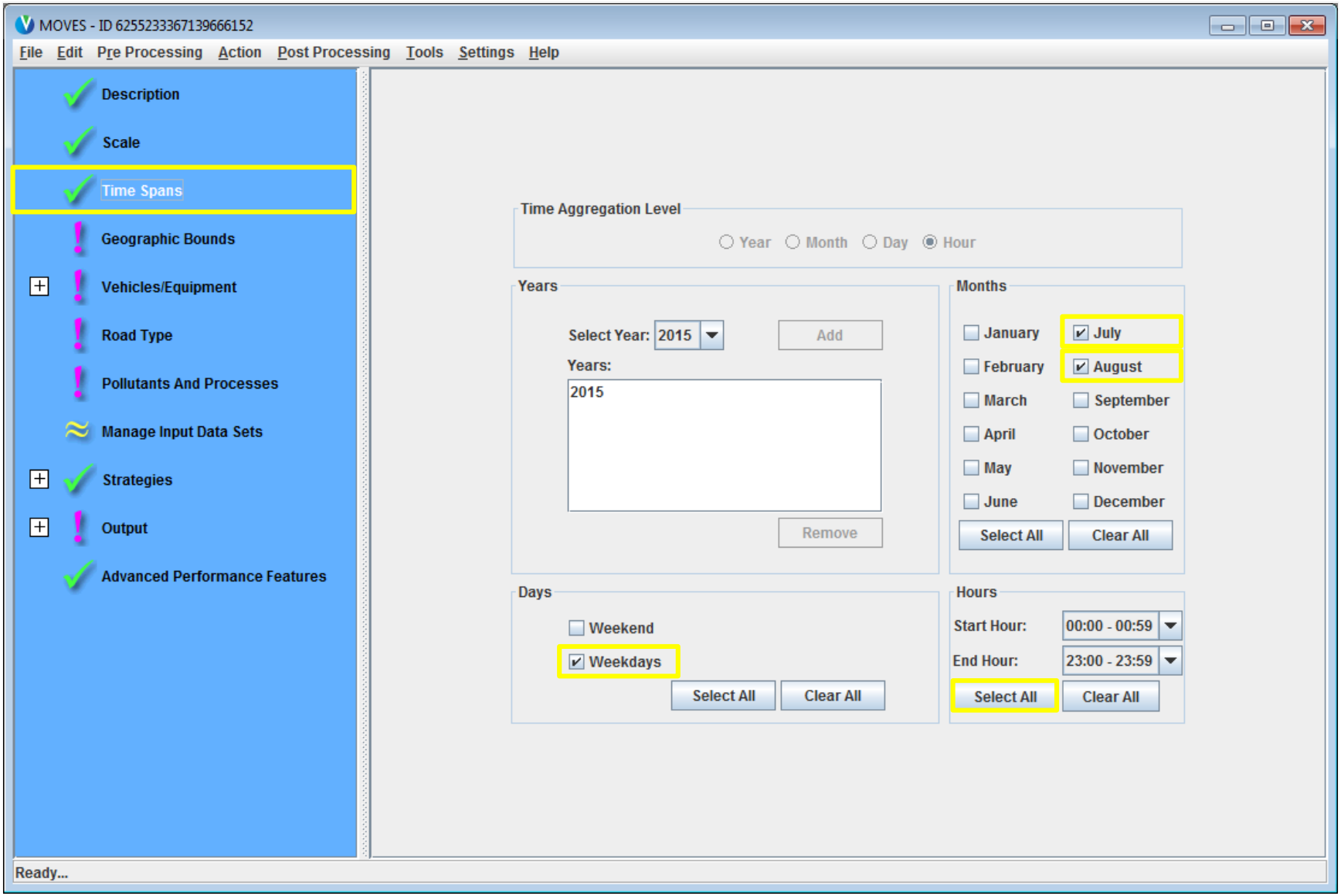
Rates RunSpec Guidance – Scale



Rates RunSpec Guidance – Time Spans

- Select one or more months
  - Each month allows rates for 24 temperatures
- Select all hours
- Select one or more day types
  - Start/evap rates will vary by day type
  - An annual inventory should use rates for weekend and weekdays
  - Daily inventory may just use weekday

Rates RunSpec Guidance – Time Spans

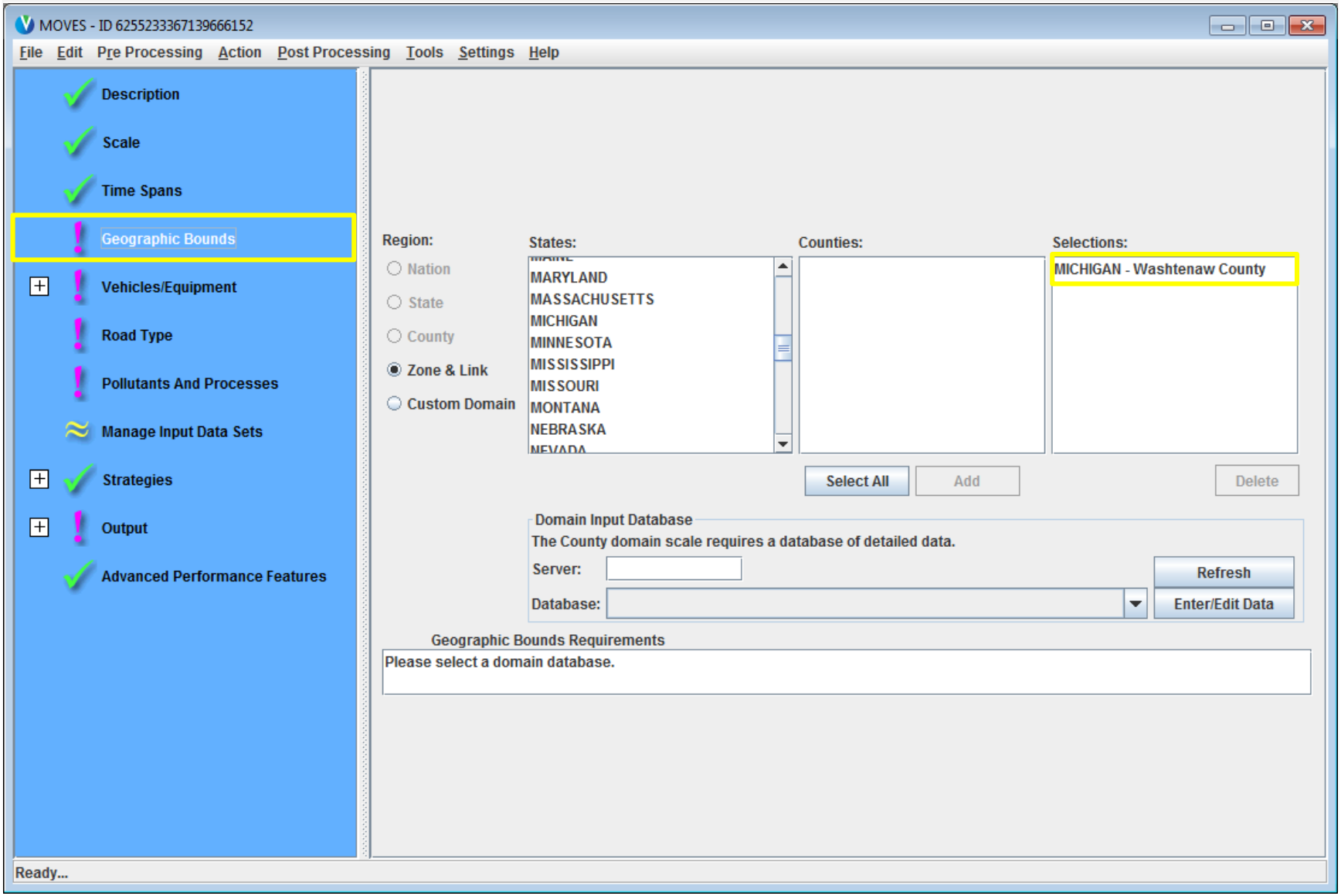


Rates RunSpec Guidance – Geographic Bounds

- Select a single county or custom domain

- Custom domain can add additional flexibility using the zone input
  - Possible to model many temperature ranges and diurnal profiles with separate zoneIDs

Rates RunSpec Guidance – Geographic Bounds



Rates RunSpec Guidance – Vehicle/Equipment

- Select all vehicle/fuel types present in modeling domain

- A rate will be produced for each ☑ source type and ☑ fuel type
  - *IF* checked on the Output panel

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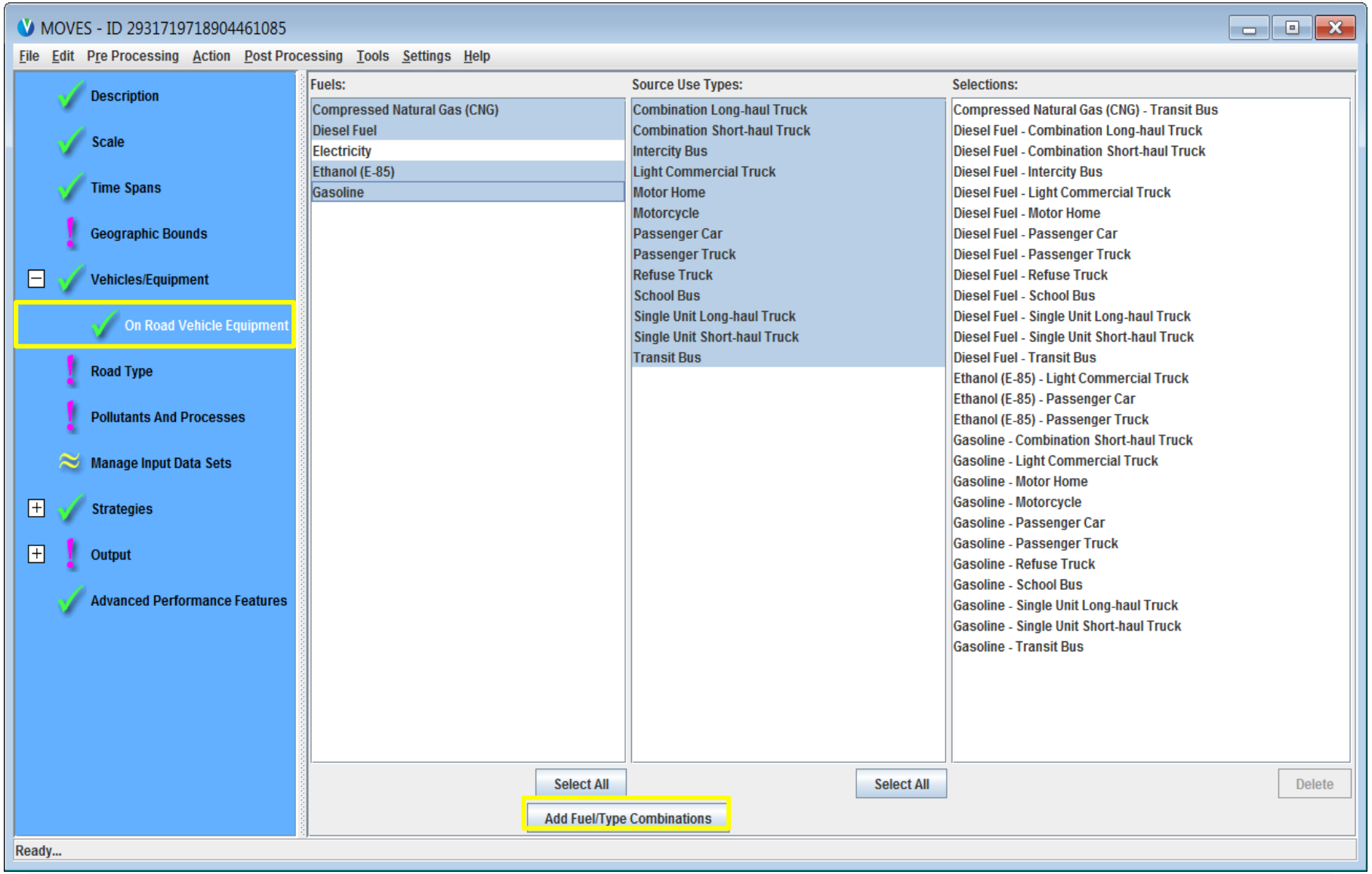
Rates RunSpec Guidance – Vehicle/Equipment



Rates RunSpec Guidance – Road Type

- Select all road types present in modeling domain
  - Usually all road types
- A running emissions rate will be produced for each road type other than "off network"
- Start, hotelling, and evaporative rates are for activity occurring on the "off network" road type

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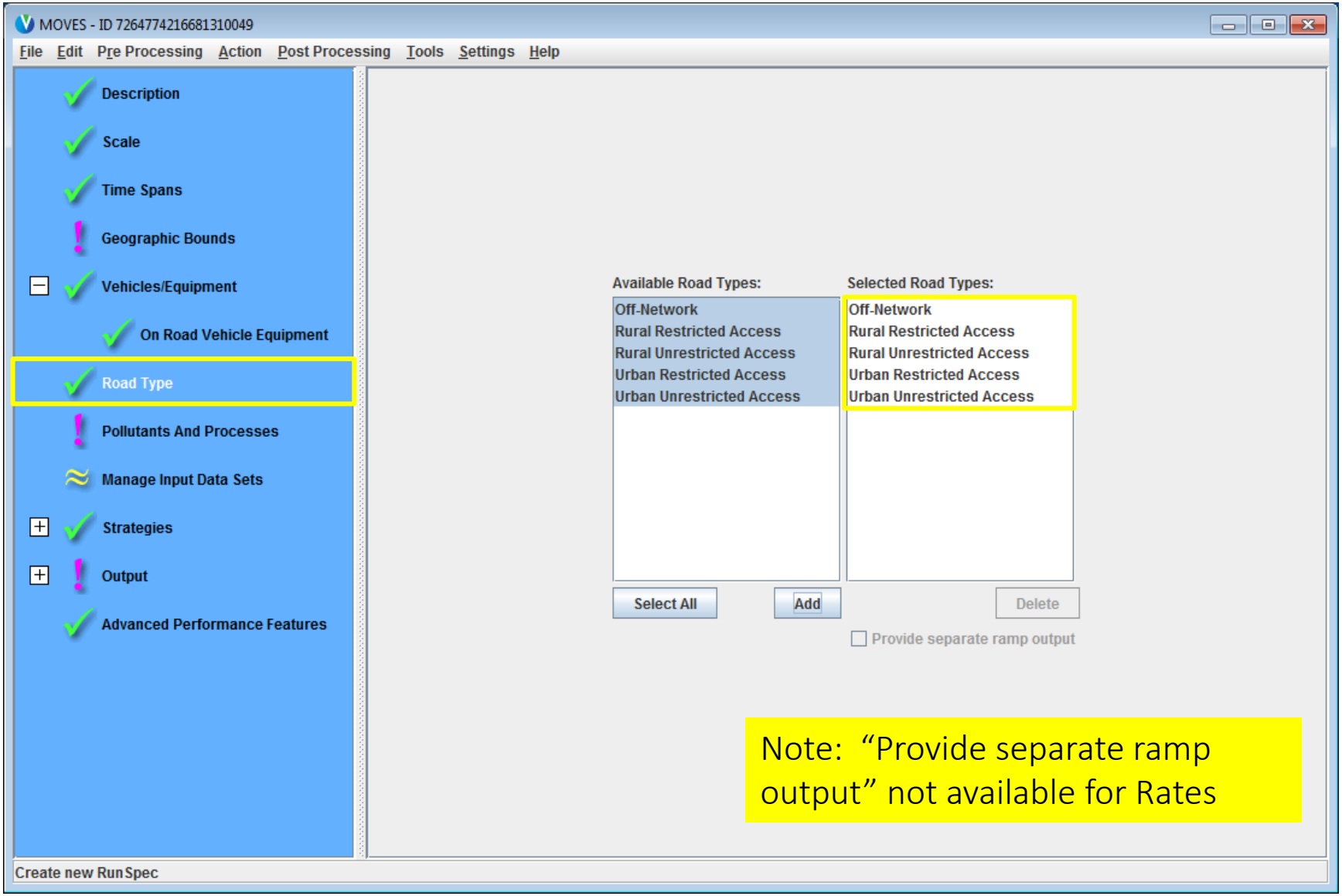
Rates RunSpec Guidance – Road Type



Note: "Provide separate ramp output" not available for Rates

Rates RunSpec Guidance – Pollutants And Processes

- Select all pollutants of interest
- For a complete inventory, it is necessary to select all processes
- A rate will be produced for each pollutant and process
  - Either expressed as rateperdistance, ratepervehicle, or rateperprofile

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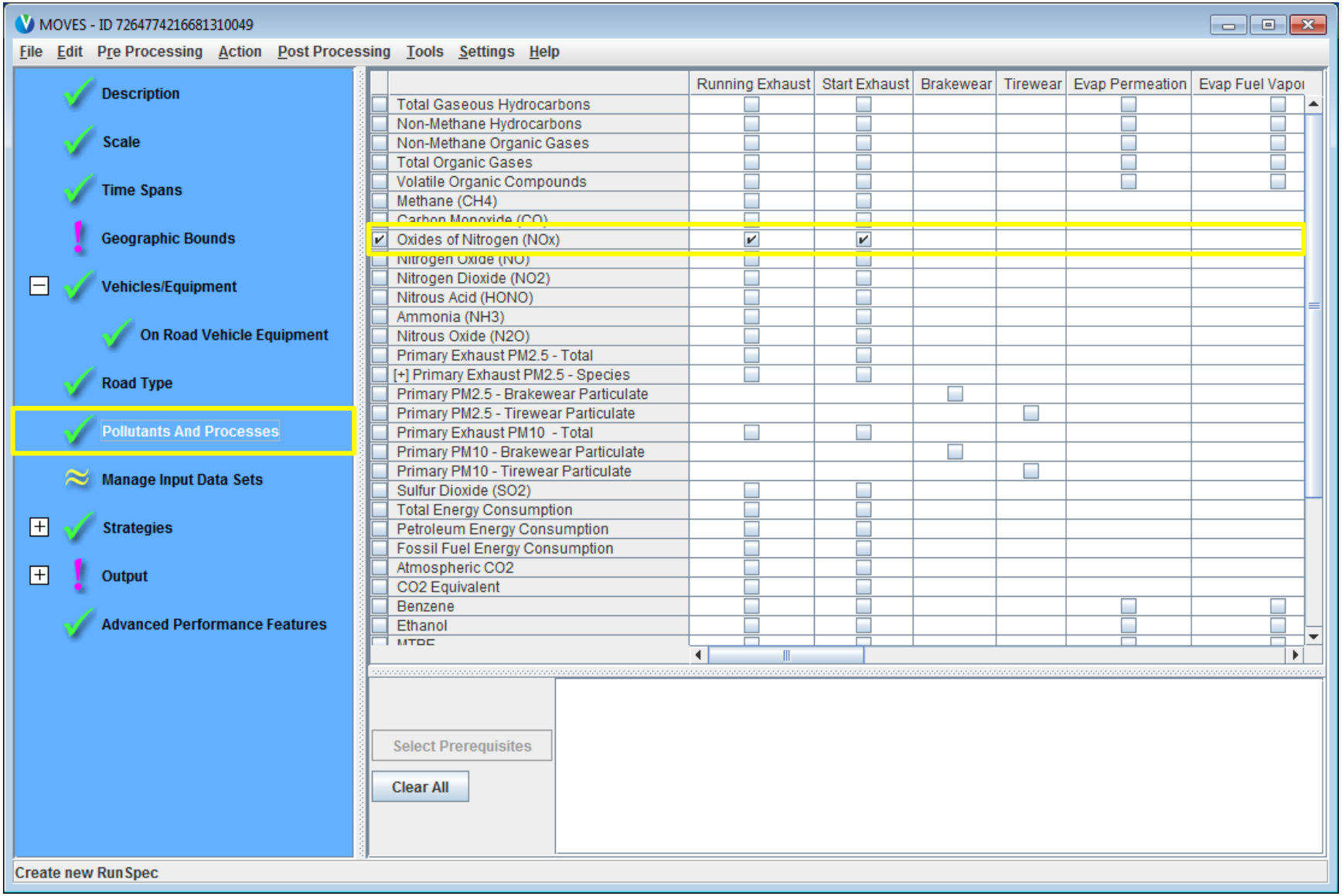
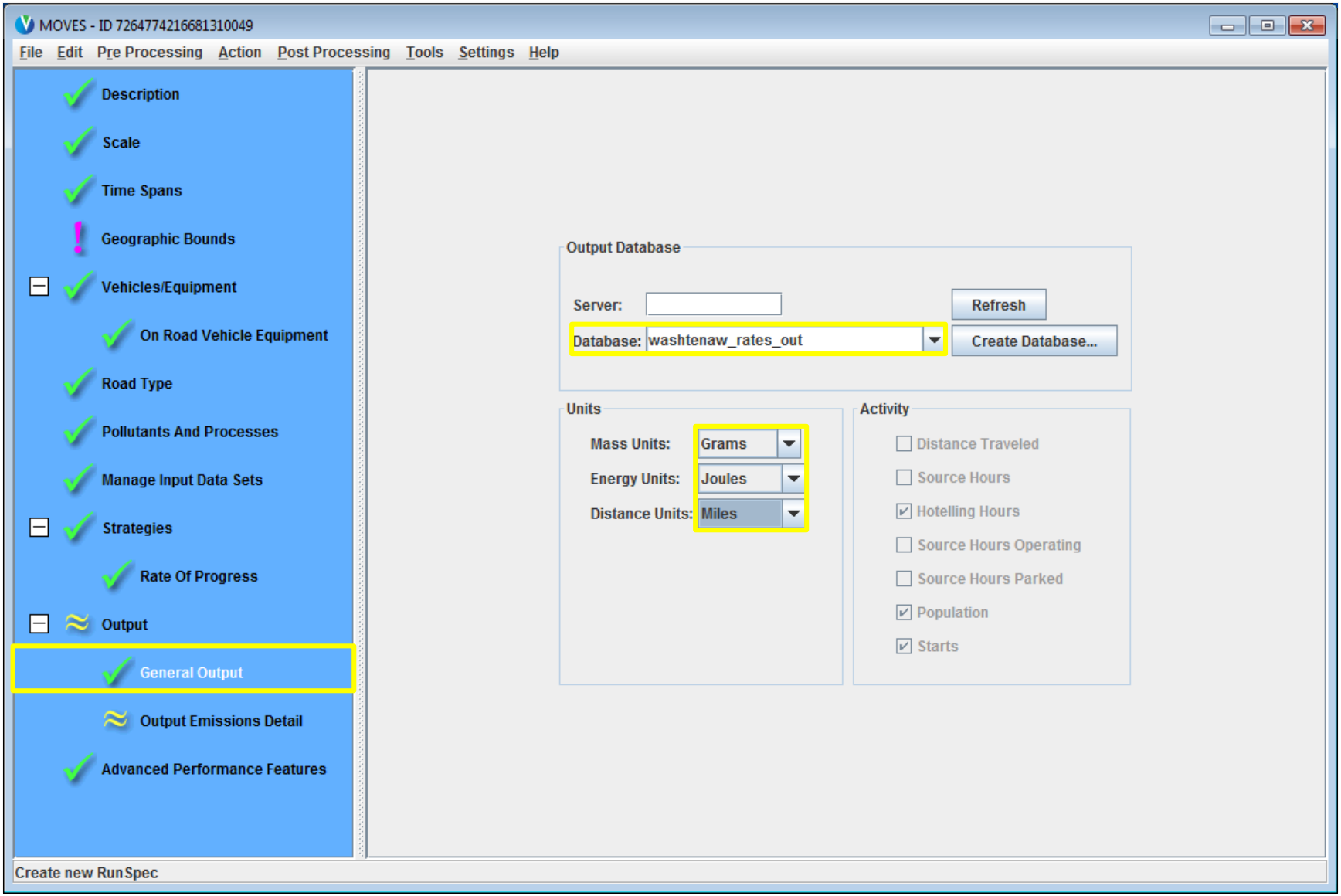
Rates RunSpec Guidance – Pollutants And Processes



Rates RunSpec Guidance – General Output

- Create an output database
- Select grams, joules, and miles
- Activity output will automatically be generated for distance traveled and population

Rates RunSpec Guidance – General Output

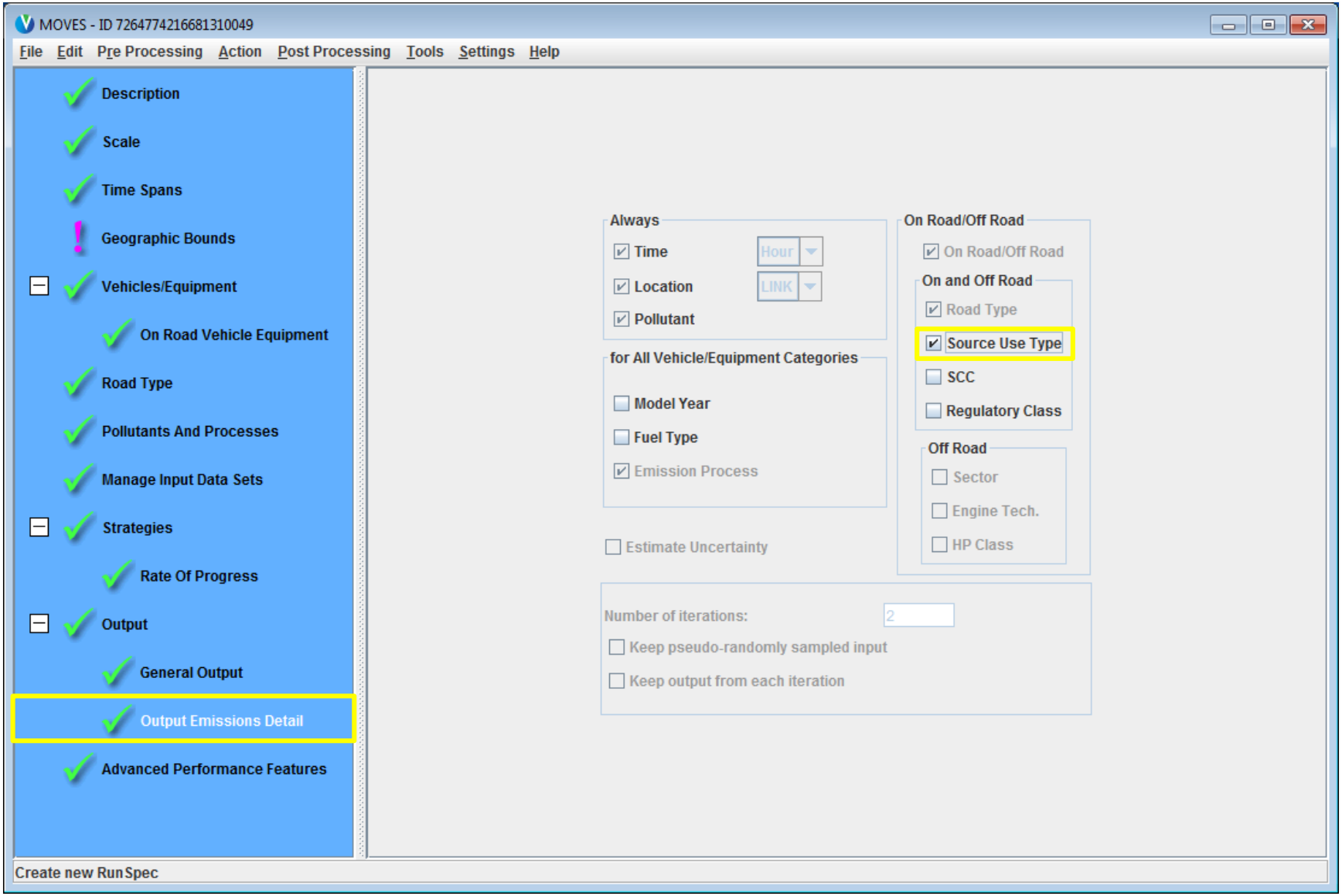


Rates RunSpec Guidance – Output Emissions Detail

- Road type and emission process are auto-selected
  - Rates will be produced for each road type and emissions process

- Additional selections depend on available activity data (VMT or vehicle population)
  - VMT by source type?
    - Usually
  - VMT by fuel type or model year?
    - Less likely

Rates RunSpec Guidance – Output Emissions Detail



Creating an Input Database for a Rates Run

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Meteorology

- Recall: meteorology tab can be used to define the range of rates produced
  - A rate is generated for every temperature defined
- Each month selected in the RunSpec allows 24 temperatures to be defined (hours 1-24)
- Select multiple months to allow a complete range of temperatures for rateperdistance as well as several diurnal profiles for ratepervehicles/rateperprofile rates
- MonthID affects fuels, but otherwise does not affect the rates produced

SourceTypePopulation

- After the run, you multiply ratepervehicle and rateperprofile rates by vehicle population
- However, population is still necessary as an input
- A population should be entered that is reasonable, and consistent with VMT
  - One option is to enter the total vehicle population of the modeling domain
  - Alternatively, a representative county's vehicle population can be used
- Most important, the ratio of vehicle population to VMT must reflect actual conditions

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Age Distribution

- Users should enter the Age Distribution of the modeling domain
- This must be uniform across all counties in order to use the output rates for all areas
- If age distribution is not uniform across all counties you need to model, either
  - Do multiple runs, or
  - Select ☑ Model Year on the output emissions detail to produce rates for each model year
    - Then rates can be post-processed to account for varying age distribution across a multi-county domain

VMT (HPMSVTypeYear)

- After the run, you multiply rateperdistance rates by VMT
- However, VMT is still necessary as an input
- A VMT should be entered that is reasonable, and consistent with vehicle population
  - One option is to enter the total VMT of the modeling domain
  - Alternatively, a representative county's VMT can be used
- Most important, the ratio to vehicle population must reflect actual conditions

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VMT (month, day, hour fractions)

- MonthVMTfraction, dayVMTfraction, and hourVMTfraction are also required by MOVES
- These fractions impact emission rate calculations
- Reasonable values should be entered
  - Either local fractions or MOVES defaults

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Speed Distribution

- Emission rates for rateperdistance will be produced for each of 16 speed bins

- MOVES still requires an average speed distribution input

- This should be a reasonable distribution
  - Either local distribution or MOVES defaults

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Road Type Distribution

- Emission rates for rateperdistance will be produced for each road type

- MOVES still requires a road type distribution input

- This should be a reasonable distribution
  - Either local distribution or MOVES defaults

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Ramp Fraction

- Users should input the local ramp fraction
  - or use the MOVES default (0.08) if none is available

- Emission rates for rateperdistance will include ramp activity within each of the 16 speed bins
  - The table does not have separate rates for ramps

- Ramp VMT should be added to Restricted Access roadway VMT since the rates are a combination of freeway and ramp emissions

Fuel

- If local data suggests that ethanol/diesel/gasoline/CNG mix for a given source type or model year differ from the defaults, these fractions should be changed

- If no local data exists, users may use the default Fuel data
  - Automatically selected in the CDM

- If user selects output by fuel type, these fractions do not need to be changed

Fuel

- Users should input the fuel information used in the modeling domain
  - Rates cannot be applied to areas that use different fuels

- Also, fuels should correspond to the temperature profile for a given month
  - For instance, a **summertime** diurnal temperature profile using the MonthID = 1 should not use January fuels (see meteorology)

I/M Programs

- Users should input the Inspection and Maintenance program used in the modeling domain
  - Rates cannot be applied to areas that have a different I/M program, or different compliance rates

Class Exercise

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Class Exercise

- We will use MOVES to develop a HC inventory for gasoline passenger cars in Lake County, IN operating on off-network and urban unrestricted roads at 12-1am in a typical summer day
  - Similar analysis to Day 1's County-level inventory run
    - Only passenger selected to save run time
  - All processes will be modeled to produce rateperdistance, ratepervehicle, and rateperprofile tables

- The output tables will be queried for relevant information and applied to known vehicle activity

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Class Exercise

Step 1: Load the RunSpec

- Open Rates.mrs (in “Course Files\Rates Exercise” folder)
- This runspec is identical to Day 1’s County Inventory Run, except:
  - Emission Rates are selected in the Scale panel
  - Both July and August are selected in Time Spans panel
    - This enables us to enter a temperature range for one month, and a diurnal temperature profile for the other month – all in one MOVES run
  - A new output database is created (lake_rates_HC_out)

Class Exercise

Step 2: Use an existing input database

- In your mysql data folder on your C:\, copy the Lake_2015_training_in folder (created on Day 1)
- Paste folder and re-name as Lake_Rates_HC_in
- In the MOVES Geographic Bounds panel, select Lake_Rates_HC_in from the drop-down menu

Step 3: Open the CDM and "Clear Imported Data" for the meteorology tab

Step 4: Import a meteorology table that produces the desired lookup table (met.xls, from "Course Files\Rates Exercise" folder)

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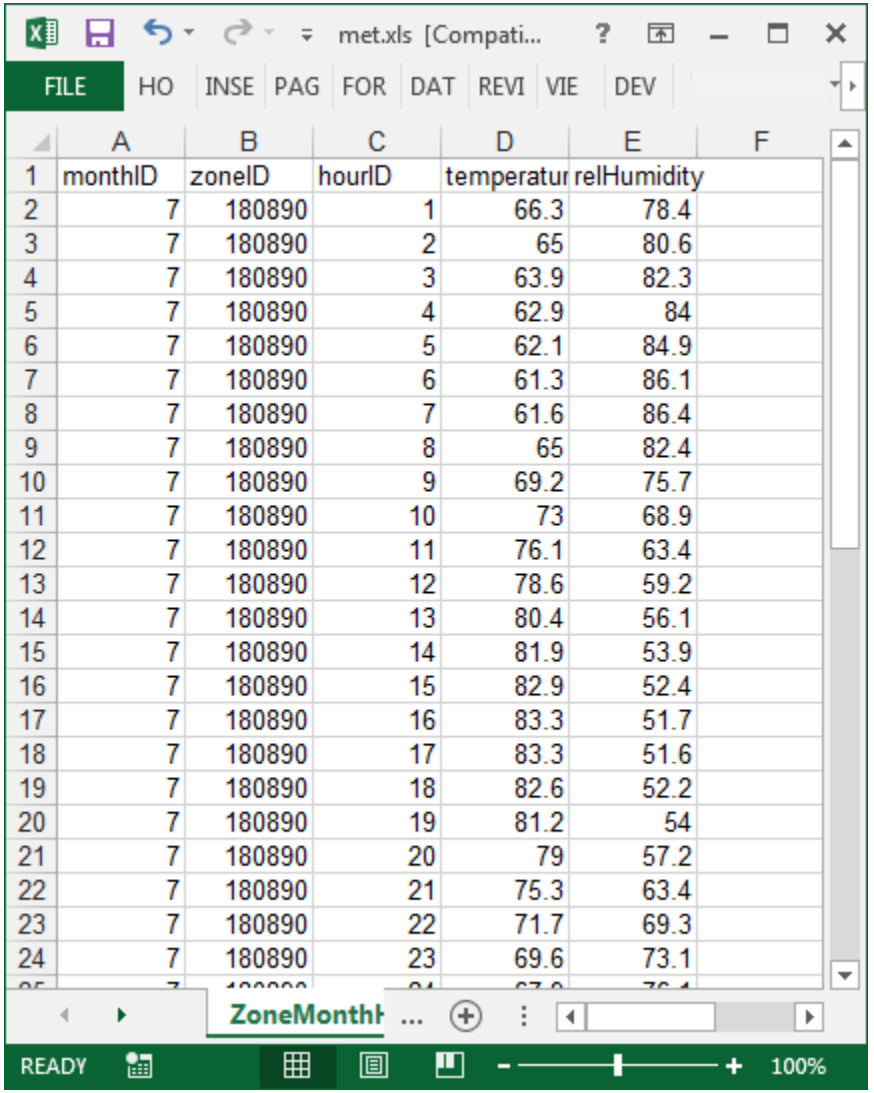
Class Exercise – Met.xls input file

- MonthID 7 will be used to define a summertime diurnal temperature profile



	A	B	C	D	E	F
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	

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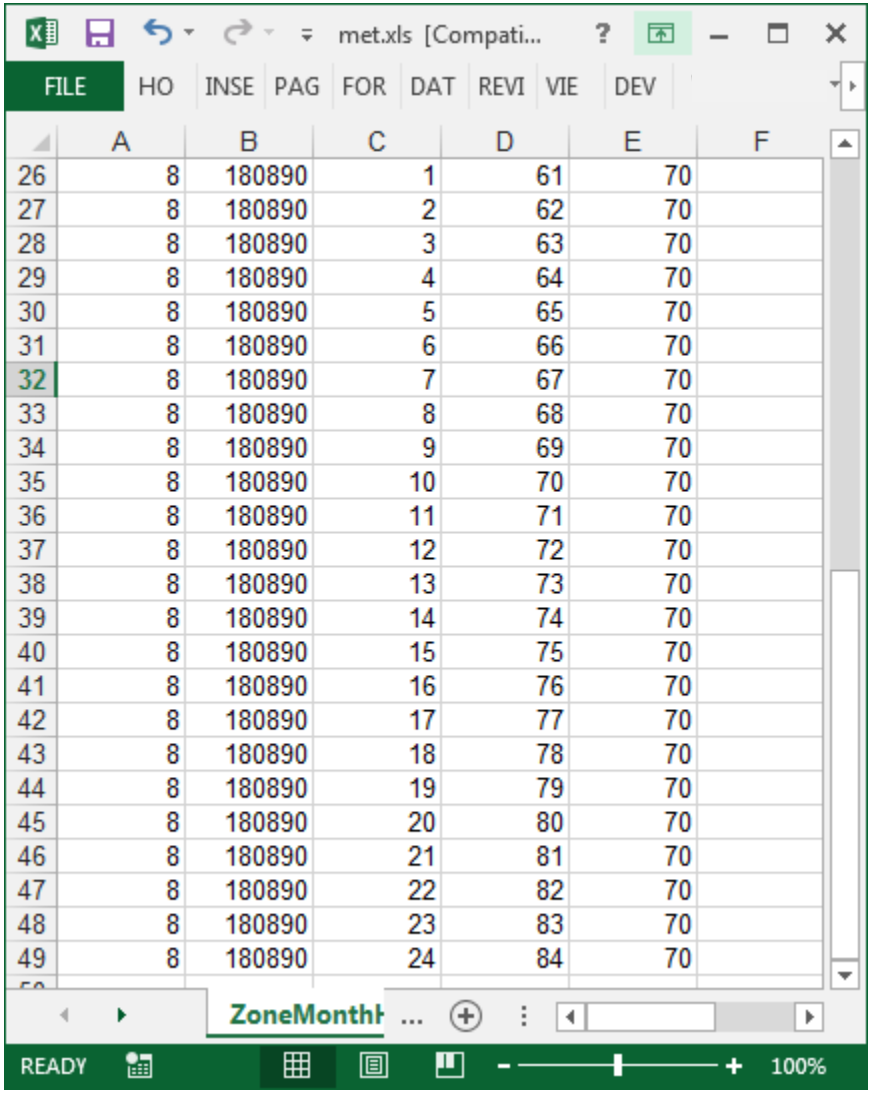
Class Exercise – Met.xls input file

- MonthID 8 will be used to create a lookup table for a summertime temperature range
  - 61 degrees through 84 degrees in 1 degree increments



	A	B	C	D	E	F
26	8	180890	1	61	70	
27	8	180890	2	62	70	
28	8	180890	3	63	70	
29	8	180890	4	64	70	
30	8	180890	5	65	70	
31	8	180890	6	66	70	
32	8	180890	7	67	70	
33	8	180890	8	68	70	
34	8	180890	9	69	70	
35	8	180890	10	70	70	
36	8	180890	11	71	70	
37	8	180890	12	72	70	
38	8	180890	13	73	70	
39	8	180890	14	74	70	
40	8	180890	15	75	70	
41	8	180890	16	76	70	
42	8	180890	17	77	70	
43	8	180890	18	78	70	
44	8	180890	19	79	70	
45	8	180890	20	80	70	
46	8	180890	21	81	70	
47	8	180890	22	82	70	
48	8	180890	23	83	70	
49	8	180890	24	84	70	

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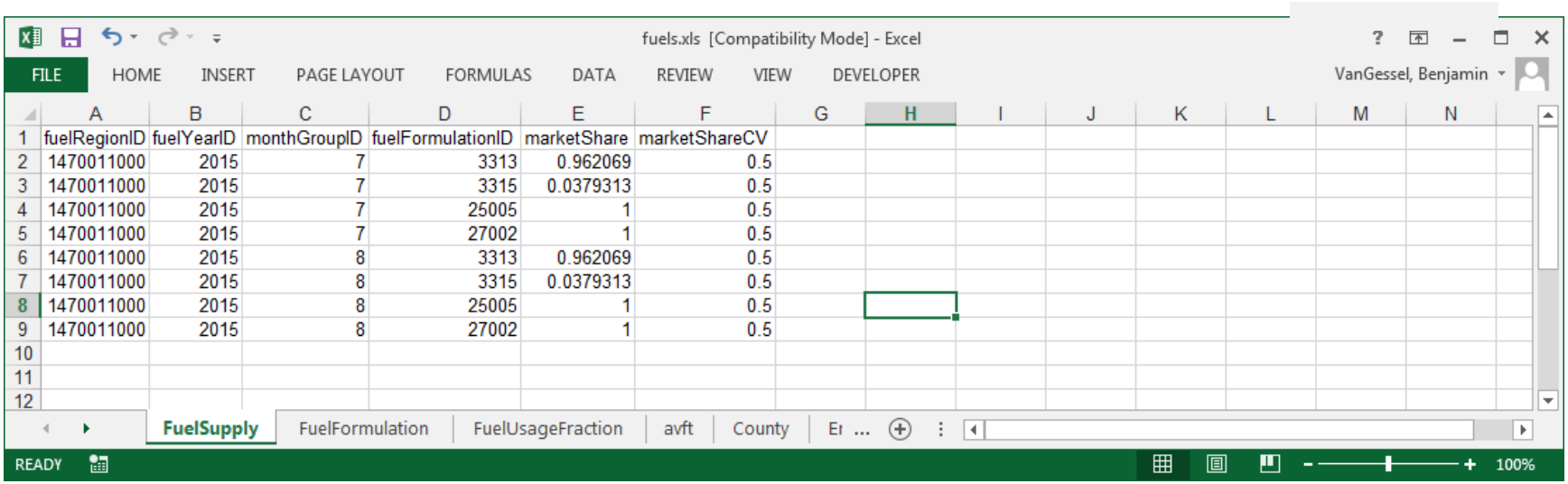
Step 5: “Clear Imported Data” for the fuels tab

Step 6: Import Fuels tables (fuels.xls), from “Course Files\Rates Exercise” folder)

- Need to do this because fuels table from Module 4 only has fuels for month 7



	A	B	C	D	E	F
1	fuelRegionID	fuelYearID	monthGroupID	fuelFormulationID	marketShare	marketShareCV
2	1470011000	2015	7	3313	0.962069	0.5
3	1470011000	2015	7	3315	0.0379313	0.5
4	1470011000	2015	7	25005	1	0.5
5	1470011000	2015	7	27002	1	0.5
6	1470011000	2015	8	3313	0.962069	0.5
7	1470011000	2015	8	3315	0.0379313	0.5
8	1470011000	2015	8	25005	1	0.5
9	1470011000	2015	8	27002	1	0.5
10						
11						
12						

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Step 7: Close the CDM

Step 8: Execute MOVES

This run should take approximately 30 minutes

We will now process the resulting data.

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Querying the output

Running Rates Query:

SELECT pollutantID, processID, temperature, avgSpeedBinID, ratePerDistance

FROM lake_rate_hc_out.rateperdistance

where monthid = 8 and temperature = 66 and roadtypeid = 5 and processid = 1 and pollutantid=1;

Export the result set to excel and save as lake_rate_per_distance.csv

Start Rates Query:

SELECT pollutantID, processID, hourID, ratePerVehicle

FROM lake_rate_hc_out.ratepervehicle

where monthID = 7 and processID = 2 and hourID = 1;

Export the result set to excel and save as lake_rate_pervehicle.csv

Resting Evap Rates Query:

SELECT pollutantID, processID, hourID, ratePerVehicle

FROM lake_rate_hc_out.rateperprofile

where hourID = 1 and temperatureProfileID = 1808900700;

Export the result set to excel and save as lake_rate_per_profile.csv

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Post-process – lake_rate_per_distance.xls (running emissions)

- Multiply the VMT shown here with the running emission rate (rateperdistance)
- Sum the result of each speed bin to calculate the total running inventory

Speedbin	VMT for sourcetype 21, roadtype 5, and hourID 1 by speed bin
1	58.25896534
2	173.89147
3	237.2757864
4	361.0571845
5	519.6937629
6	719.9321415
7	992.4559192
8	1256.651155
9	1304.047695
10	1107.341985
11	835.366105
12	573.6792065
13	419.0468009
14	289.6204933
15	151.4396146
16	73.24171502

Post-process – lake_rate_per_vehicle.xls (Start Emissions)

- Multiply the total vehicle population by the appropriate ratepervehicle (queried earlier)

- Total vehicle population for sourcetype 21 (passenger cars) is 47,292

Post-process – lake_rate_per_profile.xls (Evap Vapor Venting)

- Multiply the total vehicle population by the appropriate rateperprofile (queried earlier)

- Total vehicle population for sourcetype 21 (passenger cars) is 47,292

Sum totals

Sum the emissions that were post-processed in

- rateperdistance.xls,
- ratepervehicle.xls, and
- rateperprofile.xls tables

to calculate an inventory

Conclusions

- The total should equal 1179.21 grams
- Note that this total is only for a *very* small part of the overall HC inventory:
  - Gasoline passenger cars on road types 1 and 5 at 12-1am on a typical summer weekday (exhaust and vapor venting only)
- To get a complete inventory using the Rates approach, this process would be repeated for all source types, all road types, all processes, and all hours
- An annual inventory would involve even more post-processing

Module Summary

- A rates run allows you to generate rates for a variety of applications, especially useful for wide geographic areas
- A rates run generates potentially thousands of rates, found in several tables
  - Multiply the rates by the appropriate activity after the run
  - Be careful in post-processing to avoid introducing errors
- MOVES does the multiplying for you in Inventory mode
  - Consider whether Inventory would be simpler, e.g., for modeling a small number of counties
- Either mode is acceptable for SIP and conformity purposes and will produce the same results

Questions?

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