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MEMORANDUM

TO: Janice Godfrey, Alison Eyth, and Sarah Roberts, US EPA

FROM: Henry Byoun and Allison DenBleyker, ERG

DATE: April 2, 2024

SUBJECT: Documentation of the 2022v1 base year on-road runs

This document describes the MOVES inputs and AWS run settings and scripts to produce the base year runs for the 2022v1 platform work performed during Spring 2024.

MOVES Version

The on-road runs used MOVES code 4.0.0 and database `movesdb20230615\_nonoxadj`. This default database is a copy of the public release of `movesdb20230615` with the truncated table `noxhumidityadjust`. Truncating this table turns off the engine-out adjustments to NOx emissions based on ambient humidity for rates-mode runs. Instead, SMOKE-MOVES applies humidity adjustments to NO, NO2, HONO, and NOx emissions at the grid cell level based on gridded meteorology.

Representative Counties

EPA desired to have the 2022v1 platform representative county groups be as consistent as possible with the 2020 NEI, except for county groups with planned changes to fuel programs or inspection and maintenance (I/M) between years 2022 and 2038. For any 2020 county groups affected by a change, ERG created a new group, so that the emissions would accurately reflect the programs in place in 2022, 2026, 2032, and 2038. ERG reviewed the MOVES4 default database to determine whether there were any planned fuel or I/M changes over this period. ERG added two new county groups in Texas to capture Dallas-Fort Worth 6-county fuel region changes between the base year 2022 and the first analytic year 2026. In addition, ERG and EPA worked together to better align the remaining county groups in the state with those in use by the Texas Commission on Environmental Quality. We moved counties between groups, adding/removing representative counties as necessary. The final county assignments for all states can be found in the spreadsheet 2022_Representative_Counties_Analysis_20240125.xlsx.

MOVES County Databases

The 2022v1 base year MOVES county databases (CDB) starting point was the 2021 Center for Disease Control (CDC) run, which is mostly based on the 2020 National Emissions Inventory (NEI) except converted already into MOVES4 format. The data in the 2021 CDBs were updated for fuels and I/M programs to be specific to year 2022.

Changes from 2021 CDC: Average Speed Distribution

The CDB table AvgSpeedDistribution was updated to use January 2020 (pre-pandemic) speed distributions from StreetLight. This differs from 2021 where ERG applied December data, and the 2020 NEI where month specific speeds were used in SMOKE and annual averages into the CDBs.

Changes from 2021 CDC: Fuels and I/M

The CDB tables IMCoverage, FuelFormulation, and FuelSupply were truncated and populated with MOVES4 database information for each county for year 2022.

Changes from 2021 CDC: Month, Day, and Hour VMT Fractions

ERG downloaded the large Travel Monitoring Analysis System (TMAS) dataset for 2022 from the website <https://geodata.bts.gov/datasets/travel-monitoring-analysis-system-class/about> and converted the geodatabase into a comma-separated variable (CSV) file format for further analysis. TMAS data contains hourly traffic volume counts at the station level, with detail available by the 13 FHWA vehicle classes. The analysis removed incomplete stations as needed and transformed the volumes into state-level VMT distributions by hour (HourVMTFraction), day type (DayVMTFraction) and month (MonthVMTFraction) for the CDBs. ERG delivered similar data to GDIT for running SMOKE with the exception of day type volumes; we provided that data for SMOKE by 7 day types of the week because SMOKE can differentiate all 7 day types unlike MOVES which only differentiates weekday and weekend day types. The vehicle types were mapped to MOVES source types using the table below.

TMAS Class	TMAS Class Description	Unique Profile #	MOVES source type group name	MOVES source type(s)
1	Motorcycles	1	Motorcycles	11
2	Passenger Cars	2	Passenger Cars	21
3	Other 2-Axle, 4-Tire, Single-Unit Vehicles	3	Light Duty Trucks	30s (31,32)
4	Buses	4	Buses	40s (41,42,43)
5	2-Axle, 6-Tire, Single-Unit Trucks	5	Single Unit Trucks	50s (51,52,53,54)
6	3-Axle, Single-Unit Trucks			
7	4-or-More Axle, Single-Unit Trucks			
8	4-or-Less Axle, Single-Trailer Trucks	6	Combination Unit Short-haul Trucks	61
9	5-Axle, Single-Trailer Trucks			
10	6-or-More Axle, Single-Trailer Trucks			
11	5-or-Less Axle, Multi-Trailer Trucks	7	Combination Unit Long-haul Trucks	62
12	6-Axle, Multi-Trailer Trucks			
13	7-or-More Axle, Multi-Trailer Trucks	6	Combination Unit Short-haul Trucks	61

Some states did not have complete data or had noisy data due to low sample size (e.g., few stations) and thus required substitutions from another state. The final state substitutions for 2022 are documented in the file State_Substitutions_2022_HB_ADB_v3.xlsx.

Aside from updating the yearID to 2022, and updating the I/M programs, fuels, hour/day/month VMT fractions, and the following state-specific submitted data (below), no other changes were made to the 2021 CDBs.

- Colorado provided updated IMCoverage table.
- Georgia provided updated IMCoverage, AVFT, age distribution, population, and weekday starts activity for the urban core counties.

Note that the version of MOVES used for this work does not recommend partial starts data to be used in the CDB; as the outputs looked spurious for start emissions, ERG subsequently needed to re-run Georgia rep. counties without the `startsPerDay` table populated.

MET4MOVES

EPA provided the following 2016 meteorology files for MOVES runs in the continental US:

- MOVES_DAILY_2022hc_12US1_2022001-2022365.txt
- MOVES_RH_DAILY_2022hc_12US1_2022001-2022365.txt

The outlying areas (Alaska, Hawaii, Puerto Rico, and Virgin Islands) used the following:

- MOVES_DAILY_2022hc_3HI1_2022001-2022365.txt
- MOVES_DAILY_2022hc_3PR1_2022001-2022365.txt
- MOVES_DAILY_2022hc_9AK1_2022001-2022365.txt
- MOVES_RH_DAILY_2022hc_3HI1_2022001-2022365.txt
- MOVES_RH_DAILY_2022hc_3PR1_2022001-2022365.txt
- MOVES_RH_DAILY_2022hc_9AK1_2022001-2022365.txt

Post-Processing

The names of the applied post-processing code for the 2022 run were as follows:

Rates On-road

- aq_cb6_saprc_20240220
- nata_20240220

Inventory On-road

- invmode_speciation_movesdb20230615_nonoxadj