AERMOD HELPER Files for Gridded Run Groups in the Nonpoint, Onroad, and Nonroad Sectors

A.1. INTRODUCTION

The SMOKE4AERMOD postprocessing scripts (https://github.com/CEMPD/SMOKE/tree/master/scripts/aermod) create "helper" files for several sectors (nonpoint, nonroad, np_oilgas, rwc and onroad) that allow the AERMOD modeler[1] to create AERMOD inputs for each source. These sectors start out as county level emissions in the inventory, and are gridded for use in AERMOD (by the scripts/methods provided at (https://github.com/CEMPD/SMOKE/tree/master/scripts/aermod). This document describes the format of the helper files for these "gridded" sectors, and their content based on the 2014 National Air Toxics Assessment (NATA) application of the SMOKE4AERMOD tool.

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For these sectors, an AERMOD source is a grid cell. The size of the grid cell is specified by the user for each grid and each **run group**. A **run group** is a group of source categories (SCCs) that are grouped together (by the user) and assigned similar same source characteristics for air quality modeling. The documentation for the postprocessing scripts is organized by "sector" where a sector could be the same as a run group (e.g., residential wood combustion, or "rwc") or be broader than a run group (e.g., "nonpoint").

The specific grids, run groups, run group grid cell resolution, and run group source characterization described in this document are based on the NATA modeling application. These specifications can be changed by the user based on inputs and parameters used in the SMOKE4AERMOD scripts.

The NATA modeling uses different grids and grid cell resolutions between sources in the continental U.S. (i.e., lower 48 states and DC, referred to as **CONUS**) and outside the continental U.S. (i.e., Alaska, Hawaii, Puerto Rico and the Virgin Islands, referred to as **nonCONUS).** NonCONUS uses a 12 km grid, with 12 km or 4 km resolution (depending on run group). Alaska uses a 9 km grid with 9 km resolution for all run groups. Hawaii uses a 3 km grid, with 3km resolution for all run groups. Puerto Rico and the Virgin Islands share a 3 km grid, with 3 km resolution for all run groups.

Grids and run group grid cell resolution used for the NATA modeling are listed below.

Table A-1. Run group names with resolution depending upon run group and grid

	CONUS GRID: 12US1	**Alaska GRID: 9AK1**	**Hawaii GRID = 3HI1**	**Puerto Rico & Virgin Islands GRID = 3PR1**
Onroad On-network LD (LDON)	LDON4	LDON9AK	LDON3HI	LDON3PR
Onroad Off-network LD (LDOFF)	LDOFF12	LDOFF9AK	LDOFF3HI	LDOFF3PR
Onroad On-network HD (HDON)	HDON4	HDON9AK	HDON3HI	HDON3PR
Onroad Off-network HD (HDOFF)	HDOFF12	HDOFF9AK	HDOFF3HI	HDOFF3PR
Onroad Off-network-hoteling (extended idling and auxiliary power units) (HOTEL)	HOTEL4	HOTEL9AK	N/A	N/A
Nonroad (NONRD)	NONRD12	NONRD9AK	NONRD3HI	NONRD3PR
Nonpoint 10 meter release height (NPHI)	NPHI12	NPHI9AK	NPHI3HI	NHI3PR
Nonpoint low level release height (NPLO)	NPLO12	NPLO9AK	NPLO3HI	NPLO3PR
Nonpoint Oil and Gas (OILGAS)	OILGAS4	OILGAS9AK	OILGAS3HI	N/A
Nonpoint Residential Wood Combustion (RWC)	RWC12	RWC9AK	RWC3HI	N/A
Nonpoint Agricultural Livestock (AG)	AG12	N/A	N/A	N/A
N/A means there are no emissions for this run group in this grid				

As indicated above, a **run group** is a group of sources with the same source characteristics, specifically, release parameters, temporal profile approach -diurnal (HROFDY), monthly (MONTH) or hourly (8760 values) and source resolution- **Error! Reference source not found.** further describes the NATA run groups and their emission characterization.

Table 0-2. Rungroup-specific area source parameters and temporal variation

Run Groups	NEI Category and NATA v7.2 Platform Modeling Sector	Source Characterization: Release Height (RH; meters), Initial Vertical Dispersion (σ_z; meters), Spatial resolution and Temporal Approach	Description/Examples of Sources
LDON4 LDON9AK LDON3HI LDON3PR	**NEI:** Onroad **Platform:** Onroad	**RH** = 1.3 σ_z = 1.2 Resolution is 4 km for CONUS, 9km for AK and 3km for HI,PR,VI **Temporal:** monthly temporal variation is pollutant-specific and county-specific. County-specific hourly profiles are the same for all pollutants based on benzene hourly emissions from SMOKE-MOVES (aggregate only SCCs in this run group)	on-network light duty mobile emissions such as passenger car exhaust and light duty passenger truck brake and tire wear. Emissions derived from SMOKE-MOVES. Includes refueling since temporal profile and spatial surrogate for on-network is a better match for refueling than off-network.
LDOFF12 LDOFF9AK LDOFF3HI LDOFF3PR	**NEI:** Onroad **Platform:** Onroad	**RH** = 0.5 σ_z = 0.5 Resolution is 12km for CONUS, 9km for AK and 3km for HI,PR,VI **Temporal:** same approach as LDON4, but aggregate only SCCs in the LDOFF run group to compute hourly profiles	off-network light duty mobile emissions such as passenger car and passenger truck start emissions. Derived from SMOKE-MOVES. Tailpipe height (no turbulence).
HDON12 HDON9AK HDON3HI HDON3PR	**NEI:** Onroad **Platform:** Onroad	**RH** = 3.4 σ_z = 3.2 Resolution is 4km for CONUS, 9km for AK and 3km for HI,PR,VI **Temporal:** monthly temporal variation is pollutant-specific and county-specific. County-specific hourly profiles based on **PM2.5** hourly emissions from SMOKE-MOVES (aggregate only SCCs in this run group)	on-network heavy duty mobile emissions such as bus exhaust and heavy duty diesel truck brake and tire wear. Derived from SMOKE-MOVES.
HDOFF12 HDOFF9AK HDOFF3HI HDOFF3PR	**NEI:** Onroad **Platform:** Onroad	**RH** = 3.4 σ_z = 0.5 Resolution is 12km for CONUS, 9km for AK and 3km for HI,PR,VI **Temporal:** same approach as HDON run groups , but use only SCCs in the HDOFF run groups to compute hourly profiles	Off-network heavy duty emissions including from long and short combination trucks, transit buses and school buses. Derived from SMOKE-MOVES. Tailpipe height (no turbulence)

Run Groups	NEI Category and NATA v7.2 Platform Modeling Sector	Source Characterization: Release Height (RH; meters), Initial Vertical Dispersion (σ_z; meters), Spatial resolution and Temporal Approach	Description/Examples of Sources
HOTEL4 HOTEL9AK HOTEL3HI HOTEL3PR	**NEI:** Onroad **Platform:** Onroad	**RH** = 3.4 σ_z = 0.5 Resolution is 4km for CONUS, 9km for AK and 3km for HI,PR,VI **Temporal:** same approach as HDON run groups, but use only SCCs in the HOTEL run groups to compute hourly profiles	Extended idling and auxiliary power units (APU) that occur at truck stops. Minimal dispersion for hoteling (e.g., extended idling) emissions. Tailpipe height (no turbulence)
NONRD12 NONRD9AK NONRD3HI NONRD3PR	**NEI:** nonroad **Platform:** nonroad	**RH** = 2 σ_z = 1 Resolution is 12 km for CONUS, 9km for AK and 3km for HI,PR,VI **Temporal:** monthly, pollutant specific and county specific. Diurnal (use qflag HROFDY) that align with the county/scc diurnal profiles used in CMAQ v7.1 platform. Computed based on benzene emissions summed by hour and by county across all days of the year and across all SCCs in the run group	nonroad equipment such as lawn mowers, turf equipment, agriculture and construction equipment, commercial generators, power-washing equipment, pleasure craft, recreational offroad
NPHI12 NPHI9AK NPHI3HI NPHI3PR	**NEI:** nonpoint **Platform:** some of nonpt,	**RH**=10 σ_z =4.7 Resolution is 12km for CONUS, 9km for AK and 3km for HI,PR,VI **Temporal:** uniform monthly/day-of-week. diurnal: Use SMOKE hourly profile 26 – mostly daytime emissions- (use qflag HROFDY)	industrial processes (e.g., chemical plants, refineries, mines, metals); fuel combustion- industrial, commercial, institutional and residential (except wood); waste disposal
NPLO12 NPLO9AK NPLO3LO NPLO3PR	**NEI:** nonpoint **Platform:** some of nonpt	**RH** = 3.9 σ_z = 3.6 Resolution is 12km for CONUS, 9km for AK and 3km for HI,PR,VI **Temporal:** same as NPHI run groups.	solvents (consumer, commercial); surface coating; commercial cooking;locomotives, bulk terminals, gas stations (stage 1); miscellaneous non-industrial (portable gas cans, auto repair shops, structure fires, and nonpoint mercury categories such as human cremation, dental amalgam).
OILGAS4 OILGAS9AK OILGAS3HI OILGAS3PR	**NEI:** nonpoint **Platform:** np_oilgas	**RH**=10 σ_z =4.7 Resolution is 4km for CONUS, 9km for AK and 3km for HI,PR,VI **Temporal:** monthly profiles that align with the county/scc temporal profiles used in CMAQ v7.1 platform. use qflag= MONTH and generate county-specific run group monthly profiles based on benzene emissions aggregated over all SCCs within each county	oil and gas sources reported in the nonpoint NEI data category (i.e., county-level emissions)

Run Groups	NEI Category and NATA v7.2 Platform Modeling Sector	Source Characterization: Release Height (RH; meters), Initial Vertical Dispersion (σ_z; meters), Spatial resolution and Temporal Approach	Description/Examples of Sources
RWC12 RWC9AK RWC3HI RWC3PR	**NEI:** nonpoint **Platform:** rwc	**RH** = 6.4 σ_z = 3.2 Resolution is 12km for CONUS, 9km for AK and 3km for HI,PR,VI **Temporal:** hourly by grid cell based on county-specific hourly emissions (created by SMOKE using year-to-day factors derived from meteorological data that are used for many SCCs in this sector)-for all 8760 hours in the year-based on benzene emissions summed by hour and county across all SCCs in the run group	fireplaces, woodstoves, hydronic heaters used for residential heating
AG12	**NEI:** nonpoint **Platform:** ag	**RH** = 1 s_z = RH/(2.15) = 0.465 m Resolution is 12km **Temporal:** hourly profile based on ammonia hourly emissions for the Ag emissions sector (which includes both livestock and fertilizer)	Miscellaneous Area Sources;Agriculture Production – Livestock including: Beef cattle - finishing operations on feedlots (drylots)-Confinement; Dairy cattle - drylot/pasture dairy-Confinement; Swine production - operations with lagoons (unspecified animal age)-Manure handling and storage; Poultry production - layers with dry manure management systems-Confinement; Poultry production – turkeys-Manure handling and storage

Helper files include (1) “BEFORE-AERMOD” helper files used to create the AERMOD inputs for the grid-cell sources and (2) “AFTER AERMOD” pollutant-specific emission helper files used to create pollutant specific concentrations from the grid-cell source chi/Q’s at receptors. The "before AERMOD" files do not provide the unit emissions rate or divide by the source area. Application of the 1000 g/s and division by area where appropriate occurs in post processing steps that convert the helper files into the AERMOD SO Pathway files. These post processing steps are currently not included in the SMOKE4AERMOD package.

The “BEFORE-AERMOD” helper files consist of the following 3 types: (1) Location, (2) Area_Parameter, and (3) Temporal, for each run group. The helper files contain all sources for that run group within the grid, except where the temporal files reflect county-specific hourly information (those files are organized differently).

Sources are derived base on grid cells, their resolution and layout are based on the grid. The grids used for the NATA application are shown below. For the CONUS grid sources use either 12 or 4km resolution depending on the run group.

Table A-3. Grid Definitions for grid cell sources

Grid name	Grid Cell Size	AERMOD source size	Coverage	Grid description parameters: projection name, xorig, yorig, xcell, ycell, ncols, nrows, nthik
12US1_459X299	12 km	12km or 4km depending on run group	Continental U.S.	'LAM_40N97W', -2556000, -1728000, 12.D3, 12.D3, 459, 299, 1
9AK1	9 km	9 km	Alaska	'LAM_63N155W', -1107000, -1134000, 9.D3, 9.D3, 312,252,1
3HI1	3 km	3 km	Hawaii	'LAM_21N157W', -391500, -346500, 3.D3, 3.D3, 225,201,1
3PR1	3 km	3 km	Puerto Rico and the Virgin Islands	'LAM_18N66W', -274500, -202500, 3.D3, 3.D3, 150,150,1

For the CONUS run groups, a CMAQ 12 km grid cell, or meteorological (met) cell is analogous to a "facility". Each CMAQ 12 km grid cell has a unique set of meteorological data, which means the source (or sources) associated with each CMAQ 12 km grid cell must be run separately in AERMOD from other CMAQ 12 km grid cell sources. The sources within the "facility" can be: nine 4km grid cells that fit within the 12km grid cell OR the single 12km grid cell. The Source id naming convention is presented in A.2.1.

For nonCONUS run groups, we use the grid cells of the grid as sources with no mini grid cells. The resolution of the nonCONUS run groups are: 9km for all run groups in Alaska and 3 km for all run groups in Hawaii, Puerto Rico and the Virgin Islands.

While different run groups could have different grid cell resolution, each run group has a set of release parameters and temporal profiles that are independent of the CONUS/nonCONUS geography (shown in Table 0-2). Temporal profiles vary by county for onroad (LDON, HDON, LDOFF, HDOFF, HOTEL), OILGAS, NONRD, RWC and AG run groups. The nonpoint run groups have the same temporal profile for every source in the run group. For NONRD and OILGAS, the variation by county is incorporated into the temporal helper file. For the onroad, RWC and AG run groups, there is a county to grid cell xref so that the programs that create the AERMOD inputs from the helper files can assign the temporal profiles to the AERMOD sources. For the CONUS 4km resolution sources, we use the same profile for each AERMOD mini grid cell that is within the same 12 CMAQ grid cell.

For RWC, AG and all ONROAD run groups which have hourly temporalization, the helper files include county-specific hourly files containing hourly factors and a crosswalk from grid cell to county that provides the county that contributes the most HAP emissions to that grid cell for RWC (this will be based on the allocation surrogates for SCCs within the source group and county emissions). These helper files are used by additional programs to generate the HOUREMIS temporal files used directly by AERMOD.

The county-specific hourly helper files do not include the unit emissions or unit emissions divided by area.

Not all grid cells will have emissions for each run group. The scripts that create the helper files exclude grid-cells sources that do not have HAP or diesel PM emissions.

Below summarizes run group-specific temporal allocation:

- RWC, AG and onroad run groups use county-specific hourly temporalization- 8760 temporal factors for each county. Because the source is a grid cell (not a county) each grid cell must be mapped to a county so that the proper set of hourly profiles could be assigned. The mapping is done based on the county with total HAP emissions. These are provided to 12 values after the decimal because the scalars are very small (the sum of 8760 of them will be 1).
- For Onroad and nonroad run groups, for the "after AERMOD" step: SMOKE will need to provide monthly (I.e., NOT annual) pollutant-specific emissions because AERMOD chi/q's will be monthly. The monthly emissions for onroad and nonroad are in the SMOKE FF10.
- NPHI*, NPLO* run groups use only diurnal profiles in the "before AERMOD" step. In particular, they use diurnal profile code 26 (uniform monthly and day of week).

A.2. "BEFORE-AERMOD" HELPER FILES

A.2.1. File and source id naming conventions

Table 0-4 Names of BEFORE-AERMOD HELPER files for Gridded Sources (Nonpoint, Onroad, Nonroad)

File type	NAME[1]	Description
location	rungroup_locations.csv	Provides coordinates of one of the vertices of the source (south west corner)
Area source parameters	rungroup_area_params.csv	Release height, σz , **vertices of each of the 4 corners of the source**
Temporal factors (non-county specific)	rungroup_temporal.csv	Temporal factors
Hourly temporal factors by county	rungroup_stateabbr_hourly.csv	Hourly temporal factors by county for run groups with hourly emissions (RWC, AG and all onroad run groups)
Grid cell-to-county cross walk	rungroup_county-to-gridcell.csv * (note that it is more appropriately named "rungroup_gridcell-to-county.csv" since each grid cell should have just one assignment, and the same county could be assigned to different grid cells)	Cross reference providing the county associated with each grid cell, needed for run groups with county-specific temporal factors. (RWC, AG and all onroad run groups)

[1]the rungroup name includes the grid for these helper files. E.g., HDOFF3HI_area_params.csv

Source id and "Facility" naming conventions:

The grid cell (which, for the CONUS grid is also used as the “met cell”) is analogous to "facility". It is names as follows: put a "G" as the first character, then the column then "R" then the row number. For example: G351R148 or G088R161 (so leading zeroes are included).

The source id can be up to 12 characters in AERMOD. The value of Source id is: resolution_#, where # is the number of the source.

For sources in the CONUS domain the source naming is as follows:

- For 12km resolution: 12_1 is the source id. There is only one source id per 12km grid cell
- For 4km resolution: 4_1, 4_2, ...4_9 and the source layout is as follows.

7	8	9
4	5	6
1	2	3

For sources in any of the nonCONUS domain the source naming is as follows:

- for 9km resolution: 9_1 is the source id. There is only one source id per 9 km grid cell
- For 3km resolution: 3_1 is the source id. There is only one source id per 3 km grid cell

The values of the grid cell ("facility") and the source id are used in the AERMOD helper files and the "post AERMOD" matching of the gridded inventory pollutant-specific emissions to the chi/q from AERMOD.

A.2.2. Location files

Only sources with emissions (HAP, diesel PM) are included in the location file. The location file for the gridded sources provides the geographic coordinates of the southwest corner only. The coordinates of all 4 vertices of the grid cell source are put into the area parameters file. Every source in the location file needs to be in the area parameters file.

Table 0-5 Fields for Location Helper Files for Gridded Sources (Nonpoint, Onroad, Nonroad)

Filename **rungroup_locations.csv**, where “rungroup” is the name of the run group. One row per source. The source is the combination of the grid cell and Source id. The grid cell column/row numbering is based on the grid. CONUS uses 12US1; Alaska uses 9AK1; Hawaii uses 3HI1 and Puerto Rico and the Virgin Islands use 3PR1.	
field	**description**
rungroup	Name of the run group. e.g.; NPHI12
Grid cell	Concatenate: “G” , grid cell column # (with leading 0 so it has length of 3), “R” , grid cell row # (with leading 0 so it has length of 3). E.g.; G351R148

Source id	Concatenation of grid cell size with "_" and with number. Number is always 1 for CONUS 12km (e.g., 12_1) or nonCONUS (e.g., 9_1 or 3_1). Number is incremented by 1 up to 9 for CONUS 4 km (e.g., 4_1, 4_2, etc.)
UTM_X of southwest corner of source	
UTM_Y of southwest corner of source	
UTM ZONE	The UTM zone is based on the southwest corner of the MET cell (CONUS) or Grid Cell (nonCONUS).
Longitude of southwest corner of source (decimal degrees)	Not used by AERMOD
Latitude of southwest corner of source (decimal degrees)	Not used by AERMOD

Suggested QA procedures for the rungroup_locations.csv file

1. Provide the Number of sources in the file. Compare to SMOKE gridded inventory report. Should have same number of grid cells.
2. Check the numbering of the CMAQ grid cell by making sure the min and max column and row numbers are reasonable (i.e., they are in –either partially or fully- the US and they are reasonably situated on/near the border areas of the US part of the domain)
3. All 4km sources within the same 12km grid cell same UTM zone

A.2.3. AREA Source Parameter Files (RELEASE PARAMETER FILES AND VERTICES)

The Area source parameter file provides the coordinates of the each of the vertices for each source. The vertices for the 4 km sources must fit exactly within each 12km CMAQ grid cell (met cell).

It also provides the release parameters, release height (**RH**) and initial vertical dispersion (σ_z). Each source within the run group gets the same release parameters. Only source with emissions (HAP , diesel PM) are included in this file; every source in the Location file needs to be in this file.

Table 0-6 Fields for Area Source Parameter Helper Files for Gridded Sources (Nonpoint, Onroad, Nonroad)

Filename **rungroup_area_parameters.csv**, where "rungroup" is the name of the run group. One row per Source	
field	**description**
rungroup	e.g.; NPHI12
Grid cell	Concatenate: "G" , grid cell column # (with leading 0 so it has length of 3), "R" , grid cell row # (with leading 0 so it has length of 3). E.g.; G351R148

Source id	Concatenation of grid cell size with "_" and with number. Number is always 1 for CONUS 12km (e.g., 12_1) or nonCONUS (e.g., 9_1 or 3_1) and is incremented by 1 up to 9 for CONUS 4 km (e.g., 4_1, 4_2, etc.)
Release height (m)	Value is based on the run group. See **Table 0-2. Rungroup-specific area source parameters and temporal variation .** Rungroup-specific area source parameters and temporal variation
Number of vertices	4
Initial vertical dispersion, or Sigma z (m)	Value is based on the run group. See **Table 0-2. Rungroup-specific area source parameters and temporal variation .** Rungroup-specific area source parameters and temporal variation
UTM_X of southwest corner of source	
UTM_Y of southwest corner of source	
UTM_X -coord2	UTM x of 2nd coordinate, clockwise direction from southwest corner. All coordinates of vertices are with respect to the south west coord
UTM_Y-coord2	UTM y of 2nd coordinate, clockwise direction from southwest corner. All coordinates of vertices are with respect to the south west coord
UTM_X –coord3	UTM x of 3rd coordinate, clockwise direction from southwest corner. All coordinates of vertices are with respect to the south west coord
UTM_Y-coord3	UTM y of 3rd coordinate, clockwise direction from southwest corner. All coordinates of vertices are with respect to the south west coord
UTM_X –coord4	UTM x of 4th coordinate, clockwise direction from southwest corner. All coordinates of vertices are with respect to the south west coord
UTM_Y-coord4	UTM y of 4th coordinate, clockwise direction from southwest corner. All coordinates of vertices are with respect to the south west coord
Longitude of southwest corner of source (decimal degrees)	Not used by AERMOD
Latitude of southwest corner of source (decimal degrees)	Not used by AERMOD
Longitude of coord 2 (decimal degrees)	Not used by AERMOD
Latitude of coord 2(decimal degrees)	Not used by AERMOD
Longitude of coord 3 (decimal degrees)	Not used by AERMOD
Latitude of coord 3(decimal degrees)	Not used by AERMOD
Longitude of coord 4(decimal degrees)	Not used by AERMOD
Latitude of coord 4(decimal degrees)	Not used by AERMOD

Suggested QA procedures for the rungroup_area_parameters.csv

1. The Number of sources in this file should equal the number of sources in the **rungroup_locations.csv** file (for the same run group).
2. The same sources (check grid cells and source ids) that are in this file should be in the **rungroup_locations.csv** file (more detailed check of item 1)
3. Visually compare the UTM vertices with CMAQ grid to check alignment of UTM and Lambert cells vertices

Repeat item 3 but do the comparison at a region that includes the border between 2 UTM zones

4. Release height is in meters and matches the value (based on the run group) in the table containing Release Parameters based on the rungroup.
5. Sigmaz (σ_z) matches the value (based on the run group) in **Table 0-2. Rungroup-specific area source parameters and temporal variation .**
6. Spot checks: that the 1st coordinates match the coordinates in the location file by grid cell; that the vertices for a cell are equal to the corresponding vertices on the adjacent cell; that the UTM coordinates result in the correct source resolution (3,4,9,12km) for the run group.

A.2.4. TEMPORAL Factor files by source id for run groups that do not use hourly profiles

Table 0-7 Fields for Temporal Helper Files for Gridded Sources to be used for NPHI, NPLO, NONRD and OILGAS

Filename **rungroup_temporal.csv** where "rungroup" is the name of the run group.
1 row per source

field	description
rungroup	e.g.; NPHI12
Grid cell	Concatenate: "G" , grid cell column # (with leading 0 so it has length of 3), "R" , grid cell row # (with leading 0 so it has length of 3). E.g.; G351R148
Source id	Concatenation of grid cell size with "_" and with number. Number is always 1 for CONUS 12km (e.g., 12_1) or nonCONUS (e.g., 9_1 or 3_1) and is incremented by 1 up to 9 for CONUS 4 km (e.g., 4_1, 4_2, etc.)
Qlfag	For NPHI*, NPLO*, NONRD*: Qflag is HROFDAY For OILGAS4: Qflag is MONTH
Scalar1	Scalar value depends on run group. See "COMPUTATION OF SCALARS" below
…	
…	
Scalar N	N is the number of scalars. For HROFDAY, N= 24; For MONTH, N=12

COMPUTATION OF SCALARS:

Diurnal profile scalars for NPHI12, NPLO12: The 24 hour-of-day scalars are the factors associated with SMOKE diurnal profile "26". These factors sum to 1. They do not vary county. Values are (beginning 12am to 1am): 0.01979802, 0.01859814, 0.01819818, 0.01869813, 0.0209979, 0.0249975, 0.03109689, 0.03879612, 0.046695331, 0.052794721, 0.057094291, 0.060393961, 0.061993801, 0.063093691, 0.063493651, 0.062393761, 0.059394061, 0.054794521, 0.053094691, 0.050894911, 0.04249575, 0.03269673, 0.02569743, 0.02179782

Diurnal profile scalars for NONRD: Each source is assigned a set (i.e., 24 of them) county-specific diurnal scalars based on the county with the most emissions overlapping (or containing) that grid cell. There are 24 hour-of-day scalars and they are computed based on the hourly benzene emissions summed across all NONRD sources across all days of the year by county.

$$Hour_i = \frac{\sum_{j=1}^{j=365} \sum Benzene_{i,j}}{Benzene\_annual}$$

Where $Benzene_{i,j}$ is the benzene emissions for hour i and day j, summed across all SCCs in theNONRD12 run group

Monthly profile scalars for OILGAS: Each met cell is assigned county-specific monthly scalars based on the county with the most emissions overlapping (or containing) that grid cell. County-specific monthly scalars are computed from benzene monthly emissions across all SCCs from the run group in the county. If for a certain county, there are no benzene emissions, then the sum of HAP is used.

$$Scalar_i = \frac{Benzene_i}{\#ofdays_i} \times \frac{1}{\sum \frac{Benzene_i}{\#ofdays_i}}$$

Where $Benzene_i$ is the tons of benzene in month i for the county associated with the met grid cell across all SCCs in OILGAS

$\#ofdays_i$ is the number of days in month i

Suggested QA procedures for the rungroup_temporal.csv files

1. The Number of sources in this file should equal the number of sources in the **rungroup_locations.csv file** (for the same run group).
2. There should not be repetition of a source id (one row per source)
3. The same sources (check grid cells and source ids) that are in this file should be in the **rungroup_locations.csv** file (more detailed check of item 1)
4. The value of the qflag should match that in the table providing release parameters etc. based on the rungroup.
5. Sum and average the scalars and compare with the following
   a) Qflag=HROFDY; scalars sum to 1
   b) Qflag=MONTH; scalars sum to 1

A.2.5. Hourly temporal factors by county – used only for run groups with hourly emissions (LDON, LDOFF, HDON, HDOFF, HOTEL, RWC, AG)

Table 0-8 Fields for -county-specific Hourly Helper Files to be used for all onroad run groups, RWC and AG

Filename **rungroup_stateabbr_hourly.csv** where "rungroup" is the name of the run group 1 row per county, month/day/hour (8760 rows per county).	
field	**description**
rungroup	e.g.; RWC12
Region_cd	5- digit state and county FIPS code (5 digits total)
YEAR (2-digit)	Value is "14"
month	month is a number (1 is January, 12 is December)
Day	Day is a number (1 to number of days in the month)
Hour of day	1-24 (12am to 1am is hour 1, and is based on local time)
Scalar	$Scalar_{hour\text{-}i}$ = (Pollx emissions for the county)$_{hour\text{-}i}$ / $\Sigma_{all\ hours}$(Pollx emissions for the county) Note that Pollx is benzene emissions summed across all SCCs in the rungroup for RWC*, LDON*, LDOFF*, and Pollx is PM2.5 emissions summed across all SCCs in the rungroup for HDON*, HDOFF* and HOTEL*.

	Pollx is NH3 for AG12. These should be provided to at least 12 values after the decimal.

Suggested QA procedures for the rungroup_stateabbr_hourly.csv files

1. For rungroups using the 12US1 grid, there should be the same number of counties as there are in the county across the lower 48 states; For rungroups using the 9AK1 grid, there should be the same number of counties as there are in AK. For rungroups using the 3HI1 grid, there should be the number of counties are there are in HI. For rungroups using the 3PR1 grid, there should be the number of counties that there are in PR and VI.
2. Plot the scalars for counties in selected states, e.g., 1) WA, 2) TX, 3) MN, 4) FL, 5) NY
3. For RWC, the scalars should add to within 1% of 1. For the mobile sectors they should sum exactly to 1.

A.2.6. Grid Cell to county Xwalk

The purpose of this file is to identify which county the grid cell is in so that the proper temporal profile (which is based on the county) is used for the grid cell AERMOD source. The name of the file is county-to-gridcell but in fact it is, for each gridcell, providing the county that should be used for the temporal profile.

Table 0-9 Fields for Grid Cell to county Xwalk (to be used for run groups with county-specific temporal profiles)

Filename **rungroup_county-to-gridcell.csv** where "rungroup" is the name of the run group (it needs to include the grid resolution in the name, e.g., RWC9AK_county-to-gridcell). Note that the purpose of this file is to provide the county that the grid cell is in.
1 row per grid cell.

field	description
rungroup	e.g.; RWC12
County FIPS (5 digit)	County in which the grid cell is in. Use the county that contributed the highest sum of HAPs using all of the surrogates for the run group will get assigned to a grid cell. A county can be assigned to many grid cells, but a grid cell can only be assigned to one unique county.
Grid cell	Concatenate: "G" , grid cell column # (with leading 0 so it has length of 3), "R" , grid cell row # (with leading 0 so it has length of 3). E.g.; G351R148

Suggested QA procedures for the rungroup_county-to-gridcell.csv files

1. There should be exactly the same grid cells in this file as there are for the **rungroup_locations.csv**
2. There should only be one county assigned to each unique gridcell. Which means a grid cell should be listed only once in this file

A.3. AFTER-AERMOD Emissions files

The "After AERMOD" files contain gridded pollutant specific emissions by the specific grid cell source, county, source group and SMOKE pollutant name. The met cell (row column of 12km CMAQ grid cell) is also included. It should be noted that AERMOD needs the total emissions for the source (not apportioned by county), however, this file apportions the source emissions by county as it provides more quality assurance (QA) opportunities. The sum of source emissions across counties is done as a post processing step and is also required for the emissions layers in the NATA map app.

A.3.1. Run groups that use Annual Emissions (nonpoint)

Table 0-10 Fields for Annual Emissions Crosswalk Helper Files for Gridded Sources (to be used for non-monthly run groups)

Filename **rungroup_emis.csv** where "rungroup" is the name of the run group.	
field	**description**
rungroup	e.g.; NPHI12
Region_cd	5 digit state and county FIPS code
Grid cell	Concatenate: "G" , grid cell column # (with leading 0 so it has length of 3), "R" , grid cell row # (with leading 0 so it has length of 3). E.g.; G351R148
Source id	e.g., 4_1…. 4_9 (for a 4km resolution run group) or 12_1 for a 12km resolution run group
Source group	Aggregation of all SCCs within the source group. Use the SCC to source group and run group xwalk to assign the HAP emissions from the FF10 to source groups.
SMOKE NAME of Pollutant	Use the name that is in the SMOKE INVTABLE
Annual tons per year by source group, county and source (source is the CMAQ grid cell/source id combination)	Emissions by source group/county/CMAQ grid cell/source id. This value will reflect the county contribution to the gridded source. Note that in the post processing step in which the emissions are applied to the chi/Q, emissions are summed (across counties) by the source group/CMAQ grid cell/source id. We decided to keep them disaggregated (by source group, source AND county) to give flexibility in displaying and QA of the emissions.
Suggested QA procedures for the rungroup_county-to-gridcell.csv files 1. When summed to the county level, the emissions should be the same as the FF10 for pollutants with 1-to-1 matches between pollutant code and SMOKE name. For pollutants that don't have that relationship, sum up the PAHs in the FF10 by SMOKE name and then compare to this file. 2. The same sources (check grid cells and source ids) that are in this file should be in the **rungroup_locations.csv** file 3. Provide a unique list of all SCC, SCC descriptions, source groups for each run group as an excel spreadsheet for additional review. 4. Review the list of pollutants in each run group. Ensure NPLO is the only gridded run group with annual emissions with DIESEL_PM10.	

A.3.2. Monthly run groups (onroad, nonroad)

Table 0-11 Fields for Monthly Emissions Crosswalk Helper Files for Gridded Sources (onroad and nonroad)

Filename **rungroup_monthly_emis.csv** where "rungroup" is the name of the run group.	
field	**description**
rungroup	e.g.; LDOFF12
Region_cd	5 digit state and county FIPS code

Grid cell	Concatenate: "G" , grid cell column # (with leading 0 so it has length of 3), "R" , grid cell row # (with leading 0 so it has length of 3). E.g.; G351R148
Source id	e.g., 4_1…. 4_9 (for a 4km resolution run group) or 12_1 for a 12km resolution run group
Source group	Aggregation of all SCCs within the source group. Use the SCC to source group and run group xwalk to assign the HAP emissions from the FF10 to source groups.
SMOKE NAME of Pollutant	Use the name that is in the SMOKE INVTABLE
Annual tons per year by source group, county and source (source is the CMAQ grid cell/source id combination)	Emissions by source/ county/source group This can be summed by source and that is what is needed for the AERMOD post processing (i.e., the AERMOD modeler needs to sum emissions by source/source group)
Monthly tons per year - January	Monthly tons per year - January by source group, county and source * Note that in the post processing step in which the emissions are applied to the chi/Q, emissions are summed (across counties) by the source group/CMAQ grid cell/source id. We decided to keep them disaggregated (by source group, source AND county) to give flexibility in displaying and QA of the emissions.
Monthly tons per year - February	Monthly tons per year - February by source group, county and source *same Note as above
… (march, april, may, etc…)	…
Monthy tons per year - December	Monthly tons per year - December *same Note as above

Suggested QA procedures for the rungroup_monthly_emis.csv files

1. When summed to the county level, the emissions should be the same as the FF10 for pollutants with 1-to-1 matches between pollutant code and SMOKE name. For pollutants that don't have that relationship, sum up the PAHs in the FF10 by SMOKE name and then compare to this file.
2. The same sources (check grid cells and source ids) that are in this file should be in the **rungroup_locations.csv** file
3. The sum of the monthly tons per year across the months should be equal to the annual tons per year
4. Provide a unique list of all SCC, SCC descriptions, source groups for each run group as an excel spreadsheet for additional review.
5. Review the list of pollutants in each run group. Ensure LDON, HDON, HOTEL, and NONRD are the only gridded run groups with monthly emissions with DIESEL_PM10.