AERMOD Helper Files for Commercial Marine Vessel (CMV) port and underway run groups

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Introduction

The SMOKE4AERMOD postprocessing scripts create "helper" files for the port and underway commercial marine vessel (CMV) run groups. These helper files are used by the AERMOD modeler[1] to create AERMOD inputs for each source in the run group. This document describes the format and content of the CMV run group helper files. As with all AERMOD file preparation for national-scale AERMOD modeling project, helper files contain sources from the EPA's National Emission Inventory (NEI) with non-zero emissions. In addition, these helper files do not contain sources with FIPS 85 (Federal waters) or FIPS 98 (outside Federal waters). Unlike other run groups, the CMV run group emissions helper files contain only VOC and PM2.5 and PM10. The AERMOD modeler uses a file of HAP-to-PM2.5 and HAP-to-VOC factors in AERMOD post processing (i.e., after the model is run) to generate the modeled concentrations of selected pollutants (such as HAPs and diesel PM) based on the VOC, PM2.5 and PM10 emissions. Note that PM10 from NEI CMV sources is considered diesel pm since the NEI CMV sector has only diesel or residual oil-fueled engines.

The CMV run groups are comprised of sources within the NEI NONPOINT data category that have the following SCC codes **and** that reside in US **State** waters (i.e., includes any US State FIPS including the District of Columbia (FIPS 11), Puerto Rico (FIPS 72) and the Virgin Islands (FIPS 78); and excludes Federal waters (FIPS 85) and non-US (FIPS 98)):

PORT RUN GROUP (CMVP)

2280002101	Marine Vessels, Commercial; Diesel; C1C2 Port emissions: Main Engine
2280002102	Marine Vessels, Commercial; Diesel; C1C2 Port emissions: Auxiliary Engine
2280002103	Marine Vessels, Commercial; Diesel; C3 Port emissions: Main Engine
2280002104	Marine Vessels, Commercial; Diesel; C3 Port emissions: Auxiliary Engine
2280003103	Marine Vessels, Commercial; Residual; C3 Port emissions: Main Engine
2280003104	Marine Vessels, Commercial; Residual; C3 Port emissions: Auxiliary Engine

UNDERWAY RUN GROUP (CMVU)

2280002201	Marine Vessels, Commercial; Diesel; C1C2 Underway emissions: Main Engine
2280002202	Marine Vessels, Commercial; Diesel; C1C2 Underway emissions: Auxiliary Engine

[1] Thurman, Thurman.james@epa.gov, is the AERMOD modeler for the 2014 National Air Toxics Assessment and 2017 Hazardous Air Pollutant + Criteria Air Pollutant (HAP+CAP) Modeling Platform

2280002203 Marine Vessels, Commercial; Diesel; C3 Underway emissions: Main Engine
2280002204 Marine Vessels, Commercial; Diesel; C3 Underway emissions: Auxiliary Engine
2280003203 Marine Vessels, Commercial; Residual; C3 Underway emissions: Main Engine
2280003204 Marine Vessels, Commercial; Residual; C3 Underway emissions: Auxiliary Engine

CMV emissions files- starting point for the helper files

CMV emissions (both port and underway) were developed for the 2017 NEI using Automated Identification System (AIS) data. AIS is a tracking system used by vessels to enhance navigation and avoid collision with other AIS transmitting vessels. The data were retrieved at 5-minute intervals, spatially allocated into gridded datasets, and summed into hourly point source emissions files for modeling using photochemical gridded models such as CMAQ. The point coordinates are based on grid cell location; these coordinates and the grid cell ID as well as emissions are stored using the point source flat file format (FF10) which is described in more detail below. Separate FF10 files contain the sources from the 4 separate grids described as follows:

Grid Abbrev	description	Grid cell resolution
12US2	Contiguous U.S. states, parts of Canada	12 km
9AK1	All of Alaska except does not contain Western Aleutians	9 km
3HI1	All of Hawaii	3 km
3PR	All of Puerto Rico and the Virgin Islands	3km

For the NEI and for use in AERMOD modeling, the SCCs reflecting CMVs at ports were assigned to port shapes, i.e., polygon areas, reflecting the location of CMV hoteling or maneuvering in the water portion of the port. The 2017 NEI uses the same GIS-based, within-water port shapes that were developed for the 2014 NEI. For purposes of the NEI, the emissions are also summed to annual emissions; for the AERMOD modeling, the hourly temporal variation is utilized. It should be noted that port shapes do not overlap counties but they can be in multiple grid cells. In the NEI, underway cmv sources are at the county level. The underway cmv sources are modeled in AERMOD using grid cells.

To support AERMOD modeling, annual and hourly FF10s containing annual CMV emissions were developed. These FF10s utilize SMOKE's "Point source annual" and "point hourly" formats, documented in the SMOKE User's Guide.

Port and Underway CMV sources reside in the same FF10, although underway emissions contain do not contain any GIS-shape information. In AERMOD port emissions are modeled as polygon AREA sources, with vertices described by the shape associated with the shapeid. Underway emissions are modeled as gridded AREA sources similar to other nonpoint and mobile run groups. This document describes both the helper files for the port CMV emissions and the helper files for the underway CMV emissions.

Records for CMV sources in the annual FF10 provide the emissions by County FIPS, SCC, shape id and grid cell, for ports and by County FIPS, SCC and grid cell for underway. The FF10 provides other information such as stack parameters. SMOKE4AERMOD does not use the FF10 stack parameters for the AERMOD helper files, rather, the release information is provided by a rungroup ancillary file. For

port sources, each row in the FF10 represents the emissions for the portion of the shape in the grid cell contained in the FACILITY_ID field. For underway each row represents the emissions for the portion of the grid cell in the county.

The modeling platform contains separate annual FF10s for C1C2 vessels and for C3 vessels (and as discussed earlier, the FF10s are separate for the separate grids). The C1C2 and C3 vessels are in separate files because they are in separate sectors for CMAQ modeling. Each of the FF10s contains both port and underway emissions records. Only the port records (most readily identified by the REL_POINT_ID field, which provide the shape id, but also can be determined by SCC) are used for helper files for the port run group; and only the underway records are used for helper files for the underway run group.

The FF10 fields for CMV are described below

Position	Name	Type	Description
1	COUNTRY_CD	Char(3)	Country code; default to "US" (required)
2	REGION_CD	Char(5)	FIPS code for state and county (required) of the CMV source. For port shapes, each unique port (port id is contained in the REL_POINT_ID field) can only be in one county. There may be multiple FIPS per FACILITY_ID.
3	TRIBAL CODE	Char(3)	null
4	FACILITY_ID	Char(15)	This is the grid cell containing the polygon. Column ID (2-digit) concatenated with Row ID (3-digit), with leading zeros retained. Note that the grid is contained in the file name.
5	UNIT_ID	Char(15)	This is the type of ship, “C1C2” and “C3” concatenate with the county FIPS. These are in separate FF10 because they are in separate modeling sectors for the CMAQ runs and they are separate sources for the AERMOD runs.
6	REL_POINT_ID	Char(15)	This stores the port shape id, for port sources. For underway sources, the value is “UW”
7	PROCESS_ID	Char(15)	Same as the SCC
8	AGY_FACILITY_ID	Char(15)	null
9	AGY_UNIT_ID	Char	null
10	AGY_REL_POINT_ID	Char	null
11	AGY_PROCESS_ID	Char	null
12	SCC	Char(20)	Source Classification Code (required)
13	POLID	Char(16)	Pollutant Code (required)
14	ANN_VALUE	Real	Annual Emissions (short tons/year) (required if `SMKINVEN_MONTH` is set to 0)
15	ANN_PCT_RED	Real	Percentage Control Measure Reduction Efficiency (optional)
16	FACILITY_NAME	Char(40)	Name of the port for port sources. Null for underway sources.
17	ERPTYPE	Char(2)	Emissions release point type, is always 02 (which is a vertical stack)
18	STKHGT	Real	Release height (ft)– is 1 ft for C1C2 and 65.62 (20 m) ft for C3
19	STKDIAM	Real	Stack Diameter (ft) is 1 ft for C1C2 and 2.625 ft for C3
20	STKTEMP	Real	Stack Gas Exit Temperature (°F) is 70 F for C1C2
21	STKFLOW	Real	Is 0
22	STKVEL	Real	Stack Gas Exit Velocity (ft/sec) is 0.1 ft/s for C1C2 and 82.02 ft/s for C3
23	NAICS	Char(6)	North American Industrial Classification System Code is null
24	LONGITUDE	Real	Longitude (decimal degrees) of grid cell center
25	LATITUDE	Real	Latitude (decimal degrees) of grid cell center
26	LL_DATUM	Char(3)	Null
27	HORIZ_COLL_MTHD	Char	Null
28	DESIGN_CAPACITY	Real	Null
29	DESIGN_CAPACITY_UNITS	Char	Null
30	REG_CODES	Char	Null
31	FAC_SOURCE_TYPE	Real	Null
32	UNIT_TYPE_CODE	Real	Null
33	CONTROL_IDS	Char	Null
34	CONTROL_MEASURES	Char	Null

Position	Name	Type	Description
35	CURRENT_COST	Real	Null
36	CUMULATIVE_COST	Real	Null
37	PROJECTION_FACTOR	Real	Null
38	SUBMITTER_FAC_ID	Char(15)	Null
39	CALC_METHOD	Int	Null
40	DATA_SET_ID	Int	Null
41	FACIL_CATEGORY_CODE	Char	Null
42	ORIS_FACILITY_CODE	Char	Null
43	ORIS_BOILER_ID	Char	Null
44	IPM_YN	Char	Null
45	CALC_YEAR	Int	Null
46	DATE_UPDATED	Int	Null
47	FUG_HEIGHT	Real	Null
48	FUG_WIDTH_XDIM	Real	Null
49	FUG_LENGTH_YDIM	Real	Null
50	FUG_ANGLE	Real	Null
51	ZIPCODE	Int	Null
52	ANNUAL_AVG_HOURS_PER_YEAR	Int	Null
53	JAN_VALUE	Real	Null
...	...	...	Null
64	DEC_VALUE	Real	Null
65	JAN_PCTRED	Real	Null
...	...	...	Null
76	DEC_PCTRED	Real	Null
77	COMMENT	Char	Null

CMV helper file types

The “BEFORE-AERMOD” helper files consist of the following 3 types: (1) Location, (2) Area_Parameter, and (3) Temporal. The helper files contain all sources for the CMV port run group. The “AFTER AERMOD” helper file contains pollutant-specific emissions by source. The "before AERMOD" files do not provide the unit emissions rate or divide by the source area. The AERMOD modeler will apply the 1000 g/s and divide by area where appropriate in the post processing step.

For underway sources, which AERMOD treats as gridded AREA sources, the AERMOD modeling uses different grid cell resolutions for the different grids. For sources in the continental U.S. (i.e., lower 48 states and DC, referred to as **CONUS**) underway CMV sources are treated as 12 km area sources. Outside the continental U.S. (i.e., Alaska, Hawaii, Puerto Rico and the Virgin Islands, referred to as **nonCONUS)** also use different resolutions. Alaska sources use a 9 km grid. Hawaii sources use a 3 km grid. Puerto Rico and the Virgin Islands share a 3 km grid, with 3 km resolution.

These rungroup and grid abbreviations are used for the AERMOD helper file names and are summarized below.

	CONUS GRID: 12US1	**Alaska GRID: 9AK1**	**Hawaii GRID = 3HI1**	**Puerto Rico & Virgin Islands GRID = 3PR1**
Commercial Marine Vessel - Underway	CMVU_12	CMVU_9AK	CMVU_3HI	CMVU_3PR
Commercial Marine Vessel - Ports	CMVP_12	CMVP_9AK	CMVP_3HI	CMVP_3PR

The POLYGON file – A key input to the CMV Port Emissions Processing (run group CMVP)

The CMV port emissions processing uses a key ancillary file containing the port shape information: number of vertices, latitude & longitude of each vertex, shape id to relate the polygons to the NEI shapes. NEI port shapes are identical to the polygons used in the modeling such that each NEI shape is a single AERMOD polygon. The "POLYGON" file contains only port shape/polygon information.

The POLYGON file for port shapes for the 2017 NEI is the same as for 2014 except that the underway shapes have been removed, since for the new AIS approach underway CMV sources utilize grid cells for their spatial characterization.

The port polygon file is called: cmv_ports_v2_040718_fornata_12may20_02jun2020_v0.

Below is the format of the POLYGON file for port shapes

Field Name	Description
FACID	Facility id – basically an ID for the polygon (same as the shape id for ports) that has the FIPS in it and that can be associated with and NEI Port or Underway Shape. Concatenation of 4 strings as follows: "P", NEI ShapeID, "F", 5-digit FIPS
LON	Longitude of first polygon vertex for shape
LAT	Latitude of first polygon vertex for shape
NUMVERT	Number of vertices for the polygon
AREA	Area of the polygon in square meters

"BEFORE-AERMOD" HELPER FILES

File naming conventions

The names of the helper files are based on the run group (CMVU or CMVP) and grid abbreviation

File type	NAME	Description
location	**CMVP_[grid]_locations.csv** **CMVU_[grid]_locations.csv** **e.g.; CMVP_12 _locations.csv**	CMVP: Provides one shape vertex and cross walk between the polygon and the CMAQ grid cell (needed in order to assign correct gridded MET data and temporal profile) CMVU: Provides the grid cell column row and UTM coordinates of the centroid of the grid cell
Area source parameters	**CMVP_[grid]_area_parameters.csv** **CMVU_[grid]_area_parameters.csv** **e.g.; CMVP_12_area_parameters.csv**	Release height, σ_z, all vertices of the simplified shapes (CMVP) or grid cell (CMVU)
Temporal factors	**CMVP_ [grid]_[statefips] _hourly.csv** **CMVU_ [grid]_statefips _hourly.csv** **e.g.; CMVU_9AK_02_hourly.csv**	Temporal factors – hourly CMVP: by port and type of CMV (C1C2 vs C3); the factors take into account all portions of the port/grid cell hourly emissions and sum to the port, so the hourly data represents the entire port CMVU: by grid cell and type of CMV (C1C2 vs C3); the factors take all portions of the grid cell/county hourly emissions and sum to the grid cell so the hourly data represents the entire grid cell

Source and naming conventions

For purposes of AERMOD, a source is a unique combination of polygon-shape or grid cell and vessel type (vessel type is c1/c2 or c3). The polygon could be part of a port or a represent the whole port. Each unique NEI polygon or grid cell may be viewed as a separate facility. The number of sources at the facility depends whether there are both c1/c2 and c3 emissions for the NEI shape (or grid cell).

Source Naming Convention for the port run group

The Facid in the POLYGON file is used for constructing the source id and is comprised of the NEI shape id, the type of CMV, the FIPS.

As mentioned above (in the POLYGON file description), it is the concatenation of 4 strings as follows: "P", NEI ShapeID, "F", 5-digit FIPS

The source id is constructed from the Facid as follows: Use all characters of the Facid up until (and excluding) the "F", appended with "c1c2" or "c3" for sources for which c1/c2 or c3 emissions occur at the port, respectively. The FIPS is excluded in order to keep the source id below 13 characters.

Source Naming Convention for the underway run group

Information on the grid cell will not be part of the source id but rather will be provided as a separate field in the helper files.

The sourceid will be 2 character string for ship type (i.e., c1 representing c1/c2 Or c3 representing c3) concatenated with "_", grid cell size, "_" and number. E.g., c1_12_1; c3_12_1 for CONUS 12km grid cell.

Location files

Table 1 Fields for CMV Location Helper Files – Port Run Group

Filename **CMVP_[grid]_ locations.csv**, 1 row per polygon/ship type (c1c2 vs c3) combination (i.e., one row per AERMOD source)	
fieldname	**Description**
State 2 digit FIPS	Meta data, not used, based on the FIPS which is part of the FacId (5 digits after "F")
FIPS	Meta data, not used
Facid	This is basically an id for the shape that includes the FIPS in it. Concatenation of "P", shapeid, "F", 5-digit FIPS
Source id	ID representing the Shape/type of ship Append P", shapeid, "c1c2" or "c3" for sources for which c1/c2 or c3 emissions occur at the port, respectively
Source Type	AREAPOLY
COL	CMAQ grid cell (used as the MET cell) which contains most of the emissions of the polygon shape
ROW	
x-coord- (UTM)	UTM x for one vertex of the polygon shape based on the lat lon in the polygon vertices file and the UTM zone
y-coord- (UTM)	UTM y for one vertex of the polygon shape
UTM zone	Zone of UTM –use the SW corner the CMAQ grid cell (MET cell) which contains most of the emissions of the polygon shape
lon	Decimal degrees longitude of 1st vertex of polygon shape
lat	Decimal degrees latitude of 1st vertex of polygon shape
Suggested QA 1. Ensure each source id is unique. 2. Count the number of unique source ids and provide in QA output file 3. Make sure each polygon is in a single UTM zone 4. Compare FF10 lat lon (chosen to be the MET grid cell center if there is more than 1) with helper lat lon – they shouldn't be the same (one is polygon vertex and the other is center of grid cell) but would also not be wildly different (i.e., outside of 0.15 degrees).	

Table 2 Fields for CMV Location Helper Files – Underway Run Group

Filename **CMVU_[grid]_locations.csv** 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 (grid=12); Alaska uses 9AK1; Hawaii uses 3HI1 and Puerto Rico and the Virgin Islands use 3PR1.

field	description
rungroup	Name of the run group with domain included. e.g.; CMVU12
State 2 digit FIPS	This is used to identify the file that this grid cell uses for the hourly profile information
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	For CMV underway, there will be up to 2 source ids per grid cell depending on whether the grid cell has both c1c2 and c3 emissions. The sourceid will be 2 character string for ship type (i.e., c1 representing c1/c2 Or c3 representing c3) concatenated with "_", grid cell size, and "_1" E.g., c1_12_1; c3_12_1 for CONUS 12km grid cell and c1_3_1 for 3HI1 source.
UTM_X of the center of the MET cell	Approximate the center of the grid cell UTM which is computed based on lat/lon of SW corner and lat/lon of NE corner and taking the average
UTM_Y of the center of the MET cell	Approximate the center of the grid cell UTM which is computed based on lat/lon of SW corner and lat/lon of NE corner and taking the average
UTM ZONE	The UTM zone is based on the SW corner of the MET cell
Longitude of center of source (decimal degrees)	Not used by AERMOD
Latitude of center of source (decimal degrees)	Not used by AERMOD

Suggested QA procedures for the CMVU_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
3. Check the helper file grid cell center and compare to FF10 grid cell center and make sure its not larger than grid cell length EXCEPT for inventory longitudes at 179 (due to the method for getting the helper file grid cell center, the difference may be large but not larger than the length of a grid cell and the approach does not work where grid cells are on/near boundaries of hemispheres or near North Pole).

AREA Source Parameter Files (**RELEASE PARAMETER FILES AND VERTICES)**

Table 3 Fields for Area Source Parameter Helper Files for the CMV Port Rungroup Sources

Filename **CMVP_[grid]_area_parameters.csv** **1 row per source id and vertex.**	
field	**description**
State 2 digit FIPS	
Facid	This is basically an id for the shape that includes the FIPS in it. Concatenation of "P", shapeid, "F", 5-digit FIPS

Source id	ID representing the Shape/type of ship Append P", shapeid, "c1c2" or "c3" for sources for which c1/c2 or c3 emissions occur at the port, respectively.
SOURCE TYPE	AREAPOLY
area	area of the polygon in square meters from the POLYGON file.
RELEASE HEIGHT (M)	C1/c2 Sources – i.e., those that have c1c2 appended to them have a release height of 8.4 meters. (27.56 ft) C3 have the same release height we are using in CMAQ which is 65.62 ft (20 m) for all C3 sources.
Number of vertices	NUMVERT From the POLYGON file
SZ (M)	C1/c2 Sources – SZ is RH/2.15 C3 – The sigmaz is developed to account for the plume rise that occurs in CMAQ. For every county, we found that 50% of the emissions were above layer 3 and 50% were below. layer 3 is 60.7 meters. Therefore sigmaz is 60.7-20=40.7 m for all c3 sources.
UTM_X coord-i	VERTICES are in any order, but the first one must be the same one listed in the Location file.
UTM_y coord-i	VERTICES are in any order, but the first one must be the same one listed in the Location file.
Lon coord-i	Longitude associated with the UTM coordinate i, decimal degrees
Lat coord-i	Latitude associated with the UTM coordinate i, decimal degrees
Suggested QA procedures for the CMVP_area_parameters.csv file 1. Check that this file and the location file has exactly the same source ids in them.	

Table 4 Fields for Area Source Parameter Helper Files for the CMV Underway Rungroup Sources

Filename **CMVU_[grid]_area_parameters.csv**, where "rungroup" is the name of the run group. One row per Source	
field	**description**
rungroup	Name of the run group with domain included. e.g.; CMVU12
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	For CMV underway, there will be up to 2 source ids per grid cell depending on whether the grid cell has both c1c2 and c3 emissions. The sourceid will be 2 character string for ship type (i.e., c1 representing c1/c2 Or c3 representing c3) concatenated with "_", grid cell size, "_" and number. E.g., c1_12_1; c3_12_1 for CONUS 12km grid cell.
Release height (m)	C1/c2 Sources – i.e., those that have c1 appended to them have a release height of 8.4 meters. (27.56 ft) C3 have the same release height we are using in CMAQ which is 65.62 ft (20 m) for all C3 sources.
Number of vertices	4

Initial vertical dispersion, or Sigma z (m)	C1/c2 Sources – SZ is RH/2.15 C3 – The sigmaz is developed to account for the plume rise that occurs in CMAQ . For every county, we found that 50% of the emissions were above layer 3 and 50% were below. layer 3 is 60.7 meters. Therefore sigmaz is 60.7-20=40.7 m for all c3 sources.
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 CMVU_area_parameters.csv

1. The Number of sources in this file should equal the number of sources in the **CMVU_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 **CMVU_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 in this table
5. Sigmaz matches the value in this table
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 (3,9,12km).

TEMPORAL Factor files – factors are provided by shape, for the port run group and by grid cell for the underway run group

So as to minimize the number of actual temporal files, we put many sets of temporal factors into a single state file for each of the two run groups.

Table 5 Fields for CMV hourly factors by Shape/Source

Filename CMVP**_[grid]_statefips_hourly.csv** 1 row per, month/day/hour/shapeid for c3 and 1 row per month/day/hour/shapeid for c1/c2 (up to 8760*2 rows per file). Each file contains 2 sets (c1c2 & c3) of temporal factors (2 sets of 8760 records) for each shape in the state.	
field	**description**
rungroup	Name of the run group with domain included. e.g.; CMVP12
facid	Concatenation of "P", shapeid, "F", 5-digit FIPS
Source id	ID representing the Shape/type of ship Append P", shapeid, "c1c2" or "c3" for sources for which c1/c2 or c3 emissions occur at the port, respectively.
YEAR (2-digit)	
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 12:59am is hour 1, and is based on **standard** local time)
Scalar	$Scalar_{hour\text{-}i}$= (CO* emissions for all run group sources in the gridcell)$_{hour\text{-}i}$ / $\Sigma_{all\ hours}$(CO* emissions for all run group sources in the gridcell) These should be provided to at least 12 values after the decimal. *Note that CO is carbon monoxide emissions summed across all SCCs for the ship type. However, CO does not have to be used -- the user can specify a different criteria air pollutant (VOC or PM2.5 for example) to use for creating the temporal scalars.
Suggested QA procedures for the CMVP_statefips_hourly.csv files 1. sum factors by source id. Should sum to 1. 2. if the grid cell has both source types then the numberof rows is 8760*2 per grid cell	

Table 6 Fields for CMV hourly factors by Grid Cell

Filename **CMVU_statefips_hourly.csv** 1 row per, month/day/hour/gridcell for c3 and 1 row per month/day/hour/gridcell for c1/c2 (up to 8760*2 *# grid cells = rows per file). Each file contains 2 sets (c1c2 & c3) of temporal factors (2 sets of 8760 records) for each gridcell covered in the state file.	
field	**description**
rungroup	Name of the run group with domain included. e.g.; CMVU12

GridCell	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	The sourceid will be 2 character string for ship type (i.e., c1 representing c1/c2 Or c3 representing c3) concatenated with "_", grid cell size, "_" and number. E.g., c1_12_1; c3_12_1 for CONUS 12km grid cell.
YEAR (2-digit)	
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 12:59 am is hour 1, and is based on **standard** local time)
Scalar	$Scalar_{hour\text{-}i}$= (CO emissions for all run group sources in the gridcell)$_{hour\text{-}i}$ / $\Sigma_{all\ hours}$(CO emissions for all run group sources in the gridcell) These should be provided to at least 12 values after the decimal. *Note that CO is carbon monoxide emissions summed across all SCCs for the ship type. However, CO does not have to be used -- the user can specify a different criteria air pollutant (VOC or PM2.5 for example) to use for creating the temporal scalars.
Suggested QA procedures for the CMVU_statefips_hourly.csv files 1. sum factors by source id. Should sum to 1. 2. if the grid cell has both source types then the numberof rows is 8760*2 3. Plot the scalars for counties in selected states e.g., LA, NY	

AFTER-AERMOD Emissions files

For the "After AERMOD" (i.e., post processing after AERMOD is run), SMOKE should produce pollutant specific emissions by polygon or grid cell source id, source group and pollutant name. For underway, the emissions are ALSO by FIPS for QA purposes. Because HAPs are not contained in the starting point FF10 files, we have decided to apply ratios of HAP to VOC and HAP to PM2.5 and set diesel PM equal to PM10 as part of the AERMOD post processing as opposed to creating pollutant-specific emissions helper files for all pollutants using SMOKE4AERMOD.

For CMV, we are creating annual chi/q so the emissions are annual.

Table 7 Fields for CMV Port EMISSIONS Helper Files

Filename **CMVP__[grid]_emis.csv** One row per SMOKE name pollutant and source. There are 3 pollutants in this file: VOC, PM2.5 and PM10	
Field name	**description**
State 2 digit FIPS	
Run group	Name of the run group with domain included. e.g.; CMVP12
Facid	This is basically an id for the shape that includes the FIPS in it. Concatenation of "P", shapeid, "F", 5-digit FIPS
Source id	Same as in location helper file
Source group	For port the source group is either "NR-C1C2_ports"or "NR-C3_ports" depending on the Source id

pollutant name	Should include only PM10, VOC, PM25
Emissions (tons)	Emissions for the port source id for the pollutant
Suggested QA procedures for the CMVP_emis.csv file 1. Check all facids and source ids that are in the locations file are in this file 2. Sum emissions by county and ship type and they should match the FF10	

Table 8 Fields for Underway CMV EMISSIONS Helper Files

Filename **CMVU_[grid]_emis.csv** One row per SMOKE name pollutant and source	
Field name	**description**
Run group	Name of the run group with domain included. e.g.; CMVU12
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	Same as in location helper file
Source group	For underway the source group is "NR-C1C2C3_underway"
pollutant name	Should include only PM10, VOC, PM25
Emissions (tons)	Emissions for the portion of the source/pollutant in the county and gridcell
Suggested QA procedures for the CMV_emis.csv file 1. Check all facids and source ids that are in the locations file are in this file 2. Sum emissions by county and ship type and they should match the NEI (other than for FIPS 98 or FIPS 85)	