FLAT FILE GENERATION METHODOLOGY

Version: May 2019 Reference Case using EPA Platform v6

SECTION I: INTRODUCTION

This document provides the flat file generation methodology for the May 2019 Reference Case using EPA Platform v6. The methodology takes Integrated Planning Model (IPM®) run results and generates the formatted flat file that the U.S. Environmental Protection Agency (U.S. EPA) uses as inputs into air-quality modeling framework. Section II provides data descriptions. Section III (see page 2) describes data processing steps in detail. Section IV (see page 12) describes the layout of the formatted flat file.

SECTION II: DATA DESCRIPTIONS

IPM run results: This file contains IPM run results that have been disaggregated to the unit, emission control technology, and fuel type level. The file provides records of existing and retrofitted units and committed and new-build aggregates[1]. The committed and new-build aggregates are hereafter referred to as "generic" aggregates. All records contain:

i. Population characteristics including state FIPS codes, county FIPS codes, recognized ORIS codes (<80,000), and unit IDs for existing and retrofitted units. Generic aggregates have state level information only.
ii. Sulfur dioxide (SO_2), nitrogen oxides (NO_x), and particulate matter (PM) control information for existing and retrofitted units as well as generic aggregates.
iii. Annual and seasonal heat input (TBtu).
iv. Heat contents (MMBtu/ton, K gallon, MMcf) and SO_2 and ash contents (lb/MMBtu).
v. Annual and summer NO_x emissions (MTon), annual SO_2 emissions (MTon), HCL emissions (MTon), and mercury emissions (Ton).

Table 1 provides the rest of the input data descriptions and table locations.

Table 1. Input Data Descriptions and Locations

No.	Table Name	Description	Location
1	EIS	This table contains Emission Inventory System (EIS) unit-specific data that include unit facility name, facility code, boiler ID, tribal code, reg code, NAICS, longitude, latitude, facility ID, unit ID, release point ID, process ID, agency facility ID, agency unit ID, agency release point ID, agency process ID, stack height, stack diameter, stack temperature, stack flow, and stack velocity.	FlatFile_Inputs.xls
2	GenericUnitSite	This table contains all existing plants that serve as sister plants in siting generic units. The data include NEEDS v6 plant's state FIPS code, county FIPS code, county's most recent 8 hour ozone or $PM_{2.5}$ attainment/non-attainment status, ORIS code, latitude-longitude coordinates, and zip code.	FlatFile_Inputs.xls
3	LatLonDefault	This table contains latitude-longitude coordinates by ORIS code, state FIPS code, and county FIPS code.	FlatFile_Inputs.xls
4	SCC	This table contains Source Classification Codes (SCCs) by plant type, fuel type, coal rank, firing, and bottom type (for boilers).	Table 6
5	PlantTypeStackParameters	This table contains stack parameters (height, diameter, temperature, and velocity) by plant type.	Table 7

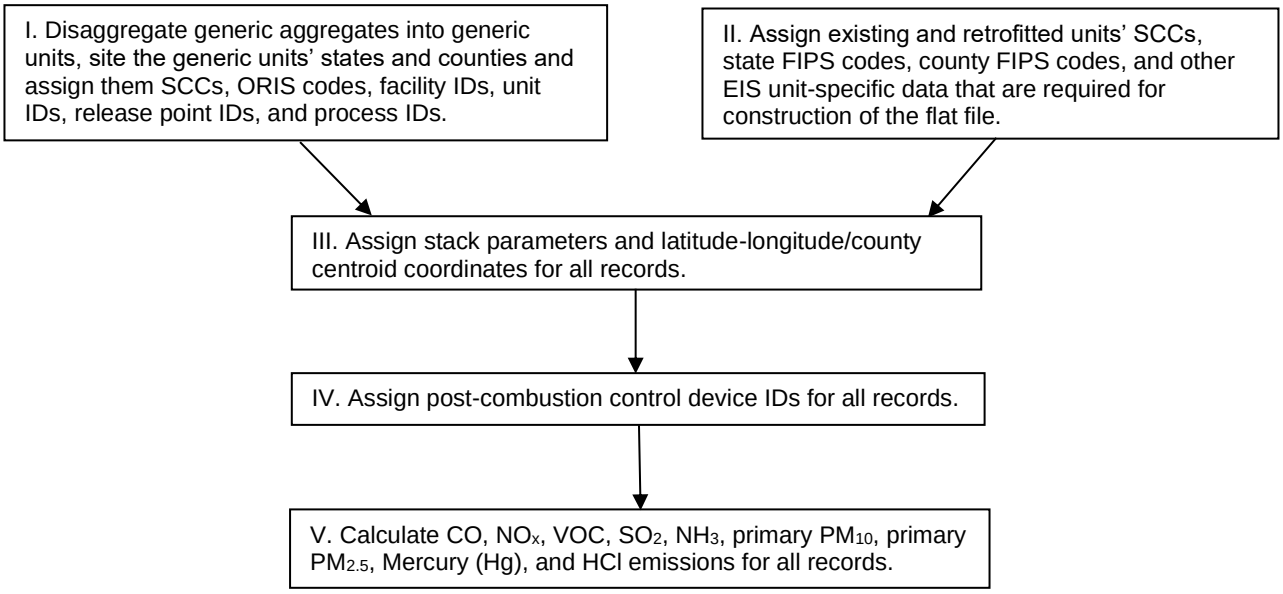
[1] All fossil, geothermal, landfill gas, non-fossil waste, municipal solid waste, tires, and biomass fired units are included in this process. Nuclear, hydro, wind, solar, fuel cell, and energy storage units are not included.

No.	Table Name	Description	Location
6	SCCDefaultStackParameters	This table contains default stack parameters (height, diameter, temperature, and velocity) by SCC.	Table 8
7	ControlDevices	This table contains post-combustion control devices and their associated control IDs.	Table 9
8	CO, VOC, and NH_3 Emission Factors	This table contains carbon monoxide (CO), volatile organic compounds (VOC), and ammonia (NH_3) emission factors for existing units of plant types Landfill Gas, Non-fossil Waste, and Municipal Solid Waste.	FlatFile_Inputs.xls
9	Generic CO, VOC, and NH_3 Emission Factors	This table contains CO, VOC, and NH_3 emission factors for generic units.	Table 10
10	SCCDefaultHeatContent	This table contains default heat contents by SCC.	Table 11
11	SCCEmsFac	This table contains emission factors for CO, VOC, and NH_3.	Table 12
12	PM_{10} and $PM_{2.5}$ Emission Factors	This table contains PM_{10} and $PM_{2.5}$ emission factors for existing units.	FlatFile_Inputs.xls
13	Generic PM_{10} and $PM_{2.5}$ Emission Factors	This table contains PM_{10} and $PM_{2.5}$ emission factors for generic units.	Table 13

SECTION III: DETAILED DATA PROCESSING

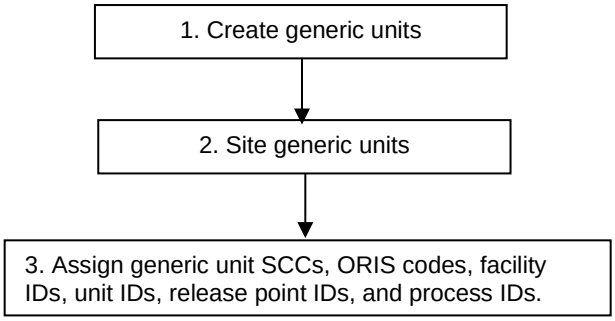
Flow Chart 1 describes general data processing steps. A more detailed description of each step is provided in the subsections followed.

Flow Chart 1. Data Processing Steps



Step 1. Disaggregate Generic Aggregates into Individual Generic Units, Site the Generic Units to their States and Counties and Assign SCCs, ORIS Codes, Facility ID's, Release Point IDs, and Process IDs: Generic unit data are prepared by transforming the generic aggregates into units similar to existing units in terms of the available data. First, the generic aggregates are disaggregated to create generic units. Second, the generic units are sited and given the state, county, and county-centroid based latitude-longitude coordinates. Third, the generic units are assigned SCCs, ORIS codes, facility IDs, unit IDs, release point IDs, and process IDs. This process is performed in three steps as described in Flow Chart 2.

Flow Chart 2. Generic Unit Processing



1. Creating generic units: Generic aggregates are first disaggregated to create generic units. The process entails two steps: i) The generic aggregates are first aggregated by state, plant type and, for coal steam and IGCC, and coal rank. Ii) They are then split into smaller generic units by dividing the aggregated capacity by a reference capacity. The result is the number of generic units to be created in a given state for each plant type and fuel type. The reference capacity is varied by plant type as shown in Table 2.

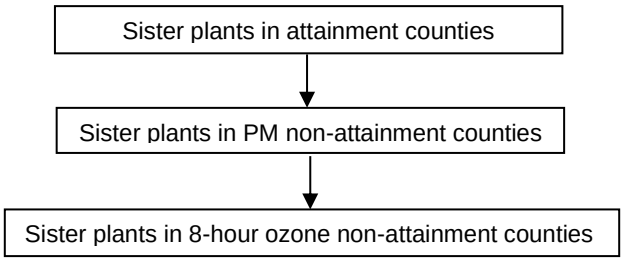
Table 2. Generic Unit Reference Capacity

Plant Type	Reference Capacity (MW)
Biomass	600
Coal Steam	600
Combined Cycle	250
Combustion Turbine	160
Fossil Waste	030
IGCC	550
Oil/Gas Steam	100
Landfill Gas	030
Geothermal	030

Aggregated heat input and emissions are then divided evenly among all generic units created in a given state for each plant type.

2. Siting generic units: The generic units are given a state FIPS code, county FIPS code, and latitude-longitude based on an algorithm that sites generic units in counties within their respective states. The generic unit siting data table, GenericUnitSite, is used in this algorithm to assign each generic unit a sister plant that is in a county based on the county's attainment/non-attainment status. Within a state the hierarchy for assignment of sister plants in the order of county code then ORIS code is shown in Flow Chart 3. All generic units are sited so that their ORIS codes are unique, and the same ORIS code has the same county and latitude-longitude across all runs of the same base case origin.

Flow Chart 3. Generic Unit Siting Hierarchy



3. Assigning generic unit SCCs, ORIS codes, facility IDs, unit IDs, release point IDs, and process IDs: SCC assignment is based on unit's plant type, fuel type, and coal rank as shown in Table 3. Generic unit ORIS code consists of a six-digit number. The units are first sorted by plant type in the order of combined cycle, fossil waste, combustion turbine, IGCC, and coal steam.

Table 3. Generic Unit SCC

Plant Type	Fuel Type / Coal Rank	SCC
Coal Steam	Bituminous	10100202
Coal Steam	Subbituminous	10100222
Coal Steam	Lignite	10100301
Fossil Waste	Process Gas	10100701
Biomass	Biomass	10100902
Combined Cycle	Natural Gas	20100201
Combined Cycle	Oil	20100101
Combustion Turbine	Natural Gas	20100201
Combustion Turbine	Oil	20100101
IGCC	Coal	20100301
IGCC	Petroleum Coke	20100301
Oil/Gas Steam	Natural Gas	10100601
Landfill Gas	Landfill Gas	00000000
Geothermal	Geothermal	00000000

Then generic unit ORIS codes are assigned. The first digit of the ORIS code represents the unit's plant type as shown in Table 4. The next three digits are a counter, starting with "000" and incrementing with each generic unit created within a given state for each plant type. The last two digits are the state FIPS code. For example, the first combined-cycle generic unit in Arizona used in the example above has a plant ID of "ORIS700104".

Table 4. Generic Unit 1st Digit ORIS Code

Plant Type	1st Digit of the ORIS Code
Biomass	3
Coal Steam	9
Combined Cycle	7
Combustion Turbine	8
Fossil Waste	5
Geothermal	2
IGCC	6
Landfill Gas	1
Oil/Gas Steam	4

Generic unit's facility ID consists of a concatenation of the word "ORIS" and the unit's ORIS code. Generic unit's unit ID consists of a concatenation of a three-letter unit ID code representing the unit's plant type as shown in Table 5 and the unit's state FIPS code. For example, the first combined-cycle generic unit in Arizona used in the example above has a unit ID of "ORISGCC04".

Table 5. Generic Unit ID Code

Plant Type	Unit ID Code
Biomass	GSC
Coal Steam	GSC
Combined Cycle	GCC
Combustion Turbine	GGT
Fossil Waste	GFW
Geothermal	GGE
IGCC	IGC
Landfill Gas	GLF
Oil/Gas Steam	GSC

Generic unit's release point ID is the same as the unit's unit ID. Generic unit's process ID is the same as the unit's facility ID.

Step 2. Assigning Existing and Retrofitted Unit's SCCs, State FIPS Codes, County FIPS Codes, Facility IDs, Release Point IDs, Process IDs, and Other EIS Unit-Specific Data That Are Required for Construction of the Flat File.

First, existing and retrofitted units' SCCs are assigned. SCC, or Source Classification Code, describes a generating unit's characteristics. The assignment of SCC for existing and retrofitted units is based on a unit's configuration that includes plant type, fuel type, and, if it's a boiler, firing and bottom type. The SCC is an eight-digit numeric code that describes characteristics of the units. Beginning from the left the first digit of the SCC represents the type of unit (boiler [=1] or turbine [=2]). The third digit of the SCC represents the economic sector of the unit (electric power sector=1). And the fifth through eighth digits of the SCC represent the unit's attributes including fuel type and, if a boiler, bottom and firing type. The second and fourth digits are zero. Table 6 displays the SCCs.

Table 6. SCC Assignment for Existing and Retrofitted Units

Plant Type	Boiler / Generator	Fuel Type / Coal Rank	Firing	Bottom	SCC
Coal Steam	Boiler/Generator	Bituminous		Wet	10100201
Coal Steam	Boiler/Generator	Bituminous	Vertical	Wet	10100201
Coal Steam	Boiler/Generator	Bituminous	Wall	Wet	10100201
Coal Steam	Boiler/Generator	Bituminous	Vertical	Dry	10100202
Coal Steam	Boiler/Generator	Bituminous	Wall	Dry	10100202
Coal Steam	Boiler/Generator	Bituminous		Dry	10100202
Coal Steam	Boiler/Generator	Bituminous			10100202
Coal Steam	Boiler/Generator	Bituminous	Wall		10100202
Coal Steam	Boiler/Generator	Bituminous	Vertical		10100202
Coal Steam		Bituminous	Turbo		10100202
Coal Steam	Boiler/Generator	Bituminous	Cyclone	Wet	10100203
Coal Steam	Boiler/Generator	Bituminous	Cyclone	Dry	10100203
Coal Steam	Boiler/Generator	Bituminous	Cyclone		10100203
Coal Steam	Boiler/Generator	Bituminous	Stoker/SPR	Wet	10100204
Coal Steam	Boiler/Generator	Bituminous	Stoker/SPR		10100204
Coal Steam	Boiler/Generator	Bituminous	Stoker/SPR	Dry	10100204
Coal Steam	Boiler/Generator	Bituminous	Tangential	Wet	10100211
Coal Steam	Boiler/Generator	Bituminous	Tangential		10100212
Coal Steam	Boiler/Generator	Bituminous	Tangential	Dry	10100212
Coal Steam	Boiler/Generator	Bituminous	Cell	Wet	10100215
Coal Steam	Boiler/Generator	Bituminous	Cell		10100215
Coal Steam	Boiler/Generator	Bituminous	Cell	Dry	10100215
Coal Steam	Boiler/Generator	Bituminous	FBC		10100218
Coal Steam	Boiler/Generator	Bituminous	FBC	Wet	10100218
Coal Steam	Boiler/Generator	Bituminous	FBC	Dry	10100218
Coal Steam	Boiler/Generator	Subbituminous		Wet	10100221
Coal Steam	Boiler/Generator	Subbituminous	Wall	Wet	10100221

Plant Type	Boiler / Generator	Fuel Type / Coal Rank	Firing	Bottom	SCC
Coal Steam	Boiler/Generator	Subbituminous	Vertical	Wet	10100221
Coal Steam	Boiler/Generator	Subbituminous			10100222
Coal Steam	Boiler/Generator	Subbituminous		Dry	10100222
Coal Steam	Boiler/Generator	Subbituminous	Vertical	Dry	10100222
Coal Steam	Boiler/Generator	Subbituminous	Wall	Dry	10100222
Coal Steam	Boiler/Generator	Subbituminous	Wall		10100222
Coal Steam	Boiler/Generator	Subbituminous	Cyclone	Dry	10100223
Coal Steam	Boiler/Generator	Subbituminous	Cyclone	Wet	10100223
Coal Steam	Boiler/Generator	Subbituminous	Cyclone		10100223
Coal Steam	Boiler/Generator	Subbituminous	Stoker/SPR		10100224
Coal Steam	Boiler/Generator	Subbituminous	Stoker/SPR	Wet	10100224
Coal Steam	Boiler/Generator	Subbituminous	Stoker/SPR	Dry	10100224
Coal Steam	Boiler/Generator	Subbituminous	Tangential	Wet	10100226
Coal Steam	Boiler/Generator	Subbituminous	Tangential	Dry	10100226
Coal Steam	Boiler/Generator	Subbituminous	Cell	Wet	10100235
Coal Steam	Boiler/Generator	Subbituminous	Cell	Dry	10100235
Coal Steam	Boiler/Generator	Subbituminous	Cell		10100235
Coal Steam	Boiler/Generator	Subbituminous	FBC	Dry	10100238
Coal Steam	Boiler/Generator	Subbituminous	FBC	Wet	10100238
Coal Steam	Boiler/Generator	Subbituminous	FBC		10100238
Coal Steam	Boiler/Generator	Lignite	Wall	Dry	10100301
Coal Steam	Boiler/Generator	Lignite		Wet	10100301
Coal Steam	Boiler/Generator	Lignite	Tangential	Wet	10100302
Coal Steam	Boiler/Generator	Lignite	Tangential	Dry	10100302
Coal Steam	Boiler/Generator	Lignite	Cyclone		10100303
Coal Steam	Boiler/Generator	Lignite	Cyclone	Wet	10100303
Coal Steam	Boiler/Generator	Lignite	Stoker/SPR	Wet	10100306
Coal Steam	Boiler/Generator	Lignite	Stoker/SPR		10100306
Coal Steam	Boiler/Generator	Lignite	Stoker/SPR	Dry	10100306
Coal Steam	Boiler/Generator	Lignite	FBC		10100318
Coal Steam	Boiler/Generator	Lignite	FBC	Wet	10100318
Coal Steam	Boiler/Generator	Lignite	FBC	Dry	10100318
O/G Steam	Boiler/Generator	Oil			10100401
O/G Steam	Boiler/Generator	Oil	Wall	Dry	10100401
O/G Steam	Boiler/Generator	Oil	Tangential		10100404
O/G Steam		Orimulsion	Wall		10100409
O/G Steam		Orimulsion	Other		10100409
O/G Steam	Boiler/Generator	Natural Gas			10100601
O/G Steam	Boiler/Generator	Natural Gas	Wall		10100601
O/G Steam	Boiler/Generator	Natural Gas	Wall	Dry	10100601
O/G Steam		Natural Gas	Wall	Wet	10100601
O/G Steam		Natural Gas	Vertical	Dry	10100601
O/G Steam		Natural Gas	Vertical		10100601
O/G Steam	_	Natural Gas	Cell	_	10100601
O/G Steam		Natural Gas	Cyclone	Dry	10100601
O/G Steam		Natural Gas	Cyclone	Wet	10100601
O/G Steam		Natural Gas	Cyclone		10100601
O/G Steam		Natural Gas	Other	Dry	10100601
O/G Steam		Natural Gas	Tangential	Dry	10100604
O/G Steam		Natural Gas	Tangential	Wet	10100604
O/G Steam	Boiler/Generator	Natural Gas	Tangential		10100604
Fossil Waste	Boiler	Process Gas			10100701
Coal Steam	Boiler/Generator	Petroleum Coke	Vertical	Dry	10100801
Coal Steam		Petroleum Coke	Wall		10100801
Coal Steam	Boiler/Generator	Petroleum Coke			10100801
Coal Steam	Boiler/Generator	Petroleum Coke	FBC	Dry	10100818
Coal Steam	Boiler/Generator	Biomass			10100902
Coal Steam	Boiler/Generator	Waste Coal			10102001

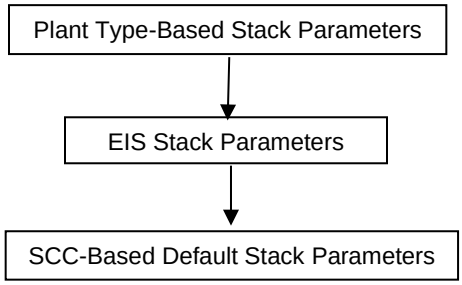
Plant Type	Boiler / Generator	Fuel Type / Coal Rank	Firing	Bottom	SCC
Coal Steam	Boiler/Generator	Waste Coal	Wall		10102001
Coal Steam	Boiler/Generator	Waste Coal	FBC		10102018
Combined Cycle	Generator	Oil			20100101
Combustion Turbine	Boiler/Generator	Oil			20100101
Combined Cycle	Boiler/Generator	Natural Gas			20100201
Combined Cycle		Natural Gas			20100201
Combustion Turbine	Boiler/Generator	Natural Gas			20100201
Fossil Waste	Generator	Process Gas			20100201
IGCC	Boiler/Generator				20100301

We then assign existing and retrofitted units' state FIPS codes, county FIPS codes, facility IDs, release point IDs, and process IDs. State FIPS codes, county FIPS codes, facility IDs, release point IDs, and process IDs are obtained from the EIS unit-specific data table. Where the EIS provides no data, default values are used. Appendix A describes the default values in detail.

Step 3. Assigning Stack Parameters and Latitude-Longitude/County Centroid Coordinates for All Units

Stack Parameters: Existing and retrofitted unit's stack parameters are assigned based on the hierarchy described in Flow Chart 4.

Flow Chart 4. Stack Parameters Assignment Hierarchy



Stack parameters are first assigned based on plant type as shown in Table 7.

Table 7. Plant Type-Based Stack Parameters

Plant Type	Stack Height (ft)	Stack Diameter (ft)	Stack Temperature (degree F)	Stack Velocity (ft/sec)	Stack Flow (cft/sec)
IGCC	150	19	340	75.8	21491.48

If Table 7 provides no plant type-based stack parameters, the units are assigned EIS stack parameters from the EIS unit-specific data table. If the EIS data table provides no stack parameters, the units are assigned default stack parameters based on a unit's SCC as shown in Table 8.

Table 8. SCC-Based Default Stack Parameters

SCC	Stack Height (ft)	Stack Diameter (ft)	Stack Temperature (ºF)	Stack Velocity (ft/sec)
10100201	603.2	19.8	281.2	076.5
10100202	509.7	14.6	226.0	062.0
10100203	491.6	16.6	278.4	080.5
10100204	225.0	00.6	067.2	002.4
10100211	490.0	17.4	280.0	076.4
10100212	445.6	17.4	275.2	077.6
10100215	509.7	14.6	226.0	062.0
10100218	399.3	10.8	245.6	040.1
10100221	983.0	22.8	350.0	110.0

SCC	Stack Height (ft)	Stack Diameter (ft)	Stack Temperature (ºF)	Stack Velocity (ft/sec)
10100222	468.5	16.0	254.7	065.6
10100223	446.8	15.9	308.0	093.6
10100224	255.5	10.0	251.3	015.3
10100226	495.8	18.9	259.2	091.2
10100235	468.5	16.0	254.7	065.6
10100238	600.0	22.5	315.0	078.0
10100301	427.5	22.3	232.8	074.2
10100302	483.5	21.0	229.4	092.4
10100303	462.0	21.7	271.3	072.5
10100306	300.0	07.2	441.0	067.0
10100318	326.7	12.3	326.7	074.7
10100401	252.9	10.1	258.1	042.6
10100404	322.1	14.0	301.8	062.8
10100409	252.9	10.1	258.1	042.6
10100601	263.9	10.3	236.0	046.9
10100604	308.0	15.2	275.2	066.0
10100701	239.2	09.4	238.0	042.3
10100801	371.3	05.5	122.4	020.4
10100818	399.3	10.8	245.6	040.1
10100902	303.4	03.3	137.7	016.1
10102001	509.7	14.6	226.0	062.0
10102018	399.3	10.8	245.6	040.1
20100101	057.7	09.6	655.8	064.9
20100201	062.0	10.0	585.3	061.3
20100301	150.0	19.0	340.0	075.8

Generic units are assigned SCC-based default stack parameters.

Stack flow data are assigned from the EIS data table for all existing and retrofitted units, except for IGCC units which receive default stack flow by plant type as shown in Table 7. If the EIS data table does not provide stack flow data or if the SCC-based default stack parameters are assigned, stack flows are calculated as follows:

$$Stack\ Flow\ (cft/sec) = 3.141592 * \left(\frac{Stack\ Diameter\ (ft)}{2} \right)^2 * Stack\ Velocity\ (ft/sec)$$

Coordinates: Latitude-longitude coordinates are assigned from the EIS data table. If the EIS data table provides no data, latitude-longitude coordinates are assigned based on a unit's sister ORIS code from the table LatLonDefault or based on the county centroid.

Step 4. Assigning Post-Combustion Control Device IDs for All Units

Control IDs are assigned reflecting all post-combustion control devices at a unit in a particular projection year. The control devices reflect both existing and refrofit controls. Table 9 lists the control devices and their associated control IDs.

Table 9: Post-Combustion Control Devices

Control ID	Description
119	Dry FGD
139	SCR
140	SNCR or other NO_X
141	Wet FGD
206	DSI
207	ACI

Step 5. Calculating CO, NO_x, VOC, SO_2, NH_3, Primary PM_{10}, Primary $PM_{2.5}$, Mercury (Hg), and HCl Emissions

Emissions are calculated at three levels: annual, seasonal, and monthly emissions.

Annual emission calculations:

i. Annual NO_x, SO_2, mercury (Hg), and HCl emissions (tons) are taken directly from IPM run results.

ii. Annual CO, VOC, and NH_3 emissions (tons) for units of plant types Landfill Gas, Non-fossil Waste, and Municipal Solid Waste are calculated by multiplying the unit's generation and unit specific emission factors as follows:

$$Annual\ Emission_{Pollutant}\ (tons) = Annual\ Generation\ (MWh) * Unit\ Specific\ Emission\ Factor_{Pollutant}\ (ton/MWh)$$

For existing units, unit specific emission factors for CO, VOC, and NH_3 are provided in the COVOCNH3EmissionFactors table. For generic units, emission factors for CO, VOC, and NH_3 are assigned by plant type as shown in Table 10.

Table 10: Generic CO, VOC, and NH_3 Emission Factors (Ton/MWh)

Plant Type	CO EF	VOC EF	NH_3 EF
Landfill Gas	0.00336001	0.00038188	0.00000432
Municipal Solid Waste	0.00035865	0.00002872	0.00001893

Note: CO, VOC, and NH_3 emissions are not calculated for Geothermal and Tires.

iii. Annual CO, VOC, and NH_3 emissions (tons) for units of the remaining plant types are calculated by multiplying the unit's fuel use and emission factors as follows:

$$Annual\ Emissions_{Pollutant}\ (tons) = \frac{Annual\ Fuel\ Use\ (ton, K\ gallon, MMcf) * Emission\ Factor_{Pollutant}\ (lb\ per\ ton, K\ gallon, MMcf)}{2000\ (lb/ton)}$$

Where 2000 converts lb to short ton and the pollutants are CO, VOC, and NH_3. Annual Fuel Use (ton, K gallon, MMcf) is calculated from IPM run results, which are in MMBtu of annual heat input and converted into physical units of annual fuel use as follows:

$$Fuel\ Use\ (ton, K\ gallon, MMcf) = \left(\frac{Heat\ Input\ (MMBtu)}{Heat\ Content\ (MMBtu\ per\ ton, K\ gallon, MMcf)}\right)$$

Where Heat Content (MMBtu per ton, K gallon, MMcf) is assigned using May 2019 Reference Case assumptions for coal and petroleum coke units. All other units are assigned default heat contents based on the unit's SCC as shown in Table 11.

Table 11: SCC-Based Default Heat Content (MMBtu/ton, K gallon, MMcf)

SCC	Heat Content
10100401	0152
10100404	0152
10100409	0152
10100601	1024
10100604	1024
10100701	0671
10100902	0012
20100101	0138
20100201	1024

Emission factor is assigned for CO, VOC, and NH_3 based on a unit's SCC as shown in Table 12.

Table 12: SCC-Based Emission Factors (lb/ton, K gallon, MMcf)

SCC	CO EF	VOC EF	NH_3 EF
10100201	0.5	0.04	0.03
10100202	0.5	0.06	0.03
10100203	0.5	0.11	0.03
10100204	5	0.05	0.03
10100211	0.5	0.04	0.03
10100212	0.5	0.06	0.03
10100215	0.5	0.06	0.03
10100218	18	0.05	0.03
10100221	0.5	0.04	0.03
10100222	0.5	0.06	0.03
10100223	0.5	0.11	0.03
10100224	5	0.05	0.03
10100226	0.5	0.06	0.03
10100235	0.5	0.06	0.03
10100238	18	0.05	0.03
10100301	0.25	0.07	0.03
10100302	0.6	0.07	0.03
10100303	0.6	0.07	0.03
10100306	5	0.07	0.03
10100318	0.15	0.03	0.03
10100401	5	0.76	0.8
10100404	5	0.76	0.8
10100409	5	0.76	0.8
10100601	84	5.5	3.2
10100604	24	5.5	3.2
10100701	6.57	0.43	1.2
10100801	0.6	0.07	0.4
10100818	18	0.05	0.4
10100902	6.8	0.19	0.09
10102001	0.25	0.07	0.03
10102018	0.15	0.03	0.03
20100101	0.46	0.06	6.62
20100201	84	2.1	6.56
20100301	35	2.2	6.56

iv. Annual primary PM_{10} and $PM_{2.5}$ emissions (tons) are calculated by multiplying the unit's generation and unit specific emission factors for PM_{10} and $PM_{2.5}$ as follows:

$$Annual\ Emission_{Pollutant}\ (tons) = \frac{Annual\ Generation\ (MWh) * \ Unit\ level\ Emission\ Factor_{Pollutant}\ (lb/MWh)}{2000\ (lb/ton)}$$

Where 2000 converts lb to short ton and the pollutants are PM_{10} and $PM_{2.5}$. For existing units, unit specific emission factor is assigned for PM_{10} and $PM_{2.5}$ as described in Appendix B. For generic units, unit specific emission factor is assigned for PM_{10} and $PM_{2.5}$ based on plant type as shown in Table 13.

Table 13: Generic PM_{10} and $PM_{2.5}$ Emission Factors (Lb/MWh)

Plant Type	Primary PM10 EF	Primary PM2.5 EF
Ultrasupercritical Coal with 30% CCS	0.10594280	0.08338125
Ultrasupercritical Coal with 90% CCS	0.10594280	0.08338125
Ultrasupercritical Coal without CCS	0.10594280	0.08338125
Combined Cycle	0.06222523	0.06183582
Combined Cycle with Carbon Capture	0.06222523	0.06183582
Combustion Turbine	0.22368918	0.06557471
Biomass	0.14128140	0.07452200
Landfill Gas	0.35752155	0.35752155

Seasonal emission calculations:

Summer Season is the 153 days between May 1 and September 30. Summer NO_x emissions are taken directly from IPM run results. For all other pollutants, summer emissions are calculated by multiplying the annual emissions by the ratio of the summer to annual heat input.

Winter Season is the 90 days between December 1 and February 28. Winter emissions are calculated by multiplying the annual emissions by the ratio of the winter to annual heat input.

Winter Shoulder Season is the 122 days between October 1 and November 30 and March 1 and April 30. Winter Shoulder emissions are calculated by multiplying the annual emissions by the ratio of the Winter Shoulder to annual heat input.

$$Seasonal\ Emission\ (tons) = Annual\ Emissions\ (tons) * \left(\frac{Seasonal\ Heat\ Input\ (MMBtu)}{Annual\ Heat\ Input\ (MMBtu)}\right)$$

Monthly emission calculations:

Summer, Winter and Winter Shoulder monthly emissions are calculated by multiplying the seasonal emissions by the number of days in a specific month and dividing by the total number of days in that season.

SECTION IV: FLAT FILE LAYOUT:

A flat file is generated with the processed data (as explained in sections above) for use in air quality modeling work. Both criteria and HAP emissions are provided in the same file. The pollutants are provided in the following order: CO, NO_x, VOC, SO_2, NH_3, primary PM_{10}, primary $PM_{2.5}$, Mercury (Hg), and HCl.

The file's naming convention is as follows:

FlatFile_<ipm run alpha-numeric only>_<year4>_<date created using yyyymmdd>.txt

where:

year4 = 4-digit year of the emissions (e.g., 2030)
yyyy = 4-digit year
mm = 2-digit month number (e.g. 01 through 12)
dd = 2-digit date number (e.g., 01 through 31)

For example: 'FlatFile_EPA513_BC_7c_2018_20131108.txt'.

All data fields are comma-delimited and character data, including comma, semi-colon, and space, are enclosed in double-quotes.

The file contains the following header lines:

#FORMAT=ff10_POINT
#COUNTRY=US
#YEAR=<year of emissions>
#VALUE_UNITS=TON
#CREATION_DATE=<date created>
#CREATOR_NAME=US EPA-CAMD
#DATA_SET_ID=1,US EPA IPM
#COUNTRY_CD,REGION_CD,TRIBAL_CODE,EIS_FACILITY_ID,EIS_UNIT_ID,EIS_REL_POINT_ID,EIS_PROCESS_ID,AGY_FACILITY_ID,AGY_UNIT_ID,AGY_REL_POINT_ID,AGY_PROCESS_ID,SCC,POLL,ANN_VALUE,ANN_PCT_RED,FACILITY_NAME,ERPTYPE,STKHGT,STKDIAM,STKTEMP,STKFLOW,STKVEL,NAICS,LONGITUDE,LATITUDE,LL_DATUM,HORIZ_COLL_MTHD,DESIGN_CAPACITY,DESIGN_CAPACITY_UNITS,REG_CODES,FAC_SOURCE_TYPE,UNIT_TYPE_CODE,CONTROL_IDS,CONTROL_MEASURES,CURRENT_COST,CUMULATIVE_COST,PROJECTION_FACTOR,SUBMITTER_FAC_ID,CALC_METHOD,DATA_SET_ID,FACIL_CATEGORY_CODE,ORIS_FACILITY_CODE,ORIS_BOILER_ID,IPM_YN,CALC_YEAR,DATE_UPDATED,FUG_HEIGHT,FUG_WIDTH_YDIM,FUG_LENGTH_XDIM,FUG_ANGLE,ZIPCODE,ANNUAL_AVG_HOURS_PER_YEAR,JAN_VALUE,FEB_VALUE,MAR_VALUE,APR_VALUE,MAY_VALUE,JUN_VALUE,JUL_VALUE,AUG_VALUE,SEP_VALUE,OCT_VALUE,NOV_VALUE,DEC_VALUE,JAN_PCTRED,FEB_PCTRED,MAR_PCTRED,APR_PCTRED,MAY_PCTRED,JUN_PCTRED,JUL_PCTRED,AUG_PCTRED,SEP_PCTRED,OCT_PCTRED,NOV_PCTRED,DEC_PCTRED,COMMENT

The last header line contains comma-delimited field names identifying the data contained in each data field.

Appendix A

Default Values

Field Name	Default Value
COUNTRY_CD	N/A
REGION_CD	N/A
TRIBAL_CODE	N/A
EIS_FACILITY_ID	"ORIS" followed by the ORIS_FACILITY_CODE. For example, ORIS55177.
EIS_UNIT_ID	"ORIS" followed by the ORIS_BOILER_ID. For example, ORISST1.
EIS_REL_POINT_ID	"ORIS" followed by the ORIS_BOILER_ID. That is, the same as the unit ID default value.
EIS_PROCESS_ID	Use the same value as in the [IPM Y/N] field. That is, the NEEDS UniqueID.
AGY_FACILITY_ID	Blank
AGY_UNIT_ID	Blank
AGY_REL_POINT_ID	Blank
AGY_PROCESS_ID	Blank
SCC	N/A
POLL	N/A
ANN_VALUE	N/A
ANN_PCT_RED	Blank
FACILITY_NAME	NEEDS Plant Name
ERPTYPE	Blank
STKHGT	SCC-based default stack parameters from SCCDefaultStackParameters table.
STKDIAM	SCC-based default stack parameters from SCCDefaultStackParameters table.
STKTEMP	SCC-based default stack parameters from SCCDefaultStackParameters table.
STKFLOW	SCC-based default stack parameters from SCCDefaultStackParameters table.
STKVEL	SCC-based default stack parameters from SCCDefaultStackParameters table.
NAICS	Blank
LONGITUDE	County-centroid based longitude by ORIS code, state FIPS code and country FIPS code from LatLonDefault table.
LATITUDE	County-centroid based longitude by ORIS code, state FIPS code and country FIPS code from LatLonDefault table.
LL_DATUM	Blank
HORIZ_COLL_MTHD	Blank
DESIGN_CAPACITY	N/A
DESIGN_CAPACITY_UNITS	N/A
REG_CODES	Blank
FAC_SOURCE_TYPE	"125"
UNIT_TYPE_CODE	"100" for Boiler, "120" for Turbine, "140" for combined cycle (boiler/gas turbine).
CONTROL_IDS	N/A
CONTROL_MEASURES	Blank
CURRENT_COST	Blank
CUMULATIVE_COST	Blank
PROJECTION_FACTOR	Blank
SUBMITTER_ID	N/A
CALC_METHOD	N/A
DATA_SET_ID	N/A
FACIL_CATEGORY_CODE	N/A
ORIS_FACILITY_CODE	NEEDS ORIS Code
ORIS_BOILER_ID	NEEDS Unit ID
IPM_YN	N/A
INV_YEAR	N/A
DATE_UPDATED	N/A
FUG_HEIGHT	Blank
FUG_WIDTH_YDIM	Blank
FUG_LENGTH_XDIM	Blank
FUG_ANGLE	Blank
ZIPCODE	N/A
ANNUAL_AVG_HOURS_PER_YE	N/A

Field Name	Default Value
AR	
JAN_VALUE	N/A
FEB_VALUE	N/A
MAR_VALUE	N/A
APR_VALUE	N/A
MAY_VALUE	N/A
JUN_VALUE	N/A
JUL_VALUE	N/A
AUG_VALUE	N/A
SEP_VALUE	N/A
OCT_VALUE	N/A
NOV_VALUE	N/A
DEC_VALUE	N/A
JAN_PCTRED	Blank
FEB_PCTRED	Blank
MAR_PCTRED	Blank
APR_PCTRED	Blank
MAY_PCTRED	Blank
JUN_PCTRED	Blank
JUL_PCTRED	Blank
AUG_PCTRED	Blank
SEP_PCTRED	Blank
OCT_PCTRED	Blank
NOV_PCTRED	Blank
DEC_PCTRED	Blank
COMMENT	Blank

Appendix B: PM Emissions

This appendix documents the updated PM Emissions Factor Methodology. This updated approach accomplishes the following:

- Improves consistency of PM emissions rates between the reported base year (2016 NEI inventory) and future year projections (IPM post-processing outputs)
- Enhances transparency by relying on reported emissions rates where possible, and calculating estimates only when necessary.
- Expedites creation and review of future year PM projections.

The steps taken to develop the unit specific primary PM_{10} and $PM_{2.5}$ emission factors are explained below. The resulting emission factors are included in the file FlatFile_Inputs.xls.

1. Developed crosswalks between NEEDS v6 and NEI 2016, and NEEDS v6 and 2016 EIA Form 923. We identified units that have no PM emissions in NEI 2016 and for those units we reviewed additional sources. These sources included NEI 2014, California Air Resources Board 2016, California Air Resources Board 2014, New York Emission Inventory 2016, Oklahoma Annual Point Source Emissions 2016, Pennsylvania Air Emissions Report 2016, and Texas Emission Inventory 2016.

2. Calculated NEEDS unit specific primary PM_{10} and primary $PM_{2.5}$ emission factors in lb/MWh as the ratio between reported PM emissions and reported generation (for those NEEDS units with reported historic emissions and generation).

3. Estimated default primary PM_{10} and $PM_{2.5}$ emission factors by plant type and FGD control status at national level based on NEEDS units with PM emission factors available from step 2 in order to use for those NEEDS units with no matching historic emissions or generation or are considered as outliers. NEEDS units with PM emission factors considered outliers are removed while calculating the default emission factors.

4. Identified those units where historic characteristics and projected characteristics are different so that correct emissions factors can be applied. For this purpose, FGD controls and fuel types (coal or natural gas) reported in NEEDS, NEI 2016, 2016 EIA Form 923 are compared with the future year IPM projections.

5. If no FGD controls or no coal-to-gas fuel changes were projected in IPM, we used primary PM_{10} and primary $PM_{2.5}$ emissions factors calculated in step 2 to projected generation (MWh). In instances of biomass co-firing, NEI based unit-level primary PM_{10} and primary $PM_{2.5}$ emission factors are used.

6. For units that have changed or are projected to change fuel from coal to gas, we used default primary PM_{10} and $PM_{2.5}$ emission factors for natural gas fired units from step 3.

7. For units that switch coal rank, we applied unit-specific primary PM_{10} and $PM_{2.5}$ emission factors from step 2. Note that expected impact of coal rank switching on emissions is minimal, and developing a methodology to capture the projected coal rank switch is complex.

8. For coal units projected to add new FGD controls, we applied default primary PM_{10} and primary $PM_{2.5}$ emission factors for coal units with FGD control from step 3 when the default emission factors from step 3 are lower than the emission factors for the coal units without FGD controls.

9. For oil/gas steam, combined cycle, combustion turbine, and all other plant types, we applied steps 1 through 8.

10. For new units, we used primary PM_{10} and primary $PM_{2.5}$ emission factors derived from the NEI for similar units with an online year of 2010 or later.

11. New York and Michigan have emission rules for filterable PM. We ensured that projected PM emissions are within the bounds of these state emission limits. For most units, PM filterable emission limits for NY and MI were higher than the primary PM emission factors estimated. For a few small combustion turbine units where the estimated emission factors were higher than the specified emission limits, the calculated emission factors were used as the primary PM emission factors are higher than the PM filterable emission factors.