DEVELOPMENT OF PRIMARY, FILTERABLE, AND CONDENSIBLE PM10 AND PM2.5 EMISSION FACTORS FOR THE FACTOR INFORMATION AND RETRIEVAL (FIRE) SYSTEM DATABASE

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ACRONYMS AND ABBREVIATIONS

AFSEF	Aerometric Information Retrieval System/Facility Subsystem Emission Factors
CON	condensible
EPA	Environmental Protection Agency
FGD	flue gas desulfurization
FIL	filterable
FIRE	Factor Information and REtrieval
L&E	Locating and Estimating
PM	particulate matter
PM_{10}	particulate matter with a mass median aerodynamic diameter less than 10 micrometers
$PM_{2.5}$	particulate matter with a mass median aerodynamic diameter less than 2.5 micrometers
PRI	primary
SCC	source classification code
S/L/T	State, Local, and Tribal
U.S.	United States
XATEF	Crosswalk/Air Toxics Emission Factors

CHAPTER I. WHAT IS THE PURPOSE OF THIS REPORT?

A. BACKGROUND

The National Emissions Inventory (NEI) requires reporting of primary (PRI) particulate matter (PM) with a mass median aerodynamic diameter less than 10 micrometers and 2.5 micrometers (PM_{10} and $PM_{2.5}$) for each emissions source of PM_{10} and $PM_{2.5}$. Primary emissions are the sum of the filterable (FIL) and condensible (CON) fractions of PM_{10}/$PM_{2.5}$. However, Version 6.23 of the Factor Information REtrieval (FIRE 6.23) data system does not include a complete set of emission factors for each of the five forms of PM_{10} and $PM_{2.5}$ (i.e., PM10-PRI, PM10-FIL, PM25-PRI, PM25-FIL, and PM-CON) for each source classification code (SCC) and control (i.e., uncontrolled and primary and secondary controls) combination (EPA, 2000).

This report documents work that was conducted to develop a database containing the complete set of emission factors for PM10-PRI, PM10-FIL, PM25-PRI, PM25-FIL, and PM-CON for each external and internal fuel combustion SCC and control combination that exist in FIRE 6.23. This "PM Emission Factor Database" can be used to update FIRE. Emission factors available in AP-42 were included in the database if available, or particle size data available in AP-42 or the PM Calculator were used to derive emission factors from factors that exist in FIRE 6.23. The results of this work provides emission factor data for State, Local, and Tribal (S/L/T) agencies to use in preparing and reporting a complete inventory of primary PM_{10} and $PM_{2.5}$ emissions for external and internal combustion sources for inclusion in the NEI.

B. OVERVIEW

This report explains how emission factors for PM10-PRI, PM10-FIL, PM25-PRI, PM25-FIL, and PM-CON were developed for external and internal fuel combustion sources to fill data gaps in FIRE 6.23. The database developed under this project is explained in Chapter I of this report. Chapters II, III, and IV explain how emission factors for PM-CON, PM10-FIL and PM25-FIL, and PM10-PRI and PM25-PRI, respectively, were developed for the database.

CHAPTER II. HOW WAS THE PM EMISSION FACTOR DATABASE DEVELOPED?

FIRE 6.23 contains emission factors from the Compilation Of Air Pollutant Emission Factors (AP-42 Fifth Edition) - Supplements A through F (September, 2000), Locating and Estimating (L&E) series of documents, and the retired the Aerometric Information Retrieval System/Facility Subsystem Emission Factors (AFSEF) and Crosswalk/Air Toxics Emission Factors (XATEF) documents. All EPA point and area SCCs through September 2000 are in the FIRE database.

The development of PM emission factors was limited to external and internal combustion source (i.e., SCCs starting with 1 and 2) and control combinations that exist in FIRE 6.23. This was done because PM-CON emission factors are available for most external and internal combustion sources and because of resource constraints.

For external and internal combustion SCCs, FIRE 6.23 contains "ACTIVE" emission factors for uncontrolled sources as well as combinations of one SCC and up to two control devices for the following forms of PM:

- PM, primary;
- PM, filterable;
- PM10, primary;
- PM10, filterable;
- PM2.5, primary;
- PM2.5, filterable; and
- PM, condensible.

The pollutant code is stored in one field in FIRE. FIRE 6.23 contains 19 fields for each SCC, control, and pollutant combination (see Table 1). To facilitate identifying and developing emission factors not in FIRE, the "ACTIVE" emission factors in FIRE were extracted into a tabular format with the pollutant codes joined at the end of the name of each of the fields and arrayed in column headings. The pollutant codes used in the field names are PM-PRI, PM-FIL, PM10-PRI, PM10-FIL, PM25-PRI, PM25-FIL, and PM-CON. All of the fields in FIRE (except for the field named "STANDARD") were included in the database. Thus, for each SCC and control combination, the database contains 126 fields or columns (i.e., 18 columns for each pollutant code). The database is supplied in a table in an Access 2000 database file named "PM Emission Factor Database.mdb".

A field named "FLAG" was added to the database for each pollutant. This field was added to identify if the data were from FIRE 6.23 (FLAG = E) or if the data were added (FLAG = A) to fill data gaps in FIRE. However, some data in FIRE were revised under this project to support calculation of missing emission factors. If data for an SCC and pollutant combination in FIRE was revised, the FLAG = RA (revise add).

After extracting the PM emission factors and associated data fields in FIRE into the tabular database format, the data were grouped into scenarios first by process type (i.e., external versus internal combustion sources), then by whether the emission factors represent uncontrolled or controlled conditions, and then by the type of emission factor (i.e., a discrete value or a formula). Each scenario was assigned a number, and then each scenario was reviewed to determine the approach for developing the missing emission factors. For example, one scenario represents external combustion SCCs for which FIRE contains uncontrolled PM-FIL and PM10-FIL emission factors that are discrete values; another scenario represents SCCs for which FIRE contains only controlled PM-FIL emission factors as a formula. These scenarios are discussed further under Chapter IV of this report.

Documentation of the methods used to develop emission factors is provided in the "NOTES" field for each pollutant code. The reference for the emission factor is provided in the "REF_DESC" field for each pollutant code. If particle size data from the PM Calculator were used to develop an emission factor, "PM Calculator" is cited in the "NOTES_PM10-FIL" and the "NOTES_PM25-FIL" fields.

Table 1. Field Names and Attributes in FIRE 6.23

FIELD	TYPE	LENGTH	DECIMALS	DESCRIPTION
SCC	Character	11	0	Source Classification Code
CAS	Character	12	0	Chemical Abstract Service number assigned to pollutant
POLLUTANT	Character	56	0	Name of toxic or criteria air pollutant
CTL_CODE1	Character	3	0	Primary control device code
CONTROL1	Character	50	0	Primary control device description
CTL_CODE2	Character	3	0	Secondary control device code
CONTROL2	Character	50	0	Secondary control device description
FACTOR	Character	22	0	Emission factor value
POLL_UNIT	Character	10	0	Emission factor unit numerator; units associated with pollutant emitted (as in "LB" in "LB of NOx per tons of coal burned")
MEASURE	Character	35	0	Emission factor unit denominator; units associated with material processed (as in "TONS" in "Lb of NOx per TONS of coal burned")
MATERIAL	Character	40	0	Material processed (as in "COAL" in "Lb of NOx per tons of COAL burned")
ACTION	Character	20	0	Action performed on the material (as in "BURNED" in "Lb of NOx per tons of coal BURNED")
STANDARD	Logical	1	0	Emission factor units are the same as the SCC standard units
TYPE	Character	9	0	Type of factor: discrete, formula, less than, range or derived
AFS	Logical	1	0	Uncontrolled, criteria pollutant emission factor in standard units of discrete or simple formula
DUPCOUNT	Numeric	3	0	Number of emission factors for each SCC, pollutant, control combination
DUPREASON	Memo	10	0	Explanation for more than one emission factor for an SCC, pollutant, control combination
NOTES	Memo	10	0	Miscellaneous notes about the factor, location of the test, sampling methods, process parameters
FORMULA	Memo	10	0	Formula-type emission factor
REF_DESC	Memo	10	0	Full reference citation
SORTNAME	Character	70	0	Internal variable - used to sort emission factors by pollutant first capital letter
SORTSCC	Character	4	0	Internal variable - used to sort emission factors by SCC description
QUALITY	Character	1	0	Emission factor quality A - E or U for unknown
UNIQID	Character	11	0	Internal variable - unique identification of emission factor
CREATED	Date	8	0	Date of the AP-42 section that contains the emission factor
REVOKED	Date	8	0	Date of the AP-42 section that contains the replacement emission factor

CHAPTER III. HOW WERE PM-CON EMISSION FACTORS DEVELOPED?

The PM-CON emission factors available in AP-42 were assigned to SCC and control combinations in FIRE. For some SCCs, the PM-CON emission factors in AP-42 are not in the units of the emission factors in FIRE. Therefore, the PM-CON emission factors were converted to match the units associated with the SCCs in FIRE. A separate Excel spreadsheet that is provided with this report shows the PM-CON emission factors that are assigned to each SCC and control combination in FIRE, and documents the conversion factors and calculations. The name of this spreadsheet is "PM-CON_Emission_Factors".

For external combustion boilers burning lignite coal, the units for some of the PM-CON emission factors in FIRE 6.23 were changed from lb/MMBtu to lb/ton to match the units for the filterable emission factors. A factor of 16 MMBtu/ton was used to make the conversion. The PM-CON emission factor units were converted for the following SCCs for uncontrolled conditions:

10100304 (Electric Generation/Lignite/Traveling Grate (Overfeed) Stoker)
10100306 (Electric Generation/Lignite/Spreader Stoker)
10200304 (Industrial/Lignite/Traveling Grate (Overfeed) Stoker)
10200306 (Industrial/Lignite/Spreader Stoker)
10300307 (Commercial/Institutional/Lignite/Traveling Grate (Overfeed) Stoker)
10300309 (Commercial/Institutional/Lignite/Spreader Stoker)

These can be found in the database for this project where the "FLAG_PM-CON" field equals "RA".

AP-42 provides general information on what types of controls to which PM-CON emission factors apply. AP-42 does not list specific control codes as indicated in the following example for external combustion boilers burning bituminous or subbituminous coal (EPA, 1998a):

Firing Configuration	Controls
All pulverized coal-fired boilers	All PM Controls (without flue gas desulfurization [FGD] controls)
All pulverized coal-fired boilers	All PM Controls combined with an FGD control
Spreader stoker, traveling grate overfeed stoker, and underfeed stoker	All PM controls, or uncontrolled

Thus, the PM-CON emission factors were assigned to SCC and control combinations in FIRE based on the AP-42 guidance. For example, uncontrolled pulverized coal-fired boilers or boilers

controlled with a fabric filter or an electrostatic precipitator (ESP) were assigned the PM-CON emission factor for "All PM Controls (without FGD controls)."

FIRE 6.23 does not contain all of the control codes that are allowed for use in the NEI. Thus, FIRE 6.23 contains SCCs with only PM-CON emission factors for miscellaneous controls (control code 099). This code is used in FIRE to represent any control that meets the AP-42 guidance but for which the control code is not included in FIRE. For example, for fabric filters (baghouses), FIRE contains control code 100 (a valid NEI code). However, other valid NEI control codes for fabric filters include 016, 017, and 018. Thus, if a State uses codes 016, 017, and/or 018 in its inventory, then it would select the PM-CON emission factor for miscellaneous controls (using the AP-42 guidance) to use with its filterable emission factor to calculate the primary emission factor.

For the six lignite coal combustion SCCs previously listed in this chapter, PM-CON emission factors for miscellaneous control code 099 are available in AP-42 but are not included in FIRE 6.23. Therefore, the emission factors were added to the database to provide a comprehensive list of PM-CON emission factors for the miscellaneous control code. Table 2 shows the SCCs for which PM-CON emission factors were added for miscellaneous controls.

PM-CON emission factors could not be identified in AP-42 for some of the SCC and control combinations for which FIRE contains filterable emission factors. These SCC and control combinations are identified in Table 3.

Table 2. PM-CON Emission Factors for Miscellaneous Controls (Control Code 099) for External Combustion Boilers in AP-42 but not in FIRE 6.23[1, 2]

SCC	SCC3 Description	SCC6 Description	SCC8 Description	Emission Factor	Emission Factor Units	Quality
External Combustion Stoker Boilers Burning Lignite Coal: All PM Controls or Uncontrolled (AP-42, Table 1.7-6)						
10100304	Electric Generation	Lignite	Traveling Grate (Overfeed) Stoker	4.000E-2	Lb/MMBtu Heat Input	D
10100306	Electric Generation	Lignite	Spreader Stoker	4.000E-2	Lb/MMBtu Heat Input	D
10200304	Industrial	Lignite	Traveling Grate (Overfeed) Stoker	4.000E-2	Lb/MMBtu Heat Input	D
10200306	Industrial	Lignite	Spreader Stoker	4.000E-2	Lb/MMBtu Heat Input	D
10300307	Commercial/Institutional	Lignite	Traveling Grate (Overfeed) Stoker	4.000E-2	Lb/MMBtu Heat Input	D
10300309	Commercial/Institutional	Lignite	Spreader Stoker	4.000E-2	Lb/MMBtu Heat Input	D

[1] EPA, 1998b.
[2] For SCC and control combinations where control code 1 is designated as 099 for miscellaneous controls and control code 2 is designated 000 for uncontrolled.

Table 3. SCC and Control Combinations in FIRE 6.23 with PM, PM10 and/or PM2.5 Emission Factors for which PM-CON Emission Factors are not Available in AP-42

SCC	SCC3 Description	SCC6 Description	SCC8 Description	Control Code 1	Control Code 1 Description	Control Code 2	Control Code 2 Description	SCC Units	Measure	Material
External Combustion Boilers										
10100801	Electric Generation	Coke	All Boiler Sizes	000	Uncontrolled	000	Uncontrolled	Tons Burned	Tons	Coke
10100801	Electric Generation	Coke	All Boiler Sizes	075	Single Cyclone	100	Baghouse	Tons Burned	Tons	Coke
10101101	Electric Generation	Bagasse	All Boiler Sizes	000	Uncontrolled	000	Uncontrolled	Tons Burned	Tons	Bagasse
10101101	Electric Generation	Bagasse	All Boiler Sizes	141	Wet Scrubber	000	Uncontrolled	Tons Burned	Tons	Bagasse
10101202	Electric Generation	Solid Waste	Refuse Derived Fuel	000	Uncontrolled	000	Uncontrolled	Tons Burned	Tons	Refuse Derived Fuel
10101302	Electric Generation	Liquid Waste	Waste Oil	000	Uncontrolled	000	Uncontrolled	1000 Gallons Burned	1000 Gallons	Waste Oil
10200107	Industrial	Anthracite Coal	Hand-fired	000	Uncontrolled	000	Uncontrolled	Tons Burned	Tons	Anthracite
10200802	Industrial	Coke	All Boiler Sizes	000	Uncontrolled	000	Uncontrolled	Tons Burned	Tons	Coke
10200804	Industrial	Coke	Cogeneration	000	Uncontrolled	000	Uncontrolled	Tons Burned	Tons	Coke
10201101	Industrial	Bagasse	All Boiler Sizes	000	Uncontrolled	000	Uncontrolled	Tons Burned	Tons	Bagasse
10201101	Industrial	Bagasse	All Boiler Sizes	141	Wet Scrubber	000	Uncontrolled	Tons Burned	Tons	Bagasse
10201101	Industrial	Bagasse	All Boiler Sizes	150	Mechanical Collector	000	Uncontrolled	Tons Burned	Tons	Bagasse
10201202	Industrial	Solid Waste	Refuse Derived Fuel	000	Uncontrolled	000	Uncontrolled	Tons Burned	Tons	Refuse Derived Fuel
10201302	Industrial	Liquid Waste	Waste Oil	000	Uncontrolled	000	Uncontrolled	1000 Gallons Burned	1000 Gallons	Waste Oil
10201401	Industrial	CO Boiler	Natural Gas	000	Uncontrolled	000	Uncontrolled	Million Cubic Feet Burned	Million Cubic Feet	Natural Gas
10201402	Industrial	CO Boiler	Process Gas	000	Uncontrolled	000	Uncontrolled	Million Cubic Feet Burned	Million Cubic Feet	Process Gas
10201403	Industrial	CO Boiler	Distillate Oil	000	Uncontrolled	000	Uncontrolled	1000 Gallons Burned	1000 Gallons	Distillate Oil
10201404	Industrial	CO Boiler	Residual Oil	000	Uncontrolled	000	Uncontrolled	1000 Gallons Burned	1000 Gallons	Residual Oil
10300103	Commercial/Institutional	Anthracite Coal	Hand-fired	000	Uncontrolled	000	Uncontrolled	Tons Burned	Tons	Anthracite
10300214	Commercial/Institutional	Bituminous/ Subbituminous Coal	Hand-fired (Bituminous Coal)	000	Uncontrolled	000	Uncontrolled	Tons Burned	Tons	Bituminous Coal
10301202	Commercial/Institutional	Solid Waste	Refuse Derived Fuel	000	Uncontrolled	000	Uncontrolled	Tons Burned	Tons	Refuse Derived Fuel
10301302	Commercial/Institutional	Liquid Waste	Waste Oil	000	Uncontrolled	000	Uncontrolled	1000 Gallons Burned	1000 Gallons	Waste Oil

Table 3 (continued)

SCC	SCC3 Description	SCC6 Description	SCC8 Description	Control Code 1	Control Code 1 Description	Control Code 2	Control Code 2 Description	SCC Units	Measure	Material
Internal Combustion Engines										
20200501	Industrial	Residual/Crude Oil	Reciprocating	000	Uncontrolled	000	Uncontrolled	1000 Gallons Burned	1000 Gallons	Residual/ Crude Oil
20100102	Electric Generation	Distillate Oil (Diesel)	Reciprocating	000	Uncontrolled	000	Uncontrolled	1000 Gallons Burned	1000 Gallons	Distillate Oil (Diesel)
20200102	Industrial	Distillate Oil (Diesel)	Reciprocating	000	Uncontrolled	000	Uncontrolled	1000 Gallons Burned	1000 Gallons	Distillate Oil (Diesel)
20200104	Industrial	Distillate Oil (Diesel)	Reciprocating: Cogeneration	000	Uncontrolled	000	Uncontrolled	1000 Gallons Burned	1000 Gallons	Distillate Oil (Diesel)
20300101	Commercial/Institutional	Distillate Oil (Diesel)	Reciprocating	000	Uncontrolled	000	Uncontrolled	1000 Gallons Burned	1000 Gallons	Distillate Oil (Diesel)
20100902	Electric Generation	Kerosene/Naphtha (Jet Fuel)	Reciprocating	000	Uncontrolled	000	Uncontrolled	1000 Gallons Burned	1000 Gallons	Jet Fuel
20200902	Industrial	Kerosene/ Naphtha (Jet Fuel)	Reciprocating	000	Uncontrolled	000	Uncontrolled	1000 Gallons Burned	1000 Gallons	Jet Fuel
20200301	Industrial	Gasoline	Reciprocating	000	Uncontrolled	000	Uncontrolled	1000 Gallons Burned	1000 Gallons	Gasoline
20300301	Commercial/Institutional	Gasoline	Reciprocating	000	Uncontrolled	000	Uncontrolled	1000 Gallons Burned	1000 Gallons	Gasoline
20400401	Engine Testing	Reciprocating Engine	Gasoline	000	Uncontrolled	000	Uncontrolled	1000 Gallons Burned	1000 Gallons	Gasoline

CHAPTER IV. HOW WERE PM10-FIL AND PM25-FIL EMISSION FACTORS DEVELOPED?

The following data sources were used in the priority order listed to develop PM10-FIL and PM25-FIL emission factors:

1 Emission factors in AP-42; www.epa.gov/ttn/chief/ap42/index.html
2 Particle size data in AP-42 for specific SCC and control combinations;
3 Technology transfer of an emission factor or particle size data from a similar process; and/or
4 The PM Calculator. www.epa.gov/ttn/chief/software/pmcalc/index.html

In general, much of the particle size data in the fifth edition of AP-42 are in the PM Calculator (EPA, 2003). One of the goals of this project was to clearly document the references and calculations applied to develop emission factors. Therefore, the fifth edition of AP-42 was used as the primary source of emission factors and particle size data.

Filterable emission factors and associated data for some SCC and control combinations in FIRE 6.23 needed to be updated in order to use the data to develop missing emission factors. Therefore, the database for this project was updated to incorporate new data or changes to the units of emission factors. Table 4 identifies the changes to the data for SCC and control combinations in FIRE 6.23. These corrections can be found in the database for this project where the "FLAG_PM-FIL", "FLAG_PM10-PRI", "FLAG_PM10-FIL", or "FLAG_PM25-FIL" field equals "RA".

Table 5 shows the algorithms applied to develop PM10-FIL and/or PM25-FIL emissions from the filterable emission factors available in FIRE 6.23. Table 6 shows the SCC and control combinations for which PM10-FIL and/or PM25-FIL emission factors were not developed.

PM10-FIL and PM25-FIL emission factors were not available in AP-42 for the following SCC and control combinations:

- Electric generation boiler burning solid waste (SCC 10101201) controlled with an ESP (Control Code 128)

- Electric generation dry bottom, wall fired (SCC 10100301) boiler or tangential fired boiler (SCC 10100302) burning pulverized lignite coal controlled with a wet scrubber (Control Code 141)

- Electric generation dry bottom, wall fired boiler (SCC 10100301) or tangential fired boiler (SCC 10100302) burning pulverized lignite coal (SCC 10100301) and controlled with a baghouse (Control Code 100)

- Electric generation boiler burning coke (SCC 10100801) and controlled with a single cyclone (Control Code 075) and a baghouse (Control Code 100)

Table 4. Changes to Emission Factors and Associated Data in FIRE 6.23

SCC	Control 1	Control 2	Pollutant Code	Field Name	FIRE 6.23 Data	Revised Data	Reason for Change	Scenario
External Combustion Boilers/Electric Generation/Distillate Oil/Grades 1 and 2 Oil								
10100501	000	000	PM10-FIL	QUALITY	A	E	Change made per Table 1.3-6 of September 1998 revision to Section 1.3 of AP-42.	2
10100501	000	000	PM10-FIL	REF_DESC	EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	EPA. September, 1998. Section 1.3, Fuel Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.		2
External Combustion Boilers/Industrial/Distillate Oil/Grades 1 and 2 Oil								
10200501	000	000	PM10-FIL and PM25-FIL	TYPE	Derived	Discrete	PM10-FIL and PM25-FIL emission factors are in Table 1.3-6 of AP-42.	4
10200501	000	000	PM25-FIL	NOTES	Factor is derived: 12% of the PM, total factor	Null		4
External Combustion Boilers/Commercial/Institutional/Distillate Oil/Grades 1 and 2 Oil								
10300501	000	000	PM10-FIL and PM25-FIL	TYPE	Derived	Discrete	PM10-FIL and PM25-FIL emission factors are in Table 1.3-7 of AP-42.	4
10300501	000	000	PM10-FIL	NOTES	Derived factor: 55% of PM, total factor.	Null		4
10300501	000	000	PM25-FIL	NOTES	Derived factor: 42% of PM, total factor.	Null		4
External Combustion Boilers/Industrial/Bituminous/Subbituminous Coal/Pulverized Coal: Dry Bottom								
10200202	000	000	PM10-PRI	All fields	See FIRE 6.23 database	Null	The PM10-PRI and PM10-FIL emission factors (2.3E0*A Lb/Ton) in FIRE 6.23 are the same; however, based on AP-42, Table 1.1-4, the factor is for PM10-FIL. The PM10-FIL and PM-CON emission factors are both formulas; therefore, removed the PM10-PRI data for all fields because the primary emission factor and supporting data are not being shown in the database for this project when the primary emission factor is the sum of two formulas.	6
10200202	000	000	PM25-FIL	QUALITY	C	E	The quality rating of E for PM10-FIL in Table 1.1-4 of AP-42 is deemed more reliable than the quality rating of C for PM10-FIL and PM25-FIL in Table 1.1-11 of AP-42. Assumed quality rating of E for PM25-FIL to be consistent with rating for PM10-FIL in Table 1.1-4.	6

Table 4 (continued)

SCC	Control 1	Control 2	Pollutant Code	Field Name	FIRE 6.23 Data	Revised Data	Reason for Change	Scenario
10200202	000	000	PM25-FIL	TYPE	Discrete	Formula	Change made since the PM25-FIL emission factor is in AP-42, Table 1.1-6.	6
External Combustion Boilers/Industrial/Bituminous/Subbituminous Coal/Underfeed Stoker								
10200206	000	000	PM10-PRI	FACTOR	6.200E0 Lb/Ton bituminous coal burned	7.240E0 Lb/Ton bituminous coal burned	The emission factor for PM10-PRI is the factor for PM10-FIL; changed factor for PM10-PRI to reflect sum of PM10-FIL and PM-CON emission factors.	13
10200206	000	000	PM10-PRI and PM25-FIL	QUALITY	C	E	The quality rating of E for PM10-FIL in Table 1.1-4 of AP-42 is deemed more reliable than the quality rating of C for PM10-FIL and PM25-FIL in Table 1.1-11 of AP-42. Assumed quality rating of E for PM25-FIL to be consistent with rating for PM10-FIL in Table 1.1-4.	13
10200206	000	000	PM10-PRI	NOTES	May also be used for uncontrolled hand-fired units	Sum of PM10-FIL and PM-CON emission factors	The notes field for the PM10-FIL and PM25-FIL emission factors contains the note replaced with the revised data.	13
External Combustion Boilers/Industrial/Bituminous/Subbituminous Coal/Underfeed Stoker Controlled with Multiple Cyclones								
10200206	121	000	PM10-FIL	All fields	See FIRE 6.23 database	Null	EPA advised that the PM10-FIL emission factor for this SCC and control combination in AP-42 Section 1.1, Table 1.1-4 is incorrect; therefore, the PM10-FIL emission factor is not included in the database.	16
External Combustion Boilers/Commercial/Institutional/Bituminous/Subbituminous Coal/Underfeed Stoker Controlled with Multiple Cyclones								
10300208	121	000	PM10-FIL	All fields	See FIRE 6.23 database	Null	EPA advised that the PM10-FIL emission factor for this SCC and control combination in AP-42 Section 1.1, Table 1.1-4 is incorrect; therefore, the PM10-FIL emission factor is not included in the database.	16
External Combustion Boilers/Industrial/Bituminous/Subbituminous Coal/Spreader Stoker (Subbituminous Coal)								
10200224	077	000	PM10-FIL	FACTOR	1.240E2 Lb/Ton subbituminous coal burned	1.240E1 Lb/Ton subbituminous coal burned	In FIRE, PM10-FIL emission factor was 10 times higher than it should be.	16
External Combustion Boilers/Electric Generation/Liquid Waste/Waste Oil								
10101302	000	000	PM-FIL	FACTOR	6.1E1*A Lb/1,000 gallons	6.4E1*A Lb/1,000 gallons	Revised PM-FIL emission factor per correction in AP-42.	18
10101302	000	000	PM-FIL and PM10-FIL	REF_DESC	EPA. 1995. Section 1.11, Waste Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	EPA. October, 1996. Section 1.11, Waste Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	Updated references for PM-FIL and PM10-FIL emission factors.	18

Table 4 (continued)

SCC	Control 1	Control 2	Pollutant Code	Field Name	FIRE 6.23 Data	Revised Data	Reason for Change	Scenario
External Combustion Boilers/Industrial/Liquid Waste/Waste Oil								
10201302	000	000	PM-FIL	FACTOR	6.1E1*A Lb/1,000 gallons	6.4E1*A Lb/1,000 gallons	Revised PM-FIL emission factor per correction in AP-42.	18
10201302	000	000	PM-FIL and PM10-FIL	REF_DESC	EPA. 1995. Section 1.11, Waste Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	EPA. October, 1996. Section 1.11, Waste Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	Updated references for PM-FIL and PM10-FIL emission factors.	18
External Combustion Boilers/Industrial/CO Boiler/Residual Oil								
10201404	000	000	PM-FIL and PM10-FIL	NOTES	Multiply the emission factor provided by the weight percent sulfur content of the fuel to obtain emission factor in lb/activity units. where S is the wt. % of the sulfur in the oil	Multiply the emission factor provided by the weight percent sulfur content of the fuel to obtain emission factor in lb/activity units; where S is the wt. % of the sulfur in the oil. Emission factor was transferred from other oil-burning boilers assuming process similarity.		18
10201404	000	000	PM-FIL and PM10-FIL	REF_DESC	Emission factor was transferred from other oil-burning boilers assuming process similarity.	EPA, September, 1998. Section 1.3, Fuel Oil Combustion. In: Compilation of Air Pollutant Emission Factors, AP-42, U.S. Environmental Protection Agency, 5th Edition, Table 1.3-5, October 1996.	Added reference for emission factor.	18
External Combustion Boilers/Industrial/Residual Oil/Cogeneration								
10200405	000	000	PM-FIL and PM10-FIL	NOTES	S=wt% sulfur	Multiply the emission factor provided by the weight percent sulfur content of the fuel to obtain emission factor in lb/activity units; where S is the wt. % of the sulfur in the oil.		18
10200405	000	000	PM-FIL and PM10-FIL	REF_DESC	EPA. 1995. Section 1.3, Fuel Oil Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	EPA, September, 1998. Section 1.3, Fuel Oil Combustion. In: Compilation of Air Pollutant Emission Factors, AP-42, U.S. Environmental Protection Agency, 5th Edition, Table 1.3-5, October 1996.	Updated reference for emission factor.	18

Table 4 (continued)

SCC	Control 1	Control 2	Pollutant Code	Field Name	FIRE 6.23 Data	Revised Data	Reason for Change	Scenario
External Combustion Boilers/Electric Generation/Bituminous/Subbituminous Coal/Traveling Grate (Overfeed) Stoker (Bituminous Coal)								
10100205	000	000	PM25-FIL	QUALITY	C	E	The quality rating of E for PM10-FIL in Table 1.1-4 of AP-42 is deemed more reliable than the quality rating of C for PM10-FIL and PM25-FIL in Table 1.1-10 of AP-42. Assumed quality rating of E for PM25-FIL to be consistent with rating for PM10-FIL in Table 1.1-4.	20
10100205	000	000	PM25-FIL	NOTES	Null	Includes traveling grate, vibrating grate and chain grate stokers. From AP-42, Tables 1.1-4 and 1.1-10. For PM25-FIL emission factor quality rating, applied rating of E for PM10-FIL from Table 1.1-4 which is deemed more reliable than the rating of C for PM25-FIL from Table 1.1-10.		20
External Combustion Boilers/Industrial/Bituminous/Subbituminous Coal/Overfeed Stoker								
10200205	000	000	PM10-FIL	QUALITY	C	E	The quality rating of E for PM10-FIL in Table 1.1-4 of AP-42 is deemed more reliable than the quality rating of C for PM10-FIL and PM25-FIL in Table 1.1-10 of AP-42. Assumed quality rating of E for PM25-FIL to be consistent with rating for PM10-FIL in Table 1.1-4.	20
10200205	000	000	PM25-FIL	NOTES	Null	Includes traveling grate, vibrating grate and chain grate stokers. From AP-42, Tables 1.1-4 and 1.1-10. For PM25-FIL emission factor quality rating, applied rating of E for PM10-FIL from Table 1.1-4 which is deemed more reliable than the rating of C for PM25-FIL from Table 1.1-10.		20
External Combustion Boilers/Commercial/Institutional/Bituminous/Subbituminous Coal/Overfeed Stoker (Bituminous Coal)								
10300207	000	000	PM25-FIL	QUALITY	C	E	The quality rating of E for PM10-FIL in Table 1.1-4 of AP-42 is deemed more reliable than the quality rating of C for PM10-FIL and PM25-FIL in Table 1.1-10 of AP-42. Assumed quality rating of E for PM25-FIL to be consistent with rating for PM10-FIL in Table 1.1-4.	20

Table 4 (continued)

SCC	Control 1	Control 2	Pollutant Code	Field Name	FIRE 6.23 Data	Revised Data	Reason for Change	Scenario
10300207	000	000	PM25-FIL	NOTES	Null	Includes traveling grate, vibrating grate and chain grate stokers. From AP-42, Tables 1.1-4 and 1.1-10. For PM25-FIL emission factor quality rating, applied rating of E for PM10-FIL from Table 1.1-4 which is deemed more reliable than the rating of C for PM25-FIL from Table 1.1-10.		20
Internal Combustion Engines/Industrial/Kerosene/Naphtha (Jet Fuel)/Turbine								
20200901	000	000	PM10-PRI	FACTOR	8.540E0 Lb/MMBtu fuel input	1.181E-2 Lb/MMBtu fuel input	PM10-PRI emission factor in FIRE 6.23 is larger than PM-PRI emission factor of 1.200E-2 Lb/MMBtu fuel input. Revised factor equals the sum of the PM10-FIL and PM-CON emission factors.	36
20200901	000	000	PM10-PRI	QUALITY	E	U	The quality is unknown for the fraction of PM10-FIL in PM-FIL [0.96] used to calculate the PM10-FIL emission factor to which the PM-CON emission factor was added to obtain the PM10-PRI emission factor.	
20200901	000	000	PM10-PRI	NOTES	Null	Sum of PM10-FIL and PM-CON emission factors		
Internal Combustion Engines/Industrial/Large Bore Engine/Dual Fuel (Oil/Gas)								
20200402	000	000	PM-FIL	FACTOR	2.200E0 Lb/1000 Horsepower-Hours	6.200E-2 Lb/MMBtu fuel input	Changed emission factor to lb/MMBtu basis in AP-42, Section 3.4, Table 3.4-2.	38
20200402	000	000	PM10-FIL	FACTOR	2.000E0 Lb/1000 Horsepower-Hours	4.960E-2 Lb/MMBtu fuel input	Changed emission factor to lb/MMBtu basis in AP-42, Section 3.4, Table 3.4-2.	38
20200402	000	000	PM-FIL and PM10-FIL	REF_DESC	EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	EPA. October, 1996. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, 5th Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.		38
20200402	000	000	PM-FIL and PM10-FIL	QUALITY	U	E	Change made per Table 3.4-2 of September 1998 revision to Section 3.4 of AP-42.	38
20200402	000	000	PM-FIL and PM10-FIL	NOTES	Null	To convert lb/MMBtu to lb/1,000 hp-hr, multiply by 7,000 and divide by 1,000		38

Table 4 (continued)

SCC	Control 1	Control 2	Pollutant Code	Field Name	FIRE 6.23 Data	Revised Data	Reason for Change	Scenario
Internal Combustion Engines/Industrial/Large Bore Engine/Cogeneration: Dual Fuel								
20200403	000	000	PM-FIL	FACTOR	2.200E2 Lb/100,000 Horsepower-Hours	6.200E-2 Lb/MMBtu fuel input	Changed emission factor to lb/MMBtu basis in AP-42, Section 3.4, Table 3.4-2.	38
20200403	000	000	PM10-FIL	FACTOR	2.000E2100,000 Horsepower-Hours	4.960E-2 Lb/MMBtu fuel input	Changed emission factor to lb/MMBtu basis in AP-42, Section 3.4, Table 3.4-2.	38
20200403	000	000	PM-FIL and PM10-FIL	REF_DESC	EPA. September 1985. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fourth Edition with Supplements A, B, and C, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.	EPA. October, 1996. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, 5th Edition, AP-42. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.		38
20200403	000	000	PM-FIL and PM10-FIL	QUALITY	U	E	Change made per Table 3.4-2 of September 1998 revision to Section 3.4 of AP-42.	38
20200403	000	000	PM-FIL and PM10-FIL	NOTES	Null	To convert lb/MMBtu to lb/100,000 hp-hr, multiply by 7,000 and divide by 10		38

Table 5. Methods for Developing PM10-PRI/FIL, PM25-PRI/FIL, and PM-CON Emission Factors Not in FIRE[1]

Scenario ID	Control 1	Control 2	PM-PRI EF	PM-FIL EF	PM10-PRI EF	PM10-FIL EF	PM25-PRI EF	PM25-FIL EF	PM-CON EF	Methods
External Combustion										
1	Uncontrolled	Uncontrolled				Formula			Discrete	For uncontrolled industrial and commercial/institutional traveling grate (overfeed) stokers burning lignite coal (SCCs 10200304 & 10300307): 1. PM25-FIL (Formula) = PM10-FIL (Formula) * uncontrolled particle-size distribution (PSD) fraction of PM25-FIL in PM10-FIL 2. PM25-PRI (Formula + Discrete Value) = PM25-FIL (Formula) + PM-CON (Discrete Value) from AP-42 3. PM10-PRI (Formula + Discrete Value) = PM10-FIL (Formula) + PM-CON (Discrete Value) from AP-42
2	Uncontrolled	Uncontrolled		Discrete		Discrete			Discrete	For uncontrolled utility and commercial/institutional boilers burning distillate oil grades 1 and 2 (SCC 10100501 and 10300501): 1. PM25-FIL (Discrete Value) = PM-FIL (Discrete Value) * uncontrolled PSD fraction of PM25-FIL in PM-FIL 2. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 3. PM10-PRI (Discrete Value) = PM10-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42
3	Uncontrolled	Uncontrolled	Formula	Formula		Discrete			Formula	For uncontrolled utility, industrial, and commercial/institutional traveling grate (overfeed) stokers burning anthracite coal (SCCs 10100102, 10200104, & 10300102): 1. PM25-FIL (Discrete Value) = PM10-FIL (Discrete Value) * uncontrolled PSD fraction 2. PM25-PRI (Discrete Value + Formula) = PM25-FIL (Discrete Value) + PM-CON from AP-42 3. PM10-PRI (Discrete Value + Formula) = PM10-FIL (Discrete Value) + PM-CON from AP-42
4	Uncontrolled	Uncontrolled		Discrete		Discrete		Discrete	Discrete	For uncontrolled industrial and commercial/institutional boilers burning distillate oil grades 1 and 2 (SCCs 10200501 & 10300501): 1. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 2. PM10-PRI (Discrete Value) = PM10-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42
5	Uncontrolled	Uncontrolled		Formula		Formula		Formula	Discrete	For uncontrolled utility, industrial, and commercial/institutional boilers burning distillate oil grade 6 (SCCs 10100401, 10100404, 10200401, & 10300401) and uncontrolled spreader stokers burning lignite coal (SCC 10100306): 1. PM25-PRI (Formula + Discrete Value) = PM25-FIL (Formula) + PM-CON (Discrete Value) from AP-42 2. PM10-PRI (Formula + Discrete Value) = PM10-FIL (Formula) + PM-CON (Discrete Value) from AP-42
6	Uncontrolled	Uncontrolled		Formula	Formula	Formula		Formula		For uncontrolled industrial bituminous/subbituminous pulverized coal dry bottom boiler (SCC 10200202). 1. Removed the PM10-PRI emission factor and supporting data in FIRE 6.23 because the PM10-PRI emission factor is for PM10-FIL. FIRE contains the correct PM10-FIL emission factor. 2. Since PM10-FIL, PM25-FIL, and PM-CON emission factors are formulas, PM10-PRI and PM25-PRI emission factors were not added to the database because the primary emission factor is Formula + Formula.

Table 5 (continued)

Scenario ID	Control 1	Control 2	PM-PRI EF	PM-FIL EF	PM10-PRI EF	PM10-FIL EF	PM25-PRI EF	PM25-FIL EF	PM-CON EF	Methods
7	Uncontrolled	Uncontrolled	Discrete	Discrete					Discrete	For uncontrolled natural gas combustion (SCCs 10100601, 10100602, 10100604, 10200601, 10200602, 10200603, 10200604, 10300601, 10300602, & 10300603): 1. PM10-FIL & PM25-FIL (Discrete Value) = PM-FIL (Discrete Value) [Note: All PM (total, condensible and filterable) is assumed to be less than 1.0 micrometer in diameter.] 2. PM10-PRI (Discrete Value) = PM10-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 3. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 [Note: In FIRE 6.23, the PM-FIL and PM-PRI emission factors were revised on March 1, 1998, and the old factors for PM-FIL/PRI, PM10-FIL/PRI, and PM25-FIL/PRI were revoked; but new factors were not added for PM10-FIL/PRI and PM25-FIL/PRI.]
8	Controlled	Uncontrolled		Discrete					Discrete	For utility boilers burning solid waste (SCC 10101201) controlled with an ESP (control code 128): 1. PM25-FIL (Discrete Value) = PM-FIL (Discrete Value) * uncontrolled PSD fraction * generic PSD-specific control efficiency for ESPs 2. PM10-FIL (Discrete Value) = PM-FIL (Discrete Value) * uncontrolled PSD fraction * generic PSD-specific control efficiency for ESPs 3. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 4. PM10-PRI (Discrete Value) = PM10-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 [Note: FIRE 6.23 contains four PM-FIL emission factors and two PM-CON emission factors based on different test methods. The PM-FIL and PM-CON emission factors included in the database for this project are based on EPA Method 5 and Method 202.]
9	Uncontrolled	Uncontrolled		Formula					Discrete	For uncontrolled utility traveling grate (overfeed) stoker burning lignite coal (SCC 10100304): 1. PM10-FIL (Formula) = PM-FIL (Formula) emission factor for SCCs 10200304 and 10300307 as reported in FIRE 6.23 2. PM25-FIL (Formula) = PM10-FIL (Formula) * uncontrolled PSD fraction 3. PM25-PRI (Formula + Discrete Value) = PM25-FIL (Formula) + PM-CON (Discrete Value) from AP-42 4. PM10-PRI (Formula + Discrete Value) = PM10-FIL (Formula) + PM-CON (Discrete Value) from AP-42
10	Uncontrolled	Uncontrolled							Discrete	For uncontrolled industrial lignite coal spreader stokers (SCC 10200306) and uncontrolled commercial/institutional lignite coal spreader stokers (SCC 10300309), FIRE contains the current PM-CON emission factor from AP-42, but not the current PM10-PRI/FIL or PM25-PRI/FIL emission factors. The PM10-PRI/FIL or PM25-PRI/FIL emission factors in the current version of Section 1.7, Table 1.7-8 of AP-42 were added to the database for this project.
11	Controlled	Uncontrolled							Discrete	PM-CON emission factors are for external combustion sources with miscellaneous controls. Default emission factors for other pollutants are not available; therefore, emission factors were not calculated for PM10-PRI, PM10-FIL, PM25-PRI, and PM25-FIL.
12	Controlled	Uncontrolled							Formula	PM-CON emission factors are for external combustion sources with miscellaneous controls. Default emission factors for other pollutants are not available; therefore, emission factors were not calculated for PM10-PRI, PM10-FIL, PM25-PRI, and PM25-FIL.

Table 5 (continued)

Scenario ID	Control 1	Control 2	PM-PRI EF	PM-FIL EF	PM10-PRI EF	PM10-FIL EF	PM25-PRI EF	PM25-FIL EF	PM-CON EF	Methods
13	Uncontrolled	Uncontrolled		Discrete	Discrete			Discrete		For uncontrolled industrial underfeed stoker burning bituminous/subbituminous coal (SCC 10200206): 1. The emission factor for PM10-PRI is the factor for PM10-FIL; changed factor for PM10-PRI to reflect sum of PM10-FIL and PM-CON emission factors. Added PM10-FIL emission factor from AP-42, Table 1.1-4. 2. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42
14	Uncontrolled	Uncontrolled				Discrete				For uncontrolled industrial and commercial/institutional space heaters (SCC 10500105 & 10500205): 1. PM25-FIL (Discrete Value) = PM10-FIL (Discrete Value) * uncontrolled PSD fraction 2. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON from AP-42 (Discrete Value) from AP-42 3. PM10-PRI (Discrete Value) = PM10-FIL (Discrete Value) + PM-CON from AP-42 (Discrete Value) from AP-42
15	Controlled	Uncontrolled				Discrete				For utility boiler burning bagasse (SCC 10101101) controlled with wet scrubber (Control Code 141): 1. PM25-FIL emission factor not added to the database due to the lack of PM25-FIL PSD data for this process. 2. No PM-CON emission factor is available to calculate a PM10-PRI emission factor.
16	Controlled	Uncontrolled		Discrete		Discrete				For utility, industrial, and commercial/institutional spreader and overfeed stokers burning bituminous/subbituminous coal (SCCs 10100224, 10100225, 10200224, 10200225, 10300224, & 10300225) controlled with multiple cyclones (without or with fly ash reinjection, or fly ash reinjection not specified [Control codes 076, 077, & 121, respectively]): 1. PM25-FIL (Discrete Value) = Taken from Section 1.1 of AP-42 2. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 3. PM10-PRI (Discrete Value) = PM10-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 B. For industrial & commercial/institutional underfeed stokers burning bituminous/subbituminous coal (SCCs 10200206 & 10300208) controlled with multiple cyclones (Control Code 121): 1. EPA advised that the PM10-FIL emission factor for these SCC and control combinations in AP-42 Section 1.1, Table 1.1-4 is incorrect; therefore, the PM10-FIL emission factor is not included in the database. 2. Data were not found to derive PM25-FIL emission factor. C. For industrial boilers burning bagasse (SCC 10201101) controlled with wet scrubber (Control Code 141): 1. Data were not found to derive PM25-FIL emission factors. 2. No PM-CON emission factor is available to calculate PM10-PRI emission factor.

Table 5 (continued)

Scenario ID	Control 1	Control 2	PM-PRI EF	PM-FIL EF	PM10-PRI EF	PM10-FIL EF	PM25-PRI EF	PM25-FIL EF	PM-CON EF	Methods
17	Uncontrolled	Uncontrolled		Discrete		Discrete				This scenario covers 35 SCCs for uncontrolled boilers and space heaters burning different types of fuels: 1. PM25-FIL (Discrete Value) = PM10-FIL (Discrete Value) * uncontrolled PSD fraction [Note: This was one of several methods used to calculate PM25-FIL emission factors. More detailed documentation of the methods applied for individual SCCs is provided in the NOTES_PM25-FIL field in the database for this project.] 2. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 3. PM10-PRI (Discrete Value) = PM10-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 [Note: PM-CON emission factors are not available for the following SCCs: 10200107, 10201202, 10201401, 10201402, 10201403, 10300103, and 10301202.]
18	Uncontrolled	Uncontrolled		Formula		Formula				A. This scenario covers 25 SCCs for uncontrolled boilers and space heaters burning different types of fuels: PM25-FIL (Formula) = PM10-FIL (Formula) * uncontrolled PSD fraction [Note: This was one of several methods used to calculate PM25-FIL emission factors. More detailed documentation of the methods applied for individual SCCs is provided in the NOTES_PM25-FIL field in the database for this project.] B. For SCCs 10500113, 10500213, 10200405, and 10200307: 1. PM25-PRI (Formula+ Discrete Value) = PM25-FIL (Formula) + PM-CON (Discrete Value) from AP-42 2. PM10-PRI (Formula + Discrete Value) = PM10-FIL (Formula) + PM-CON (Discrete Value) from AP-42 C. For SCCs 10300226, 10300223, 10300221, 10200229, 10200223, 10200222, 10200221, 10200219, 10200303, 10300222, 10100226, 10100222, 10100221, & 10100223: 1. PM10-FIL, PM25-FIL, and PM-CON emission factors are formulas; therefore, PM10-PRI and PM25-PRI emission factors were not added to the database because the primary emission factor is Formula + Formula. D. For SCCs: 10100801, 10200802, 10200804, 10101302, 10201302, 10301302, and 10201404: 1. PM10-PRI and PM25-PRI emission factors were not added to the database because PM-CON EFs were not available.
19	Controlled	Uncontrolled		Discrete		Discrete		Discrete		For utility, industrial, and commercial/institutional spreader stokers burning bituminous coal (SCCs 10100204, 10200204, & 10300209) controlled with a baghouse (Control Code 100), an electrostatic precipitator (Control Code 128), multiple cyclones without fly ash reinjection (Control Code 076), or multiple cyclones with fly ash reinjection (Control Code 077); utility, industrial, and commercial/institutional overfeed stokers burning bituminous coal (SCCs 10100205, 10200205 & 10300207) controlled with multiple cyclones (Control Code 121); utility and industrial boilers burning grade 4 distillate oil (SCC 10100505 & 10200504) controlled with an electrostatic precipitator (Control Code 128) or multiple cyclones (Control Code 121); and industrial boilers burning grade 5 residual oil (SCC 10200404) controlled with multiple cyclones (Control Code 121): 1. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 2. PM10-PRI (Discrete Value) = PM10-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42

Table 5 (continued)

Scenario ID	Control 1	Control 2	PM-PRI EF	PM-FIL EF	PM10-PRI EF	PM10-FIL EF	PM25-PRI EF	PM25-FIL EF	PM-CON EF	Methods
20	Uncontrolled	Uncontrolled		Discrete		Discrete		Discrete		For uncontrolled utility, industrial, and commercial/institutional boilers burning grade 4 distillate oil (SCCs 10100505, 10200504, & 10300504); industrial and commercial/institutional boilers burning distillate oil (SCCs 10200502, 10200503, 10300502, & 10300503); utility, industrial, and commercial/institutional spreader stokers burning bituminous coal (SCCs 10100204, 10200204, & 10300209); utility, industrial, and commercial/institutional overfeed stokers burning bituminous coal (SCCs 10100205, 10200205, & 10300207); commercial/institutional underfeed stokers burning bituminous coal (SCCs 10300208); and industrial boilers burning grade 5 residual oil (SCC 10200404): 1. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 2. PM10-PRI (Discrete Value) = PM10-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42
21	Uncontrolled	Uncontrolled		Formula		Discrete		Discrete		For uncontrolled commercial/institutional boiler burning grade 5 residual oil (SCC 10300404): 1. PM25-PRI (Formula + Discrete Value) = PM25-FIL (Formula) + PM-CON (Discrete Value) from AP-42 2. PM10-PRI (Formula + Discrete Value) = PM10-FIL (Formula) + PM-CON (Discrete Value) from AP-42
22	Controlled	Uncontrolled				Formula		Formula		For industrial boiler burning grade 6 residual oil (SCC 10200401) controlled with multiple cyclones (Control Code 121): 1. PM25-PRI (Formula + Discrete Value) = PM25-FIL (Formula) + PM-CON (Discrete Value) from AP-42 2. PM10-PRI (Formula + Discrete Value) = PM10-FIL (Formula) + PM-CON (Discrete Value) from AP-42
23	Uncontrolled	Uncontrolled		Discrete		Formula		Formula		For uncontrolled utility boilers burning residual oil grades 4 & 5 (SCCs 10100405, 10100406, & 10100504) and uncontrolled commercial/institutional boilers burning residual oil (SCCs 10300402 & 10300403): 1. PM25-PRI (Formula + Discrete Value) = PM25-FIL (Formula) + PM-CON (Discrete Value) from AP-42 2. PM10-PRI (Formula + Discrete Value) = PM10-FIL (Formula) + PM-CON (Discrete Value) from AP-42
24	Controlled	Uncontrolled		Discrete		Formula		Formula		A. For utility boilers burning grade 5 residual oil (SCCs 10100405 & 10100406) controlled with an electrostatic precipitator (Control Code 128) or scrubber (Control Code 128); and controlled utility boilers burning grade 4 distillate oil (SCC 10100504) controlled with an electrostatic precipitator (Control Code 128) or scrubber (Control Code 128): 1. PM25-PRI (Formula + Discrete Value) = PM25-FIL (Formula) + PM-CON from AP-42 (Discrete Value for oil fired boilers only) 2. PM10-PRI (Formula + Discrete Value) = PM10-FIL (Formula) + PM-CON from AP-42 (Discrete Value for oil fired boilers only) B. For utility, industrial, and commercial/institutional boilers burning pulverized anthracite coal (SCCs 10100101, 10200101, & 10300101) controlled with a baghouse (Control Code 100) or multiple cyclones (Control Code 121): 1. PM-CON emission factor is a Formula; therefore, PM10-PRI and PM25-PRI emission factors were not added to the database because primary emission factor is Formula + Formula.

Table 5 (continued)

Scenario ID	Control 1	Control 2	PM-PRI EF	PM-FIL EF	PM10-PRI EF	PM10-FIL EF	PM25-PRI EF	PM25-FIL EF	PM-CON EF	Methods
25	Controlled	Uncontrolled		Formula		Formula		Formula		A. For utility boilers burning residual grade 6 oil: normal firing (SCC 10100401) controlled with an electrostatic precipitator (Control Code 128) or scrubber (Control Code 128); utility boilers burning residual grade 6 oil: tangential firing (SCC 10100404) controlled with an electrostatic precipitator (Control Code 128) or scrubber (Control Code 128); utility spreader stoker burning lignite coal (SCC 10100306) controlled with multiple cyclones (Control Code 121); and industrial boilers burning residual oil (SCCs 10200402 and 10200403) controlled with multiple cyclones (Control Code 121): 1. PM25-PRI (Formula + Discrete Value) = PM25-FIL (Formula) + PM-CON (Discrete Value) from AP-42 2. PM10-PRI (Formula + Discrete Value) = PM10-FIL (Formula) + PM-CON (Discrete Value) from AP-42 B. For the remaining 38 SCC and control combinations, the PM10-FIL, PM25-FIL, and PM-CON emission factors are formulas; therefore, PM10-PRI and PM25-PRI emission factors were not added to the database because the factor is Formula + Formula.
26	Uncontrolled	Uncontrolled		Formula		Formula		Formula		A. For uncontrolled industrial boilers burning residual oil (SCCs 10200402 and 10200403): 1. PM25-PRI (Formula + Discrete Value) = PM25-FIL (Formula) + PM-CON (Discrete Value) from AP-42 2. PM10-PRI (Formula + Discrete Value) = PM10-FIL (Formula) + PM-CON (Discrete Value) from AP-42 B. For uncontrolled utility, industrial, and commercial/institutional boilers burning pulverized anthracite coal (SCCs 10100101, 10200101, & 10300101); utility boilers burning pulverized lignite coal (SCCs 10100301 & 10100302); and utility, industrial, and commercial/institutional boilers burning pulverized bituminous/subbituminous coal (SCCs 10100201, 10100202, 10100203, 10100212, 10200201, 10200203, 10200212, 10300203, 10300205, 10300206, & 10300216). 1. For these remaining 16 SCCs, the PM10-FIL, PM25-FIL, and PM-CON emission factors are formulas; therefore, PM10-PRI and PM25-PRI emission factors were not added to the database because the primary emission factor is Formula + Formula.
27	Controlled	Controlled		Discrete						A. For utility and commercial/institutional boilers burning distillate oil grades 1 & 2 (SCCs 10100501 & 10300501) controlled with low-NOx burners (205) and flue-gas recirculation (026); assumes low-NOx burner and flue gas recirculation do not control PM10-FIL or PM25-FIL emissions: 1. PM25-FIL (Discrete Value) = PM-FIL (Discrete Value) * uncontrolled PSD fraction 2. PM10-FIL (Discrete Value) = PM-FIL (Discrete Value) * uncontrolled PSD fraction 3. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 4. PM10-PRI (Discrete Value) = PM10-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 B. For utility boiler burning coke (SCC 10100801) controlled with a single cyclone (075) and a baghouse (100): 1. PM25-FIL (Discrete Value) = PM-FIL (Discrete Value) * uncontrolled PSD fraction * PSD-specific control efficiency for 2 control devices 2. PM10-FIL (Discrete Value) = PM-FIL (Discrete Value) * uncontrolled PSD fraction * PSD-specific control efficiency for 2 control devices 3. No PM-CON emission factors available to calculate PM10-PRI and PM25-PRI emission factors

Table 5 (continued)

Scenario ID	Control 1	Control 2	PM-PRI EF	PM-FIL EF	PM10-PRI EF	PM10-FIL EF	PM25-PRI EF	PM25-FIL EF	PM-CON EF	Methods
28	Controlled	Uncontrolled		Discrete						For industrial boiler burning bagasse (SCC 10201101) controlled with a mechanical collector (150): 1. PM10-FIL, PM25-FIL, and PM-CON emission factors not added to the database due to the lack of PSD data for this process.
29	Uncontrolled	Uncontrolled		Discrete						For uncontrolled industrial and commercial/institutional overfeed stokers burning bituminous/subbituminous coal (SCCs 10200210 & 10300211): 1. PM10-FIL (Discrete Value) and PM25-FIL (Discrete Value) emission factors from AP-42 2. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 3. PM10-PRI (Discrete Value) = PM10-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 For uncontrolled boilers burning bagasse (SCC 10101101), solid waste (SCC 10101202), and hand-fired boilers burning bituminous/subbituminous coal (SCC 10300214): 1. PM25-FIL (Discrete Value) = PM-FIL (Discrete Value) * PSD fraction 2. PM10-FIL (Discrete Value) = PM-FIL (Discrete Value) * PSD fraction 3. No PM-CON emission factors available to calculate PM10-PRI and PM25-PRI emission factors
30	Controlled	Uncontrolled		Formula						A. For utility dry bottom boilers burning pulverized lignite coal (SCCs 10100301 & 10100302) controlled with a baghouse (100) or a wet scrubber (141): 1. PM25-FIL (Formula) = PM-FIL (Formula) * uncontrolled PSD fraction * PSD-specific control efficiency for 1 control device 2. PM10-FIL (Formula) = PM-FIL (Formula) * uncontrolled PSD fraction * PSD-specific control efficiency for 1 control device 3. PM-CON taken from AP-42 (Formula) 4. Since PM10-FIL and PM25-FIL emission factors are formulas, PM10-PRI and PM25-PRI emission factors were not added to database because primary emission factor is Formula + Formula. B. For atmospheric fluidized bed boilers burning lignite coal (SCCs 10100316, 10100317, & 10100318) controlled with dry limestone injection (041) or an ESP (128): 1. PM-CON (Discrete Value) from AP-42 2. PM10-FIL and PM25-FIL emission factors not added to the database due to the lack of PSD data for this process.

Table 5 (continued)

Scenario ID	Control 1	Control 2	PM-PRI EF	PM-FIL EF	PM10-PRI EF	PM10-FIL EF	PM25-PRI EF	PM25-FIL EF	PM-CON EF	Methods
31	Uncontrolled	Uncontrolled		Formula						A. For uncontrolled utility cyclone furnace burning lignite coal (SCC 10100303): 1. PM25-FIL (Formula) = PM-FIL (Formula) * uncontrolled PSD fraction 2. PM10-FIL (Formula) = PM-FIL (Formula) * uncontrolled PSD fraction [Notes: PSD data not available for cyclone boilers burning lignite coal; PSD fraction based on emission factor ratios for cyclone boilers burning bituminous/subbituminous coal in AP-42, Table 1.1-8.] 3. PM-CON (Formula) taken from AP-42 4. Since PM10-FIL and PM25-FIL emission factors are formulas, PM10-PRI and PM25-PRI emission factors were not added to the database because primary emission factor is Formula + Formula B. For uncontrolled industrial boiler burning pulverized bituminous/subbituminous coal (SCC 10200226): 1. PM10-FIL (Formula) and PM25-FIL (Formula) emission factors taken from AP-42, Table 1.1-6. 2. PM-CON (Formula) taken from AP-42 3. Since PM10-FIL and PM25-FIL emission factors are formulas, PM10-PRI and PM25-PRI emission factors were not added to the database because primary emission factor is Formula + Formula C. For uncontrolled industrial and commercial/institutional space heaters burning waste oil (SCCs 10500114 & 10500214): 1. PM25-FIL (Formula) = PM-FIL (Formula) * uncontrolled PSD fraction 2. PM10-FIL (Formula) = PM-FIL (Formula) * uncontrolled PSD fraction 3. PM25-PRI (Formula + Discrete Value) = PM25-FIL (Formula) + PM-CON from AP-42 (Discrete Value) 4. PM10-PRI (Formula + Discrete Value) = PM10-FIL (Formula) + PM-CON from AP-42 (Discrete Value).

Table 5 (continued)

Scenario ID	Control 1	Control 2	PM-PRI EF	PM-FIL EF	PM10-PRI EF	PM10-FIL EF	PM25-PRI EF	PM25-FIL EF	PM-CON EF	Methods
Internal Combustion										
32	Uncontrolled	Uncontrolled				Discrete		Discrete	Discrete	For uncontrolled reciprocating engines burning natural gas (SCCs 20200252, 20200253, & 20200254): 1. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 2. PM10-PRI (Discrete Value) = PM10-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42
33	Controlled	Uncontrolled	Discrete	Discrete					Discrete	For utility, industrial, and commercial/institutional natural gas fired turbines (SCCs 20100201, 20200201, 20200203, 20300202, & 20300203) controlled with steam or water injection (Control Code 028): 1. PM10-FIL & PM25-FIL (Discrete Value) = PM-FIL (Discrete Value) [Note: All PM (total, condensible and filterable) is assumed to be less than 1.0 micrometer in diameter.] 2. PM10-PRI (Discrete Value) = PM10-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 3. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42
34	Controlled	Uncontrolled	Discrete	Discrete					Discrete	For distillate oil fired turbine (SCCs 20100101, 20200101, 20200103, & 20300102); kerosene/naphtha (jet fuel) fired turbines (SCC 20100901); and diesel/kerosene engine testing turbines (SCC 20400302) each controlled with steam or water injection (Control Code 028): 1. PM25-FIL (Discrete Value) = PM-FIL (Discrete Value) * PSD fraction 2. PM10-FIL (Discrete Value) = PM-FIL (Discrete Value) * PSD fraction 3. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 4. PM10-PRI (Discrete Value) = PM10-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42
35	Uncontrolled	Uncontrolled	Discrete	Discrete	Discrete	Discrete		Discrete	Discrete	For uncontrolled large-bore engines burning diesel (SCC 20200401): 1. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42
36	Uncontrolled	Uncontrolled	Discrete							For uncontrolled industrial turbine burning kerosene/naphtha (jet fuel) (SCC 20200901): 1. PM25-FIL (Discrete Value) = PM-FIL (Discrete Value) * uncontrolled PSD fraction 2. PM10-FIL (Discrete Value) = PM-FIL (Discrete Value) * uncontrolled PSD fraction 3. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 4. PM10-PRI (Discrete Value) = PM10-FIL (Discrete Value) + PM-CON (Discrete Value) from AP-42 [Note: PM10-PRI emission factor is more than PM-PRI emission factor in FIRE 6.23; PM10-PRI emission factor was replaced with the sum of the PM10-FIL and PM-CON emission factors.
37	Uncontrolled	Uncontrolled				Discrete				For uncontrolled commercial/institutional turbines burning digester gas (SCC 20300701) and landfill gas (SCC 20300801): 1. PM25-FIL (Discrete Value) = PM10-FIL (Discrete Value) [Note: All PM (total, condensible and filterable) is assumed to be less than 1.0 micrometer in diameter.] 2. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON from AP-42 (Discrete Value) from AP-42 3. PM10-PRI (Discrete Value) = PM10-FIL (Discrete Value) + PM-CON from AP-42 (Discrete Value) from AP-42

Table 5 (continued)

Scenario ID	Control 1	Control 2	PM-PRI EF	PM-FIL EF	PM10-PRI EF	PM10-FIL EF	PM25-PRI EF	PM25-FIL EF	PM-CON EF	Methods
38	Uncontrolled	Uncontrolled		Discrete		Discrete				A. For uncontrolled utility, industrial, commercial/institutional reciprocating engines burning natural gas (SCCs 20100202, 20200202, 20200204, & 20300201); test engines burning natural gas (SCC 20400301); and industrial large bore engines burning dual fuels (SCCs 20200402 & 20200403): 1. PM25-FIL (Discrete Value) = PM10-FIL (Discrete Value) * uncontrolled PSD fraction [Note: For natural gas combustion, all PM (total, condensible and filterable) is assumed to be less than 1.0 micrometer in diameter.] 2. PM25-PRI (Discrete Value) = PM25-FIL (Discrete Value) + PM-CON from AP-42 (Discrete Value) from AP-42 3. PM10-PRI (Discrete Value) = PM10-FIL (Discrete Value) + PM-CON from AP-42 (Discrete Value) from AP-42 B. For uncontrolled industrial reciprocating engines burning dual fuels (SCC 20200501 & 20200902) and utility reciprocating engines burning dual fuels (SCC 20100902): 1. No PSD data available to derive PM25-FIL emission factors. C. For uncontrolled SCC 20100102, 20200104, 20200301, 20400401, & 20400402: 1. PM-CON emission factors are not available to calculate primary emission factors.
39	Uncontrolled	Uncontrolled		Discrete		Discrete		Discrete		For uncontrolled industrial and commercial/institutional reciprocating engines burning distillate oil (diesel) (SCCs 20200102 & 20300101) and commercial/institutional reciprocating engines burning gasoline (SCC 20300301): 1. No PM-CON emission factors are available in AP-42 for these SCCs.

[1] The terms "Discrete" and "Formula" in the pollutant columns identify SCC and control combinations for which FIRE 6.23 contains emission factors; null values in these columns identify SCC and control combinations for which FIRE 6.23 does not contain emission factors.

Table 6. SCC and Control Combinations in FIRE 6.23 for which PM10-FIL and/or PM25-FIL Emission Factors were not Estimated

Scenario	SCC	SCC3 Description	SCC6 Description	SCC8 Description	Control 1	Control 1 Description	Control 2	Control 2 Description	Emission Factor Available in FIRE 6.23?							Notes
									PM-PRI	PM-FIL	PM10-PRI	PM10-FIL	PM25-PRI	PM25-FIL	PM-CON	
External Combustion Boilers																
30	10100316	Electric Generation	Lignite	Atmospheric Fluidized Bed ** (See 101003-17 & -18)	041	Dry Limestone Injection	000	Uncontrolled	No	Yes	No	No	No	No	No	This SCC and control combination is not in Final Version 3 of the 1999 NEI; therefore, PM10-FIL and PM25-FIL emission factors were not developed partially because of the lack of particle size data and partially because of project resource constraints. A PM-CON emission factor in AP-42 was added to the PM Emission Factor Database.
30	10100317	Electric Generation	Lignite	Atmospheric Fluidized Bed Combustion - Bubbling Bed	128	Electrostatic Precipitator	000	Uncontrolled	No	Yes	No	No	No	No	No	This SCC and control combination is not in Final Version 3 of the 1999 NEI; therefore, PM10-FIL and PM25-FIL emission factors were not developed partially because of the lack of particle size data and partially because of project resource constraints. A PM-CON emission factor in AP-42 was added to the PM Emission Factor Database.
30	10100318	Electric Generation	Lignite	Atmospheric Fluidized Bed Combustion - Circulating Bed	128	Electrostatic Precipitator	000	Uncontrolled	No	Yes	No	No	No	No	No	This SCC and control combination is not in Final Version 3 of the 1999 NEI; therefore, PM10-FIL and PM25-FIL emission factors were not developed partially because of the lack of particle size data and partially because of project resource constraints. A PM-CON emission factor in AP-42 was added to the PM Emission Factor Database.
15	10101101	Electric Generation	Bagasse	All Boiler Sizes	141	Wet Scrubber	000	Uncontrolled	No	No	No	Yes	No	No	No	This SCC and control combination is not in Final Version 3 of the 1999 NEI; therefore, a PM25-FIL emission factor was not developed partially because of the lack of particle size data and partially because of project resource constraints. A PM-CON emission factor was not identified for this SCC and control combination.
16	10200206	Industrial	Bituminous/ Subbituminous Coal	Underfeed Stoker	121	Multiple Cyclones	000	Uncontrolled	No	Yes	No	Yes	No	No	No	EPA advised that the PM10-FIL emission factor for this SCC and control combination in AP-42 Section 1.1, Table 1.1-4 is incorrect; therefore, the PM10-FIL emission factor is not included in the database. A PM-CON emission factor in AP-42 was added to the PM Emission Factor Database.
16	10300208	Commercial/Institutional	Bituminous/ Subbituminous Coal	Underfeed Stoker (Bituminous Coal)	121	Multiple Cyclones	000	Uncontrolled	No	Yes	No	No	No	No	No	EPA advised that the PM10-FIL emission factor for this SCC and control combination in AP-42 Section 1.1, Table 1.1-4 is incorrect; therefore, the PM10-FIL emission factor is not included in the database. A PM-CON emission factor in AP-42 was added to the PM Emission Factor Database.
16	10201101	Industrial	Bagasse	All Boiler Sizes	141	Wet Scrubber	000	Uncontrolled	No	Yes	No	Yes	No	No	No	This SCC and control combination is not in Final Version 3 of the 1999 NEI; therefore, PM25-FIL emission factor was not developed partially because of the lack of particle size data and partially because of project resource constraints. A PM-CON emission factor was not identified for this SCC and control combination.
28	10201101	Industrial	Bagasse	All Boiler Sizes	150	Mechanical Collector	000	Uncontrolled	No	Yes	No	No	No	No	No	This SCC and control combination is not in Final Version 3 of the 1999 NEI; therefore, PM10-FIL and PM25-FIL emission factors were not developed partially because of the lack of particle size data and partially because of project resource constraints. A PM-CON emission factor was not identified for this SCC and control combination.

Table 6 (continued)

Scenario	SCC	SCC3 Description	SCC6 Description	SCC8 Description	Control 1	Control 1 Description	Control 2	Control 2 Description	Emission Factor Available in FIRE 6.23?							Notes
									PM-PRI	PM-FIL	PM10-PRI	PM10-FIL	PM25-PRI	PM25-FIL	PM-CON	
Internal Combustion Engines																
38	20100902	Electric Generation	Kerosene/Naphtha (Jet Fuel)	Reciprocating	000	Uncontrolled	000	Uncontrolled	No	Yes	No	Yes	No	No	No	This SCC and control combination is in Final Version 3 of the 1999 NEI; however, a PM25-FIL emission factor was not developed because of the lack of particle size data on the fraction of PM25-FIL in PM10-FIL or PM-FIL. A PM-CON emission factor was not identified for this SCC and control combination.
38	20200501	Industrial	Residual/ Crude Oil	Reciprocating	000	Uncontrolled	000	Uncontrolled	No	Yes	No	Yes	No	No	No	This SCC and control combination is in Final Version 3 of the 1999 NEI; however, a PM25-FIL emission factor was not developed because of the lack of particle size data on the fraction of PM25-FIL in PM10-FIL or PM-FIL. A PM-CON emission factor was not identified for this SCC and control combination.
38	20200902	Industrial	Kerosene/ Naphtha (Jet Fuel)	Reciprocating	000	Uncontrolled	000	Uncontrolled	No	Yes	No	Yes	No	No	No	This SCC and control combination is in Final Version 3 of the 1999 NEI; however, a PM25-FIL emission factor was not developed because of the lack of particle size data on the fraction of PM25-FIL in PM10-FIL or PM-FIL. A PM-CON emission factor was not identified for this SCC and control combination.

For these cases, uncontrolled particle size data and particle-size-specific control efficiency data from AP-42 were used to derive PM10-FIL and PM25-FIL emission factors from the controlled PM-FIL emission factor in FIRE 6.23. For the SCC and control combinations shown in the first three bullets, the boilers are controlled with one control device. For the SCC and control combination shown in the fourth bullet, the boiler is controlled with two control devices in series. The uncontrolled particle size data, particle-size-specific control efficiency data, references, and calculations for the first three cases are shown in Tables 7, 8, and 9. For the fourth case, the uncontrolled particle size data, particle-size-specific control efficiency data, references, and calculations for the first three cases are shown in Table 10. It should be noted that the quality of the controlled PM10-FIL and PM25-FIL emission factors is unknown and process- and control-specific data should always be used instead of these emission factors, when available.

Table 7. Calculation of Controlled PM10-FIL and PM25-FIL Emission Factors for Electric Generation Boiler Burning Solid Waste (SCC 10101201) and Controlled with an Electrostatic Precipitator (ESP) (Control Code 128)

Scenario 8						
Controlled Filterable Emission Factors (lb/MMBtu)		**Condensible Emission Factors (lb/MMBtu)**	**Controlled Primary Emission Factors (lb/MMBtu)**			
PM-FIL	1.140E-02			Reference 1		
PM10-FIL	1.342E-03	1.480E-02	1.614E-02	PM10-FIL Emission Factor Calculated; see procedures below		
PM25-FIL	1.026E-03	1.480E-02	1.583E-02	PM25-FIL Emission Factor Calculated; see procedures below		
ESP Control Data (Reference 2)		**Particle-Size-Specific Control Efficiencies**				
SCC	Control 1	Control 2	PM10_CE	PM6_CE	PM2.5_CE	
10101201	011	000	97	90	80	
	ESP					
Uncontrolled Particle Size Data (Reference 3)			**Fraction of Total PM-FIL**			
SCC			PM10-FIL	PM6-FIL	PM25-FIL	
10101201			0.79	0.7	0.45	
Calculate Controlled Particle Size Fractions Applied to Controlled PM-FIL Emission Factor and Calculate Controlled PM10-FIL and PM25-FIL Emission Factors						
	Controlled PM-FIL EF =	1.14E-02	Lb/MMBtu			
			Controlled Fractions Relative to PM-FIL		**Controlled Emission Factors**	
PM25-FIL Fraction of PM-FIL	(PM2.5 uncontrolled particle size fraction) x (1-(PM2.5_CE/100))		(0.45) x (1-(80/100))	0.0900	1.026E-03	PM-FIL EF * PM25-FIL Fraction (1.14E-02 x 0.0900)
PM6-FIL Fraction of PM-FIL	(PM6 uncontrolled particle size fraction - PM2.5 uncontrolled PS fraction) x (1-(PM6_CE/100)) + PM2.5 controlled particle size fraction		(0.7-0.45) x (1-(90/100)) + (0.0900)	0.1150	1.311E-03	PM-FIL EF * PM6-FIL Fraction (1.14E-02 x 0.1150)
PM10-FIL Fraction of PM-FIL	(PM10 uncontrolled particle size fraction - PM6 uncontrolled particle size fraction) x (1-(PM10_CE/100)) + PM6 controlled particle size fraction		(0.79-0.7) x (1-(97/100)) + (0.1150)	0.1177	1.342E-03	PM-FIL EF * PM10-FIL Fraction (1.14E-02 x 0.1177)
Overall Control Efficiencies (%)						
PM25-FIL				80.00		
PM6-FIL				83.57		
PM10-FIL				85.10		

References

1 Stationary Source Sampling Final Report, Reference No. 10759, Baltimore Resco Company, Baltimore, Maryland. May 12 - 15, 1992. (Confidential Report No. ERC-103)

2 AP-42, Appendix B.2 for PM10-FIL and PM25-FIL particle-size-specific control efficiencies used in PM Calculator

3 Unknown for PM10-FIL and PM25-FIL uncontrolled particle size fractions used in PM Calculator

Table 8. Calculation of Controlled PM10-FIL and PM25-FIL Emission Factors for Electric Generation Dry Bottom, Wall Fired (SCC 10100301) Boiler or Tangential Fired Boiler (SCC 10100302) Burning Pulverized Lignite Coal Controlled with a Wet Scrubber (Control Code 141)

Scenario 30						
Controlled Filterable Emission Factors (lb/Ton)		**Condensible Emission Factors (lb/Ton)**	**Controlled Primary Emission Factors (lb/Ton)**			
PM-FIL	5.000E-02			Reference 1		
PM10-FIL	9.450E-04	(0.1*S-0.03)*16	(0.1*S-0.03)*16 + 0.000945	PM10-FIL Emission Factor Calculated; see procedures below		
PM25-FIL	5.000E-04	(0.1*S-0.03)*16	(0.1*S-0.03)*16 + 0.0005	PM25-FIL Emission Factor Calculated; see procedures below		
Wet Scrubber Control Data (Reference 2)		**Particle-Size-Specific Control Efficiencies**				
SCC	Control 1	Control 2	PM10_CE	PM6_CE	PM2.5_CE	
10100301/02	001	000	99	95	90	
	Wet Scrubber - High Efficiency	Uncontrolled				
Uncontrolled Particle Size Data (Reference 3)			**Fraction of Total PM-FIL**			
SCC			PM10-FIL	PM6-FIL	PM25-FIL	
10100301/02			0.35	0.26	0.1	
Calculate Controlled Particle Size Fractions Applied to Controlled PM-FIL Emission Factor and Calculate Controlled PM10-FIL and PM25-FIL Emission Factors						
	Controlled PM-FIL EF =	5.00E-02	lb/Ton			
			Controlled Fractions Relative to PM-FIL		**Controlled Emission Factors (lb/Ton)**	
PM25-FIL Fraction of PM-FIL	(PM2.5 uncontrolled particle size fraction) x (1-(PM2.5_CE/100))		(0.1) x (1-(90/100))	0.0100	5.000E-04	PM-FIL EF * PM25-FIL Fraction (5.00E-02 x 0.0100)
PM6-FIL Fraction of PM-FIL	(PM6 uncontrolled particle size fraction - PM2.5 uncontrolled PS fraction) x (1-(PM6_CE/100)) + PM2.5 controlled particle size fraction		(0.26-0.1) x (1-(95/100)) + (0.0100)	0.0180	9.000E-04	PM-FIL EF * PM6-FIL Fraction (5.00E-02 x 0.0180)
PM10-FIL Fraction of PM-FIL	(PM10 uncontrolled particle size fraction - PM6 uncontrolled particle size fraction) x (1-(PM10_CE/100)) + PM6 controlled particle size fraction		(0.35-0.26) x (1-(99/100)) + (0.0180)	0.0189	9.450E-04	PM-FIL EF * PM10-FIL Fraction (5.00E-02 x 0.0189)
Overall Control Efficiencies (%) Calculated from Controlled and Uncontrolled Fractions						
PM25-FIL				90.00		
PM6-FIL				93.08		
PM10-FIL				94.60		

References

1 EPA. September, 1998. Section 1.7, Lignite Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S.Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.

2 AP-42, Appendix B.2 for PM10-FIL and PM25-FIL particle-size-specific control efficiencies used in PM Calculator

3 EPA, 1998. Section 1.7, Lignite Combustion (Tables 1.7-4 and 1.7-7) and Appendix B.2. In: Compilation of Air Pollutant Emission Factors, AP-42, U.S. Environmental Protection Agency, 5th Edition, September 1998.

Table 9. Calculation of Controlled PM10-FIL and PM25-FIL Emission Factors for Electric Generation Dry Bottom, Wall Fired Boiler (SCC 10100301) or Tangential Fired Boiler (SCC 10100302) Burning Pulverized Lignite Coal (SCC 10100301) Controlled with a Baghouse (Control Code 100)

Scenario 30						
Controlled Filterable Emission Factors (lb/Ton)		**Condensible Emission Factors (lb/Ton)**	**Controlled Primary Emission Factors (lb/Ton)**			
PM-FIL	8.000E-02			Reference 1		
PM10-FIL	1.800E-04	(0.1*S-0.03)*16	(0.1*S-0.03)*16 + 0.00018	PM10-FIL Emission Factor Calculated; see procedures below		
PM25-FIL	8.000E-05	(0.1*S-0.03)*16	(0.1*S-0.03)*16 + 0.00008	PM25-FIL Emission Factor Calculated; see procedures below		
Baghouse Control Data (Reference 2)		**Particle-Size-Specific Control Efficiencies**				
SCC	Control 1	Control 2	PM10_CE	PM6_CE	PM2.5_CE	
10100301/02	016, 017, or 018	000	99.5	99.5	99	
	Fabric Filter	Uncontrolled				
Uncontrolled Particle Size Data (Reference 3)			**Fraction of Total PM-FIL**			
SCC			PM10-FIL	PM6-FIL	PM25-FIL	
10100301/02			0.35	0.26	0.1	
Calculate Controlled Particle Size Fractions Applied to Controlled PM-FIL Emission Factor and Calculate Controlled PM10-FIL and PM25-FIL Emission Factors						
	Controlled PM-FIL EF =	8.00E-02	lb/Ton			
			Controlled Fractions Relative to PM-FIL		**Controlled Emission Factors (lb/Ton)**	
PM25-FIL Fraction of PM-FIL	(PM2.5 uncontrolled particle size fraction) x (1-(PM2.5_CE/100))		(0.1) x (1-(99/100))	0.0010	8.000E-05	PM-FIL EF * PM25-FIL Fraction (8.00E-02 x 0.0010)
PM6-FIL Fraction of PM-FIL	(PM6 uncontrolled particle size fraction - PM2.5 uncontrolled PS fraction) x (1-(PM6_CE/100)) + PM2.5 controlled particle size fraction		(0.26-0.1) x (1-(99.5/100)) + (0.0010)	0.0018	1.440E-04	PM-FIL EF * PM6-FIL Fraction (8.00E-02 x 0.0018)
PM10-FIL Fraction of PM-FIL	(PM10 uncontrolled particle size fraction - PM6 uncontrolled particle size fraction) x (1-(PM10_CE/100)) + PM6 controlled particle size fraction		(0.35-0.26) x (1-(99.5/100)) + (0.0018)	0.0023	1.800E-04	PM-FIL EF * PM10-FIL Fraction (8.00E-02 x 0.0023)
Overall Control Efficiencies (%) Calculated from Controlled and Uncontrolled Fractions						
PM25-FIL				99.00		
PM6-FIL				99.31		
PM10-FIL				99.36		

References

1 EPA. September, 1998. Section 1.7, Lignite Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E. U.S.Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.

2 AP-42, Appendix B.2 for PM10-FIL and PM25-FIL particle-size-specific control efficiencies used in PM Calculator

3 EPA, 1998. Section 1.7, Lignite Combustion (Tables 1.7-4 and 1.7-7) and Appendix B.2. In: Compilation of Air Pollutant Emission Factors, AP-42, U.S. Environmental Protection Agency, 5th Edition, September 1998.

Table 10. Calculation of Controlled PM10-FIL and PM25-FIL Emission Factors for Electric Generation Boiler Burning Coke (SCC 10100801) and Controlled with a Single Cyclone (Control Code 075) and a Baghouse (Control Code 100)

Scenario 27						
Controlled Filterable Emission Factors (lb/MMBtu)		**Condensible Emission Factors (lb/MMBtu)**	**Controlled Primary Emission Factors (lb/MMBtu)**			
PM-FIL	1.200E-02			Reference 1		
PM10-FIL	6.105E-05	Not Available	Not Available	PM10-FIL Emission Factor Calculated; see procedures below		
PM25-FIL	4.860E-05	Not Available	Not Available	PM25-FIL Emission Factor Calculated; see procedures below		
ESP Control Data (Reference 2)		**Particle-Size-Specific Control Efficiencies**				
SCC	Control 1	Control 2	PM10_CE	PM6_CE	PM2.5_CE	
10100801	Centrifugal Collector		50	35	10	
	008					
10100801		016, 017, or 018	99.5	99.5	99	
		Fabric Filter				
Uncontrolled Particle Size Data (Reference 3)			**Fraction of Total PM-FIL**			
SCC			PM10-FIL	PM6-FIL	PM25-FIL	
10100801			0.79	0.7	0.45	
Calculate Controlled Particle Size Fractions Applied to Controlled PM-FIL Emission Factor and Calculate Controlled PM10-FIL and PM25-FIL Emission Factors						
	Controlled PM-FIL EF =	1.20E-02	Lb/MMBtu			
Control 1 (Centrifugal Collector)			**Controlled Fractions Relative to PM-FIL**		**Controlled Emission Factors (lb/MMBtu)**	
PM25-FIL Fraction of PM-FIL	(PM2.5 uncontrolled particle size fraction) x (1-(PM2.5_CE/100))		(0.45) x (1-(10/100))	0.4050	4.860E-03	PM-FIL EF * PM25-FIL Fraction (1.2E-02 x 0.4050)
PM6-FIL Fraction of PM-FIL	(PM6 uncontrolled particle size fraction - PM2.5 uncontrolled PS fraction) x (1-(PM6_CE/100)) + PM2.5 controlled particle size fraction		(0.7-0.45) x (1-(35/100)) + (0.4050)	0.5675	6.810E-03	PM-FIL EF * PM6-FIL Fraction (1.2E-02 x 0.5675)
PM10-FIL Fraction of PM-FIL	(PM10 uncontrolled particle size fraction - PM6 uncontrolled particle size fraction) x (1-(PM10_CE/100)) + PM6 controlled particle size fraction		(0.79-0.7) x (1-(50/100)) + (0.5675)	0.6125	7.350E-03	PM-FIL EF * PM10-FIL Fraction (1.2E-02 x 0.6125)
Control 2 (Fabric Filter)						
PM25-FIL Fraction of PM-FIL	(PM2.5 control 1 particle size fraction) x (1-(PM2.5_CE/100))		(0.4050) x (1-(99/100))	0.0041	4.86E-05	PM-FIL EF * PM25-FIL Fraction (1.2E-02 x 0.0041)
PM6-FIL Fraction of PM-FIL	(PM6 control 1 particle size fraction - PM2.5 control 1 particle size fraction) x (1-(PM6_CE/100)) + PM2.5 controlled control 1 size fraction		(0.5675-0.4050) x (1-(99.5/100)) + (0.0041)	0.0049	5.84E-05	PM-FIL EF * PM6-FIL Fraction (1.2E-02 x 0.0049)
PM10-FIL Fraction of PM-FIL	(PM10 control 1 particle size fraction - PM6 control 1 particle size fraction) x (1-(PM10_CE/100)) + PM6 control 1 particle size fraction		(0.6125-0.5675) x (1-(99.5/100)) + (0.00497)	0.0051	6.11E-05	PM-FIL EF * PM10-FIL Fraction (1.2E-02 x 0.0051)
Overall Control Efficiencies (%)						
PM25-FIL				99.10		
PM6-FIL				99.31		
PM10-FIL				99.36		

References

1 Emission Testing on Units 1A and 2A, Nelson Industrial Steam Company (NISCO), Westlake, California. November 4 - 5, 1992.

2 AP-42, Appendix B.2 for PM10-FIL and PM25-FIL particle-size-specific control efficiencies used in PM Calculator

3 Unknown for PM10-FIL and PM25-FIL uncontrolled particle size fractions used in PM Calculator

CHAPTER V. HOW WERE PM10-PRI AND PM25-PRI EMISSION FACTORS DEVELOPED?

For each SCC and control combination, the PM-CON emission factor was summed with the PM10-FIL emission factor to obtain the PM10-PRI emission factor, and the PM25-FIL emission factor to obtain the PM25-PRI emission factor. The PM10-PRI and PM25-PRI emission factors are displayed in the database if at least one of the emission factors is a discrete value. If both emission factors are formulas, it was decided not to show the primary emission factor as the sum of two formulas in the database.

The quality rating for the primary emission factor was set to the lowest quality rating of either the filterable or condensible emission factor. If the quality rating for either the filterable or condensible emission factor was "U" (unknown), the quality rating for the primary emission factor was set to "U".

The following was entered in the "NOTES" fields:

Field Name	Note
NOTES_PM10-PRI	Sum of PM10-FIL and PM-CON emission factors
NOTES_PM25-PRI	Sum of PM25-FIL and PM-CON emission factors

A reference was not entered in the "REF_DESC" field because the references are provided in the "REF_DESC" field for the filterable and condensible emission factors that are added to obtain the primary emission factor.

CHAPTER VI. REFERENCES

EPA, 2003: Enhanced Particulate Matter Controlled Emissions Calculator, User's Manual, U.S. Environmental Protection Agency, Emission Factor and Inventory Group, Emissions Monitoring and Analysis Division, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina. September 2003.

EPA, 2000: Factor Information and REtrival (FIRE) Data System, located on the Technology Transfer Network Clearinghouse for Inventories & Emission Factors Web Site at http://www.epa.gov/ttn/chief/software/fire/index.html. October 2000.

EPA, 1998a: Section 1.1, Bituminous and Subbituminous Coal Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E, September 1998. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.

EPA, 1998b: Section 1.7, Lignite Combustion. In: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, Supplement E, September 1998. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.