Updated PM Augmentation Procedures for the 2002 Point Source NEI

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ABSTRACT

Emission inventories are critical for the efforts of state, local, and tribal agencies to attain and maintain National Ambient Air Quality Standards (NAAQS) that the U.S. Environmental Protection Agency (EPA) has established for criteria air pollutants. Emission inventories are needed to develop State Implementation Plans to demonstrate compliance with the 8-hour ozone NAAQS, the particulate matter $(PM)_{2.5}$ NAAQS , and the Regional Haze Rule. The $PM_{2.5}$ NAAQS and the Regional Haze Rule focus special attention on emission inventory efforts for the multiple PM species needed in regional air quality modeling. EPA requires emission inventory submittals to the National Emission Inventory (NEI) for filterable and primary PM (PM_{10}-FIL, PM_{10}-PRI, $PM_{2.5}$-FIL, and $PM_{2.5}$-PRI), along with condensible PM (PM-CON). If state, local, and tribal agencies do not submit complete PM inventories for the 2002 point source NEI, EPA implements augmentation procedures as described in this paper. The stepwise PM augmentation procedures and data sources that form the basis for the associated 2002 NEI computer algorithms are described.

INTRODUCTION

The U.S. Environmental Protection Agency (EPA) is developing the point source National Emission Inventory (NEI) for 2002. In developing the NEI, the EPA requires that particulate matter (PM_{10}-PRI, PM_{10}-FIL, $PM_{2.5}$-PRI, $PM_{2.5}$-FIL, and PM-CON) be submitted by state, local, and tribal (SLT) agencies. However, sometimes, fewer PM terms are submitted. Therefore, the PM data need to be augmented to achieve the required PM terms.

PM DEFINITIONS

PM-FIL = Total Filterable particulate matter that is a solid or liquid at stack or release point. This PM can be captured on the filter of a stack test train. It is NOT equal to PM_{10}-FIL + $PM_{2.5}$-FIL.

PM_{10}-FIL = Filterable PM up to 10 microns in diameter.

$PM_{2.5}$-FIL = Filterable PM up to 2.5 microns in diameter.

PM-CON = Condensible particulate matter that is a vapor at stack conditions but condenses upon cooling and mixing with ambient air to a solid or liquid. Generally less than

1 µm. As a result, the PM-CON portion of PM-PRI, PM_{10}-PRI, and $PM_{2.5}$-PRI is identical.

PM-PRI = Total Primary PM, which is both the filterable PM plus condensible PM. It is NOT equal to PM_{10}-PRI + $PM_{2.5}$-PRI.

PM_{10}-PRI = Primary PM up to 10 microns in diameter.

$PM_{2.5}$-PRI = Primary PM up to 2.5 microns in diameter

PM-SEC = Secondary particulate matter that forms when emissions react in the ambient air, well after dilution and condensation have occurred. PM-SEC should not be reported for emission inventories. (Examples: secondary organics from VOC, ammonium sulfate from ammonia and SO_2, and ammonium nitrate from NO_x and ammonia.)[1]

As mentioned above, the only required terms of the 2002 NEI are: PM_{10}-PRI, PM_{10}-FIL, $PM_{2.5}$-PRI, $PM_{2.5}$-FIL, and PM-CON.

OVERVIEW OF THE AUGMENTATION PROCESS

A decision tree flowchart was developed to provide augmentation procedures for the possible SLT agency submittal scenarios. This flowchart is provided in Figure 1. Decision points are represented by diamonds, while calculations and PM Calculator operations are represented by boxes.

The Figure 1 decision tree flowchart provides the logic for the programming code used to automate the augmentation process.

This decision tree addresses all possible SLT agency submittal scenarios. For a submittal scenario that already includes the five NEI pollutants, the decision path progresses straight down the left side of Figure 1 to the 2002 NEI. For the PM non-submittal scenario, the decision path progresses down the sloping decision points until being rejected at the “No PM Submittal” box. The other submittal scenarios will follow a decision path somewhere between these two extremes.

In some cases, augmenting the data will only require the use of ratios and also simple subtraction and addition. Subtraction and addition will be used because some of the PM terms have a simple relationship between each other.

The following equations show how the PM terms relate to each other:

PM-PRI = PM-FIL + PM-CON Eq. 1
PM_{10}-PRI = PM_{10}-FIL + PM-CON Eq. 2
$PM_{2.5}$-PRI = $PM_{2.5}$-FIL + PM-CON Eq. 3

From those three equations, seven steps were developed and applied to augment the reported PM terms in the 2002 point source NEI, which are listed below. It is important to note that these steps are SCC- and control device-specific. That is, these equations can only be used for pairs of values with the same SCC and reported control device. If conflicting control device information were provided for the two available terms, the missing term was not augmented in this phase.

Step 1

PM-CON term was needed. PM-PRI and PM-FIL were available
PM-CON = PM-PRI – PM-FIL

Step 2

PM-CON term was needed. PM_{10}-PRI and PM_{10}-FIL were available
PM-CON = PM_{10}-PRI – PM_{10}-FIL

Step 3

PM-CON term was needed. $PM_{2.5}$-PRI and $PM_{2.5}$-FIL were available
PM-CON = $PM_{2.5}$-PRI – $PM_{2.5}$-FIL

Step 4

PM_{10}-FIL term was needed. PM_{10}-PRI and PM-CON were available
PM_{10}-FIL = PM_{10}-PRI – PM-CON

Step 5

PM_{10}-PRI term was needed. PM_{10}-FIL and PM-CON were available
PM_{10}-PRI = PM_{10}-FIL + PM-CON

Step 6

$PM_{2.5}$-FIL term was needed. $PM_{2.5}$-PRI and PM-CON were available
$PM_{2.5}$-FIL = $PM_{2.5}$-PRI – PM-CON

Step 7

$PM_{2.5}$-PRI term was needed. $PM_{2.5}$-FIL and PM-CON were available
$PM_{2.5}$-PRI = $PM_{2.5}$-FIL + PM-CON

Once steps 1 through 7 were implemented, they were not adequate in filling in all of the missing PM term(s). This is due in part to conflicting control device information. After this shortcoming is corrected and Steps 1 through 7 are re-run, additional augmentation steps will still be needed that will require the use of ratios developed from available emissions and particle size distribution data. These ratios will be needed when only one PM term is available, and two or more terms need to be augmented. Examples of how we will use the PM ratios are shown below:

$FIL \times Ratio_{CON/FIL} = CON$
$PRI \times Ratio_{CON/PRI} = CON$
$CON \times Ratio_{FIL/CON} = FIL$
$CON \times Ratio_{PRI/CON} = PRI$

From these generic equations, Steps 8 through 15 shown below will be implemented in the final PM augmentation.

Step 8

$PM_{2.5}$-FIL term is needed. PM_{10}-FIL is available

$PM_{2.5}\text{-FIL} = PM_{10}\text{-FIL} \times Ratio_{PM25\text{-}FIL/PM10\text{-}FIL}$

Step 9

PM_{10}-FIL term is needed. $PM_{2.5}$-FIL is available

$PM_{10}\text{-FIL} = PM_{2.5}\text{-FIL} \times Ratio_{PM10\text{-}FIL/PM25\text{-}FIL}$

Step 10A

PM-CON term is needed. PM_{10}-PRI is available

$\text{PM-CON} = PM_{10}\text{-PRI} \times Ratio_{PM\text{-}CON/PM10\text{-}PRI}$

Step 10B

$PM_{2.5}$-PRI term is needed. PM_{10}-PRI is available

$PM_{2.5}\text{-PRI} = PM_{10}\text{-PRI} \times Ratio_{PM25\text{-}PRI/PM10\text{-}PRI}$

Step 11A

PM-CON term is needed. $PM_{2.5}$-PRI is available

$\text{PM-CON} = PM_{2.5}\text{-PRI} \times Ratio_{PM\text{-}CON/PM25\text{-}PRI}$

Step 11B

PM_{10}-PRI term is needed. $PM_{2.5}$-PRI is available

$PM_{10}\text{-PRI} = PM_{2.5}\text{-PRI} \times Ratio_{PM10\text{-}PRI/PM25\text{-}PRI}$

Step 12A

PM-CON term is needed. PM_{10}-FIL is available

$\text{PM-CON} = PM_{10}\text{-FIL} \times Ratio_{PM\text{-}CON/PM10\text{-}FIL}$

Step 12B

$PM_{2.5}$-FIL term is needed. PM_{10}-FIL is available

$PM_{2.5}\text{-FIL} = PM_{10}\text{-FIL} \times Ratio_{PM25\text{-}FIL/PM10\text{-}FIL}$

Step 13

PM-CON term is needed. $PM_{2.5}$-FIL is available

$\text{PM-CON} = PM_{2.5}\text{-FIL} \times Ratio_{PM\text{-}CON/PM25\text{-}FIL}$

Step 14

PM_{10}-PRI is needed. PM-CON is available

$PM_{10}\text{-PRI} = \text{PM-CON} \times Ratio_{PM10\text{-}PRI/PM\text{-}CON}$

Step 15

PM-CON is needed. PM-PRI is available

$\text{PM-CON} = \text{PM-PRI} \times Ratio_{PM\text{-}CON/PM\text{-}PRI}$

Development of PM Augmentation Ratios

Draft CON/FIL, CON/PRI, and other ratios were developed from the 2002 EGU NEI data,[2] PM Calculator,[3] and AP-42.[4]

Because some of the ratios developed are more SCC and control device specific, there is a hierarchy that should be followed when using the ratios. In some cases, particularly for PM-CON, only generic ratios can be used.

Ratios have been developed (and applied) in the following order: EGU ratios for processes that start with SCC 101* and 201*, ratios developed using EPA's PM Calculator, ratios developed using AP-42 emission factors, and, finally, ratios developed using AP-42 particle size distribution. Below is a summary of these ratios.

1) EGU Data
   a. PM_{10} and $PM_{2.5}$ primary and filterable
   b. SCC and control device specific
   c. Developed by EPA's Emission Inventory Group (EIG) using PM Calculator and AP-42 data
   d. Applicable to 101* and 201* SCCs

2) PM Calculator
   a. SCC and control device specific
   b. The limitation is that only filterable PM can be entered
   c. Does not include PM-CON ratios

3) AP-42
   a. SCC specific (and sometimes control device specific)
   b. Not limited to filterable PM, includes PM-PRI and PM-CON
   c. Limited number of SCCs
   d. Ratios can be developed based on emission factors (preferred) or particle size distribution
   e. General/generic PM ratios based on SCC 1-digit least preferred

A key issue with using PM ratios for PM augmentation is whether or not the PM emissions are controlled or uncontrolled. It is important to use the correct controlled or uncontrolled ratios when augmenting the PM terms.

Detailed Look at the Creation of PM Ratios

EGU Data

Ratios developed using EGU data are SCC and control device specific. Ratios were developed using the available PM emissions in the EGU data disaggregated by SCC. The ratios were then averaged according to SCC. However, this applied only to SCCs starting with 101 and 201. Table 1 presents a subset of the ratios developed for EGUs. Details on the development of the

PM emission estimates for EGUs can be found in the "Documentation for the 2002 Electric Generating Unit (EGU) National Emissions Inventory (NEI)."[2]

PM-Calculator

Ratios developed using PM Calculator are also SCC and control device specific. If ratios cannot be developed from PM Calculator, ratios will be developed and applied from other sources. PM Calculator is EPA's software for estimating various PM terms from certain existing PM terms.[3]

PM Calculator is applicable to point sources only and requires the user to input uncontrolled emissions (either total PM-FIL or PM_{10}-FIL) for each source, the SCC and the control device, if any. The program will then calculate controlled emissions for $PM_{2.5}$-FIL and PM_{10}-FIL for each point source.[3]

This method is preferred because it is SCC and control device specific. However, PM Calculator is limited in the different terms available, so PM ratios will have to be found using other sources. PM Calculator can only calculate controlled or uncontrolled PM_{10}-FIL and $PM_{2.5}$-FIL using uncontrolled PM_{10}-FIL or PM-FIL. Although the program is designed to calculate emissions in batches, it does not appear to be able to handle large quantities of data, such as the 2002 NEI point source inventory. In addition, the PM Calculator does not directly import NIF files, so generic ratios were developed from the output file by inputting a simple dummy file.

A dummy file, with all of the SCCs and control code device codes in the 2002 point source inventory, was imported into the PM Calculator. Emissions of 100 tons were entered as the emissions in the dummy file for simplicity. The PM Calculator then created an output file that listed for each of SCC and control device codes the following: PM uncontrolled, PM_{10} uncontrolled, $PM_{2.5}$ uncontrolled, PM_{10} controlled, $PM_{2.5}$ controlled, PM_{10} Control Efficiency (CE), and $PM_{2.5}$ CE.

The ratios were then developed by simply dividing the term needed by the term available. As an example, if PM_{10}-FIL controlled were submitted and $PM_{2.5}$-FIL controlled were needed, the ratio $PM_{2.5}$-FIL controlled / PM_{10}-FIL controlled would be 5.4/15.55 = 0.347267.

To the extent possible, PM-FIL ratios have been developed using PM Calculator for all of the SCCs and control device codes in the 2002 point source SLT submittals. When a ratio based on SCC and control device cannot be developed using PM Calculator, other sources of emissions data or emission factors (like AP-42) are needed.

Emission Factors from AP-42

PM ratios can be developed using the emission factors from the U.S. EPA's AP-42.[4] There are, however, a few drawbacks associated with the use of AP-42 emission factors in this manner. In some cases, the ash content or the sulfur content in the fuel used in the process are needed to calculate the emission factors. Unfortunately, most of the SLT records do not include viable sulfur contents. The same is true for ash content.

To overcome this shortcoming, assumptions made in "PM Augmentation Procedures for the 1999 Point and Area Source NEI"[5] were also made here. Specifically, it is assumed that for coal combustion, the sulfur content is 1% and ash content is 8% for SCCs that start with 1 and 2. It is also assumed that PM-CON is only controlled with flue gas desulfurization. To develop the PM ratios, PM emission factors for various PM terms were grouped together based on their SCCs. This required PM emission factors for both the available PM and the needed PM term. Table 2 presents a sample of the results.

In some cases, ash content and sulfur content are not needed to develop PM ratios. PM ratios were developed for these SCCs by again looking for emission factors for the various PM terms available. However, there still were situations when there was just not enough data, and other surrogate data had to be used to develop PM ratios.

<u>Other SCC Emission Factors as Surrogates</u>

For SCCs that start with 3 and 4, PM emissions can occur from the fuel-fired equipment, process heaters, incinerators, and coating ovens. A similar assumption was made in Reference 5 that for SCCs that start with 3 or 4 and have combustion sources, surrogate ratios can be developed based on emission factors for industrial external combustion boilers. These surrogates were matched on the fuel type used. Table 3 shows some of the SCCs that were used as surrogates for the SCC's that start with 402 and have combustion sources. For coating ovens, the assumption was made that natural gas is the fuel used.

SCCs that start with 5, solid waste disposal, do not have the necessary emission factors (or cumulative particle distribution data discussed below) in AP-42. Therefore, average emission factors for external combustion sources and stationary internal combustion sources were used. This assumption again was made in Reference 5. A list of these SCCs is provided in Table 4.

Even after the use of surrogate emission factor data in AP-42, there were situations where ratios still needed to be calculated. In these cases, cumulative particle distributions were used, as discussed below.

<u>Cumulative Particle Distribution from AP-42</u>

AP-42 also has particle distribution data for some SCCs based on the 6- and 8-digit SCC level. These are less specific than the ratios developed from the PM Calculator and AP-42 emission factors, and should only be used when there are not corresponding ratios from the PM Calculator and AP-42 emission factors.

For this method, the following was assumed:

- Percent distribution less than or equal to 1 micron are PM-CON emissions
- Percent distribution less than or equal to 2.5 microns are $PM_{2.5}$-PRI emissions (since they would also include emissions less than or equal to 1 micron)
- Percent distribution less than or equal to 10 microns are PM_{10}-PRI emissions (since they would also include emissions less than or equal to 1 micron)

- The percent for PM-PRI will always be 100%

The data available from the AP-42 included the percent distribution less than or equal to 1 micron, the percent distribution less than or equal to 2.5 microns, and the percent distribution less than or equal to 10 microns. Therefore, the data could be easily converted into ratios. First, the percent distributions were labeled as PM-CON, $PM_{2.5}$-PRI, and PM_{10}-PRI. Then PM-FIL, $PM_{2.5}$-FIL, and PM_{10}-FIL were calculated using the available terms. Finally, the ratios were calculated by dividing the needed term by the available term where X = the Available Term (see Table 5). Therefore, if PM-PRI is available and PM_{10}-FIL is needed, simply multiply PM-PRI to "PM-PRI to PM_{10}-FIL," which is PM_{10}-FIL/ PM-PRI, to calculate PM_{10}-FIL.

<u>1st Digit SCC Cumulative Particle Distribution from AP-42</u>

At the most generic level, certain ratios were also calculated based on the 1st digit of the SCC if specific SCC ratios could not be found. These were developed from AP-42 emission factors and cumulative particle distribution. Again, ratios based on emission factors are preferred over those based on cumulative particle distribution. These 1st digit SCC based ratios also have very generic control efficiencies that can be applied. For this method, the same assumptions and methods for the 6 and 8 digit SCCs discussed above were used. Table 6 presents some of the SCC digit 1 ratios. These very generic ratios and multipliers should be used as a last resort.

CONCLUSIONS

Augmenting the existing PM data to include more PM terms is beneficial because it gives modelers more data to work with. Because of its importance, a consistent, albeit imperfect, method of developing those ratios for augmentation is necessary and should be documented clearly for transparency and reproducibility. For these reasons, EIG has posted the ratio tables developed and discussed in this paper at http://www.epa.gov/ttn/chief/net/2002inventory.html. You are encouraged to review these tables and determine if they are useful in your PM inventory development efforts, and provide comments to EIG as needed. For the most part, these ratios may be needed when the necessary emission factors or activity data are not available for calculating the PM term(s) needed. In the 2002 NEI for point sources, augmented PM data are flagged with a data source of "A" in the Emission table.

The ratios developed using EIG's EGU NEI database are to be applied to electric generation external combustion boilers and internal combustion engines. These ratios are comprehensive and cover PM_{10} and $PM_{2.5}$ primary and filterable and condensable PM, and they are SCC and control device specific. PM calculator, which is specific for other types of sources in terms of SCC and control codes, does not have PM-CON as an output. Ratios involving PM-CON are the most difficult to find. AP-42 would normally be a good source to find emission factors, however, to develop ratios, emission factors for two PM terms are needed (PM-CON, and one other submitted PM term). In many cases, both are not available, or there is conflicting control device information. The majority of PM-CON ratios are not SCC specific, so some assumptions had to be made. Some are at different levels of SCC detail. And occasionally, cumulative particle distributions were a possible source last choice to calculate ratios. Cumulative particle distributions were also available at different levels. At the very least, they are available at the 1st digit SCC, which is very general. But ultimately, ratios are available for all possible SCCs.

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KEY WORDS

Condensible particulate matter
Filterable particulate matter
National emission inventory
Particulate matter
Point sources
Primary particulate matter

Figure 1. 2002 NEI PM Augmentation Decision Tree Flowchart

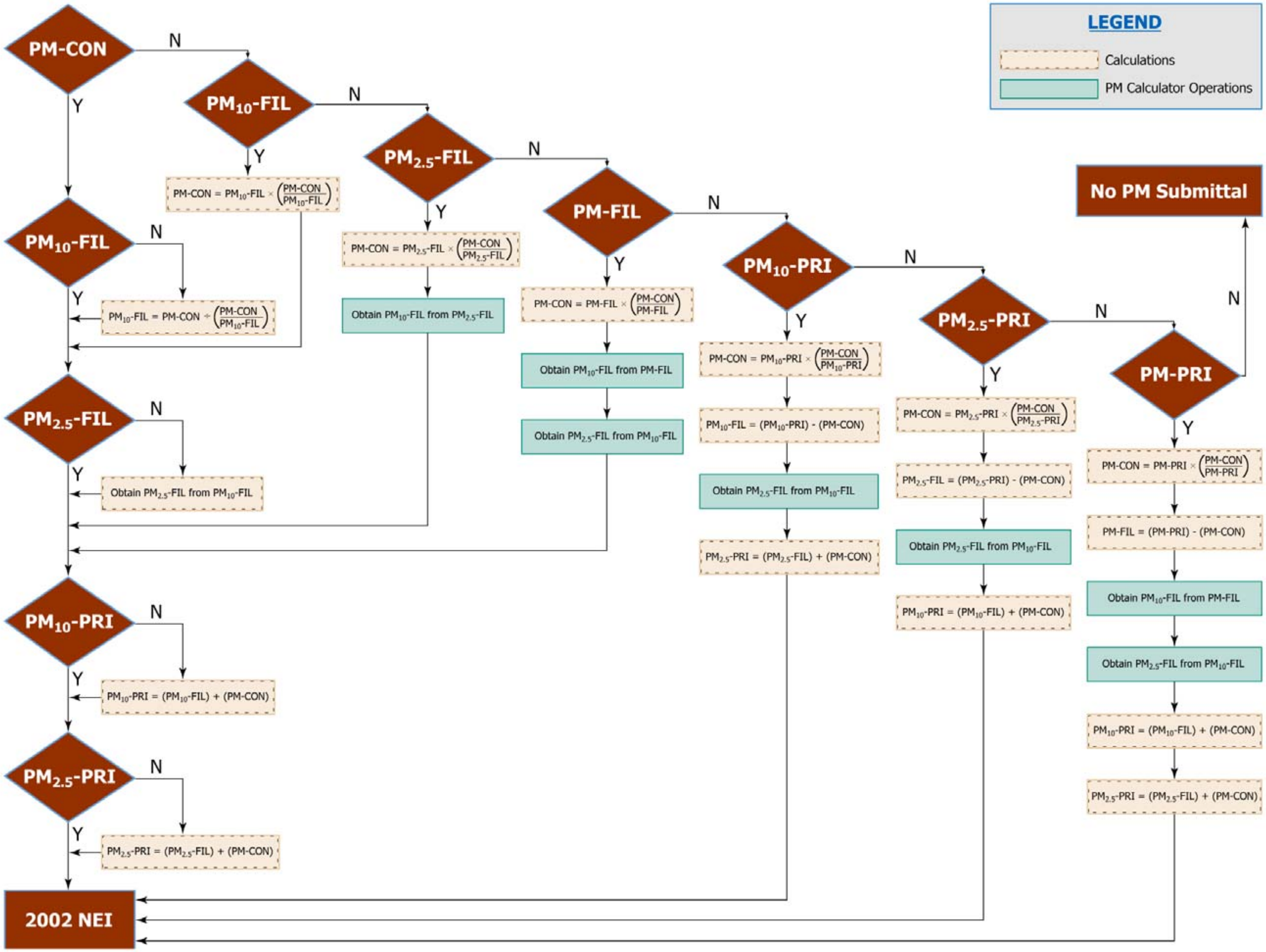

Table 1. Example Uncontrolled EGU Ratios

SCC	Primary Control Device Code	PM10-PRI to PM-CON Ratio	PM10-FIL to PM-CON Ratio	PM25-PRI to PM-CON Ratio	PM25-FIL to PM-CON Ratio
10100401	000	0.17	0.22	0.22	0.30
10100404	000	0.20	0.26	0.25	0.35
10100501	000	0.56	1.35	0.84	5.37
10100601	000	0.75	6.34	0.75	6.34
10100604	000	0.74	3.09	0.74	3.09
10100701	000	0.62	6.39	0.62	6.39
10100702	000	0.77	3.53	0.77	3.53
10100703	000	0.79	3.90	0.79	3.90
10100704	000	0.78	5.64	0.78	5.64
10100707	000	0.76	3.11	0.76	3.11
10100711	000	0.75	3.25	0.75	3.25
10100712	000	0.75	3.07	0.75	3.07
10100204	000	0.91	10.22	0.96	27.13
10101002	000	0.77	3.33	0.77	3.33
10101204	000	0.73	2.72	0.91	10.42
10101206	000	0.01	0.01	0.01	0.01
10101301	000	0.55	1.20	0.83	4.81
10101302	000	0.04	0.04	0.06	0.07
20100101	000	0.63	1.67	0.63	1.67
20100201	000	0.72	2.55	0.72	2.55
20100301	000	0.01	0.01	0.01	0.01

Table 2. Example Uncontrolled PM Emission Factors and PM Ratios Developed for Bituminous and Subbituminous Coal Combustion

Description	SCC	PM-FIL Emission Factor (lb/ton)	PM10-FIL Emission Factor (lb/ton)	PM-CON Emission Factor (lb/ton)	PM-FIL to PM-CON Ratio	PM_{10}-FIL to PM-CON Ratio
PC-Fired, dry, bottom, wall-fired	1020020222	80	18.4	0.07	0.00087	0.00380
PC-Fired, dry, bottom, tangentially fired	1020021226	80	18.4	0.07	0.00087	0.00380
PC-Fired, dry, bottom, tangentially fired	1030021626	80	18.4	0.07	0.00087	0.00380
PC-fired, wet bottom	1020020121	56	20.8	0.07	0.00125	0.00336
PC-fired, wet bottom	1030020521	56	20.8	0.07	0.00125	0.00336
Spreader stoker	1020020424	66	13.2	0.04	0.00061	0.00303
Spreader stoker	1030020924	66	13.2	0.04	0.00061	0.00303
Spreader stoker, w/ multiple cyclones, & reinjection	1020020424	17	12.4	0.04	0.00235	0.00322
Spreader stoker, w/ multiple cyclones, & reinjection	1030020924	17	12.4	0.04	0.00235	0.00322
Spreader stoker, w/ multiple cyclones, no reinjection	1020020424	12	7.8	0.04	0.00333	0.00513
Spreader stoker, w/ multiple cyclones, no reinjection	1030020924	12	7.8	0.04	0.00333	0.00513
Overfeed stoker	1020020525	16	6	0.04	0.0025	0.00667
Overfeed stoker	1030020725	16	6	0.04	0.0025	0.00667
Overfeed stoker, w/ multiple cyclones	1020020525	9	5	0.04	0.00444	0.008
Overfeed stoker, w/ multiple cyclones	1030020725	9	5	0.04	0.00444	0.008
Underfeed stoker	1020020606	15	6.2	0.04	0.00267	0.00645
Underfeed stoker, w/ multiple cyclone	1020020606	11	6.2	0.04	0.00364	0.00645

Table 3. SCCs Starting with "402" and the Surrogate SCCs

SCC	SCC Third Description	SCC Fourth Description	SCC to Use	Description of SCC to Use
402008	Coating Oven - General		102006	Industrial External Fuel Combustion, Natural Gas
40200801	Coating Oven - General	General	102006	Industrial External Fuel Combustion, Natural Gas
40200803	Coating Oven - General	Baked > 175F **	102006	Industrial External Fuel Combustion, Natural Gas
40200810	Coating Oven - General	General	102006	Industrial External Fuel Combustion, Natural Gas
40200820	Coating Oven - General	Prime/Base Coat Oven	102006	Industrial External Fuel Combustion, Natural Gas
40200830	Coating Oven - General	Topcoat Oven	102006	Industrial External Fuel Combustion, Natural Gas
40200840	Coating Oven - General	Two Piece Can Curing Ovens: General	102006	Industrial External Fuel Combustion, Natural Gas
40200845	Coating Oven - General	Three Piece Can Curing Ovens	102006	Industrial External Fuel Combustion, Natural Gas
40200870	Coating Oven - General	Color Coat Oven	102006	Industrial External Fuel Combustion, Natural Gas
40200898	Coating Oven - General	General	102006	Industrial External Fuel Combustion, Natural Gas
40200899	Coating Oven - General	See Comment **	102006	Industrial External Fuel Combustion, Natural Gas
40201001	Coating Oven Heater	Natural Gas	102006	Industrial External Fuel Combustion, Natural Gas
40201002	Coating Oven Heater	Distillate Oil	102005	Industrial External Fuel Combustion, Distillate Oil
40201122	Fabric Coating/Printing	Fabric Print:Dryer: Fuel-fired	102006	Industrial External Fuel Combustion, Natural Gas
40204340	Fabric Coating, Dip Coating	Drying/Curing	102006	Industrial External Fuel Combustion, Natural Gas
40290013	Fuel Fired Equipment	Natural Gas: Incinerator/Afterburner	102006	Industrial External Fuel Combustion, Natural Gas
40290023	Fuel Fired Equipment	Natural Gas: Flares	102006	Industrial External Fuel Combustion, Natural Gas

Table 4. Solid Waste Disposal SCCs That Have Incinerators and Flares

SCC	SCC Second Description	SCC Third Description	SCC Fourth Description
501001	Government	Municipal Incineration	
50100101	Government	Municipal Incineration	Starved Air: Multiple Chamber
50100102	Government	Municipal Incineration	Mass Burn: Single Chamber
50100103	Government	Municipal Incineration	Refuse Derived Fuel
50100104	Government	Municipal Incineration	Mass Burn Refractory Wall Combustor
50100105	Government	Municipal Incineration	Mass Burn Waterwall Combustor
50100106	Government	Municipal Incineration	Mass Burn Rotary Waterwall Combustor
50100107	Government	Municipal Incineration	Modular Excess Air Combustor
50100108	Government	Municipal Incineration	Fluidized Bed: Refuse Derived Fuel
50100410	Government	Landfill Dump	Waste Gas Destruction: Waste Gas Flares
50100411	Government	Landfill Dump	Waste Gas Destruction: Incinerators
50100505	Government	Other Incineration	Medical Waste Incinerator, unspecified type, Infectious wastes only
50100506	Government	Other Incineration	Sludge
50100515	Government	Other Incineration	Sludge: Multiple Hearth
50100516	Government	Other Incineration	Sludge: Fluidized Bed
502001	Commercial/Institutional	Incineration	
50200101	Commercial/Institutional	Incineration	Multiple Chamber
50200102	Commercial/Institutional	Incineration	Single Chamber
50200501	Commercial/Institutional	Incineration: Special Purpose	Med Waste Controlled Air Incin-aka Starved air, 2-stg, or Modular comb
50200502	Commercial/Institutional	Incineration: Special Purpose	Med Waste Excess Air Incin - aka Batch, Multiple Chamber, or Retort
50200503	Commercial/Institutional	Incineration: Special Purpose	Medical Waste Rotary Kiln Incinerator
50200504	Commercial/Institutional	Incineration: Special Purpose	Medical Waste Incinerator, unspecified type (use 502005-01, -02, -03)
50200505	Commercial/Institutional	Incineration: Special Purpose	Medical Waste Incinerator, unspecified type, Infectious wastes only
50200507	Commercial/Institutional	Incineration: Special Purpose	VOC Contaminated Soil
50200515	Commercial/Institutional	Incineration: Special Purpose	Sewage Sludge Incinerator: Multiple Hearth
50200518	Commercial/Institutional	Incineration: Special Purpose	Sewage Sludge Incinerator: Single Hearth Cyclone
50200601	Commercial/Institutional	Landfill Dump	Waste Gas Flares ** (Use 5-01-004-10)
50300101	Industrial	Incineration	Multiple Chamber
50300102	Industrial	Incineration	Single Chamber
50300107	Industrial	Incineration	Trench Burner: Tires
50300112	Industrial	Incineration	Mass Burn Waterwall Combustor
50300501	Industrial	Incineration	Hazardous Waste
50300502	Industrial	Incineration	Hazardous Waste Incinerators: Fluidized Bed
50300503	Industrial	Incineration	Hazardous Waste Incinerators: Liquid Injection
50300506	Industrial	Incineration	Sludge
50300520	Industrial	Incineration	Sewage Sludge Incinerator: High Pressure, Wet Oxidation
50300599	Industrial	Incineration	Fuel Not Classified
50300601	Industrial	Landfill Dump	Waste Gas Flares
50300789	Industrial	Liquid Waste	Sludge Digester Gas Flare

Table 5. PM Ratios Based on 6 and 8 Digit SCCs

SCC	Control	Available PM (X)	PM-X to PM-PRI Ratio	PM-X to PM – CON Ratio	PM-X to PM-FIL Ratio	PM-X to PM_{10}-PRI Ratio	PM-X to $PM_{2.5}$-PRI Ratio	PM-X to PM_{10}-FIL Ratio	PM-X to $PM_{2.5}$-FIL Ratio
10200203 10300203	None	PM-PRI	1	0.050	0.950	0.130	0.055	0.080	0.005
		PM-CON	20.00	1	19.00	2.600	1.100	1.600	0.100
		PM-FIL	1.053	0.053	1	0.137	0.058	0.084	0.005
		PM_{10}-PRI	7.692	0.385	7.308	1	0.423	0.615	0.038
		$PM_{2.5}$-PRI	18.182	0.909	17.273	2.364	1	1.455	0.091
		PM_{10}-FIL	12.500	0.625	11.875	1.625	0.688	1	0.063
		$PM_{2.5}$-FIL	200.00	10.00	190.00	26.00	11.00	16.00	1
10200203 10300203	Multiple Cyclones	PM-PRI	1	0.820	0.180	0.940	0.920	0.120	0.100
		PM-CON	1.220	1	0.220	1.146	1.122	0.146	0.122
		PM-FIL	5.556	4.556	1	5.222	5.111	0.667	0.556
		PM_{10}-PRI	1.064	0.872	0.191	1	0.979	0.128	0.106
		$PM_{2.5}$-PRI	1.087	0.891	0.196	1.022	1	0.130	0.109
		PM_{10}-FIL	8.333	6.833	1.500	7.833	7.667	1	0.833
		$PM_{2.5}$-FIL	10.00	8.200	1.800	9.400	9.200	1.200	1
10200203 10300203	ESP	PM-PRI	1	0.170	0.830	0.680	0.360	0.510	0.190
		PM-CON	5.882	1	4.882	4.000	2.118	3.000	1.118
		PM-FIL	1.205	0.205	1	0.819	0.434	0.614	0.229
		PM_{10}-PRI	1.471	0.250	1.221	1	0.529	0.750	0.279
		$PM_{2.5}$-PRI	2.778	0.472	2.306	1.889	1	1.417	0.528
		PM_{10}-FIL	1.961	0.333	1.627	1.333	0.706	1	0.373
		$PM_{2.5}$-FIL	5.263	0.895	4.368	3.579	1.895	2.684	1
10200101 10300101	None	PM-PRI	1	0.020	0.980	0.230	0.060	0.210	0.040
		PM-CON	50.000	1	49.000	11.500	3.000	10.500	2.000
		PM-FIL	1.020	0.020	1	0.235	0.061	0.214	0.041
		PM_{10}-PRI	4.348	0.087	4.261	1	0.261	0.913	0.174
		$PM_{2.5}$-PRI	16.667	0.333	16.333	3.833	1	3.500	0.667
		PM_{10}-FIL	4.762	0.095	4.667	1.095	0.286	1	0.190
		$PM_{2.5}$-FIL	25.000	0.500	24.500	5.750	1.500	5.250	1
10200101 10300101	Multiple Cyclone	PM-PRI	1	0.100	0.900	0.550	0.240	0.450	0.140
		PM-CON	10.000	1	9.000	5.500	2.400	4.500	1.400
		PM-FIL	1.111	0.111	1	0.611	0.267	0.500	0.156
		PM_{10}-PRI	1.818	0.182	1.636	1	0.436	0.818	0.255
		$PM_{2.5}$-PRI	4.167	0.417	3.750	2.292	1	1.875	0.583
		PM_{10}-FIL	2.222	0.222	2.000	1.222	0.533	1	0.311
		$PM_{2.5}$-FIL	7.143	0.714	6.429	3.929	1.714	3.214	1
10200101 10300101	Baghouse	PM-PRI	1	0.180	0.820	0.670	0.320	0.490	0.140
		PM-CON	5.556	1	4.556	3.722	1.778	2.722	0.778
		PM-FIL	1.220	0.220	1	0.817	0.390	0.598	0.171
		PM_{10}-PRI	1.493	0.269	1.224	1	0.478	0.731	0.209
		$PM_{2.5}$-PRI	3.125	0.563	2.563	2.094	1	1.531	0.438
		PM_{10}-FIL	2.041	0.367	1.673	1.367	0.653	1	0.286

Table 6. PM Ratios Based on 1st Digit SCC

1st Digit SCC	Available PM (X)	PM-X to PM-PRI Ratio	PM-X to PM-CON Ratio	PM-X to PM-FIL Ratio	PM-X to PM_{10}-PRI Ratio	PM-X to $PM_{2.5}$-PRI Ratio	PM-X to PM_{10}-FIL Ratio	PM-X to $PM_{2.5}$-FIL Ratio
1	PM-PRI	1	0.820	0.180	0.960	0.900	0.140	0.080
1	PM-CON	1.220	1	0.220	1.171	1.098	0.171	0.098
1	PM-FIL	5.556	4.556	1	5.333	5.000	0.778	0.444
1	PM_{10}-PRI	1.042	0.854	0.188	1	0.938	0.146	0.083
1	$PM_{2.5}$-PRI	1.111	0.911	0.200	1.067	1	0.156	0.089
1	PM_{10}-FIL	7.143	5.857	1.286	6.857	6.429	1	0.571
1	$PM_{2.5}$-FIL	12.500	10.250	2.250	12.000	11.250	1.750	1
2	PM-PRI	1	0.230	0.770	0.790	0.450	0.560	0.220
2	PM-CON	4.348	1	3.348	3.435	1.957	2.435	0.957
2	PM-FIL	1.299	0.299	1	1.026	0.584	0.727	0.286
2	PM_{10}-PRI	1.266	0.291	0.975	1	0.570	0.709	0.278
2	$PM_{2.5}$-PRI	2.222	0.511	1.711	1.756	1	1.244	0.489
2	PM_{10}-FIL	1.786	0.411	1.375	1.411	0.804	1	0.393
2	$PM_{2.5}$-FIL	4.545	1.045	3.500	3.591	2.045	2.545	1
3	PM-PRI	1	0.040	0.960	0.510	0.150	0.470	0.110
3	PM-CON	25.000	1	24.000	12.750	3.750	11.750	2.750
3	PM-FIL	1.042	0.042	1	0.531	0.156	0.490	0.115
3	PM_{10}-PRI	1.961	0.078	1.882	1	0.294	0.922	0.216
3	$PM_{2.5}$-PRI	6.667	0.267	6.400	3.400	1	3.133	0.733
3	PM_{10}-FIL	2.128	0.085	2.043	1.085	0.319	1	0.234
3	$PM_{2.5}$-FIL	9.091	0.364	8.727	4.636	1.364	4.273	1
4	PM-PRI	1	0.060	0.940	0.850	0.300	0.790	0.240
4	PM-CON	16.667	1	15.667	14.167	5.000	13.167	4.000
4	PM-FIL	1.064	0.064	1	0.904	0.319	0.840	0.255
4	PM_{10}-PRI	1.176	0.071	1.106	1	0.353	0.929	0.282
4	$PM_{2.5}$-PRI	3.333	0.200	3.133	2.833	1	2.633	0.800
4	PM_{10}-FIL	1.266	0.076	1.190	1.076	0.380	1	0.304
4	$PM_{2.5}$-FIL	4.167	0.250	3.917	3.542	1.250	3.292	1
5	PM-PRI	1	0.060	0.940	0.530	0.180	0.470	0.120
5	PM-CON	16.667	1	15.667	8.833	3.000	7.833	2.000
5	PM-FIL	1.064	0.064	1	0.564	0.191	0.500	0.128
5	PM_{10}-PRI	1.887	0.113	1.774	1	0.340	0.887	0.226
5	$PM_{2.5}$-PRI	5.556	0.333	5.222	2.944	1	2.611	0.667
5	PM_{10}-FIL	2.128	0.128	2.000	1.128	0.383	1	0.255
5	$PM_{2.5}$-FIL	8.333	0.500	7.833	4.417	1.500	3.917	1
6	PM-PRI	1	0.001	0.999	0.150	0.010	0.149	0.009
6	PM-CON	1428.571	1	1427.571	214.286	14.286	213.286	13.286
6	PM-FIL	1.001	0.001	1	0.150	0.010	0.149	0.009
6	PM_{10}-PRI	6.667	0.005	6.662	1	0.067	0.995	0.062
6	$PM_{2.5}$-PRI	100.000	0.070	99.930	15.000	1	14.930	0.930
6	PM_{10}-FIL	6.698	0.005	6.693	1.005	0.067	1	0.062
6	$PM_{2.5}$-FIL	107.527	0.075	107.452	16.129	1.075	16.054	1