

# **DETAILED PLAN TO DEVELOP 2008 EGU EMISSIONS**

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## **A. INTRODUCTION**

The U.S. Environmental Protection Agency (EPA) produces a comprehensive National Emissions Inventory (NEI) for criteria and hazardous air pollutants (CAP and HAP) every three years, using a combination of submittals from state and local air pollution control agencies, as well as EPA estimates for some sources where available. One of the significant source types in the NEI, and one for which data are available to EPA to make emissions estimates, is Electric Generating Units (EGUs). The state and local air agencies typically report emissions for the vast majority of these sources, although the number of pollutants that each state or local agency may report varies. The objective of this assignment is to provide EPA with an independent estimate of emissions from the largest of the EGUs, with a complete and consistent coverage of pollutants for similar fuel types. These estimates will be made available for comparison or for substitution of the state and local provided estimates, or to fill any gaps created by missing state and local estimates for some pollutants. Both the EPA-generated estimates and the state and local estimates will be housed in EPA's Emissions Inventory System (EIS), and all estimates will be identified by the EIS identifiers, at a minimum.

This document is the detailed plan that provides the comprehensive technical approach that will be used for the development of the 2008 EGU emissions. The data sources and methodologies for estimating each pollutant are described, along with information about assumptions, caveats, quality assurance (QA) procedures, and work assignment deliverables.

## **B. TECHNICAL APPROACH**

### **1. Data Sources**

- Several data sources are used as inputs to estimate emissions. These are listed below, with their descriptions.

The 2008 EPA/CAMD (CAMD08) annual, all programs, unit level data file that was downloaded on October 30, 2009 from the CAMD Data & Maps Emissions website, <http://camddataandmaps.epa.gov/gdm/index.cfm?fuseaction=emissions.wizard> (EPA, 2008). These data can be updated on a daily basis, but for this project are deemed fixed as of the October 30, 2009 download. There are 174 units that have been eliminated per EPA WAM directive: 170 with heat input, NO<sub>x</sub>, SO<sub>2</sub>, and CO<sub>2</sub> with all null values; two (Holcim US Inc, ORISPL= 880043, blrid=1 and Lafarge Building Materials, Inc., ORISPL= 880044, blrid=41000) have "kiln" as their unit type; one, Ninemile Point, ORISPL=1403, BLRID=2, has very small heat; and P H Glatfelter Company ORISPL=50397, BLRID=033, has significant heat input, but all emissions are blank. There are 4,684 units in the final file, the EGU frame; 4,660 have positive heat input and 24 have only positive NO<sub>x</sub> emissions. The heat input and emissions values are all reported with three decimal places.

- The quantity weighted average annual fuel heat, sulfur, and ash contents (based on delivered fuel to the plant), calculated at the state-fuel type level and at the national-fuel type level, based on the 2008 Energy Information Administration (EIA)-923 Schedule 2 data (EIA, 2008), and, for two fuels, on the 2005 EIA-767 (EIA, 2005) and for one fuel, on the 2004 EIA-767 (EIA, 2004). The quantity weighted average annual fuel heat, sulfur, and ash contents are used in calculations and displayed in Tables A-1 and A-2 after rounding to zero, two, and one decimal places, respectively – the same number of decimal places as the original reported values.
- The (uncontrolled) emissions factors (EF) for CAP have been obtained from EPA-approved Integrated Planning Model (IPM)-utilized emission factors (ICF, 2007b) except for those from an EPA file with Ron Myer's EF for PM<sub>10</sub> and PM<sub>2.5</sub> primary (EPA, 2005a). The EF are used in emissions calculations and displayed in Tables A-3, A-4, and A-5 in scientific notation with two, or at most three, significant digits. The measurement units for the EF for particulate matter (PM) condensable and PM<sub>10</sub> and PM<sub>2.5</sub> primary for gas-fired and IGCC units are pounds per million British thermal units (lb/MMBtu); the other CAP EF measurement units are lbs per ton (lb/ton), thousand gallons (k-gal), or million cubic feet (MMcf).
- The emissions factors for HAP (except for Hg) are in table format based on data provided by the EPA WAM (IPM\_EFDataFile\_wHAPNames.xls), (ICF, 2007a). The HAP EF measurement units for coal, oil, and gas boilers are in lb/ton, k-gal, and MMcf, respectively; the HAP EF measurement units for wood and Hg boilers, as well as for oil and gas turbines are in lb/MMBtu. The EF are used in emissions calculations and displayed in Table A-7 in scientific notation with two, or at most three, significant digits.
- The 2002 EPA CAMD annual, all programs, unit level data file that was downloaded on October 19, 2009 from the CAMD Data & Maps Emissions website, <http://camddataandmaps.epa.gov/gdm/index.cfm?fuseaction=emissions.wizard> (EPA, 2002a).
- The 2002 Hg emissions at the ORISPL-BLRID level, obtained from Research Triangle Institute (RTI)'s Jeff Coles (RTI, 2005). These data were incorporated into the 2002 NEI and were used to estimate Hg emissions for year 2004 and 2005 data for eGRID2006 and eGRID2007 (Pechan, 2008b).
- PM<sub>10</sub> and PM<sub>2.5</sub> control measures reduction efficiencies are obtained from a file based on the 2001 EIA-767 (EIA, 2001), consistent with the IPM methodology.
- SO<sub>2</sub> control measures reduction efficiencies for units whose SO<sub>2</sub> emissions are estimated, is based on CAMD08 SO<sub>2</sub> controls, boiler type, and primary fuel and AirControlNET version 4.2 data (Pechan, 2008a). All of these control measures

operated for the entire year, so that the control measures reduction efficiencies are 100%.

## 2. Emission Estimates Methodology

CAP and HAP emissions are estimated using the following emissions algorithm:

$$\text{Pollutant emissions} = (\text{activity}) * EF * (100 - \text{control efficiency} / 100),$$

where control efficiency (%) = control measure reduction efficiency (%) \* control approach effectiveness (%).

The activity data are expressed as heat input values in MMBtu, although physical fuel quantity in ton, k-gal, or MMcf, is used for some emissions calculations. The heat input has three decimal places, as reported. All HAP emissions are expressed in pounds; CAP emissions are expressed in tons (the emissions expressed in pounds are divided by 2000). Estimations are Source Classification Code (SCC) or fuel-based. Emissions have been calculated using double precision format.

For CAP emissions calculations, one SCC is assigned per unit, based on the CAMD08 fuel and unit types. Specific coal types for the CAMD units whose primary fuel is reported as coal are assigned a default value of bituminous coal. However, if the unit matches with a unit in the 2005 ARP units CAMD file (EPA, 2005b), then its specific coal type, based on 2005 EIA-767 data (EIA, 2005), is assigned.

Quantity-weighted average heat contents (in MMBtu/ton, k-gal, or MMcf) are assigned to each unit using Table A-1 or Table A-2 when necessary. Two “other solid fossil” burning unit with positive heat input do not have heat content and therefore, no physical fuel quantity; one “process heater” unit does not have an SCC since there is none known and as indicated earlier, 24 other units do not have any heat input reported.

Otherwise, the SCC are assigned. Some fuels are combined and mapped into a specific SCC: all oil turbines and combined cycles are mapped into 20100101; all diesel/distillate oil boilers are mapped into 10100501; all gas turbines and combined cycles are mapped into 20100201; all process gas and other gas boilers are mapped into 10100701. For boilers, if firing and/or bottom type are missing, wall-fired and dry bottom are the assumed defaults. The specific details are delineated below:

- 61 process gas and 19 other gas boilers were assigned a 10100701 SCC;
- 3 process gas and 4 other gas combined cycles were assigned a 20100201 SCC;
- 56 “other oil” boilers were assigned a 20100101 SCC; and
- 3 boilers with a CAMD primary fuel of coal were matched to the CAMD05/2005 EIA-767 and the primary fuel was petroleum coke, so its SCC is based on that fuel.

The physical fuel quantity for each unit is calculated using the following equation:

$$\text{Physical fuel quantity (ton, k-gal, or MMcf)} = \text{heat input} / \text{default heat content},$$

where heat input is in MMBtu and heat content is in MMBtu/ton, k-gal, or MMcf.

The physical fuel quantity, an intermediate value used in some emissions calculations, is unrounded. This value is displayed in the final file as a numeric field with six decimal places.

See Table A-3 for carbon monoxide (CO), volatile organic compound (VOC), sulfur dioxide (SO<sub>2</sub>), PM<sub>10</sub> and PM<sub>2.5</sub> filterable, and ammonia (NH<sub>3</sub>) uncontrolled emission factors; Table A-4 for PM condensable emissions factors; and Table A-5 for PM<sub>10</sub> and PM<sub>2.5</sub> primary for gas-fired and IGCC units.

Specific emissions estimation methods are described below.

**a. NO<sub>x</sub>**

NO<sub>x</sub> emissions in tons for all units are included in the CAMD08 data file.

**b. CO<sub>2</sub>**

CO<sub>2</sub> emissions in tons are reported to CAMD for those units affected by the Acid Rain Program (ARP) as well as 28 additional non-ARP units. Only the CAMD08 units with CAMD-reported emissions have values for CO<sub>2</sub>; no CO<sub>2</sub> is calculated.

**c. CO, VOC, NH<sub>3</sub>, and SO<sub>2</sub>**

The emissions for the first three pollutants are considered uncontrolled and are estimated in tons using the above emissions algorithm, physical fuel quantity and EF (in MMBtu/ton, k-gal, or MMcf) from Table A-3.

SO<sub>2</sub> emissions in tons are reported to CAMD for those units affected by the Acid Rain Program (ARP). For those units that did not report SO<sub>2</sub> to CAMD08, emissions are calculated using the emissions algorithm above, EF (in MMBtu/ton, k-gal, or MMcf) from Table A-3, which often necessitates sulfur content values from Table A-1 or Table A-2 when necessary, and an SO<sub>2</sub> control efficiency.

**d. PM<sub>10</sub> Filterable and Primary, PM<sub>2.5</sub> Filterable and Primary, and PM Condensable**

PM<sub>10</sub> filterable and PM<sub>2.5</sub> filterable emissions are estimated in tons using the above emissions algorithm and Table A-3 EF – except for CAMD gas-fired and IGCC (see footnote 2 of Table A-3).

SCC-level default PM<sub>10</sub> filterable and PM<sub>2.5</sub> filterable control efficiencies are obtained from a 2001 file based on the EIA-767 (EIA, 2001), consistent with the IPM emissions methodology (ICF, 2007b). This file includes the EPA PM Calculator control efficiency results, which in turn are based on particle size distribution data from AP-42 for specific SCCs, where available. If no control measures reduction efficiencies are assigned from this file, 99.2 percent default control efficiency is assigned to a boiler burning coal, petroleum coke, or oil.

The EF for PM condensable emissions – except for CAMD gas-fired and IGCC (see footnote 3 of Table A-4) – are based on the assigned SCC and SO<sub>2</sub> and PM control measures from CAMD08. These EF are in lb/MMBtu measurement units and are displayed in Table A-4.

PM<sub>10</sub> and PM<sub>2.5</sub> primary emissions are estimated for gas-fired and IGCC units. Their EF, in lb/MMBtu measurement units, are described in Table A-5 and are based on the assigned SCC and EF derived specifically for gas units (EPA, 2005a) and for IGCC (EPA, 2002b) since otherwise estimating PM<sub>10</sub> and PM<sub>2.5</sub> filterable and PM condensable emissions for these units result in uncertainty due to an artifact of the test method used in the past. This methodology is described in an email from the EPA WAM to Pechan (EPA, 2009c).

#### **e. All HAP, Except Hg**

The 97 unique HAP emissions except Hg are estimated in pounds, using methods consistent with the IPM estimation method. The emissions are calculated using the emissions algorithm above and the EF displayed in Table A-7, both found in the IPM HAP documentation (ICF, 2007a and 2008).

The 219 distinct HAP EF have a mixture of measurement units and controlled or uncontrolled EF: the HAP EF measurements units are lb/ton, k-gal, or MMcf for all non-wood boiler SCC (those beginning with 101); for wood boilers, turbines, and combined cycles – including IGCC – the HAP EF measurements units are lb/MMBtu.

For coal-fired boilers, the EF are controlled with two exceptions: hydrochloric acid (HCl) and hydrofluoric acid (HF), calculated for coal boilers, are uncontrolled. All other boilers and turbines have uncontrolled EF, with one exception: the type of EF is unknown for acetaldehyde, so it is assumed to be uncontrolled (ICF, 2008).

For HCl and HF emission estimates, the CAMD08 data help determine the control efficiencies. If a coal unit has a flue gas desulfurization (FGD) or has wet limestone injection, then a control efficiency of 99 percent is assigned. If a coal unit is a fluidized bed combustor (FBC), then a control efficiency of 80 percent is assigned (ICF, 2007a and 2008).

#### **f. Mercury (Hg)**

The initial data source for estimating 2008 Hg emissions in lbs is the 2002 Hg emission file described under Data Sources (RTI, 2005). In order to estimate 2008 Hg emissions from this file, the unit level 2002 Hg emissions divided by the unit level 2002 CAMD heat input determines the unit-level growth factor. Emissions are calculated using the emissions algorithm above, where activity is the 2008 CAMD heat input and the growth factor is the Hg EF (which are used in the emissions calculations with two significant digits).

The ORISPL-BLRID records for CAMD08, CAMD02, and the 2002 Hg data files have been matched by hand after first using an electronic match, since some units have different IDs among the three files.

For the two units (Possum Point, ORISPL=3804, BLRIDs= 3 and 4) whose fuel type changed from coal in 2002 to natural gas in 2008, the Hg emissions are assigned a zero value. For units with positive 2008 heat input but null 2002 heat input or null 2002 Hg, no 2008 Hg emissions are estimated.

## **C. ASSUMPTIONS AND LIMITATIONS**

### **1. Assumptions**

Assumptions made in estimating 2008 EGU emissions, as described above, include the following:

- HAP emissions are reported in pounds; CAP emissions are reported in tons.
- Each CAMD08 unit burns a single fuel. Although the CAMD08 file can include at least two fuels per unit, it is not possible from these data to determine the breakdown of the fuels. In general, the CAMD08 primary fuel is considered the unit's fuel type for purposes of assigning an SCC and a fuel-based heat content for calculating the unit's physical fuel quantity. Exceptions are noted earlier in this document.
- The control approach effectiveness is assumed to be 100%, as is the control approach capture efficiency.
- Estimation of Hg emission by developing an EF consisting of the unit level 2002 Hg emissions (lb) divided by the heat input from CAMD02 and applying it to the heat input from CAMD08, does not take into consideration any change in controls. Any CAMD08 unit that does not have any 2002 Hg and/or CAMD02 data is assigned a blank value for 2008 Hg emissions.
- HCl and HF control efficiencies for coal boilers are estimated based on specified CAMD08 SO<sub>2</sub> controls and the control measures reduction efficiencies assigned (ICF, 2008), as well as the control approach effectiveness, which is based on the CAMD08 reported length of time that the control was installed during the year.

### **2. Limitations**

The analysis should consider the following limitations:

- EF are average values and may not represent the best value to use for a specific unit. Some of the EF may be based on a limited set of data and may have been given a poor quality rating, but they may be the only available EF. Thus, emissions data using these EF are the best available for estimating CAP and HAP emissions.

- Control efficiencies are estimates and may not represent the actual control efficiency obtained for a specific unit.
- Heat, sulfur, and ash contents are state-fuel or nation-fuel weighted averages based on a 2008 EIA survey form data file and may not represent the best value to use for a specific unit. However, these values are necessary in order to be able to estimate CAP and HAP emissions.
- There are no known available heat, sulfur, or ash contents for two units with “other solid fossil” as the primary fuel: Manitowoc ORISPL=4125 blrid=9 and Fibrominn Biomass Power Plant ORISPL=55867 blrid=BLR-1, so they only have reported emissions; none are calculated.
- There are no CO<sub>2</sub> emissions estimated for units that did not report values to CAMD08; and no other emissions calculated for units with positive NO<sub>x</sub> emissions but null heat input.
- PM<sub>10</sub> and PM<sub>2.5</sub> primary emissions – not PM condensable, or PM<sub>10</sub> or PM<sub>2.5</sub> filterable emissions – are calculated for gas-fired and IGCC units.
- PM<sub>10</sub> and PM<sub>2.5</sub> filterable control efficiencies may not be representative since they did not match specific CAMD08 units’ PM control information (or lack thereof) since these efficiencies were assigned either 2001 values from an independent file with 2001 data or a default value.
- There are no HAP emissions calculated for “other oil,” or tire-derived fuel since there are no HAP EF for these fuels.
- Hg emission estimates are based on 1999 data collected for a specific set of coal units and updated to 2002. The growth factor used to estimate 2008 Hg values only takes the change in the amount of fuel burned into account; no new controls are considered because these data are not readily available.
- There are 991 units with 2008 Hg calculated values, although the 2002 Hg emissions file includes 1,227 units. Fewer units have 2008 Hg estimates since 236 units with 2002 Hg emissions no longer exist or do not have both CAMD08 and CAMD02 non-blank heat input data.
- Although the assumption is made for emissions estimation that each unit in the CAMD08 file burns only one fuel, in fact that is not the case. However, it is not possible to allocate fuel use to other fuels based on the data in the file.
- All CAMD08 units’ fuel-based heat input data, along with a quantity-weighted average fuel heat content, is used to back calculate the physical fuel quantity for the year as reported. Since the entire unit may not burn only one fuel, the amount of the one fuel burned at the unit may be an overestimation.



- Some CAMD08 units with positive heat input reported data for a time period of fewer than 12 months (either 6 or 3 months). In most of these cases, it is because the ORISPL-BLRID are not ARP (only NO<sub>x</sub> Budget Program (NBP)), are not either ARP or NBP but are only CAIR, came on-line in late 2007 or 2008, or retired during 2008. Some ORISPL-BLRID have no apparent reason for reporting fewer than 12 months of data, although we can assume that they simply didn't operate during some 3-month periods in 2008 due to maintenance or outages.

## **D. QUALITY ASSURANCE**

To deliver the best possible EGU emissions inventory, Pechan applied a multi-layered QA Strategy that employs various QA techniques during database development. As described in the work plan, a QA Coordinator was identified and assigned to the project. The QA Coordinator is responsible for conducting a quality audit and is responsible for QA.

### **1. Data Coding and Recording**

Pechan ensured that coding and recording of data is consistent by enforcing the data coding formats, recording procedures, and nomenclature developed by EPA for EIS for point sources.

### **2. Data Tracking**

Data tracking took place through the review of data files that contain emission estimates, calculations, and associated individual data for all emission sources. Calculation programs have been reviewed and hand calculations performed.

Documentation of the methods have been developed and reviewed. Pechan's QA coordinator reviewed this document for accuracy and completeness and ensured that spot hand-calculations have been performed. The written descriptions of the methods were submitted to the EPA WAM for review and comment.

### **3. Missing Data**

Missing data elements were identified early in the project. EPA was informed of missing data elements and Pechan implemented and documented the results of decisions made by the EPA WAM.

### **4. Review of Estimates**

Pechan reviewed the emission estimates for quality and identification of outliers. If the EPA WAM or the audit detected a problem, then the QA reviewer checked that the changes were implemented.

### **5. Data Analysis**

Data analysis included identification of emission sources and activity data collection, selection of appropriate emission factors, emission estimation methods, emission calculations, and data validation procedures. Data QA and control is an iterative process with automated and manual steps that were performed to check reasonableness and completeness of emissions data.

## **6. Project Audit**

Pechan conducted one internal audit of project activities. This section briefly describes the schedule, responsibilities, and focus of the audit; how results of the audit were reported; and procedures for correcting any quality problems identified during the audit.

The QA Coordinator is responsible for conducting the audit of the EGU emissions file, which occurred before it was submitted to EPA for review. The audit included an assessment of data collection, documentation, handling, calculation, and reporting procedures as well as an evaluation of whether the QA procedures were being followed. The primary goals of the audit are to prevent quality problems from occurring and to correct any problems identified at an early stage in the project.

The QA Coordinator worked with the Project Manager to develop a checklist for each audit. The audit focused on overall quality issues as well as any specific issues that had been identified by the Project Manager and technical reviewer as potential problems. The audit included interviews with members of the project team and review of the documentation.

## **E. DELIVERABLES AFTER DETAILED PLAN IS APPROVED**

### **1. 2008 Draft EGU Estimated Emissions File**

The format for the deliverable of 2008 EGU estimated emissions is an MS Access database as described in Table A-7. This file format is primarily extracted from the EIS Bridge staging table (EPA, 2009a), but contains additional information that is needed to calculate emissions and/or document data, as requested by the EPA WAM. As with the EIS Bridge staging tables, all data are in text format.

This deliverable is designed to make the emissions calculations transparent, while at the same time aiding in the ease of conversion to the Consolidated Emissions Reporting Schema CERS Extensible Markup Language (XML) format at a later date. The deliverable contains all the data related to unit-level emissions estimation; this includes emissions, emission factors for each pollutant as well as calculation methods, and comments. It also contains the necessary information about the control measures by pollutant; supplemental parameters of heat content, sulfur content, and ash content; data for any other needed data element; and flags.

### **2. 2008 Final EGU Estimated Emissions File**

The final deliverable is the 2008 EGU Estimated Emissions File, in MS Access format. Based on January 14, 2010 comments from the EPA WACOR, the emissions were recalculated using double precision format so that all pollutant emissions that are calculated display a value

greater than zero, even if very small. The final file has the same format as the draft file -- except that the emissions field is numeric with 15 decimal places and in double precision format; the heat input field is numeric with three decimal places; the heat content field is numeric with no decimal places; and the physical fuel quantity is numeric with six decimal places.

### **3. Final Documentation**

The final documentation consists of the Access emissions file, Excel summary tables by pollutant and state, the original CAMD08 downloaded text file, an Excel workbook with the appendix tables from the detailed plan plus additional data files needed for calculations (the Hg data needed for emission calculations, the SO<sub>2</sub> control measures – efficiencies, the PM<sub>10</sub>/PM<sub>2.5</sub> filterable control efficiencies), and the final documentation (the detailed plan, including references).

### **F. REFERENCES**

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## **APPENDIX A**

All tables referred to in the text are included in this appendix, along with their source. They are as follows.

- Table A-1: State Fuel Heat/Sulfur/Ash Contents Weighted Averages
- Table A-2: National Fuel Default Heat/Sulfur/Ash Contents Weighted Averages
- Table A-3: CAP Uncontrolled Emissions Factors
- Table A-4: PM Condensable Emission Factors
- Table A-5: PM<sub>10</sub> and PM<sub>2.5</sub> Primary Emissions Factors for Gas-fired and IGCC Units
- Table A-6: HAP (except for Hg) Emissions Factors
- Table A-7: Format for the Access File for the Emissions Data Deliverables

**Table A-1. State Fuel Heat/Sulfur/Ash Contents Weighted Averages**

| State | Fuel | Fuel Name                  | Heat content (wtd av<br>in MMBtu/ton, k-gal,<br>MMcf) | Sulfur<br>Content (wtd<br>av in %) | Ash Content (wtd<br>av in %) |
|-------|------|----------------------------|-------------------------------------------------------|------------------------------------|------------------------------|
| AL    | BIT  | Bituminous coal            | 24                                                    | 1.23                               | 10.6                         |
| AZ    | BIT  | Bituminous coal            | 21                                                    | 0.58                               | 11.2                         |
| CO    | BIT  | Bituminous coal            | 23                                                    | 0.50                               | 10.9                         |
| CT    | BIT  | Bituminous coal            | 25                                                    | 0.99                               | 11.6                         |
| DE    | BIT  | Bituminous coal            | 25                                                    | 0.73                               | 10.2                         |
| FL    | BIT  | Bituminous coal            | 24                                                    | 1.22                               | 9.7                          |
| GA    | BIT  | Bituminous coal            | 25                                                    | 1.08                               | 10.8                         |
| IA    | BIT  | Bituminous coal            | 22                                                    | 2.92                               | 8.4                          |
| IL    | BIT  | Bituminous coal            | 22                                                    | 3.08                               | 9.5                          |
| IN    | BIT  | Bituminous coal            | 23                                                    | 2.43                               | 9.2                          |
| KY    | BIT  | Bituminous coal            | 23                                                    | 2.45                               | 10.9                         |
| MA    | BIT  | Bituminous coal            | 23                                                    | 0.52                               | 6.8                          |
| MD    | BIT  | Bituminous coal            | 25                                                    | 1.23                               | 10.8                         |
| MI    | BIT  | Bituminous coal            | 25                                                    | 1.23                               | 9.1                          |
| MO    | BIT  | Bituminous coal            | 24                                                    | 2.46                               | 8.9                          |
| MS    | BIT  | Bituminous coal            | 23                                                    | 0.65                               | 8.8                          |
| NC    | BIT  | Bituminous coal            | 24                                                    | 1.01                               | 11.8                         |
| NH    | BIT  | Bituminous coal            | 26                                                    | 1.20                               | 6.8                          |
| NJ    | BIT  | Bituminous coal            | 26                                                    | 1.38                               | 7.5                          |
| NV    | BIT  | Bituminous coal            | 23                                                    | 0.50                               | 10.2                         |
| NY    | BIT  | Bituminous coal            | 26                                                    | 2.25                               | 8.4                          |
| OH    | BIT  | Bituminous coal            | 24                                                    | 2.41                               | 10.6                         |
| PA    | BIT  | Bituminous coal            | 25                                                    | 2.24                               | 11.0                         |
| SC    | BIT  | Bituminous coal            | 25                                                    | 1.34                               | 10.4                         |
| TN    | BIT  | Bituminous coal            | 24                                                    | 1.70                               | 9.8                          |
| UT    | BIT  | Bituminous coal            | 22                                                    | 0.52                               | 12.1                         |
| VA    | BIT  | Bituminous coal            | 25                                                    | 0.93                               | 10.0                         |
| WI    | BIT  | Bituminous coal            | 24                                                    | 0.90                               | 9.6                          |
| WV    | BIT  | Bituminous coal            | 24                                                    | 2.11                               | 11.8                         |
| CT    | DFO  | Distillate/diesel fuel oil | 137                                                   | 0.13                               |                              |
| DE    | DFO  | Distillate/diesel fuel oil | 138                                                   | 0.04                               |                              |
| FL    | DFO  | Distillate/diesel fuel oil | 139                                                   | 0.10                               |                              |
| GA    | DFO  | Distillate/diesel fuel oil | 138                                                   | 0.05                               |                              |
| IA    | DFO  | Distillate/diesel fuel oil | 137                                                   | 0.01                               |                              |
| IL    | DFO  | Distillate/diesel fuel oil | 137                                                   | 0.11                               |                              |
| IN    | DFO  | Distillate/diesel fuel oil | 138                                                   | 0.14                               |                              |
| KY    | DFO  | Distillate/diesel fuel oil | 139                                                   | 0.13                               |                              |
| MA    | DFO  | Distillate/diesel fuel oil | 138                                                   | 0.02                               |                              |
| MD    | DFO  | Distillate/diesel fuel oil | 138                                                   | 0.18                               |                              |
| MI    | DFO  | Distillate/diesel fuel oil | 138                                                   | 0.13                               |                              |
| MN    | DFO  | Distillate/diesel fuel oil | 136                                                   | 0.05                               |                              |
| MO    | DFO  | Distillate/diesel fuel oil | 138                                                   | 0.10                               |                              |
| MS    | DFO  | Distillate/diesel fuel oil | 138                                                   | 0.12                               |                              |
| NC    | DFO  | Distillate/diesel fuel oil | 138                                                   | 0.08                               |                              |
| NH    | DFO  | Distillate/diesel fuel oil | 138                                                   | 0.11                               |                              |
| NJ    | DFO  | Distillate/diesel fuel oil | 140                                                   | 0.15                               |                              |
| NY    | DFO  | Distillate/diesel fuel oil | 140                                                   | 0.01                               |                              |
| OH    | DFO  | Distillate/diesel fuel oil | 138                                                   | 0.03                               |                              |
| PA    | DFO  | Distillate/diesel fuel oil | 138                                                   | 0.16                               |                              |

| State | Fuel | Fuel Name                  | Heat content (wtd av<br>in MMBtu/ton, k-gal,<br>MMcf) | Sulfur<br>Content (wtd<br>av in %) | Ash Content (wtd<br>av in %) |
|-------|------|----------------------------|-------------------------------------------------------|------------------------------------|------------------------------|
| SC    | DFO  | Distillate/diesel fuel oil | 138                                                   | 0.10                               |                              |
| TN    | DFO  | Distillate/diesel fuel oil | 135                                                   | 0.15                               |                              |
| VA    | DFO  | Distillate/diesel fuel oil | 138                                                   | 0.08                               |                              |
| WI    | DFO  | Distillate/diesel fuel oil | 138                                                   | 0.03                               |                              |
| WV    | DFO  | Distillate/diesel fuel oil | 139                                                   | 0.09                               |                              |
| LA    | LIG  | Lignite coal               | 14                                                    | 0.75                               | 11.6                         |
| MS    | LIG  | Lignite coal               | 10                                                    | 0.48                               | 15.9                         |
| ND    | LIG  | Lignite coal               | 13                                                    | 0.76                               | 9.9                          |
| TX    | LIG  | Lignite coal               | 13                                                    | 0.98                               | 16.4                         |
| AL    | NG   | Natural gas                | 1028                                                  |                                    |                              |
| AR    | NG   | Natural gas                | 1032                                                  |                                    |                              |
| AZ    | NG   | Natural gas                | 1028                                                  |                                    |                              |
| CA    | NG   | Natural gas                | 1015                                                  |                                    |                              |
| CO    | NG   | Natural gas                | 1037                                                  |                                    |                              |
| CT    | NG   | Natural gas                | 1012                                                  |                                    |                              |
| DE    | NG   | Natural gas                | 1035                                                  |                                    |                              |
| FL    | NG   | Natural gas                | 1028                                                  |                                    |                              |
| GA    | NG   | Natural gas                | 1035                                                  |                                    |                              |
| IA    | NG   | Natural gas                | 1011                                                  |                                    |                              |
| ID    | NG   | Natural gas                | 1020                                                  |                                    |                              |
| IL    | NG   | Natural gas                | 1015                                                  |                                    |                              |
| IN    | NG   | Natural gas                | 1015                                                  |                                    |                              |
| KS    | NG   | Natural gas                | 1018                                                  |                                    |                              |
| KY    | NG   | Natural gas                | 1023                                                  |                                    |                              |
| LA    | NG   | Natural gas                | 1034                                                  |                                    |                              |
| MA    | NG   | Natural gas                | 1034                                                  |                                    |                              |
| MD    | NG   | Natural gas                | 1049                                                  |                                    |                              |
| ME    | NG   | Natural gas                | 1063                                                  |                                    |                              |
| MI    | NG   | Natural gas                | 1013                                                  |                                    |                              |
| MN    | NG   | Natural gas                | 1013                                                  |                                    |                              |
| MO    | NG   | Natural gas                | 1021                                                  |                                    |                              |
| MS    | NG   | Natural gas                | 1022                                                  |                                    |                              |
| NC    | NG   | Natural gas                | 1030                                                  |                                    |                              |
| NE    | NG   | Natural gas                | 1007                                                  |                                    |                              |
| NH    | NG   | Natural gas                | 1049                                                  |                                    |                              |
| NJ    | NG   | Natural gas                | 1031                                                  |                                    |                              |
| NM    | NG   | Natural gas                | 907                                                   |                                    |                              |
| NV    | NG   | Natural gas                | 1039                                                  |                                    |                              |
| NY    | NG   | Natural gas                | 1018                                                  |                                    |                              |
| OH    | NG   | Natural gas                | 1035                                                  |                                    |                              |
| OK    | NG   | Natural gas                | 1032                                                  |                                    |                              |
| OR    | NG   | Natural gas                | 1021                                                  |                                    |                              |
| PA    | NG   | Natural gas                | 1031                                                  |                                    |                              |
| RI    | NG   | Natural gas                | 1020                                                  |                                    |                              |
| SC    | NG   | Natural gas                | 1030                                                  |                                    |                              |
| SD    | NG   | Natural gas                | 1013                                                  |                                    |                              |
| TN    | NG   | Natural gas                | 1031                                                  |                                    |                              |
| TX    | NG   | Natural gas                | 1023                                                  |                                    |                              |
| UT    | NG   | Natural gas                | 1049                                                  |                                    |                              |
| VA    | NG   | Natural gas                | 1036                                                  |                                    |                              |
| WA    | NG   | Natural gas                | 1029                                                  |                                    |                              |

| State | Fuel | Fuel Name          | Heat content (wtd av<br>in MMBtu/ton, k-gal,<br>MMcf) | Sulfur<br>Content (wtd<br>av in %) | Ash Content (wtd<br>av in %) |
|-------|------|--------------------|-------------------------------------------------------|------------------------------------|------------------------------|
| WI    | NG   | Natural gas        | 1017                                                  |                                    |                              |
| WV    | NG   | Natural gas        | 1028                                                  |                                    |                              |
| WY    | NG   | Natural gas        | 986                                                   |                                    |                              |
| CA    | OG   | Other/process gas  | 1288                                                  |                                    |                              |
| IL    | OG   | Other/process gas  | 1001                                                  |                                    |                              |
| IN    | OG   | Other/process gas  | 86                                                    |                                    |                              |
| LA    | OG   | Other/process gas  | 955                                                   |                                    |                              |
| MI    | OG   | Other/process gas  | 500                                                   |                                    |                              |
| PA    | OG   | Other/process gas  | 520                                                   |                                    |                              |
| TX    | OG   | Other/process gas  | 702                                                   |                                    |                              |
| FL    | PC   | Petroleum coke     | 28                                                    | 4.87                               |                              |
| KY    | PC   | Petroleum coke     | 28                                                    | 5.51                               |                              |
| LA    | PC   | Petroleum coke     | 29                                                    | 6.20                               |                              |
| OH    | PC   | Petroleum coke     | 28                                                    | 4.71                               | 0.4                          |
| TX    | PC   | Petroleum coke     | 29                                                    | 4.10                               |                              |
| WI    | PC   | Petroleum coke     | 28                                                    | 5.70                               | 0.1                          |
| CT    | RFO  | Residual fuel oil  | 151                                                   | 0.30                               |                              |
| DE    | RFO  | Residual fuel oil  | 152                                                   | 0.65                               |                              |
| FL    | RFO  | Residual fuel oil  | 154                                                   | 1.05                               |                              |
| GA    | RFO  | Residual fuel oil  | 150                                                   | 1.88                               |                              |
| LA    | RFO  | Residual fuel oil  | 156                                                   | 0.73                               |                              |
| MA    | RFO  | Residual fuel oil  | 150                                                   | 0.55                               |                              |
| MD    | RFO  | Residual fuel oil  | 152                                                   | 0.38                               |                              |
| ME    | RFO  | Residual fuel oil  | 151                                                   | 1.27                               |                              |
| MI    | RFO  | Residual fuel oil  | 155                                                   | 0.87                               |                              |
| MS    | RFO  | Residual fuel oil  | 156                                                   | 3.00                               |                              |
| NC    | RFO  | Residual fuel oil  | 150                                                   | 2.03                               |                              |
| NH    | RFO  | Residual fuel oil  | 154                                                   | 0.94                               |                              |
| NJ    | RFO  | Residual fuel oil  | 152                                                   | 0.60                               |                              |
| NY    | RFO  | Residual fuel oil  | 152                                                   | 0.63                               |                              |
| PA    | RFO  | Residual fuel oil  | 152                                                   | 0.75                               |                              |
| SC    | RFO  | Residual fuel oil  | 150                                                   | 2.06                               |                              |
| VA    | RFO  | Residual fuel oil  | 152                                                   | 0.74                               |                              |
| KY    | SC   | Synthetic coal     | 23                                                    | 2.20                               | 12.4                         |
| OH    | SC   | Synthetic coal     | 23                                                    | 0.61                               | 16.5                         |
| PA    | SC   | Synthetic coal     | 26                                                    | 1.61                               | 7.0                          |
| AL    | SUB  | Subbituminous coal | 17                                                    | 0.29                               | 5.0                          |
| AR    | SUB  | Subbituminous coal | 17                                                    | 0.27                               | 4.9                          |
| AZ    | SUB  | Subbituminous coal | 18                                                    | 0.60                               | 9.0                          |
| CO    | SUB  | Subbituminous coal | 18                                                    | 0.33                               | 5.8                          |
| CT    | SUB  | Subbituminous coal | 18                                                    | 0.10                               | 1.8                          |
| GA    | SUB  | Subbituminous coal | 17                                                    | 0.28                               | 4.6                          |
| IA    | SUB  | Subbituminous coal | 17                                                    | 0.31                               | 5.2                          |
| IL    | SUB  | Subbituminous coal | 17                                                    | 0.24                               | 4.8                          |
| IN    | SUB  | Subbituminous coal | 18                                                    | 0.25                               | 4.8                          |
| KS    | SUB  | Subbituminous coal | 17                                                    | 0.35                               | 5.1                          |
| LA    | SUB  | Subbituminous coal | 17                                                    | 0.29                               | 4.9                          |
| MI    | SUB  | Subbituminous coal | 18                                                    | 0.29                               | 4.9                          |
| MN    | SUB  | Subbituminous coal | 18                                                    | 0.44                               | 6.4                          |
| MO    | SUB  | Subbituminous coal | 17                                                    | 0.28                               | 5.1                          |
| MT    | SUB  | Subbituminous coal | 17                                                    | 0.69                               | 9.5                          |



| <b>State</b> | <b>Fuel</b> | <b>Fuel Name</b>   | <b>Heat content (wtd av<br/>in MMBtu/ton, k-gal,<br/>MMcf)</b> | <b>Sulfur<br/>Content (wtd<br/>av in %)</b> | <b>Ash Content (wtd<br/>av in %)</b> |
|--------------|-------------|--------------------|----------------------------------------------------------------|---------------------------------------------|--------------------------------------|
| ND           | SUB         | Subbituminous coal | 16                                                             | 0.32                                        | 5.1                                  |
| NE           | SUB         | Subbituminous coal | 17                                                             | 0.31                                        | 5.2                                  |
| NM           | SUB         | Subbituminous coal | 19                                                             | 0.69                                        | 21.5                                 |
| NY           | SUB         | Subbituminous coal | 18                                                             | 0.28                                        | 5.0                                  |
| OH           | SUB         | Subbituminous coal | 18                                                             | 0.26                                        | 5.1                                  |
| OK           | SUB         | Subbituminous coal | 17                                                             | 0.32                                        | 5.2                                  |
| OR           | SUB         | Subbituminous coal | 17                                                             | 0.28                                        | 4.7                                  |
| SD           | SUB         | Subbituminous coal | 17                                                             | 0.31                                        | 5.4                                  |
| TN           | SUB         | Subbituminous coal | 18                                                             | 0.28                                        | 5.0                                  |
| TX           | SUB         | Subbituminous coal | 17                                                             | 0.30                                        | 4.8                                  |
| WA           | SUB         | Subbituminous coal | 17                                                             | 0.32                                        | 10.2                                 |
| WI           | SUB         | Subbituminous coal | 17                                                             | 0.29                                        | 5.0                                  |
| WY           | SUB         | Subbituminous coal | 17                                                             | 0.49                                        | 7.4                                  |
| IL           | WC          | Coal waste/refuse  | 14                                                             | 2.50                                        | 23.4                                 |
| PA           | WC          | Coal waste/refuse  | 12                                                             | 2.37                                        | 50.1                                 |
| WV           | WC          | Coal waste/refuse  | 17                                                             | 2.34                                        | 32.0                                 |

SOURCE: 2008 EIA-923 Schedule 2-based (EIA, 2008).

**Table A-2. National Fuel Heat/Sulfur/Ash Contents Weighted Averages**

| <b>Fuel</b>      | <b>Fuel Name</b>  | <b>Heat content (wtd av in<br/>MMBtu/ton, k-gal, MMcf)</b> | <b>Sulfur Content<br/>(wtd av in %)</b> | <b>Ash Content<br/>(wtd av in %)</b> |
|------------------|-------------------|------------------------------------------------------------|-----------------------------------------|--------------------------------------|
| BIT              | Bituminous coal   | 24                                                         | 1.67                                    | 10.8                                 |
| LIG              | Lignite coal      | 13                                                         | 0.87                                    | 13.9                                 |
| NG               | Natural gas       | 1024                                                       |                                         |                                      |
| OG               | Other/process gas | 671                                                        |                                         |                                      |
| OO <sup>1</sup>  | Other oil         | 104                                                        | 0.28                                    |                                      |
| RFO              | Residual fuel oil | 152                                                        | 0.89                                    |                                      |
| SC               | Synthetic coal    | 23                                                         | 2.06                                    | 11.5                                 |
| TDF <sup>2</sup> | Tire-derived fuel | 29                                                         | 1.99                                    | 15.8                                 |
| WDS <sup>2</sup> | Wood solid        | 12                                                         |                                         |                                      |

SOURCES: 2008 EIA-923 Schedule 2 –based (EIA, 2008), unless <sup>1</sup> or <sup>2</sup>.

<sup>1</sup>2004 EIA-767 based (EIA, 2004).

<sup>2</sup>2005 EIA-767 based (EIA, 2005).

**Table A-3. CAP Uncontrolled Emissions Factors (lb/ton, k-gal, or MMcf)**

| SCC      | Fuel | CO EF    | VOC EF   | PM <sub>10</sub> fil. EF | PM <sub>2.5</sub> fil. EF | PM FLAG <sup>1</sup> | SO <sub>2</sub> EF | SO <sub>2</sub> FLAG <sup>1</sup> | NH <sub>3</sub> EF |
|----------|------|----------|----------|--------------------------|---------------------------|----------------------|--------------------|-----------------------------------|--------------------|
| 10100201 | BIT  | 5.00E-01 | 4.00E-02 | 2.60E+00                 | 1.48E+00                  | A                    | 3.80E+01           | S                                 | 3.00E-02           |
| 10100202 | BIT  | 5.00E-01 | 6.00E-02 | 2.30E+00                 | 6.00E-01                  | A                    | 3.80E+01           | S                                 | 3.00E-02           |
| 10100203 | BIT  | 5.00E-01 | 1.10E-01 | 2.60E-01                 | 1.10E-01                  | A                    | 3.80E+01           | S                                 | 3.00E-02           |
| 10100204 | BIT  | 5.00E+00 | 5.00E-02 | 1.32E+01                 | 4.60E+00                  |                      | 3.80E+01           | S                                 | 3.00E-02           |
| 10100212 | BIT  | 5.00E-01 | 6.00E-02 | 2.30E+00                 | 6.00E-01                  | A                    | 3.80E+01           | S                                 | 3.00E-02           |
| 10100215 | BIT  | 5.00E-01 | 6.00E-02 | 2.30E+00                 | 6.00E-01                  | A                    | 3.80E+01           | S                                 | 3.00E-02           |
| 10100218 | BIT  | 1.80E+01 | 5.00E-02 | 1.24E+01                 | 1.36E+00                  |                      | 3.10E+01           | S                                 | 3.00E-02           |
| 10100221 | SUB  | 5.00E-01 | 4.00E-02 | 2.60E+00                 | 1.48E+00                  | A                    | 3.50E+01           | S                                 | 3.00E-02           |
| 10100222 | SUB  | 5.00E-01 | 6.00E-02 | 2.30E+00                 | 6.00E-01                  | A                    | 3.50E+01           | S                                 | 3.00E-02           |
| 10100223 | SUB  | 5.00E-01 | 1.10E-01 | 2.60E-01                 | 1.10E-01                  | A                    | 3.50E+01           | S                                 | 3.00E-02           |
| 10100224 | SUB  | 5.00E+00 | 5.00E-02 | 1.32E+01                 | 4.60E+00                  |                      | 3.50E+01           | S                                 | 3.00E-02           |
| 10100226 | SUB  | 5.00E-01 | 6.00E-02 | 2.30E+00                 | 6.00E-01                  | A                    | 3.50E+01           | S                                 | 3.00E-02           |
| 10100235 | SUB  | 5.00E-01 | 6.00E-02 | 2.30E+00                 | 6.00E-01                  | A                    | 3.50E+01           | S                                 | 3.00E-02           |
| 10100301 | LIG  | 2.50E-01 | 7.00E-02 | 1.80E+00                 | 5.20E-01                  | A                    | 3.00E+01           | S                                 | 3.00E-02           |
| 10100302 | LIG  | 6.00E-01 | 7.00E-02 | 2.30E+00                 | 6.60E-01                  | A                    | 3.00E+01           | S                                 | 3.00E-02           |
| 10100303 | LIG  | 6.00E-01 | 7.00E-02 | 8.70E-01                 | 3.70E-01                  | A                    | 3.00E+01           | S                                 | 3.00E-02           |
| 10100318 | LIG  | 1.50E-01 | 3.00E-02 | 1.20E+01                 | 1.40E+00                  |                      | 1.00E+01           | S                                 | 3.00E-02           |
| 10100401 | RFO  | 5.00E+00 | 7.60E-01 | 5.9*(1.12*S+0.37)        | 4.3*(1.12*S+0.37)         |                      | 1.57E+02           | S                                 | 8.00E-01           |
| 10100404 | RFO  | 5.00E+00 | 7.60E-01 | 5.9*(1.12*S+0.37)        | 4.3*(1.12*S+0.37)         |                      | 1.57E+02           | S                                 | 8.00E-01           |
| 10100501 | DFO  | 5.00E+00 | 2.00E-01 | 1.00E+00                 | 2.50E-01                  |                      | 1.42E+02           | S                                 | 8.00E-01           |
| 10100601 | NG   | 8.40E+01 | 5.50E+00 | <sup>2</sup>             | <sup>2</sup>              |                      | 3.50E+00           |                                   | 3.20E+00           |
| 10100604 | NG   | 2.40E+01 | 5.50E+00 | <sup>2</sup>             | <sup>2</sup>              |                      | 3.50E+00           |                                   | 3.20E+00           |
| 10100701 | OG   | 6.60E+00 | 4.30E-01 | <sup>2</sup>             | <sup>2</sup>              |                      | 3.50E+00           |                                   | 1.20E+00           |
| 10100801 | PC   | 6.00E-01 | 7.00E-02 | 7.90E+00                 | 4.50E+00                  | A                    | 3.90E+01           | S                                 | 3.97E-01           |
| 10100818 | PC   | 1.80E+01 | 5.00E-02 | 1.24E+01                 | 1.36E+00                  |                      | 3.10E+01           | S                                 | 3.97E-01           |
| 10100902 | WDS  | 6.80E+00 | 1.90E-01 | 5.70E+00                 | 4.90E+00                  |                      | 2.90E-01           |                                   | 8.60E-02           |
| 10101201 | OTS  | 1.30E+00 | 7.20E-01 | 2.30E+01                 | 1.30E+01                  |                      | 8.00E-02           |                                   | 1.20E+00           |
| 10101204 | TDF  | 5.00E-01 | 6.00E-02 | 2.30E+00                 | 6.00E-01                  | A                    | 3.80E+01           | S                                 | 1.20E+00           |
| 10101901 | SC   | 5.00E-01 | 6.00E-02 | 2.30E+00                 | 6.00E-01                  | A                    | 3.80E+01           | S                                 | 3.00E-02           |
| 10102018 | WC   | 1.50E-01 | 3.00E-02 | 1.20E+01                 | 1.40E+00                  |                      | 1.00E+01           | S                                 | 3.00E-02           |
| 10102101 | OO   | 5.00E+00 | 2.00E-01 | 1.00E+00                 | 2.50E-01                  |                      | 1.42E+02           | S                                 | ---                |
| 20100101 | DFO  | 4.60E-01 | 5.70E-02 | 6.00E-01                 | 6.00E-01                  |                      | 1.41E+02           | S                                 | 6.62E+00           |
| 20100201 | NG   | 8.40E+01 | 2.10E+00 | <sup>2</sup>             | <sup>2</sup>              |                      | 3.50E+00           |                                   | 6.56E+00           |
| 20100301 | IGCC | 3.50E+01 | 2.20E+00 | <sup>2</sup>             | <sup>2</sup>              |                      | 3.50E+00           |                                   | 6.56E+00           |

<sup>1</sup>Multiply sulfur/ash content by the SO<sub>2</sub> EF/PM EF numeric value to obtain the respective EF.

<sup>2</sup>There are no EF for these SCC because of uncertainty due to an artifact of the test method used in the past. PM<sub>10</sub> and PM<sub>2.5</sub> primary are calculated directly from their EF (see Table A-5).

SOURCE: EPA-approved emission factor file, consistent with IPM CAP documentation, "ORL File Generation Methodology," ORL\_Methodology\_Long\_10-02-07.doc (ICF, 2007b).

**Table A-4. PM Condensable Emission Factors (lb/MMBtu)**

| SCC      | Fuel | PM Condensable EF |
|----------|------|-------------------|
| 10100201 | BIT  | 1 or 2            |
| 10100202 | BIT  | 1 or 2            |
| 10100203 | BIT  | 1 or 2            |
| 10100204 | BIT  | 4.00E-02          |
| 10100212 | BIT  | 1 or 2            |
| 10100215 | BIT  | 1 or 2            |
| 10100218 | BIT  | 1.00E-02          |
| 10100221 | SUB  | 1 or 2            |
| 10100222 | SUB  | 1 or 2            |
| 10100223 | SUB  | 1 or 2            |
| 10100224 | SUB  | 4.00E-02          |
| 10100226 | SUB  | 1 or 2            |
| 10100235 | SUB  | 1 or 2            |
| 10100301 | LIG  | 1 or 2            |
| 10100302 | LIG  | 1 or 2            |
| 10100303 | LIG  | 1 or 2            |
| 10100318 | LIG  | 1.00E-02          |
| 10100401 | RFO  | 1.00E-02          |
| 10100404 | RFO  | 1.00E-02          |
| 10100501 | DFO  | 9.00E-03          |
| 10100601 | NG   | 4                 |
| 10100604 | NG   | 4                 |
| 10100701 | OG   | 4                 |
| 10100801 | PC   | 1.00E-02          |
| 10100818 | PC   | 1.00E-02          |
| 10100902 | WDS  | 1.70E-02          |
| 10101204 | TDF  | 3                 |
| 10101901 | SC   | 1 or 2            |
| 10102018 | WC   | 1.00E-02          |
| 10102101 | OO   | 9.00E-03          |
| 20100101 | DFO  | 7.20E-03          |
| 20100201 | NG   | 4                 |
| 20100301 | IGCC | 4                 |

<sup>1</sup> If there is either an SO<sub>2</sub> FGD or a PM wet scrubber then EF = 0.02.

<sup>2</sup> Otherwise if not <sup>1</sup>, EF = (0.1 \* sulfur content - .03, but if the EF is less than 0.01, set it equal to 0.01.

<sup>3</sup> If no value possible from table, EF is calculated as in <sup>2</sup>.

<sup>4</sup> There are no EF for these SCC because of uncertainty due to an artifact of the test method used in the past. PM<sub>10</sub> and PM<sub>2.5</sub> primary are calculated directly from their EF (see Table A-5).

SOURCE: "ORL File Generation Methodology,"  
ORL\_Methodology\_Long\_10-02-07.doc (ICF, 2007b).

**Table A-5. PM<sub>10</sub> and PM<sub>2.5</sub> Primary Emissions Factors (lb/MMBtu)  
for Gas-Fired and IGCC Units**

| SCC      | PM <sub>10</sub> Primary EF | PM <sub>2.5</sub> Primary EF |
|----------|-----------------------------|------------------------------|
| 10100601 | 6.80E-02                    | 5.70E-02                     |
| 10100604 | 6.80E-02                    | 5.70E-02                     |
| 10100701 | 6.00E-02                    | 5.80E-02                     |
| 20100201 | 4.60E-02                    | 2.80E-02                     |
| 20100301 | 1.10E-01                    | 1.10E-01                     |

SOURCE: Ron Myer's EF in  
ratios\_to\_adjust\_pmvalues\_in\_nei\_for\_naturalgas\_combustion082005.xls  
from <http://www.epa.gov/ttn/chief/net/2002inventory.html#inventorydata>  
under Point Documentation ("Ratios to adjust PM") (EPA, 2005a).

**Table A-6. HAP (except for Hg) Emissions Factors**

| <b>Pollutant</b>                    | <b>EIS Pollutant Code</b> | <b>Emission Factor</b> | <b>Unit</b> | <b>Fuel</b>  | <b>Unit Type</b> |
|-------------------------------------|---------------------------|------------------------|-------------|--------------|------------------|
| 1,3-Butadiene                       | 106990                    | 1.60E-05               | lb/MMBtu    | Diesel Oil   | Turbine          |
| 1,3-Butadiene                       | 106990                    | 4.30E-07               | lb/MMBtu    | Natural Gas  | Turbine          |
| 2,3,7,8-Tetrachlorodibenzofuran     | 51207319                  | 9.00E-11               | lb/MMBtu    | Wood         | Boiler           |
| 2,3,7,8-Tetrachlorodibenzo-p-Dioxin | 1746016                   | 8.60E-12               | lb/MMBtu    | Wood         | Boiler           |
| 2,4,6-Trichlorophenol               | 88062                     | 2.20E-08               | lb/MMBtu    | Wood         | Boiler           |
| 2,4-Dinitrophenol                   | 51285                     | 1.80E-07               | lb/MMBtu    | Wood         | Boiler           |
| 2,4-Dinitrotoluene                  | 121142                    | 2.80E-07               | lb/ton      | Coal         | Boiler           |
| 2-Chloroacetophenone                | 532274                    | 7.00E-06               | lb/ton      | Coal         | Boiler           |
| 2-Chloronaphthalene                 | 91587                     | 2.40E-09               | lb/MMBtu    | Wood         | Boiler           |
| 2-Methylnaphthalene                 | 91576                     | 2.40E-05               | lb/MMcf     | Natural Gas  | Boiler           |
| 2-Methylnaphthalene                 | 91576                     | 1.60E-07               | lb/MMBtu    | Wood         | Boiler           |
| 3-Methylcholanthrene                | 56495                     | 1.80E-06               | lb/MMcf     | Natural Gas  | Boiler           |
| 4-Nitrophenol                       | 100027                    | 1.10E-07               | lb/MMBtu    | Wood         | Boiler           |
| 5-Methylchrysene                    | 3697243                   | 2.20E-08               | lb/ton      | Coal         | Boiler           |
| 7,12-Dimethylbenz[a]Anthracene      | 57976                     | 1.60E-05               | lb/MMcf     | Natural Gas  | Boiler           |
| Acenaphthene                        | 83329                     | 5.10E-07               | lb/ton      | Coal         | Boiler           |
| Acenaphthene                        | 83329                     | 1.80E-06               | lb/MMcf     | Natural Gas  | Boiler           |
| Acenaphthene                        | 83329                     | 2.11E-05               | lb/k-gal    | Residual Oil | Boiler           |
| Acenaphthene                        | 83329                     | 9.10E-07               | lb/MMBtu    | Wood         | Boiler           |
| Acenaphthylene                      | 208968                    | 2.50E-07               | lb/ton      | Coal         | Boiler           |
| Acenaphthylene                      | 208968                    | 1.80E-06               | lb/MMcf     | Natural Gas  | Boiler           |
| Acenaphthylene                      | 208968                    | 2.53E-07               | lb/k-gal    | Residual Oil | Boiler           |
| Acenaphthylene                      | 208968                    | 5.00E-06               | lb/MMBtu    | Wood         | Boiler           |
| Acetaldehyde                        | 75070                     | 5.70E-04               | lb/ton      | Coal         | Boiler           |
| Acetaldehyde                        | 75070                     | 4.20E-03               | lb/MMcf     | Natural Gas  | Boiler           |
| Acetaldehyde                        | 75070                     | 4.00E-05               | lb/MMBtu    | Natural Gas  | Turbine          |
| Acetaldehyde                        | 75070                     | 5.25E-03               | lb/k-gal    | Residual Oil | Boiler           |
| Acetaldehyde                        | 75070                     | 8.30E-04               | lb/MMBtu    | Wood         | Boiler           |
| Acetophenone                        | 98862                     | 1.50E-05               | lb/ton      | Coal         | Boiler           |
| Acetophenone                        | 98862                     | 3.20E-09               | lb/MMBtu    | Wood         | Boiler           |
| Acrolein                            | 107028                    | 2.90E-04               | lb/ton      | Coal         | Boiler           |
| Acrolein                            | 107028                    | 6.40E-06               | lb/MMBtu    | Natural Gas  | Turbine          |
| Acrolein                            | 107028                    | 4.00E-03               | lb/MMBtu    | Wood         | Boiler           |
| Anthracene                          | 120127                    | 2.10E-07               | lb/ton      | Coal         | Boiler           |
| Anthracene                          | 120127                    | 2.40E-06               | lb/MMcf     | Natural Gas  | Boiler           |
| Anthracene                          | 120127                    | 1.22E-06               | lb/k-gal    | Residual Oil | Boiler           |
| Anthracene                          | 120127                    | 3.00E-06               | lb/MMBtu    | Wood         | Boiler           |
| Antimony                            | 7440360                   | 1.80E-05               | lb/ton      | Coal         | Boiler           |
| Antimony                            | 7440360                   | 5.25E-03               | lb/k-gal    | Residual Oil | Boiler           |
| Antimony                            | 7440360                   | 7.90E-06               | lb/MMBtu    | Wood         | Boiler           |
| Arsenic                             | 7440382                   | 4.10E-04               | lb/ton      | Coal         | Boiler           |
| Arsenic                             | 7440382                   | 1.10E-05               | lb/MMBtu    | Diesel Oil   | Turbine          |
| Arsenic                             | 7440382                   | 2.00E-04               | lb/MMcf     | Natural Gas  | Boiler           |
| Arsenic                             | 7440382                   | 1.32E-03               | lb/k-gal    | Residual Oil | Boiler           |
| Arsenic                             | 7440382                   | 2.20E-05               | lb/MMBtu    | Wood         | Boiler           |
| Benz[a]Anthracene                   | 56553                     | 8.00E-08               | lb/ton      | Coal         | Boiler           |
| Benz[a]Anthracene                   | 56553                     | 1.80E-06               | lb/MMcf     | Natural Gas  | Boiler           |
| Benz[a]Anthracene                   | 56553                     | 4.01E-06               | lb/k-gal    | Residual Oil | Boiler           |
| Benz[a]Anthracene                   | 56553                     | 6.50E-08               | lb/MMBtu    | Wood         | Boiler           |
| Benzene                             | 71432                     | 1.30E-03               | lb/ton      | Coal         | Boiler           |

| Pollutant                   | EIS Pollutant Code | Emission Factor | Unit     | Fuel         | Unit Type |
|-----------------------------|--------------------|-----------------|----------|--------------|-----------|
| Benzene                     | 71432              | 5.50E-05        | lb/MMBtu | Diesel Oil   | Turbine   |
| Benzene                     | 71432              | 2.10E-03        | lb/MMcf  | Natural Gas  | Boiler    |
| Benzene                     | 71432              | 1.20E-05        | lb/MMBtu | Natural Gas  | Turbine   |
| Benzene                     | 71432              | 2.14E-04        | lb/k-gal | Residual Oil | Boiler    |
| Benzene                     | 71432              | 4.20E-03        | lb/MMBtu | Wood         | Boiler    |
| Benzo[a]Pyrene              | 50328              | 3.80E-08        | lb/ton   | Coal         | Boiler    |
| Benzo[a]Pyrene              | 50328              | 1.20E-06        | lb/MMcf  | Natural Gas  | Boiler    |
| Benzo[a]Pyrene              | 50328              | 2.60E-06        | lb/MMBtu | Wood         | Boiler    |
| Benzo[b]Fluoranthene        | 205992             | 1.80E-06        | lb/MMcf  | Natural Gas  | Boiler    |
| Benzo[b]Fluoranthene        | 205992             | 1.00E-07        | lb/MMBtu | Wood         | Boiler    |
| Benzo[b+k]Fluoranthene      | 102                | 1.48E-06        | lb/k-gal | Residual Oil | Boiler    |
| Benzo[e]Pyrene              | 192972             | 2.60E-09        | lb/MMBtu | Wood         | Boiler    |
| Benzo[g,h,i]Perylene        | 191242             | 2.70E-08        | lb/ton   | Coal         | Boiler    |
| Benzo[g,h,i]Perylene        | 191242             | 1.20E-06        | lb/MMcf  | Natural Gas  | Boiler    |
| Benzo[g,h,i]Perylene        | 191242             | 2.26E-06        | lb/k-gal | Residual Oil | Boiler    |
| Benzo[g,h,i]Perylene        | 191242             | 9.30E-08        | lb/MMBtu | Wood         | Boiler    |
| Benzo[k]Fluoranthene        | 207089             | 1.80E-06        | lb/MMcf  | Natural Gas  | Boiler    |
| Benzo[k]Fluoranthene        | 207089             | 3.60E-08        | lb/MMBtu | Wood         | Boiler    |
| Benzyl Chloride             | 100447             | 7.00E-04        | lb/ton   | Coal         | Boiler    |
| Beryllium                   | 7440417            | 2.10E-05        | lb/ton   | Coal         | Boiler    |
| Beryllium                   | 7440417            | 3.10E-07        | lb/MMBtu | Diesel Oil   | Turbine   |
| Beryllium                   | 7440417            | 1.20E-05        | lb/MMcf  | Natural Gas  | Boiler    |
| Beryllium                   | 7440417            | 2.78E-05        | lb/k-gal | Residual Oil | Boiler    |
| Beryllium                   | 7440417            | 1.10E-06        | lb/MMBtu | Wood         | Boiler    |
| Biphenyl                    | 92524              | 1.70E-06        | lb/ton   | Coal         | Boiler    |
| Bis(2-Ethylhexyl) Phthalate | 117817             | 7.30E-05        | lb/ton   | Coal         | Boiler    |
| Bis(2-Ethylhexyl) Phthalate | 117817             | 4.70E-08        | lb/MMBtu | Wood         | Boiler    |
| Bromoform                   | 75252              | 3.90E-05        | lb/ton   | Coal         | Boiler    |
| Cadmium                     | 7440439            | 5.10E-05        | lb/ton   | Coal         | Boiler    |
| Cadmium                     | 7440439            | 4.80E-06        | lb/MMBtu | Diesel Oil   | Turbine   |
| Cadmium                     | 7440439            | 1.10E-03        | lb/MMcf  | Natural Gas  | Boiler    |
| Cadmium                     | 7440439            | 3.98E-04        | lb/k-gal | Residual Oil | Boiler    |
| Cadmium                     | 7440439            | 4.10E-06        | lb/MMBtu | Wood         | Boiler    |
| Carbon Disulfide            | 75150              | 1.30E-04        | lb/ton   | Coal         | Boiler    |
| Carbon Tetrachloride        | 56235              | 4.50E-05        | lb/MMBtu | Wood         | Boiler    |
| Chlorine                    | 7782505            | 7.90E-04        | lb/MMBtu | Wood         | Boiler    |
| Chlorobenzene               | 108907             | 2.20E-05        | lb/ton   | Coal         | Boiler    |
| Chlorobenzene               | 108907             | 3.30E-05        | lb/MMBtu | Wood         | Boiler    |
| Chloroform                  | 67663              | 5.90E-05        | lb/ton   | Coal         | Boiler    |
| Chloroform                  | 67663              | 2.80E-05        | lb/MMBtu | Wood         | Boiler    |
| Chromium                    | 7440473            | 1.10E-05        | lb/MMBtu | Diesel Oil   | Turbine   |
| Chromium                    | 7440473            | 1.40E-03        | lb/MMcf  | Natural Gas  | Boiler    |
| Chromium                    | 7440473            | 2.10E-05        | lb/MMBtu | Wood         | Boiler    |
| Chromium (III)              | 16065831           | 1.81E-04        | lb/ton   | Coal         | Boiler    |
| Chromium (III)              | 16065831           | 5.97E-04        | lb/k-gal | Residual Oil | Boiler    |
| Chromium (VI)               | 18540299           | 7.90E-05        | lb/ton   | Coal         | Boiler    |
| Chromium (VI)               | 18540299           | 2.48E-04        | lb/k-gal | Residual Oil | Boiler    |
| Chromium (VI)               | 18540299           | 3.50E-06        | lb/MMBtu | Wood         | Boiler    |
| Chrysene                    | 218019             | 1.00E-07        | lb/ton   | Coal         | Boiler    |
| Chrysene                    | 218019             | 1.80E-06        | lb/MMcf  | Natural Gas  | Boiler    |
| Chrysene                    | 218019             | 2.38E-06        | lb/k-gal | Residual Oil | Boiler    |
| Chrysene                    | 218019             | 3.80E-08        | lb/MMBtu | Wood         | Boiler    |

| <b>Pollutant</b>           | <b>EIS Pollutant Code</b> | <b>Emission Factor</b> | <b>Unit</b> | <b>Fuel</b>  | <b>Unit Type</b> |
|----------------------------|---------------------------|------------------------|-------------|--------------|------------------|
| Cobalt                     | 7440484                   | 1.00E-04               | lb/ton      | Coal         | Boiler           |
| Cobalt                     | 7440484                   | 8.40E-05               | lb/MMcf     | Natural Gas  | Boiler           |
| Cobalt                     | 7440484                   | 6.02E-03               | lb/k-gal    | Residual Oil | Boiler           |
| Cobalt                     | 7440484                   | 6.50E-06               | lb/MMBtu    | Wood         | Boiler           |
| Cumene                     | 98828                     | 5.30E-06               | lb/ton      | Coal         | Boiler           |
| Cyanide                    | 57125                     | 2.50E-03               | lb/ton      | Coal         | Boiler           |
| Dibenzo[a,h]Anthracene     | 53703                     | 1.20E-06               | lb/MMcf     | Natural Gas  | Boiler           |
| Dibenzo[a,h]Anthracene     | 53703                     | 1.67E-06               | lb/k-gal    | Residual Oil | Boiler           |
| Dibenzo[a,h]Anthracene     | 53703                     | 9.10E-09               | lb/MMBtu    | Wood         | Boiler           |
| Dimethyl Sulfate           | 77781                     | 4.80E-05               | lb/ton      | Coal         | Boiler           |
| Ethyl Benzene              | 100414                    | 9.40E-05               | lb/ton      | Coal         | Boiler           |
| Ethyl Benzene              | 100414                    | 3.20E-05               | lb/MMBtu    | Natural Gas  | Turbine          |
| Ethyl Benzene              | 100414                    | 6.36E-05               | lb/k-gal    | Residual Oil | Boiler           |
| Ethyl Benzene              | 100414                    | 3.10E-05               | lb/MMBtu    | Wood         | Boiler           |
| Ethyl Chloride             | 75003                     | 4.20E-05               | lb/ton      | Coal         | Boiler           |
| Ethyl Chloride             | 75003                     | 8.60E-04               | lb/MMBtu    | Wood         | Boiler           |
| Ethylene Dibromide         | 106934                    | 1.20E-06               | lb/ton      | Coal         | Boiler           |
| Ethylene Dichloride        | 107062                    | 4.00E-05               | lb/ton      | Coal         | Boiler           |
| Ethylene Dichloride        | 107062                    | 2.90E-05               | lb/MMBtu    | Wood         | Boiler           |
| Fluoranthene               | 206440                    | 7.10E-07               | lb/ton      | Coal         | Boiler           |
| Fluoranthene               | 206440                    | 3.00E-06               | lb/MMcf     | Natural Gas  | Boiler           |
| Fluoranthene               | 206440                    | 4.84E-06               | lb/k-gal    | Residual Oil | Boiler           |
| Fluoranthene               | 206440                    | 1.60E-07               | lb/MMBtu    | Wood         | Boiler           |
| Fluorene                   | 86737                     | 9.10E-07               | lb/ton      | Coal         | Boiler           |
| Fluorene                   | 86737                     | 2.80E-06               | lb/MMcf     | Natural Gas  | Boiler           |
| Fluorene                   | 86737                     | 4.47E-06               | lb/k-gal    | Residual Oil | Boiler           |
| Fluorene                   | 86737                     | 3.40E-06               | lb/MMBtu    | Wood         | Boiler           |
| Formaldehyde               | 50000                     | 2.40E-04               | lb/ton      | Coal         | Boiler           |
| Formaldehyde               | 50000                     | 2.80E-04               | lb/MMBtu    | Diesel Oil   | Turbine          |
| Formaldehyde               | 50000                     | 7.50E-02               | lb/MMcf     | Natural Gas  | Boiler           |
| Formaldehyde               | 50000                     | 7.10E-04               | lb/MMBtu    | Natural Gas  | Turbine          |
| Formaldehyde               | 50000                     | 3.30E-02               | lb/k-gal    | Residual Oil | Boiler           |
| Formaldehyde               | 50000                     | 4.40E-03               | lb/MMBtu    | Wood         | Boiler           |
| Hexachlorodibenzo-p-Dioxin | 34465468                  | 1.60E-06               | lb/MMBtu    | Wood         | Boiler           |
| Hexane                     | 110543                    | 6.70E-05               | lb/ton      | Coal         | Boiler           |
| Hexane                     | 110543                    | 1.80E+00               | lb/MMcf     | Natural Gas  | Boiler           |
| Hydrochloric Acid          | 7647010                   | 1.20E+00               | lb/ton      | Coal         | Boiler           |
| Hydrochloric Acid          | 7647010                   | 1.90E-02               | lb/MMBtu    | Wood         | Boiler           |
| Hydrogen Fluoride          | 7664393                   | 1.50E-01               | lb/ton      | Coal         | Boiler           |
| Indeno[1,2,3-c,d]Pyrene    | 193395                    | 6.10E-08               | lb/ton      | Coal         | Boiler           |
| Indeno[1,2,3-c,d]Pyrene    | 193395                    | 1.80E-06               | lb/MMcf     | Natural Gas  | Boiler           |
| Indeno[1,2,3-c,d]Pyrene    | 193395                    | 2.14E-06               | lb/k-gal    | Residual Oil | Boiler           |
| Indeno[1,2,3-c,d]Pyrene    | 193395                    | 8.70E-08               | lb/MMBtu    | Wood         | Boiler           |
| Isophorone                 | 78591                     | 5.80E-04               | lb/ton      | Coal         | Boiler           |
| Lead                       | 7439921                   | 4.20E-04               | lb/ton      | Coal         | Boiler           |
| Lead                       | 7439921                   | 1.40E-05               | lb/MMBtu    | Diesel Oil   | Turbine          |
| Lead                       | 7439921                   | 1.51E-03               | lb/k-gal    | Residual Oil | Boiler           |
| Lead                       | 7439921                   | 4.80E-05               | lb/MMBtu    | Wood         | Boiler           |
| Manganese                  | 7439965                   | 4.90E-04               | lb/ton      | Coal         | Boiler           |
| Manganese                  | 7439965                   | 7.90E-04               | lb/MMBtu    | Diesel Oil   | Turbine          |
| Manganese                  | 7439965                   | 3.80E-04               | lb/MMcf     | Natural Gas  | Boiler           |
| Manganese                  | 7439965                   | 3.00E-03               | lb/k-gal    | Residual Oil | Boiler           |



| <b>Pollutant</b>           | <b>EIS Pollutant Code</b> | <b>Emission Factor</b> | <b>Unit</b> | <b>Fuel</b>  | <b>Unit Type</b> |
|----------------------------|---------------------------|------------------------|-------------|--------------|------------------|
| Manganese                  | 7439965                   | 1.60E-03               | lb/MMBtu    | Wood         | Boiler           |
| Methly Chloride            | 74873                     | 2.30E-05               | lb/MMBtu    | Wood         | Boiler           |
| Methly Ethyl Ketone        | 78933                     | 5.40E-06               | lb/MMBtu    | Wood         | Boiler           |
| Methyl Bromide             | 74839                     | 1.60E-04               | lb/ton      | Coal         | Boiler           |
| Methyl Bromide             | 74839                     | 1.50E-05               | lb/MMBtu    | Wood         | Boiler           |
| Methyl Chloride            | 74873                     | 5.30E-04               | lb/ton      | Coal         | Boiler           |
| Methyl Chloroform          | 71556                     | 3.10E-05               | lb/MMBtu    | Wood         | Boiler           |
| Methyl Ethyl Ketone        | 78933                     | 3.90E-04               | lb/ton      | Coal         | Boiler           |
| Methyl Methacrylate        | 80626                     | 2.00E-05               | lb/ton      | Coal         | Boiler           |
| Methyl Tert-Butyl Ether    | 1634044                   | 3.50E-05               | lb/ton      | Coal         | Boiler           |
| Methylene Chloride         | 75092                     | 2.90E-04               | lb/ton      | Coal         | Boiler           |
| Methylene Chloride         | 75092                     | 2.90E-04               | lb/MMBtu    | Wood         | Boiler           |
| Methylhydrazine            | 60344                     | 1.70E-04               | lb/ton      | Coal         | Boiler           |
| Naphthalene                | 91203                     | 1.30E-05               | lb/ton      | Coal         | Boiler           |
| Naphthalene                | 91203                     | 3.50E-05               | lb/MMBtu    | Diesel Oil   | Turbine          |
| Naphthalene                | 91203                     | 6.10E-04               | lb/MMcf     | Natural Gas  | Boiler           |
| Naphthalene                | 91203                     | 1.30E-06               | lb/MMBtu    | Natural Gas  | Turbine          |
| Naphthalene                | 91203                     | 1.13E-03               | lb/k-gal    | Residual Oil | Boiler           |
| Naphthalene                | 91203                     | 9.70E-05               | lb/MMBtu    | Wood         | Boiler           |
| Nickel                     | 7440020                   | 2.80E-04               | lb/ton      | Coal         | Boiler           |
| Nickel                     | 7440020                   | 4.60E-06               | lb/MMBtu    | Diesel Oil   | Turbine          |
| Nickel                     | 7440020                   | 2.10E-03               | lb/MMcf     | Natural Gas  | Boiler           |
| Nickel                     | 7440020                   | 8.45E-02               | lb/k-gal    | Residual Oil | Boiler           |
| Nickel                     | 7440020                   | 3.30E-05               | lb/MMBtu    | Wood         | Boiler           |
| Octachlorodibenzofuran     | 39001020                  | 8.80E-11               | lb/MMBtu    | Wood         | Boiler           |
| Octachlorodibenzo-p-Dioxin | 3268879                   | 6.60E-08               | lb/MMBtu    | Wood         | Boiler           |
| o-Xylene                   | 95476                     | 1.09E-04               | lb/k-gal    | Residual Oil | Boiler           |
| o-Xylene                   | 95476                     | 2.50E-05               | lb/MMBtu    | Wood         | Boiler           |
| Pentachlorophenol          | 87865                     | 5.10E-08               | lb/MMBtu    | Wood         | Boiler           |
| Perylene                   | 198550                    | 5.20E-10               | lb/MMBtu    | Wood         | Boiler           |
| Phenanthrene               | 85018                     | 2.70E-06               | lb/ton      | Coal         | Boiler           |
| Phenanthrene               | 85018                     | 1.05E-05               | lb/k-gal    | Residual Oil | Boiler           |
| Phenanthrene               | 85018                     | 7.00E-06               | lb/MMBtu    | Wood         | Boiler           |
| Phenol                     | 108952                    | 1.60E-05               | lb/ton      | Coal         | Boiler           |
| Phenol                     | 108952                    | 5.10E-05               | lb/MMBtu    | Wood         | Boiler           |
| Phosphorus                 | 7723140                   | 9.46E-03               | lb/k-gal    | Residual Oil | Boiler           |
| Phosphorus                 | 7723140                   | 2.70E-05               | lb/MMBtu    | Wood         | Boiler           |
| Propionaldehyde            | 123386                    | 3.80E-04               | lb/ton      | Coal         | Boiler           |
| Propionaldehyde            | 123386                    | 6.10E-05               | lb/MMBtu    | Wood         | Boiler           |
| Propylene Dichloride       | 78875                     | 3.30E-05               | lb/MMBtu    | Wood         | Boiler           |
| Propylene Oxide            | 75569                     | 2.90E-05               | lb/MMBtu    | Natural Gas  | Turbine          |
| Pyrene                     | 129000                    | 3.30E-07               | lb/ton      | Coal         | Boiler           |
| Pyrene                     | 129000                    | 5.00E-06               | lb/MMcf     | Natural Gas  | Boiler           |
| Pyrene                     | 129000                    | 4.25E-06               | lb/k-gal    | Residual Oil | Boiler           |
| Pyrene                     | 129000                    | 3.70E-06               | lb/MMBtu    | Wood         | Boiler           |
| Selenium                   | 7782492                   | 1.30E-03               | lb/ton      | Coal         | Boiler           |
| Selenium                   | 7782492                   | 2.50E-05               | lb/MMBtu    | Diesel Oil   | Turbine          |
| Selenium                   | 7782492                   | 2.40E-05               | lb/MMcf     | Natural Gas  | Boiler           |
| Selenium                   | 7782492                   | 6.83E-04               | lb/k-gal    | Residual Oil | Boiler           |
| Selenium                   | 7782492                   | 2.80E-06               | lb/MMBtu    | Wood         | Boiler           |
| Styrene                    | 100425                    | 2.50E-05               | lb/ton      | Coal         | Boiler           |
| Styrene                    | 100425                    | 1.90E-03               | lb/MMBtu    | Wood         | Boiler           |

| <b>Pollutant</b>                         | <b>EIS Pollutant Code</b> | <b>Emission Factor</b> | <b>Unit</b> | <b>Fuel</b>  | <b>Unit Type</b> |
|------------------------------------------|---------------------------|------------------------|-------------|--------------|------------------|
| Tetrachloroethylene                      | 127184                    | 4.30E-05               | lb/ton      | Coal         | Boiler           |
| Tetrachloroethylene                      | 127184                    | 3.80E-05               | lb/MMBtu    | Wood         | Boiler           |
| Toluene                                  | 108883                    | 2.40E-04               | lb/ton      | Coal         | Boiler           |
| Toluene                                  | 108883                    | 3.40E-03               | lb/MMcf     | Natural Gas  | Boiler           |
| Toluene                                  | 108883                    | 1.30E-04               | lb/MMBtu    | Natural Gas  | Turbine          |
| Toluene                                  | 108883                    | 6.20E-03               | lb/k-gal    | Residual Oil | Boiler           |
| Toluene                                  | 108883                    | 9.20E-04               | lb/MMBtu    | Wood         | Boiler           |
| Trichloroethylene                        | 79016                     | 3.00E-05               | lb/MMBtu    | Wood         | Boiler           |
| Vinyl Acetate                            | 108054                    | 7.60E-06               | lb/ton      | Coal         | Boiler           |
| Vinyl Chloride                           | 75014                     | 1.80E-05               | lb/MMBtu    | Wood         | Boiler           |
| Xylenes                                  | 1330207                   | 5.36E-06               | lb/MMBtu    | Wood         | Boiler           |
| Xylenes (Mixture of o, m, and p Isomers) | 1330207                   | 3.70E-05               | lb/ton      | Coal         | Boiler           |
| Xylenes (Mixture of o, m, and p Isomers) | 1330207                   | 6.40E-05               | lb/MMBtu    | Natural Gas  | Turbine          |

SOURCE: IPM\_EFDataFile\_wHAPNames.xls (ICF, 2007a) and "Documentation of the Emission Factors Used to Generate HAP emissions in IPM Post Processing," (ICF, 2008).

**Table A-7. Format for the Access File for Emissions Data Deliverables<sup>1</sup>**

| Unit level                                  |                                            |                                                                                                                                                                       |                                                                                                                                                                                                                                                                  |
|---------------------------------------------|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Staging Table Name                          | Field Name                                 | Comment                                                                                                                                                               | Definition                                                                                                                                                                                                                                                       |
| AlternativeFacilityIdentification           | AlternativeAgencyIdentifier                | ORIS code from CAMD08 file.                                                                                                                                           |                                                                                                                                                                                                                                                                  |
| AlternativeUnitIdentification               | AlternativeUnitIdentifier                  | Unit ID from CAMD08 file.                                                                                                                                             |                                                                                                                                                                                                                                                                  |
| ReportingPeriod                             | EISFacilitySiteIdentifier                  | Blank at this time.                                                                                                                                                   | An identifier by which the facility site is referred to by a system.                                                                                                                                                                                             |
| ReportingPeriod                             | EISEmissionsUnitIdentifier                 | Blank at this time.                                                                                                                                                   | Identifiers by which the emissions unit is known or has been known.                                                                                                                                                                                              |
| ReportingPeriod                             | CalculationParameterTypeCode               | I (Input) for Heat Input and Physical Constant of Fuel Use                                                                                                            | Code indicating whether the material measured is an input to the process, an output of the process or a static count (not a throughput).                                                                                                                         |
| ReportingPeriod                             | CalculationParameterValue                  | Heat Input                                                                                                                                                            | Activity or throughput of the process for a given time period.                                                                                                                                                                                                   |
| ReportingPeriod                             | CalculationParameterUnitofMeasure          | E6BTU                                                                                                                                                                 | Code for the unit of measure for calculation parameter value.                                                                                                                                                                                                    |
| ReportingPeriod                             | CalculationMaterialCode                    | 142 for Heat Input.                                                                                                                                                   | Code for material or fuel processed.                                                                                                                                                                                                                             |
| EmissionsProcess                            | CalculationDataSource                      | From CAMD08 file                                                                                                                                                      | The source of the data used.                                                                                                                                                                                                                                     |
| ControlApproach                             | ControlApproachDescription                 | For some SO <sub>2</sub> , PM <sub>10</sub> -FIL, PM <sub>25</sub> -FIL, and HCl and HF                                                                               | Description of the overall control system or approach applied to an emissions unit or process.                                                                                                                                                                   |
| ControlApproach                             | PercentControlApproachCaptureEfficiency    | Assumed to be 100%                                                                                                                                                    | An estimate of that portion of an affected emission stream that is collected and routed to the control measures when the capture or collection system is operating as designed, reported as a percent.                                                           |
| ControlApproach                             | PercentControlApproachEffectiveness        | Assumed to be 100%                                                                                                                                                    | An estimate of the portion of the reporting period's activity for which the overall control system or approach (including both capture and control measures) were operating as designed (regardless of whether the control measure is due to rule or voluntary). |
| ControlApproach                             | ControlApproachComment                     | The control approach describes the multiple controls that are in place for the SO <sub>2</sub> and PM emissions when the controls are used for calculating emissions. | Comments regarding the control approach.                                                                                                                                                                                                                         |
| SupplementalParameter                       | SupplementalCalculationParameterType       | Pechan lists heat content here.                                                                                                                                       | Name of the parameter that describes the type of activity, throughput or input used in the calculation. (All Supplemental Calculation Parameters must be associated with a fuel combustion SCC).                                                                 |
| SupplementalParameter                       | SupplementalCalculationParameterValue      | This value is found in Table A-1 or A-2 of this document.                                                                                                             | The value of the parameter.                                                                                                                                                                                                                                      |
| SupplementalParameter                       | SupplementalCalculationParameterDataSource | Based on EIA quantity weighted average tables.                                                                                                                        | The source of the supplemental parameter data used.                                                                                                                                                                                                              |
| SupplementalParameter                       | SupplementalCalculationParameterComment    | Comments if necessary.                                                                                                                                                | Any comments regarding the parameter.                                                                                                                                                                                                                            |
| Additional information which is not in EIS. | CAMD08 Unit Type                           | The reported unit type from the CAMD08 file.                                                                                                                          |                                                                                                                                                                                                                                                                  |
|                                             | CAMD Primary Fuel                          | The reported primary fuel from the CAMD08 file.                                                                                                                       |                                                                                                                                                                                                                                                                  |

| Unit level         |                                    |                                                                                                                                                                              |                                                                                               |
|--------------------|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Staging Table Name | Field Name                         | Comment                                                                                                                                                                      | Definition                                                                                    |
|                    | Coal Type                          | When CAMD Primary Fuel is Coal, Coal Type is determined based on eGRID defaults                                                                                              |                                                                                               |
|                    | HAP Primary Fuel Category          | HAP fuel category based on IPM documentation needed for assignment of EF                                                                                                     | This is used in emissions calculations to determine the HAP emission factors to be used.      |
|                    | SCC                                | This is used for CAP calculations, and is assigned by Pechan based on fuel and unit type.                                                                                    | In EIS, SCC is only available at the process level.                                           |
|                    | Physical Fuel Quantity             | This is calculated based on the heat input and the default heat content values. It is used in the calculation of emissions for some combinations of fuel type and pollutant. | The calculated fuel use based on the default heat content supplemental calculation parameter. |
|                    | PhysicalFuelQtyUnitofMeasure       | TON, E3GAL, or E6FT3                                                                                                                                                         | Fuel quantity possible measurement units.                                                     |
|                    | PM Control Name                    | From CAMD08 file.                                                                                                                                                            |                                                                                               |
|                    | SO2 Control Name                   | From CAMD08 file.                                                                                                                                                            |                                                                                               |
|                    | Sulfur Content Value               | This value is found in Table A-1 or A-2 of this document.                                                                                                                    | The weighted percent sulfur content in the primary fuel.                                      |
|                    | Ash Content Value                  | This value is found in Table A-1 or A-2 of this document.                                                                                                                    | The weighted percent ash content in the primary fuel.                                         |
|                    | Sulfur and Ash Content Data Source | Table A-1 or A-2                                                                                                                                                             | The source of the supplemental parameter data used.                                           |
|                    | Months Reporting                   | From CAMD08 file.                                                                                                                                                            |                                                                                               |
|                    | Unit Operating Time (Hours)        | From CAMD08 file.                                                                                                                                                            |                                                                                               |

| Unit-pollutant level                         |                                            |                                                                                                                                                                                                                                                                                                       |                                                                                                                                  |
|----------------------------------------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Staging Table Name                           | Field Name                                 | Comment                                                                                                                                                                                                                                                                                               | Definition                                                                                                                       |
| Emissions                                    | EISFacilitySiteIdentifier                  | Blank at this time.                                                                                                                                                                                                                                                                                   | An identifier by which the facility site is referred to by a system.                                                             |
| Emissions                                    | EISEmissionsUnitIdentifier                 | Blank at this time.                                                                                                                                                                                                                                                                                   | Identifiers by which the emissions unit is known or has been known.                                                              |
| Emissions                                    | PollutantCode                              | 97 HAPs, 7439976 (Hg), NOX, SO2, CO2, VOC, CO, and PM10-FIL, PM25-FIL, PM-CON, PM10-PRI, PM25-PRI for specified units.                                                                                                                                                                                | Code identifying the pollutant for which emissions are reported.                                                                 |
| Emissions                                    | TotalEmissions                             | Reported or Calculated                                                                                                                                                                                                                                                                                | Total calculated or estimated amount of the pollutant.                                                                           |
| Emissions                                    | EmissionsUnitofMeasureCode                 | TON for CAP, LB for HAP                                                                                                                                                                                                                                                                               | Unit of measure for reported emissions.                                                                                          |
| Emissions                                    | EmissionFactor                             | From EF tables, or ratio (if >0) of 2002 Hg to 2002 CAMD Heat Input.                                                                                                                                                                                                                                  | The emission factor used for the emissions value if a calculated value was provided.                                             |
| Emissions                                    | EmissionFactorNumeratorUnitofMeasureCode   | LB                                                                                                                                                                                                                                                                                                    | The numerator for reported EF's unit of measure.                                                                                 |
| Emissions                                    | EmissionFactorDenominatorUnitofMeasureCode | TON, E3GAL, E6FT3, or E6BTU                                                                                                                                                                                                                                                                           | The denominator for the unit of measure of the reported emission factor.                                                         |
| Emissions                                    | EmissionCalculationMethodCode              | 1 for CEM when available, 8 for USEPA Emission Factor (no CE), 28 for USEPA Emission Factor plus Control Efficiency, and 2 for Engineering Judgment in case of Hg.                                                                                                                                    | Code that defines the method used to calculate emissions.                                                                        |
| Emissions                                    | EmissionFactorText                         | Reference for the emission factor used.                                                                                                                                                                                                                                                               | Explanation for emission factor.                                                                                                 |
| Emissions                                    | EmissionsComment                           | Comments are provided as necessary.                                                                                                                                                                                                                                                                   | Any comments regarding emissions, EF, calc. method.                                                                              |
| ControlPollutant                             | PollutantCode (Control)                    | SO2, 7647010 (HCl), 7664393 (HF), and PM10-FIL, PM25-FIL                                                                                                                                                                                                                                              | The code for the pollutant which is controlled by the control measure.                                                           |
| ControlPollutant                             | PercentControlMeasureReductionEfficiency   | Based on IPM for HCl and HF.<br>Based on AirControlNET for SO2 when there is no reported CEM value and SO2 emissions are calculated.<br>Based on 2001 EIA-767 file or assigned a default 99.2% if unit is a coal/oil/pet coke boiler, but no values have yet been assigned for PM10-FIL and PM25-FIL. | The percent reduction achieved for the pollutant when all control measures are operating as designed.                            |
| Additional information which are not in EIS. | AlternativeAgencyIdentifier                | ORIS code from CAMD08 file.                                                                                                                                                                                                                                                                           |                                                                                                                                  |
|                                              | AlternativeUnitIdentifier                  | Unit ID from CAMD08 file.                                                                                                                                                                                                                                                                             |                                                                                                                                  |
|                                              | Pollutant Name                             | 1-to-1 with pollutant code.                                                                                                                                                                                                                                                                           | Name of pollutant                                                                                                                |
|                                              | Sulfur Content Flag                        | 1 if used to calculate SO2, PM10-FIL, PM25-FIL, or PM-CON emission factors, 0 if not.                                                                                                                                                                                                                 | This flag designates whether the Sulfur content from the unit level is used to calculate the emission factor for this pollutant. |
|                                              | Ash Content Flag                           | 1 if used to calculate PM10-FIL or PM25-FIL emission factors, 0 if not.                                                                                                                                                                                                                               | This flag designates whether the Ash content from the unit level is used to calculate the emission factor for this pollutant.    |
|                                              | Fuel Input Data Flag                       | H for Heat Input, P for Physical Fuel Quantity                                                                                                                                                                                                                                                        | This flag is used to develop the ControlApproachComment field                                                                    |

| Unit-pollutant level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                        |                                                                                   |                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Staging Table Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Field Name                             | Comment                                                                           | Definition                                                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Control Measure Name                   | Based on reported CAMD08 SO2 and PM control measures.                             | The control or controls which are used to calculate emissions for this pollutant |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | SO2 Control Flag                       | 1 if SO2 control efficiency was used for SO2 calculations, 0 if not.              | This flag is used to develop the ControlApproachComment field                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | PM10/PM2.5 FIL Control Efficiency Flag | 1 if PM-FIL control efficiency was used for PM-FIL calculations, 0 if not.        | This flag is used to develop the ControlApproachComment field                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | PM CON Control Flag                    | 1 if information about SO2 or PM controls was used to assign PM-CON EF, 0 if not. | This flag is used to develop the ControlApproachComment field                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | HCl/HF Control Flag                    | 1 if HCl/HF control efficiency was used for HCl/HF calculations, 0 if not.        | This flag is used to develop the ControlApproachComment field                    |
| <p><sup>1</sup> For the draft deliverable file, all data fields are in text format. For the final deliverable file, four fields are not in text format: TotalEmissions is double precision numeric with 15 decimal places; CalculationParameterValue [heat input] is numeric with three decimal places; SupplementalCalculationParameterValue [heat content] is numeric with no decimal places; and Physical Fuel Quantity is numeric with six decimal places.</p> <p>SOURCE: Facility and Point Source Staging tables generated by EIS Bridge Version 2.1 Subversion revision 8638, downloaded from <a href="https://eis.epa.gov/eis-system-web/downloads/bridge.jnlp">https://eis.epa.gov/eis-system-web/downloads/bridge.jnlp</a> (EPA, 2009a), EIS Code Tables (EPA, 2009b), and additional data for completely understanding the emissions calculations (not in EIS or final deliverable).</p> |                                        |                                                                                   |                                                                                  |