RESIDENTIAL AND COMMERCIAL/INSTITUTIONAL COAL COMBUSTION

DESCRIPTION

This source category covers air emissions from coal combustion in the residential and commercial sectors for space heating or water heating. This category includes small boilers, furnaces, heaters, and other heating units that are not inventoried as point sources. Residential and commercial coal combustion sectors comprise housing units; wholesale and retail businesses; health institutions; social and educational institutions; and Federal, state, and local government institutions (e.g., military installations, prisons, office buildings).

POLLUTANTS

Particulate matter (PM), sulfur dioxides (SO_X), carbon monoxide (CO), carbon dioxide (CO_2), nitrogen oxides (NO_x), nitrous oxide (N_2O), methane and non-methane total organic carbon (TOC), hydrogen chloride (HCl), hydrogen fluoride (HF), polycyclic aromatic hydrocarbons (7-PAH and 16-PAH), extractable organic matter (EOM), 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), 2,3,7,8-tetrachlorodibenzofuran (TCDF), 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalent quantity (TCDD TEQ), dioxins (CDD), furans (CDF), speciated metals, and organic compounds.

AVAILABLE METHODS

Activity: The preferred source for coal consumption information is the state energy office. If an assumption is required to separate residential and commercial consumption, the following resources may be used:

- Contact a small number of local distributors to obtain estimates for the residential and commercial portions of deliveries; or
- The U.S. Census Bureau[1] reports the number of households at state and county levels that use coal as their primary space heating fuel. Household data are available from the 1990 census.

If very few households use coal, then coal deliveries can be assumed to be entirely to the commercial sector.

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[1] http://venus.census.gov/cdrom/lookup/CMD=LIST/DB=C90STF3A/LEV=STATE

An alternative source of activity data is the Department of Energy (DOE) Energy Information Administration (EIA) document *State Energy Data Report*.[2] The *State Energy Data Report* is based on an EIA survey of all U.S. companies that own or purchase and distribute more than 50,000 short tons of coal annually. EIA does not collect the information necessary to separate coal combustion into residential and commercial/institutional consumption, but disaggregates data based on assumptions and statistical methods detailed in the *State Energy Data Report*. The assumptions used by EIA to disaggregate the data are applicable to the national level and may not be correct for the inventory area. To separate *State Energy Data Report* information into residential and commercial/institutional consumption, the following resources may be used:

- Use the EIA data as reported;
- Contact a small number of local distributors to obtain estimates for the residential and commercial portions of deliveries; or
- The U.S. Census Bureau[1] reports the number of households at state and county levels that use coal as their primary space heating fuel. Household data are available from the 1990 census.

If very few households use coal, then coal deliveries can be assumed to be entirely to the commercial sector.

Emission Factors: Emission factors are available from *AP-42*, Chapter 1: External Combustion Sources; Section 1.1 for bituminous and subbituminous coals; and Section 1.2 for anthracite coal (EPA, 1998a). For residential sources, the emission factor for residential space heaters should be used for anthracite coals and the emission factor for hand-fed units should be used for bituminous and subbituminous coals. For commercial sources, the combustion method varies greatly within an inventory area; therefore, it is difficult to determine the predominant combustion method. To be conservative, the highest emission factor should be used for commercial sources.

Emission factors are available for 7-PAH and 16-PAH from *Locating and Estimating Air Emissions from Sources of Polycyclic Organic Matter* (EPA, 1998b). Also, the *1990 Emission Inventory of Section 112(c)(6) Pollutants* (EPA, 1998c) provides residential emission factors for 2,3,7,8-TCDD, 2,3,7,8-TCDF, 2,3,7,8-TCDD TEQ, CDD, CDF and a commercial emission factor for EOM.[3]

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2 http://www.eia.doe.gov/emeu/sep/states.html

3 See reference section of this abstract for websites.

POINT SOURCE ADJUSTMENTS

A portion of the activity data may represent deliveries to larger commercial, institutional, or multi-family facilities that may be inventoried as point individual sources. Estimated area source activity or emissions should be adjusted by subtracting the activity or emissions attributable to point sources. It is preferable to use activity data when making point source adjustments because emission estimates are not easily comparable due to differences in emission estimation methods or emission factors. If only emissions are available, then it is preferable to subtract pre-control emission estimates for point sources. See the EIIP Volume III, Chapter 1, Section 4 for methodology to account for point sources in an area source emission inventory.[4]

ADJUSTMENTS FOR CONTROLS

Regulations for coal combustion are generally applicable to point sources and do not apply to the area sources in this category. Inventory preparers should research rules applying to this source category. If some controls are being used, then refer to EIIP Volume III, Chapter 1, Section 4.2.

SPATIAL AND TEMPORAL ALLOCATIONS

Inventory preparers should develop a preliminary state-wide estimate of emissions from this source and then decide if emission levels justify the effort required to collect data for spatial and temporal apportioning. If this category is not expected to be a significant contributor during the inventory time period, then apportioning methods that require less effort may be used.

Residential Spatial Allocation: The preferable method to spatially allocate residential emissions to the county level is to allocate fuel use based on the number of households heating with coal and the number of heating degree days.

A "heating degree day" is a unit of measure used to indicate how cold it has been over a 24-hour period. Daily heating degree days are calculated as the difference between the base value of 65°F and the mean temperature for the day (mean of the high and low temperatures for the day). Annual heating degree days are the sum of the daily heating degree days. Heating degree data is available from the National Oceanographic and Atmospheric Administration (NOAA).[5]

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4 http://www.epa.gov/ttn/chief/eiip/techrep.htm#areasrc

5 http://www.noaa.gov (homepage) or http://www.ncdc.noaa.gov/ol/climate/climateproducts.html#PUBS (for a list of available data)

Residential Spatial Apportioning Factor =

$$\frac{HDD_{InventoryCounty} * CHU_{InventoryCounty}}{\left[\sum_{\substack{allcounties \\ instate}} (HDD_{county} * CHU_{county})\right]}$$

Where:

$HDD_{Inventory\ County}$	=	Annual heating degree days for inventory county
$CHU_{Inventory\ County}$	=	Housing units using coal for inventory county
HDD_{county}	=	Annual heating degree days for each county in the state
CHU_{county}	=	Housing units using coal for each county in the state

Alternative spatial apportioning factors for residential emissions include households that use coal as a primary fuel, population data, or total number of households.

Commercial/Institutional Spatial Allocation: Commercial/institutional coal combustion emissions may be apportioned based on employment data for SICs 50-99 and heating degree days. Employment information may be obtained from the state department of labor or from Economic Census data from the U.S. Census Bureau.[6]

Commercial/Institutional Spatial Apportioning Factor =

$$\frac{HDD_{InventoryCounty} * SE_{InventoryCounty}}{\left[\sum_{\substack{allcounties \\ instate}} (HDD_{county} * SE_{county})\right]}$$

Where:

$HDD_{Inventory\ County}$	=	Annual heating degree days for inventory county
$SE_{Inventory\ County}$	=	SIC 50-99 employment numbers for inventory county
HDD_{county}	=	Annual heating degree days for each county in the state
SE_{county}	=	SIC 50-99 employment for each county in the state

[6] http://govinfo.kerr.orst.edu/index.html

Alternative methods to spatially apportion emissions from commercial/institutional sources are to use either employment data or population data as allocation factors.

Residential Temporal Allocation: Residential coal combustion is primarily used for space heating purposes. Space heating consumption may be seasonally apportioned using the percentage of annual heating degree days occurring in each month or season:

$$Residential\ Fuel_{month} = Residential\ Fuel_{annual} * \frac{Heating\ Degree\ Days_{month}}{Heating\ Degree\ Days_{annual}}$$

Commercial/Institutional Temporal Allocation: Commercial use may be temporally apportioned based on information from local distributors. Monthly deliveries should be obtained from a small sample of commercial/institutional coal distributors. The monthly percentages of annual deliveries found for the sampled distributors may be used to apportion consumption for the inventory area.

OTHER EMISSION CALCULATION ISSUES

None.

REFERENCES

EPA. 1998a. *Compilation of Air Pollutant Emission Factors--Volume I: Stationary Point and Area Sources. Fifth Edition, AP-42.* U. S. Environmental Protection Agency, Office of Air Quality Planning and Standards. (GPO 055-000-00251-7). Research Triangle Park, North Carolina.

EPA. 1998b. *Locating and Estimating Air Emissions from Sources of Polycyclic Organic Matter* (EPA-454/R-98-014). U. S. Environmental Protection Agency, Air Quality Strategies and Standards Division. Research Triangle Park, North Carolina (http://www.epa.gov/ttn/chief/pom.html).

EPA. 1998c. *1990 Emission Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TDCC), 2,3,7,8-Tetrachlorodibenzofuran (TDCF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury and Alkylated Lead.* U. S. Environmental Protection Agency, Air Quality Strategies and Standards Division. Research Triangle Park, North Carolina (http://www.epa.gov/ttncaaa1/t3/meta/m23804.html).