**FOSSIL FUEL COMBUSTION – RESIDENTIAL – NATURAL GAS**

## *a. Source Category Description*

Residential natural gas combustion is natural gas that is burned to heat residential housing as well as in grills, hot water heaters, and dryers.

The general approach to calculating emissions for this SCC is to take State natural gas consumption from the EIA and allocate it to the county level using the methods described below. County level natural gas consumption is multiplied by the emission factors to calculate emissions.

For this source category, the following SCC was assigned:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SCC** | **Descriptor 1** | **Descriptor 3** | **Descriptor 6** | **Descriptor 8** |
| 2104006000 | Stationary Source Fuel Combustion | Residential | Natural Gas | Total: Boilers and IC Engines |

## *b. Activity Data*

The state-level volume of natural gas consumed by residential combustion in the United States was used to estimate emissions. Natural gas consumption by energy use sector was obtained from the State Energy Data 2009 Consumption tables published by the EIA.1 Year 2009 consumption data were used as a surrogate for 2011 emissions because these data were the latest data available when this inventory was prepared.

State-level natural gas consumption was allocated to each county using the US Census Bureau’s 2000 Census Detailed Housing Information.2 These data include the number of housing units using a specific type of fuel for residential heating. State natural gas consumption was allocated to each county using the ratio of the number of houses burning natural gas in each county to the total number of houses burning natural gas in the State.

## *c. Control Factors*

No control measures are assumed for this category.

## *d. Emission Factors*

Criteria pollutant emission factors for natural gas are from AP-42. 3 The ammonia emission factor is from EPA’s *Estimating Ammonia Emissions from Anthropogenic Sources, Draft Final Report*.4 HAP emission factors are from AP-42 and “Documentation for the 1999 Base Year Nonpoint Area Source National Emission Inventory for Hazardous Air Pollutants.”5 According to AP-42 (maximum value provided)2, natural gas has a heat content of 1,050 million BTU per million cubic feet. This value was required to convert those emission factors originally given in units “pounds per million Btu” to units “pounds per million cubic feet.” The grains of sulfur per million cubic feet are assumed to be 2000.6 Some emission factors were revised based on recommendations by an ERTAC advisory panel composed of state and EPA personnel.

County-level criteria pollutant and HAP emissions were calculated by multiplying the total natural gas consumed in each county per year by an emission factor. Table 1 provides a summary of the pollutants, pollutant codes, and emissions factors for residential combustion of natural gas.

## *e. Sample Calculations*

Emissions are calculated for each county using emission factors and activity as:

E*x,p* = FC*x* × EF*x,p*

where:

E*x,p* = annual emissions for fuel type x and pollutant p,

FC*x* = annual fuel consumption for fuel type x,

EF*x,p* = emission factor for fuel type x and pollutant p,

And FC*x* = AState x (Hcounty / HState)

where :

AState = State activity data from EIA

HCounty = number of houses in the county using natural gas as the primary heating fuel

HState = number of houses in the state using natural gas as the primary heating fuel

**Example:**

Using Allegheny County, PA as an example:

The State of Pennsylvania had a reported use of 227,709 million cubic feet of natural gas in the residential sector in 2009. Allegheny County, PA had 474,292 houses out of the state total of 2,452,941 that use natural gas as the primary heating fuel. This equates to a share of 19.34% of the natural gas used for residential heating in the state. From Table 1, CO emission factor is 40 lb/million ft3.

ECO= 227,709 million ft3 × (474,292 houses / 2,452,941 houses) × 40 lb CO/ million ft3

= 1,761,160 lb CO or 880.6 ton CO

## f. References

1. U.S. Department of Energy, Energy Information Administration (EIA). [State Energy Data 2009 Consumption](https://www.eia.gov/state/seds/). Washington, DC 2012, accessed June 2019.

2. U.S. Census Bureau. "[Table H40. House Heating Fuel Type](https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t)", Census 2000: Summary File 3, accessed June 2019.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

4. U.S. Environmental Protection Agency. Emission Inventory Improvement Program. Estimating Ammonia Emissions from Anthropogenic Sources, Draft Final Report. Prepared by E.H. Pechan and Associates, Inc. Research Triangle Park, NC. April 2004.

5. U.S. Environmental Protection Agency, Emission Factors and Inventory Group. “Documentation for the 1999 Base Year Nonpoint Area Source National Emission Inventory for Hazardous Air Pollutants.” Prepared by Eastern Research Group, Inc. Morrisville, NC. September 2002.

6. U.S. Environmental Protection Agency. Emission Factor and Inventory Group. [Final Summary of the Development and Results of a Methodology for Calculating Area Source Emissions from Residential Fuel Combustion](https://www.epa.gov/air-emissions-inventories). Prepared by Pacific Environmental Services, Inc. Research Triangle Park, NC. September 2002, accessed June 2019.

**Table 1. National Criteria Pollutant and HAP Emission Factors for Residential Natural Gas Combustion**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Pollutant Code** | **Pollutant Code Description** | **Factor Numeric Value** | **Factor Unit Numerator** | **Factor Unit Denominator** |
| 129000 | PYRENE | 0.00000525 | LB | E6FT3 |
| 206440 | FLUORANTHENE | 0.00000315 | LB | E6FT3 |
| 50000 | FORMALDEHYDE | 0.07875 | LB | E6FT3 |
| 71432 | BENZENE | 0.002205 | LB | E6FT3 |
| 75070 | ACETALDEHYDE | 0.00001365 | LB | E6FT3 |
| 85018 | PHENANTHRENE | 0.00001785 | LB | E6FT3 |
| 86737 | FLUORENE | 0.00000294 | LB | E6FT3 |
| 91203 | NAPHTHALENE | 0.0006405 | LB | E6FT3 |
| CO | CARBON MONOXIDE | 40 | LB | E6FT3 |
| NH3 | AMMONIA | 20 | LB | E6FT3 |
| NOX | NITROGEN OXIDES | 94 | LB | E6FT3 |
| PM10-PRI | PRIMARY PM10 (INCLUDES FILTERABLES + CONDENSIBLES) | 0.52 | LB | E6FT3 |
| PM25-PRI | PRIMARY PM2.5 (INCLUDES FILTERABLES + CONDENSIBLES) | 0.43 | LB | E6FT3 |
| PM10-FIL | PRIMARY PM10, FILTERABLE PORTION ONLY | 0. 2 | LB | E6FT3 |
| PM25-FIL | PRIMARY PM2.5, FILTERABLE PORTION ONLY | 0.11 | LB | E6FT3 |
| PM-CON | PRIMARY PM CONDENSIBLE PORTION ONLY | 0.32 | LB | E6FT3 |
| SO2 | SULFUR DIOXIDE | 0.6 | LB | E6FT3 |
| VOC | VOLATILE ORGANIC COMPOUNDS | 5.5 | LB | E6FT3 |