**FOSSIL FUEL COMBUSTION – RESIDENTIAL – LIQUIFIED PETROLEUM GAS (LPG)**

## *a. Source Category Description*

Residential LPG combustion is liquefied propane gas that is burned in residential housing. Common uses of energy associated with this sector include space heating, water heating, and cooking.

The general approach to calculating emissions for this SCC is to take State LPG consumption from the EIA and allocate it to the county level using methods described below. County level LPG 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** |
| 2104007000 | Stationary Source  Fuel Combustion | Residential | Liquefied Petroleum Gas (LPG) | Total: All Combustion Types |

## *b. Activity Data*

Residential liquefied petroleum gas (LPG) combustion emissions were calculated using the volume of LPG consumed in the United States. State-level LPG consumption by sector is available from the Energy Information Administration (EIA).1 Year 2009 consumption data were used as a surrogate for 2011 emissions because these were the latest data available when this inventory was prepared.

State-level LPG 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 LPG consumption was allocated to each county using the ratio of the number of houses burning LPG in each county to the total number of houses burning LPG in the State.

## *c. Control Factors*

No control measures are assumed for this category.

## *d. Emission Factors*

Pollutant emission factors for residential LPG are based on the residential natural gas emission factors.3,4,5 For all counties in the United States, the natural gas consumed by residential combustion is assumed to have a heating value of 1,020 Btu per cubic foot and a sulfur content of 2,000 grains per million cubic feet.3 Those natural gas emission factors originally presented in the units “pounds per million cubic feet” were converted to energy-based units using the 1,020 Btu/cubic foot conversion factor. Once all the natural gas emission factors were converted to energy-based units, the natural gas emission factors were converted to LPG emission factors by multiplying by 96,750 Btu/gallon. Some emission factors were revised based on recommendations by an ERTAC advisory panel composed of state and EPA personnel.

## *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 LPG as the primary heating fuel

HState = number of houses in the state using LPG as the primary heating fuel.

**Example:**

Using Allegheny County, PA as an example:

The State of Pennsylvania had a reported use of 5,617 thousand barrels of LPG in the residential sector in 2006. Allegheny County, PA had 4,317 houses out of the state total of 145,254 that use LPG as the primary heating fuel. This equates to a share of 2.97% of the LPG used for residential heating in the state. From Table 1, CO emission factor is 159.6 lb/thousand barrels.

ECO = 5,617 thousand barrels × (4,317 houses / 145,254 houses)   
× 159.6 lb/thousand barrels

= 26,643 lb CO or 13.32 tons CO

## *f. References*

1. U.S. Department of Energy, Energy Information Administration (EIA). [State Energy Data 2009 Consumption](https://www.eia.gov/consumption/residential/reports/2009/state_briefs/). 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 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.

5. 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 LPG Combustion**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Pollutant Code** | **Pollutant Code Description** | **Factor Numeric Value** | **Factor Unit Numerator** | **Factor Unit Denominator** |
| 129000 | Pyrene | 2.092E-05 | LB | E3BBL |
| 206440 | Fluoranthene | 1.255E-05 | LB | E3BBL |
| 50000 | Formaldehyde | 3.137E-01 | LB | E3BBL |
| 71432 | Benzene | 8.784E-03 | LB | E3BBL |
| 75070 | Acetaldehyde | 5.438E-05 | LB | E3BBL |
| 85018 | Phenanthrene | 7.111E-05 | LB | E3BBL |
| 86737 | Fluorene | 1.171E-05 | LB | E3BBL |
| 91203 | Naphthalene | 2.552E-03 | LB | E3BBL |
| CO | CO | 1.596E+02 | LB | E3BBL |
| NH3 | Ammonia | 1.950E+00 | LB | E3BBL |
| NOX | NOX | 5.628E+02 | LB | E3BBL |
| PM10-PRI | PRIMARY PM10 (INCLUDES FILTERABLES + CONDENSIBLES) | 2.072E+00 | LB | E3BBL |
| PM25-PRI | PRIMARY PM2.5 (INCLUDES FILTERABLES + CONDENSIBLES) | 1.713E+00 | LB | E3BBL |
| PM10-FIL | PRIMARY PM10, FILTERABLE PORTION ONLY | 7.968E-01 | LB | E3BBL |
| PM25-FIL | PRIMARY PM2.5, FILTERABLE PORTION ONLY | 4.382E-01 | LB | E3BBL |
| PM-CON | PRIMARY PM CONDENSIBLE PORTION ONLY (<1 MICRON) | 1.275E+00 | LB | E3BBL |
| SO2 | SO2 | 2.390E+00 | LB | E3BBL |
| VOC | VOC | 2.191E+01 | LB | E3BBL |