

Residential Wood Combustion:

Documentation for EPA’s Nonpoint Emissions Estimation Tool

Residential Wood Combustion Tool Version 3.2

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A. Introduction

Residential wood combustion (RWC) appliances, such as fireplaces, fireplace inserts, woodstoves, and hydronic heaters, are significant sources of air pollution in the United States—especially during winter months. RWC emits large amounts of fine particulate matter, volatile organic compounds (VOCs), and hazardous air pollutants that are known to contribute to poor human health, air quality, and visibility.

EPA worked with a group of State, local, and regional planning organization representatives to create the new methodology. This paper describes the new methodology and introduces a revised Microsoft Access Tool that was developed to allow S/L/T agencies to calculate annual emissions from RWC sources in the future.

To help estimate emissions from residential wood combustion, the EPA and Abt Associates have developed and improved the Residential Wood Combustion (RWC) tool. The Tool is designed to allow users to update county-level input parameters (based on local survey data) and then easily recalculate county-level emissions at the click of a button. The RWC tool is a Microsoft Access-based tool that computes the amount of wood burned and emissions of criteria pollutants and HAPs from 12 different wood burning appliance types, including fireplaces, seven types of woodstoves, wood-fired furnaces and boilers, outdoor burning devices, and wax firelogs (Table 1). The woodstoves are divided into conventional and EPA-certified units. In general, the conventional units were constructed prior to 1988. Units constructed after 1988 had to meet EPA emission standards and they are either catalytic or non-catalytic, depending on whether they contain a catalyst to improve the burn efficiency.

In recent years, sales and use of residential woodstoves have been increasing due to rising costs of home heating fuel. In addition and over the past 5-years, sales of outdoor hydronic heaters (OHH) are also strong in the Northern U.S. where they are used as the primary heating source for some homes. These OHHs have, until recently, been essentially unregulated by Federal air pollution regulations and emit, on an average per hour basis, about four times as much fine particulate matter (PM) as conventional woodstoves and about 12 times as much as EPA-certified stoves (OAGEB, 2008).

Table 1 lists the appliance categories and SCCs for RWC sources. The first column of Table 1 indicates which source categories are included in the RWC Tool.

Table 1. Appliance Types and Source Category Codes for RWC Sources

| **Included** | **SCC** | **Fuel** | **Appliance Type** | **Comment** |
| --- | --- | --- | --- | --- |
|  | 2104008100 | Wood | Fireplace: general |  |
|  | 2104008110 | Wood | Fireplace: open | Conventional fireplace with open hearth |
|  | 2104008120 | Wood | Fireplace: enclosed (or otherwise modified) | Enclosed with glass doors or other modifications to a conventional fireplace such as devices to boost efficiency (heat exchangers) |
|  | 2104008130 | Wood | Fireplace: qualified for EPA voluntary program |  |
|  | 2104008200 | Wood | Woodstove: fireplace inserts; general | Fireplace inserts are similar to freestanding woodstove but they sit inside a fireplace. Other types of inserts should use SCC = 2104008120 |
|  | 2104008210 | Wood | Woodstove: fireplace inserts; non EPA-certified |  |
|  | 2104008220 | Wood | Woodstove: fireplace inserts; EPA-certified; non-catalytic |  |
|  | 2104008230 | Wood | Woodstove: fireplace inserts; EPA-certified; catalytic |  |
|  | 2104008300 | Wood | Woodstove: freestanding, general |  |
|  | 2104008310 | Wood | Woodstove: freestanding, non-EPA certified |  |
|  | 2104008320 | Wood | Woodstove: freestanding, EPA certified, non-catalytic |  |
|  | 2104008330 | Wood | Woodstove: freestanding, EPA certified, catalytic |  |
|  | 2104008340 | Wood | Woodstove: freestanding, masonry heater |  |
|  | 2104008400 | Wood | Woodstove: pellet-fired, general | Freestanding or fireplace insert |
|  | 2104008410 | Wood | Woodstove: pellet-fired, non-EPA certified | Freestanding or fireplace insert |
|  | 2104008420 | Wood | Woodstove: pellet-fired, EPA certified | Freestanding or fireplace insert |
|  | 2104008500 | Wood | Furnace: Indoor, general |  |
|  | 2104008510 | Wood | Furnace: Indoor, cordwood-fired, non-EPA certified |  |
|  | 2104008520 | Wood | Furnace: Indoor, cordwood-fired, EPA certified |  |
|  | 2104008530 | Wood | Furnace: Indoor, pellet-fired, general |  |
|  | 2104008540 | Wood | Furnace: Indoor, pellet-fired, non-EPA certified |  |
|  | 2104008550 | Wood | Furnace: Indoor, pellet-fired, EPA certified |  |
|  | 2104008600 | Wood | Hydronic heater: general, all types |  |
|  | 2104008610 | Wood | Hydronic heater: outdoor |  |
|  | 2104008620 | Wood | Hydronic heater: indoor |  |
|  | 2104008630 | Wood | Hydronic heater: pellet-fired |  |
|  | 2104008640 | Wood | Hydronic heater: meets NESCAUM phase II standards |  |
|  | 2104008700 | Wood | Outdoor wood burning device, NEC | Fire-pits and chimenaes |
|  | 2104009000 | Firelog | Total: All Combustor Types |  |
|  | 2104010000 | Biomass; All Except Wood | Total: All Combustor Types |  |

B. Calculation Metholodgy

The emissions from RWC are calculated using the equation below.

*Ey = Homes × ApplianceFrac ×BurnRate × WoodDensity× EFy*

where:

Ey = annual emissions (ton/year) for a specific appliance (or SCC),

Homes = the number of occupied homes in each county,

ApplianceFrac = fraction of homes in each county that use the appliance,

BurnRate = the average amount of wood burned per appliance (cords/appliance),

WoodDensity = the density of firewood (tons/cord),

EFy = emission factor (tons of pollutant emitted/ton of fuel used), and

y is a specific pollutant

For each of the terms in the equation, the term and its source are explained further below.

## 1. Activity Data

The activity data for RWC is the total amount of wood burned. It is estimated by multiplying the number of occupied homes in each county by the appliance fraction to estimate the number of appliances operated annually in the county. This number is multiplied by the burn rate to estimate the total amount of wood burned in each appliance in each county.

### a. Occupied Housing Units

Since appliance fractions are estimated in terms of the fraction of occupied units by appliance type, it is important that county population also be based on number of occupied units. The data on occupied housing units in each county comes from the 2014 American Community Survey (U.S. Census Bureau 2016a), which reports on the number of homes by the type of house:

* Single-family detached homes,
* Single-family attached homes,
* Multi-family homes with 2-4 units,
* Multi-family homes with more than 5 units, and
* Mobile homes.

Each of these home types is divided into urban and rural homes (e.g. number of urban single-family detached homes, number of rural single-family detached homes, etc.) using the proportion of total urban and rural homes in each county from the 2010 census.

The number of occupied units by county by house type appears in the RWC tool in the table named “Homes\_by\_House\_Type” and the total number of homes in each county appears in the table named “Master County Table.”

### b. Appliance Fractions

Appliance fractions are the fraction of occupied homes in each county that uses each type of wood burning appliance. The appliance fractions are calculated using two main data sources: the Energy Information Administration Residential Energy Combustion Survey (RECS, EIA 2016) and the American Housing Survey (AHS, U.S. Census Bureau 2016b).

Each of these sources includes survey data that asks respondents whether they use a given wood burning appliance. The methodology for determining the appliance fractions from these data sources differs by the type of appliance.

**Fireplaces, Woodstoves, and Furnaces**

The methodology for estimating the appliance fraction from fireplaces, fireplace inserts, freestanding woodstoves, pellet stoves, and indoor furnaces uses the EIA’s RECS microdata, which consists of 27,187 individual survey responses between 1997 and 2009. RECS asks a wide variety of questions related to home energy use, including several that are important for RWC emissions estimation:

* The appliance used for the main heat source in the home,
* The fuel used for the main heat source in the home,
* Whether the home uses a woodstove for a secondary heat source,
* Whether the home uses a fireplace for a secondary heat source.
* The amount of wood burned (cords) annually by the home.

The RECS data also includes demographic data about the respondent, including their census division location, the number of heating degree days in their area, the type of house they live in, and whether their home is in an urban or rural setting.

The appliance fractions were estimated using a regression technique called logistic regression that estimates the likelihood of a binary (i.e. yes or no) outcome. In this case the outcome is whether or not the home uses the wood burning appliance. The result of the regression analysis is an equation that uses the demographic variables to predict the proportion of homes in each county that uses each appliance.

To estimate the appliance fraction for each county, the regression equation is used with the number of heating degree days in each county from NOAA (2016) and each unique combination of:

* Home type (5 types),
* Urban or rural setting,
* Appliance type (fireplaces, woodstoves, and furnaces), and
* Burn types (main heat or other heating; only main heating was used for furnaces)

The result is 50 unique appliance fractions for each county. These appliance fractions are multiplied by the number of homes in each county in each category. For example, the appliance fraction for main heating by woodstoves in urban mobile homes is multiplied by the number of urban mobile homes in each county to determine the total number of woodstoves that were used for main heating in urban mobile homes. This process is repeated for all home types, appliance types, and burn types.

For fireplaces, the appliance fractions are also adjusted to account for the fraction of fireplaces that burn natural gas or propane rather than wood. Data from RECS suggests that approximately 49 percent of fireplaces in urban homes and 47 percent of fireplaces in rural homes burn wood. These assumptions about the ratio of wood to gas fireplaces can be adjusted in the RWC Tool, in the table called “ApplFracBurnRate” in the column called “WoodRatio.” The default assumption of the RWC tool is that all woodstoves are 100 percent wood burning.

**Outdoor Hydronic Heaters (OHHs)**

For OHHs a different approach is used to determine the number of appliances in use. There are not enough survey responses to RECS by respondents that use OHHs to allow for the type of regression analysis used for the other appliance types. Therefore the appliance fractions for OHHs are calculated using data from the American Housing Survey. In 2011 (the only year in which this question was included in the AHS), the AHS asked whether the respondent used an OHH. Like the RECS data, the AHS includes demographic data about the respondent, including their census region and division location, and climate zone, which is defined by number of heating degree days.

The total number of estimated OHHs are divided into each unique combination of census region and climate zone. This total OHHs population is then distributed to each county within the unique census region and climate zone based on proportion of rural population. For example, there are estimated to be approximately 15,000 OHHs in the coldest climate zone of the Northeast census region, which includes 100 counties. These 15,000 OHHs are distributed to the counties with the highest proportion of rural population.

There are two exceptions to this methodology. The first is that for the West census region, the OHH population is apportioned based on unique combinations of census division (rather than census region) and climate zone. The second is that there are some states, particularly Michigan, Ohio, and Wisconsin, that prefer to distribute the OHHs based on inverse population density rather than rural population. In this way, most of the OHHs are distributed to the least dense (people/mi2) counties. The RWC tool offers the capability in the “Edit Assumptions” window to redistribute the emissions from OHHs and furnaces based on inverse population density rather than rural population. The user may wish to run the tool with and without this option selected to see if the emissions distribution in the selected state(s) are more appropriate. However, it is recommended that for most states the inverse population density method should NOT be chosen.

The appliance fractions for OHHs are estimated by dividing the number of OHHs distributed to each county by the number of occupied houses in each county in 2011. This number is then multiplied by the number of occupied houses in 2014 to estimate the county-level OHH population in 2014.

**Wax Firelogs and Outdoor Wood Burning Devices**

Data are unavailable to update the activity data for wax firelogs and outdoor wood burning devices (e.g. firepits or chimeneas). The activity data for these source categories is pulled forward from the 2011 NEI methodology, which is based mostly on expert judgment.

### c. Burn Rates

Burn rates are the amount of wood burned annually per appliance. The burn rates for fireplaces, woodstoves, and indoor furnaces in the RWC tool are estimated using EIA RECS data.

Similar to the methodology for estimating the appliance fractions, the burn rates are estimated using regression analysis based on each unique combination of home type, urban or rural setting, appliance type, and burn type. The results of the regression analysis show that the number of heating degree days is not a significant predictor variable for most of the United States, and therefore it is not included in the analysis for all census divisions except the South Atlantic division.

The burn rates match the level of specificity of the appliance fractions. For example, there are unique burn rates and appliance fractions for each county for rural mobile homes that use fireplaces as a secondary heat source, as well as all other combinations of home type, appliance type, and burn type.

The AHS data used to estimate the appliance fractions for OHHs does not include data on the amount of wood burned. Therefore, the burn rates for OHHs are pulled forward from the 2011 methodology, which is based largely on expert judgment.

Similarly, the burn rates for wax firelogs and outdoor wood burning devices are pulled forward from the 2011 NEI methodology, which is based mostly on expert judgment.

The burn rates for specific counties and SCCs can be adjusted in the RWC tool in the table called “BurnRateOverride” in the column called “BurnRate.” The user can enter a specific burn rate (tons of wood burned per appliance). If no burn rate is entered in this table, the default burn rates estimated from RECS will be used.

### d. Wood Density

To compute average density of wood by county, the density of oven dried wood is used because emission factors developed by EPA are based on oven dried wood mass units. Dried wood density data are obtained from the U.S. Forest Service (USDA, 2007) for various wood species. The Forest Service developed a database (called the Timber Products Output) that contains survey results of sawmill operators that includes the volume of wood by species for several different categories of use - one of the uses being fuel wood.

Using the oven dried density by species multiplied by the per-species volumes gives a per species weight which is summed to calculate the total weight for the county. This is then divided by the total volume of wood in the county to get the average density by county. If a county specific density is not available, regional averages are used instead.

The calculated density by county from the Forest Service data is then converted to tons/cords. Officially a cord is defined as a stack of wood 4 feet wide, 8 feet long, and 4 feet tall or 128 ft3. However, to account for air spaces in the stack, a value of 80 ft3 per cord is assumed instead.

For wax firelogs, density is assumed to not vary from county to county, and a density of 4.005 tons per cord is used. This is based on the volume of a typical 5 pound firelog. For wax firelogs, a cord is assumed to be 128 ft3 because air spaces assumptions are not applicable.

The wood density data can be found in the RWC tool in the table called “Master County Table,” in the “WoodDensity” column.

### e. Certification Profiles

Because the data from EIA’s RECS does not specify whether the respondent uses a woodstove or fireplace insert that is certified, the general data on the number of woodstoves and fireplaces must be split into specific SCCs based on assumptions. In the RWC tool, these assumptions are found in the “Certification Profiles” table. The certification profiles are grouped by Appliance Type (woodstove or fireplace) and county.

The certification profile assumptions can be adjusted in the tool, but the profile ratios when grouped by appliance type and county should sum to 1. For example, if you filter the table on “woodstoves” and “Autauga, AL,” the sum of the certification ratios should equal 1. *It is recommended that caution should be taken before adjusting these assumptions.*

Table 2 shows the default regional certification profiles for woodstoves, which are used to split the general data on woodstove populations into four SCCs: freestanding non-EPA certified stoves, freestanding EPA certified non-catalytic stoves, freestanding EPA certified catalytic stoves, and pellet stoves.

RECS is used to estimate these certification profiles. Although RECS does not specifically ask whether the woodstove is EPA certified, the 2009 edition does ask the age of the appliance. It is assumed that any appliance older than 20 years old is uncertified, since the appliance would have been built prior to the first NSPS for woodstoves finalized in 1988. All appliances less than 20 years old are assumed to be EPA certified. The split between EPA certified non-catalytic and catalytic stoves is based on data provided by Minnesota from their 2014/2015 residential wood survey. The certification profile for pellet stoves is based on the proportion of respondents to RECS that use a woodstove but their main fuel source is wood pellets, rather than cordwood.

The default certification profiles are estimated at the Census Region level, but the tool allows the profiles to be adjusted for each county.

Table 2. Certification Profiles for Woodstoves

| **SCC** | **Description** | **Appliance Type** | **NE** | **MW** | **S** | **W** |
| --- | --- | --- | --- | --- | --- | --- |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Woodstove | 0.286 | 0.286 | 0.286 | 0.286 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Woodstove | 0.355 | 0.355 | 0.355 | 0.355 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Woodstove | 0.237 | 0.237 | 0.237 | 0.237 |
| 2104008400 | Woodstove: pellet-fired, general | Woodstove | 0.122 | 0.122 | 0.122 | 0.122 |
|  |  | Total | 1 | 1 | 1 | 1 |

Table 3 shows the default regional certification profiles for fireplaces, which are used to split the general data on fireplace populations into four SCCs: general fireplaces, non-EPA certified fireplace inserts, EPA certified non-catalytic inserts, and EPA certified catalytic inserts. The AHS asks respondents whether their fireplace has an insert, and reports these data at the census region level. The split between certified and non-certified, and catalytic and non-catalytic inserts are based on data provided by Minnesota from their 2014/2015 residential wood survey.

Table 3. Certification Profiles for Fireplaces

| **SCC** | **Description** | **ApplianceType** | **NE** | **MW** | **S** | **W** |
| --- | --- | --- | --- | --- | --- | --- |
| 2104008100 | Fireplace: general | Fireplace | 0.487 | 0.438 | 0.575 | 0.523 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Fireplace | 0.278 | 0.305 | 0.23 | 0.258 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Fireplace | 0.182 | 0.199 | 0.151 | 0.169 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Fireplace | 0.053 | 0.058 | 0.044 | 0.050 |
|  |  | Total | 1 | 1 | 1 | 1 |

### f. Appliance and Burn Ban Adjustments

The RWC tool also allows users to make adjustments to specific SCCs in specific counties to account for appliance or burn bans. Users can update the table “Appliance or Burn Bans” with additional SCCs and counties where the emissions should be adjusted. The calculated throughput and emissions for that SCC and county will be multiplied by the value in the “Adjustment Factor” column. If, for example, a particular county has banned OHHs, then add the county FIPS code and the correct SCC (2104008610 for OHHs), and set the adjustment factor to 0. This will zero out the throughput and emissions for OHHs in that county.

If a county has instituted a burn ban that is expected to reduce burning by 50%, the adjustment factor could be set to 0.5. This would reduce the calculated throughput and emissions for the listed SCC by 50%.

## 2. Emission Factors

The emission factors used are expressed as tons of pollutant produced for every ton of wood burned. The emission factors were last reviewed for the 2011 NEI by the ERTAC committee. The emission factors are shown in the Appendix.

The references for the emission factors are listed in the references section. Many of the emission factors used to determine national emission estimates for RWC are from EPA’s AP-42 document (Tables 1.9-1, 1.10-3, and 1.10-4). Some of the stove and insert factors were adjusted based on new data developed in the reference *Review of Wood Heater and Fireplace Emission Factors* (Houck et al. 2001)*.* The emission factors generated by Houck, et. al. for 7-PAH and 16-PAH are lower than the associated AP-42 emission factors. Therefore, the AP-42 PAH emission factors were adjusted downward by 62% for conventional woodstoves, 51% for catalytic woodstoves, and 40% for non-catalytic woodstoves.

In version 3.0 the volatile organic compounds (VOC) emission factor for pellet stoves was updated. Based on a review of the literature, the previous VOC emission factor used in the RWC tool, 0.041 lb./ton of wood, was deemed to be too low, given that it is much lower than emission factors for individual hazardous air pollutant (HAP) VOC compounds as reported in the literature. The pellet stove VOC emission factor was updated based on the ratio of the sum of the HAP-VOC emission factors to the VOC emission factor for EPA certified non-catalytic woodstoves. This ratio is multiplied by the sum of the HAP-VOC emission factors for pellet stoves to estimate the VOC emission factor for pellet stoves, of 2.2 lb./ton of wood.

In version 3.1 of the tool, there were changes made to all emission factors for EPA-certified non-catalytic and catalytic wood stoves and fireplace inserts to account for an increase in appliances that meet emissions standards from EPA and Washington state.

The particulate matter (PM10) EFs in the most recent version of the Residential Wood Combustion (RWC) Tool (v3.0) are based on an average of the Phase I and Phase II EFs from the 1988 New Source Performance Standards (NSPS) included in AP-42 (Table 4).

While EPA did not update the federal NSPS until 2015, the Regulatory Impact Analysis (RIA) for the 2015 NSPS notes that the state of Washington introduced more stringent emissions standards for woodstoves in 1995. These standards result in approximately 40 percent less emissions than the Phase II EPA NSPS.

Table 4. Particulate Matter (PM10) Woodstove Standards and Emission Factors

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  | **PM10 EF (lb/ton)** | |
| **Standard** | **Source** | **Years** | **Catalytic** | **Non-Catalytic** |
| ’88 NSPS Phase I | AP-42 | 1988-1990 | 19.6 | 20.0 |
| ’88 NSPS Phase II | AP-42 | 1990- 1995 | 16.2 | 14.6 |
| WA Standards | 2015 NSPS[[1]](#footnote-1) | 1995-2015 | 9.72 | 8.76 |

When EPA calculated the baseline residential wood combustion emissions for the 2015 NSPS RIA, they assumed that shipments of woodstoves after 1995 would meet the more stringent Washington state standards.

Because the EPA-certified non-catalytic and catalytic SCCs include many stoves of various ages that meet different standards, Abt developed a methodology to estimate the number of woodstoves that fall under each of the standards shown in Table 1. This enables creation of a weighted-average emission factor for certified woodstoves.

EIA’s Residential Energy Consumption Survey (RECS) contains data on energy use in homes, including the age of heating devices (including woodstoves) used in homes in the United States. RECS data are available for the years 1997, 2001, 2005, and 2009. Abt used the RECS data to determine the proportion of stoves in each data year that fall under each standard. Abt then projected the data to determine the proportion of stoves in 2014 that would meet each standard (Figure 1). We use this proportion to determine a weighted average EF for PM­10 and CO (Table 5).

**Figure 1.** Proportion of woodstoves meeting each emissions standard. Data for 1997 – 2009 are from EIA REC. Data for 2014 are projections of the RECS data.

Table 5. Previous and Updated Emission Factors for PM10 and CO.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Previous EFs (v3.0)** | | **Updated EFs (v3.1)** | |
|  | **PM10 (lb/ton)** | **CO (lb/ton)** | **PM10 (lb/ton)** | **CO (lb/ton)** |
| Catalytic | 20.4 | 104.4 | 15.2 | 92.3 |
| Non-Catalytic | 19.6 | 140.8 | 14.5 | 122.6 |

For the different wood stove emissions standards, AP-42 only provides different EFs for PM10 and CO. For all other pollutants, including HAPs, Abt adjusts the EF based on the percent decrease in the PM10EF, which is 25 percent for catalytic and 26 for non-catalytic stoves.

The EF for mercury is taken from AP-42, Chapter 1.6 Wood Residue Combustion in Boilers. The original EF of 3.50E-06 lbs. Hg/MMBtu was converted to a factor of 4.26E-05 lbs. Hg/ton of wood using a heating value of 15.3 MMBtu/cord from the U.S. Forest Service (USDA 2004) and an average density from the RWC Tool of 1.26 tons per cord.

C. Description and Use of the RWC Tool

The RWC Tool was developed in Microsoft Access to allow S/L/T agencies to adjust assumptions and calculate annual emissions from RWC sources. The Tool is designed to allow users to update county-level input parameters (based on local survey data) and then calculate county-level emissions by clicking on the button in the Control Module form called “Create Emissions Inventory.”

The results of the calculated emissions inventory are also exported to a separate database called “RWC Tool Output – EIS Format.” **This output database must be saved in the same folder as the RWC tool for the tool to run correctly.** The output database is in staging table format which can be used with the EPA Bridge Tool to generate XML files to be uploaded to the Central Data Exchange.

Figure 1 provides the flow of the RWC Tool calculations. The green boxes in Figure 1 show calculated values whereas the gray boxes show data inputs or assumptions.

As shown in Table 6, the RWC Tool consists of several tables of parameters used to calculate emissions associated with burning. Each is described below.

Figure 1. RWC Tool Data Flow Diagram

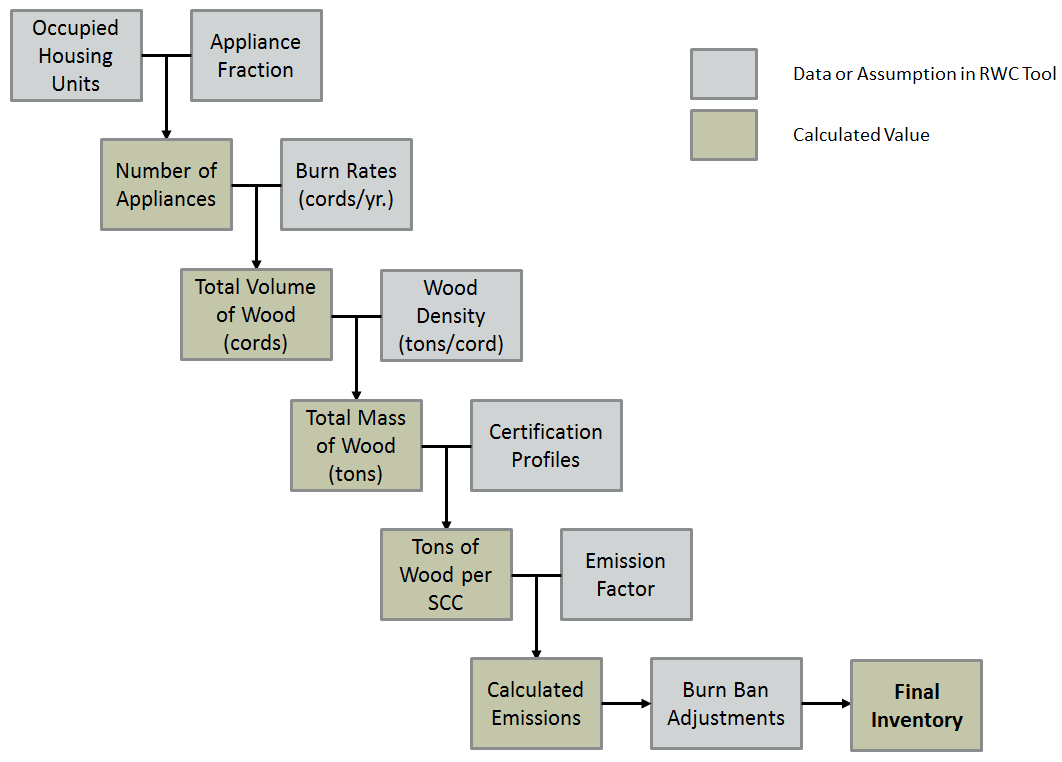


Table 6. Listing and Descriptions of the Tables Included in the RWC Tool

| **Data Element** | **Location in RWC Tool** | **Data Element Description** |
| --- | --- | --- |
| Occupied Housing Units | Homes\_by\_House\_Type;  Master County Table | Number of occupied housing units in 2014. “Homes\_by\_House\_Type” provides data for each house type. “Master County Table” provides the total number of homes. |
| Appliance Fraction | ApplFracBurnRate (for woodstoves, fireplaces, and furnaces)  ApplFracBurnRate\_other (for OHHs, wax firelogs, and outdoor devices) | Fraction of homes in each county that use each type of wood burning appliance. The appliance fractions in the “ApplFracBurnRate” table (used for woodstoves, fireplaces, and furnaces) are split into separate fractions by house type. The appliance fractions in the “ApplFracBurnRate\_other” table (used for OHHs, wax firelogs, and outdoor devices) apply to all houses in the county. |
| Burn Rates | ApplFracBurnRate (for woodstoves, fireplaces, and furnaces)  ApplFracBurnRate\_other (for OHHs, wax firelogs, and outdoor devices) | Burn rates, which are the number of cords burned per year per appliance. The burn rates in the “ApplFracBurnRate” table (used for woodstoves, fireplaces, and furnaces) are split into separate rates by house type. The burn rates in the “ApplFracBurnRate\_other” table (used for OHHs, wax firelogs, and outdoor devices) apply to all houses in the county. |
| Wood Density | Master County Table | Density (tons/cord) of firewood in each county. |
| Certification Profiles | Certification Profiles | Assumptions used to split general data on the total number of fireplaces or woodstoves into specific SCCs. |
| Emission Factor | Emission Factor by SCC | Emission factor with units by pollutant and SCC. |
| Burn Ban Adjustments | Appliance or Burn Bans | Assumptions that can be used to adjust throughput and calculated emissions for specific SCCs in specific counties. Can be used to account for banned appliances, such as OHHs or furnaces. |

D. References

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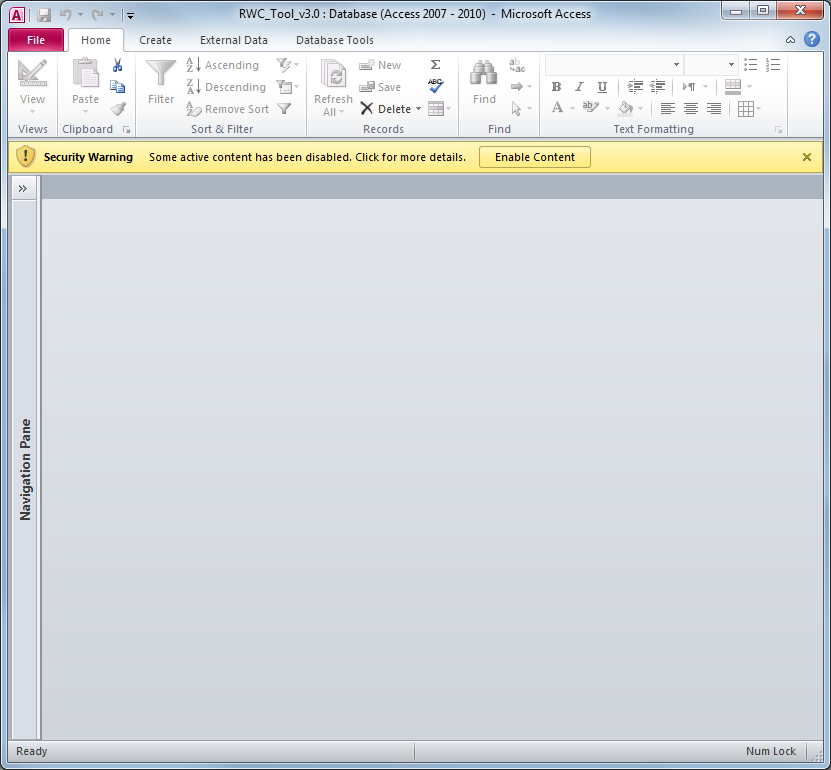
E. Appendix: Emission Factors

Table 7. Emission factors for Residential Wood Combustion appliances.

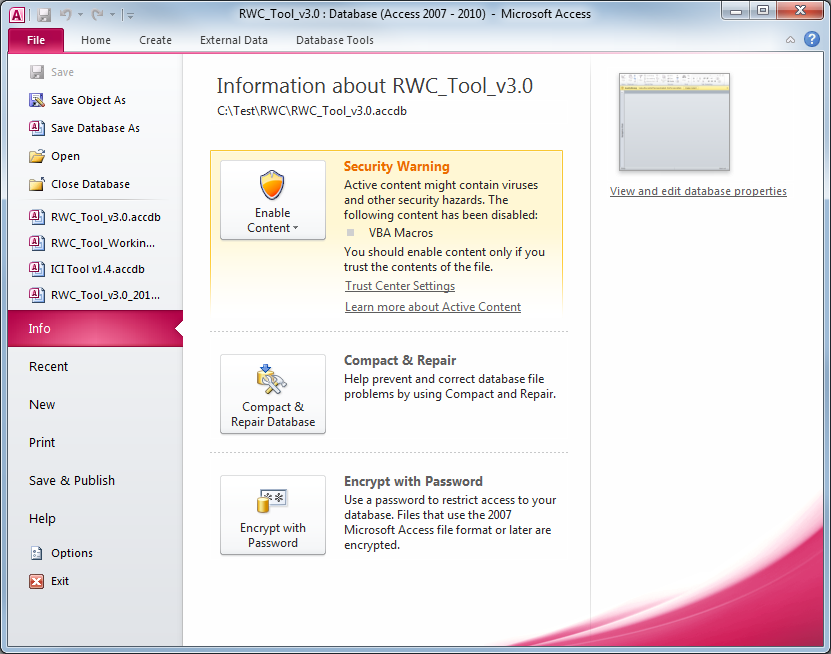
| **SCC** | **Description** | **Pollutant** | **Emission Factor (lb/ton)** | **Ref.** |
| --- | --- | --- | --- | --- |
| 2104008100 | Fireplace: general | 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 3E-10 | 8 |
| 2104008100 | Fireplace: general | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin | 3.16E-10 | 8 |
| 2104008100 | Fireplace: general | 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 2.34E-10 | 8 |
| 2104008100 | Fireplace: general | 1,2,3,4,7,8-Hexachlorodibenzofuran | 3.56E-10 | 8 |
| 2104008100 | Fireplace: general | 1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin | 2.5E-10 | 8 |
| 2104008100 | Fireplace: general | 1,2,3,6,7,8-Hexachlorodibenzofuran | 2.2E-10 | 8 |
| 2104008100 | Fireplace: general | 1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin | 2.5E-10 | 8 |
| 2104008100 | Fireplace: general | 1,2,3,7,8,9-Hexachlorodibenzofuran | 1.98E-10 | 8 |
| 2104008100 | Fireplace: general | 1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin | 2.5E-10 | 8 |
| 2104008100 | Fireplace: general | 1,2,3,7,8-Pentachlorodibenzofuran | 4.56E-10 | 8 |
| 2104008100 | Fireplace: general | 1,2,3,7,8-Pentachlorodibenzo-p-Dioxin | 2.58E-10 | 8 |
| 2104008100 | Fireplace: general | 1,3-Butadiene | 0.157 | 4 |
| 2104008100 | Fireplace: general | 2,3,4,6,7,8-Hexachlorodibenzofuran | 1.65E-10 | 8 |
| 2104008100 | Fireplace: general | 2,3,4,7,8-Pentachlorodibenzofuran | 6.44E-10 | 8 |
| 2104008100 | Fireplace: general | 2,3,7,8-Tetrachlorodibenzofuran | 1.25E-09 | 8 |
| 2104008100 | Fireplace: general | 2,3,7,8-Tetrachlorodibenzo-p-Dioxin | 2.28E-10 | 8 |
| 2104008100 | Fireplace: general | Acetaldehyde | 1.07 | 4 |
| 2104008100 | Fireplace: general | Acrolein | 0.123 | 4 |
| 2104008100 | Fireplace: general | Ammonia | 1.8 | 4 |
| 2104008100 | Fireplace: general | Benzene | 0.686 | 4 |
| 2104008100 | Fireplace: general | Benzo[a]Pyrene | 0.001 | 4 |
| 2104008100 | Fireplace: general | Carbon Monoxide | 149 | 4 |
| 2104008100 | Fireplace: general | Cresols (Includes o, m, & p)/Cresylic Acids | 0.357 | 4 |
| 2104008100 | Fireplace: general | Dioxins/Furans as 2,3,7,8-TCDD TEQs - WHO2005 | 7.87E-10 | 4 |
| 2104008100 | Fireplace: general | Formaldehyde | 1.79 | 4 |
| 2104008100 | Fireplace: general | Mercury | 4.26E-05 | 7 |
| 2104008100 | Fireplace: general | Methane | 14.4 | 4 |
| 2104008100 | Fireplace: general | Naphthalene | 0.265 | 4 |
| 2104008100 | Fireplace: general | Nitrogen Oxides | 2.6 | 6 |
| 2104008100 | Fireplace: general | Octachlorodibenzofuran | 1.67E-10 | 8 |
| 2104008100 | Fireplace: general | Octachlorodibenzo-p-Dioxin | 6.66E-10 | 8 |
| 2104008100 | Fireplace: general | Phenol | 0.472 | 4 |
| 2104008100 | Fireplace: general | Primary PM10 | 23.6 | 3 |
| 2104008100 | Fireplace: general | Primary PM2.5 | 23.6 | 3 |
| 2104008100 | Fireplace: general | Sulfur Dioxide | 0.4 | 6 |
| 2104008100 | Fireplace: general | Volatile Organic Compounds | 18.9 | 4 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 3E-10 | 8 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin | 3.16E-10 | 8 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 2.34E-10 | 8 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | 1,2,3,4,7,8-Hexachlorodibenzofuran | 3.56E-10 | 8 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | 1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin | 2.5E-10 | 8 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | 1,2,3,6,7,8-Hexachlorodibenzofuran | 2.2E-10 | 8 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | 1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin | 2.5E-10 | 8 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | 1,2,3,7,8,9-Hexachlorodibenzofuran | 1.98E-10 | 8 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | 1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin | 2.5E-10 | 8 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | 1,2,3,7,8-Pentachlorodibenzofuran | 4.56E-10 | 8 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | 1,2,3,7,8-Pentachlorodibenzo-p-Dioxin | 2.58E-10 | 8 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | 1,3-Butadiene | 0.39 | 4 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | 2,3,4,6,7,8-Hexachlorodibenzofuran | 1.65E-10 | 8 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | 2,3,4,7,8-Pentachlorodibenzofuran | 6.44E-10 | 8 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | 2,3,7,8-Tetrachlorodibenzofuran | 1.25E-09 | 8 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | 2,3,7,8-Tetrachlorodibenzo-p-Dioxin | 2.28E-10 | 8 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Acenaphthene | 0.00621 | 6 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Acenaphthylene | 0.132 | 6 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Acetaldehyde | 0.616 | 4 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Acrolein | 0.091 | 4 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Ammonia | 1.7 | 4 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Anthracene | 0.00869 | 6 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Benzene | 1.938 | 6 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Benzo[a]anthracene | 0.000577 | 2 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Benzo[a]fluoranthene | 0.000321 | 2 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Benzo[a]Pyrene | 0.000979 | 2 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Benzo[b]fluoranthene | 0.000592 | 2 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Benzo[e]Pyrene | 0.000589 | 2 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Benzo[g,h,i,]Perylene | 0.000201 | 2 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Benzo[k]Fluoranthene | 0.000509 | 2 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Cadmium | 0.000022 | 6 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Carbon Monoxide | 230.8 | 6 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Chrysene | 0.000472 | 2 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Cresols (Includes o, m, & p)/Cresylic Acids | 0.16 | 4 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Dibenzo[ah]anthracene | 3.92E-05 | 2 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Dioxins/Furans as 2,3,7,8-TCDD TEQs - WHO2005 | 4.6E-09 | 4 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Fluoranthene | 0.000249 | 2 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Fluorene | 0.0149 | 6 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Formaldehyde | 1.45 | 4 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Indeno[1; 2; 3 . cd]pyrene | 0.000408 | 2 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Manganese | 0.00017 | 6 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Mercury | 4.26E-05 | 7 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Methane | 64 | 4 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Methylchrysene | 5.84E-05 | 2 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Naphthalene | 0.179 | 6 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Nickel | 0.000014 | 6 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Nitrogen Oxides | 2.8 | 6 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Octachlorodibenzofuran | 1.67E-10 | 8 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Octachlorodibenzo-p-Dioxin | 6.66E-10 | 8 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | o-Xylene | 0.202 | 6 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Perylene | 0.000155 | 2 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Phenanthrene | 0.0484 | 6 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Phenol | 0.295 | 4 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Primary PM10 | 30.6 | 6 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Primary PM2.5 | 30.6 | 6 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Pyrene | 0.000217 | 2 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Sulfur Dioxide | 0.4 | 6 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Toluene | 0.73 | 6 |
| 2104008210 | Woodstove: fireplace inserts; non-EPA certified | Volatile Organic Compounds | 53 | 6 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 2.22E-10 | 8 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin | 2.34E-10 | 8 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 1.73E-10 | 8 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | 1,2,3,4,7,8-Hexachlorodibenzofuran | 2.63E-10 | 8 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | 1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin | 1.85E-10 | 8 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | 1,2,3,6,7,8-Hexachlorodibenzofuran | 1.63E-10 | 8 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | 1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin | 1.85E-10 | 8 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | 1,2,3,7,8,9-Hexachlorodibenzofuran | 1.47E-10 | 8 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | 1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin | 1.85E-10 | 8 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | 1,2,3,7,8-Pentachlorodibenzofuran | 3.37E-10 | 8 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | 1,2,3,7,8-Pentachlorodibenzo-p-Dioxin | 1.91E-10 | 8 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | 1,3-Butadiene | 0.129464 | 4 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | 2,3,4,6,7,8-Hexachlorodibenzofuran | 1.22E-10 | 8 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | 2,3,4,7,8-Pentachlorodibenzofuran | 4.76E-10 | 8 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | 2,3,7,8-Tetrachlorodibenzofuran | 9.25E-10 | 8 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | 2,3,7,8-Tetrachlorodibenzo-p-Dioxin | 1.69E-10 | 8 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Acenaphthene | 0.002989 | 6 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Acenaphthylene | 0.009543 | 6 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Acetaldehyde | 0.467551 | 4 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Acrolein | 0.029888 | 4 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Ammonia | 0.665816 | 4 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Anthracene | 0.002693 | 6 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Benzene | 0.709464 | 4 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Benzo[a]anthracene | 0.000427 | 2 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Benzo[a]fluoranthene | 0.000237 | 2 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Benzo[a]Pyrene | 0.000725 | 2 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Benzo[b]Fluoranthene | 0.000438 | 2 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Benzo[e]Pyrene | 0.000436 | 2 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Benzo[g,h,i,]Perylene | 0.000149 | 2 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Benzo[k]Fluoranthene | 0.000377 | 2 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Cadmium | 1.48E-05 | 6 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Carbon Monoxide | 122.6 | 6 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Chrysene | 0.000349 | 2 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Cresols (Includes o, m, & p)/Cresylic Acids | 0.341786 | 4 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Dibenzo[ah]anthracene | 2.9E-05 | 2 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Dioxins/Furans as 2,3,7,8-TCDD TEQs - WHO2005 | 5.87E-10 | 4 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Fluoranthene | 0.000184 | 2 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Fluorene | 0.004187 | 6 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Formaldehyde | 1.642347 | 4 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Indeno[1; 2; 3 . cd]pyrene | 0.000302 | 2 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Manganese | 0.000104 | 6 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Mercury | 4.26E-05 | 7 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Methane | 21.0102 | 4 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Methylchrysene | 4.32E-05 | 2 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Naphthalene | 0.043056 | 6 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Nickel | 1.48E-05 | 6 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Nitrogen Oxides | 1.686735 | 4 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Octachlorodibenzofuran | 1.23E-10 | 8 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Octachlorodibenzo-p-Dioxin | 4.93E-10 | 8 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Perylene | 0.000115 | 2 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Phenanthrene | 0.035288 | 6 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Phenol | 0.360281 | 4 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Primary PM10 | 14.5 | 6 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Primary PM2.5 | 14.5 | 6 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Pyrene | 0.000161 | 2 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Sulfur Dioxide | 0.295918 | 6 |
| 2104008220 | Woodstove: fireplace inserts; EPA certified; non-catalytic | Volatile Organic Compounds | 8.877551 | 6 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 2.23E-10 | 8 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin | 2.35E-10 | 8 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 1.74E-10 | 8 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | 1,2,3,4,7,8-Hexachlorodibenzofuran | 2.65E-10 | 8 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | 1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin | 1.86E-10 | 8 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | 1,2,3,6,7,8-Hexachlorodibenzofuran | 1.64E-10 | 8 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | 1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin | 1.86E-10 | 8 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | 1,2,3,7,8,9-Hexachlorodibenzofuran | 1.48E-10 | 8 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | 1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin | 1.86E-10 | 8 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | 1,2,3,7,8-Pentachlorodibenzofuran | 3.4E-10 | 8 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | 1,2,3,7,8-Pentachlorodibenzo-p-Dioxin | 1.92E-10 | 8 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | 1,3-Butadiene | 0.145294 | 4 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | 2,3,4,6,7,8-Hexachlorodibenzofuran | 1.23E-10 | 8 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | 2,3,4,7,8-Pentachlorodibenzofuran | 4.8E-10 | 8 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | 2,3,7,8-Tetrachlorodibenzofuran | 9.31E-10 | 8 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | 2,3,7,8-Tetrachlorodibenzo-p-Dioxin | 1.7E-10 | 8 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Acenaphthene | 0.002295 | 6 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Acenaphthylene | 0.026004 | 6 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Acetaldehyde | 0.395647 | 4 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Acrolein | 0.023396 | 4 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Ammonia | 0.670588 | 4 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Anthracene | 0.003055 | 6 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Benzene | 1.090824 | 6 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Benzo[a]anthracene | 0.00043 | 2 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Benzo[a]fluoranthene | 0.000239 | 2 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Benzo[a]Pyrene | 0.00073 | 2 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Benzo[b]Fluoranthene | 0.000441 | 2 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Benzo[e]Pyrene | 0.000439 | 2 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Benzo[g,h,i,]Perylene | 0.00015 | 2 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Benzo[k]Fluoranthene | 0.000379 | 2 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Carbon Monoxide | 92.3 | 6 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Chrysene | 0.000351 | 2 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Cresols (Includes o, m, & p)/Cresylic Acids | 0.395647 | 4 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Dibenzo[ah]anthracene | 2.92E-05 | 2 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Dioxins/Furans as 2,3,7,8-TCDD TEQs - WHO2005 | 1.7E-09 | 4 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Fluoranthene | 0.000185 | 2 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Fluorene | 0.00535 | 6 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Formaldehyde | 0.731686 | 4 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Indeno[1; 2; 3 . cd]pyrene | 0.000304 | 2 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Mercury | 4.26E-05 | 7 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Methane | 19.37255 | 4 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Methylchrysene | 4.35E-05 | 2 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Naphthalene | 0.071082 | 6 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Nitrogen Oxides | 1.490196 | 6 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Octachlorodibenzofuran | 1.24E-10 | 8 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Octachlorodibenzo-p-Dioxin | 4.96E-10 | 8 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | o-Xylene | 0.138588 | 6 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Perylene | 0.000116 | 2 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Phenanthrene | 0.018329 | 6 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Phenol | 0.304 | 4 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Primary PM10 | 15.2 | 6 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Primary PM2.5 | 15.2 | 6 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Pyrene | 0.000162 | 2 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Sulfur Dioxide | 0.298039 | 6 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Toluene | 0.387451 | 6 |
| 2104008230 | Woodstove: fireplace inserts; EPA certified; catalytic | Volatile Organic Compounds | 11.17647 | 6 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 3E-10 | 8 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin | 3.16E-10 | 8 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 2.34E-10 | 8 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | 1,2,3,4,7,8-Hexachlorodibenzofuran | 3.56E-10 | 8 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | 1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin | 2.5E-10 | 8 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | 1,2,3,6,7,8-Hexachlorodibenzofuran | 2.2E-10 | 8 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | 1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin | 2.5E-10 | 8 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | 1,2,3,7,8,9-Hexachlorodibenzofuran | 1.98E-10 | 8 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | 1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin | 2.5E-10 | 8 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | 1,2,3,7,8-Pentachlorodibenzofuran | 4.56E-10 | 8 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | 1,2,3,7,8-Pentachlorodibenzo-p-Dioxin | 2.58E-10 | 8 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | 1,3-Butadiene | 0.39 | 4 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | 2,3,4,6,7,8-Hexachlorodibenzofuran | 1.65E-10 | 8 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | 2,3,4,7,8-Pentachlorodibenzofuran | 6.44E-10 | 8 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | 2,3,7,8-Tetrachlorodibenzofuran | 1.25E-09 | 8 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | 2,3,7,8-Tetrachlorodibenzo-p-Dioxin | 2.28E-10 | 8 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Acenaphthene | 0.00621 | 6 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Acenaphthylene | 0.132 | 6 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Acetaldehyde | 0.616 | 4 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Acrolein | 0.091 | 4 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Ammonia | 1.7 | 4 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Anthracene | 0.00869 | 6 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Benzene | 1.938 | 6 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Benzo[a]anthracene | 0.000577 | 2 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Benzo[a]fluoranthene | 0.000321 | 2 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Benzo[a]Pyrene | 0.000979 | 2 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Benzo[b]fluoranthene | 0.000592 | 2 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Benzo[e]Pyrene | 0.000589 | 2 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Benzo[g,h,i,]Perylene | 0.000201 | 2 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Benzo[k]Fluoranthene | 0.000509 | 2 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Cadmium | 0.000022 | 6 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Carbon Monoxide | 230.8 | 6 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Chrysene | 0.000472 | 2 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Cresols (Includes o, m, & p)/Cresylic Acids | 0.16 | 4 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Dibenzo[ah]anthracene | 3.92E-05 | 2 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Dioxins/Furans as 2,3,7,8-TCDD TEQs - WHO2005 | 4.6E-09 | 4 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Fluoranthene | 0.000249 | 2 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Fluorene | 0.0149 | 6 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Formaldehyde | 1.45 | 4 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Indeno[1; 2; 3 . cd]pyrene | 0.000408 | 2 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Manganese | 0.00017 | 6 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Mercury | 4.26E-05 | 7 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Methane | 64 | 4 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Methylchrysene | 5.84E-05 | 2 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Naphthalene | 0.179 | 6 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Nickel | 0.000014 | 6 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Nitrogen Oxides | 2.8 | 6 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Octachlorodibenzofuran | 1.67E-10 | 8 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Octachlorodibenzo-p-Dioxin | 6.66E-10 | 8 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | o-Xylene | 0.202 | 6 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Perylene | 0.000155 | 2 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Phenanthrene | 0.0484 | 6 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Phenol | 0.295 | 4 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Primary PM10 | 30.6 | 6 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Primary PM2.5 | 30.6 | 6 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Pyrene | 0.000217 | 2 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Sulfur Dioxide | 0.4 | 6 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Toluene | 0.73 | 6 |
| 2104008310 | Woodstove: freestanding, non-EPA certified | Volatile Organic Compounds | 53 | 6 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 2.22E-10 | 8 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin | 2.34E-10 | 8 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 1.73E-10 | 8 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | 1,2,3,4,7,8-Hexachlorodibenzofuran | 2.63E-10 | 8 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | 1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin | 1.85E-10 | 8 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | 1,2,3,6,7,8-Hexachlorodibenzofuran | 1.63E-10 | 8 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | 1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin | 1.85E-10 | 8 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | 1,2,3,7,8,9-Hexachlorodibenzofuran | 1.47E-10 | 8 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | 1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin | 1.85E-10 | 8 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | 1,2,3,7,8-Pentachlorodibenzofuran | 3.37E-10 | 8 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | 1,2,3,7,8-Pentachlorodibenzo-p-Dioxin | 1.91E-10 | 8 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | 1,3-Butadiene | 0.129464 | 4 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | 2,3,4,6,7,8-Hexachlorodibenzofuran | 1.22E-10 | 8 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | 2,3,4,7,8-Pentachlorodibenzofuran | 4.76E-10 | 8 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | 2,3,7,8-Tetrachlorodibenzofuran | 9.25E-10 | 8 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | 2,3,7,8-Tetrachlorodibenzo-p-Dioxin | 1.69E-10 | 8 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Acenaphthene | 0.002989 | 6 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Acenaphthylene | 0.009543 | 6 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Acetaldehyde | 0.467551 | 4 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Acrolein | 0.029888 | 4 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Ammonia | 0.665816 | 4 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Anthracene | 0.002693 | 6 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Benzene | 0.709464 | 4 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Benzo[a]anthracene | 0.000427 | 2 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Benzo[a]fluoranthene | 0.000237 | 2 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Benzo[a]Pyrene | 0.000725 | 2 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Benzo[b]Fluoranthene | 0.000438 | 2 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Benzo[e]Pyrene | 0.000436 | 2 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Benzo[g,h,i,]Perylene | 0.000149 | 2 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Benzo[k]Fluoranthene | 0.000377 | 2 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Cadmium | 1.48E-05 | 6 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Carbon Monoxide | 122.6 | 6 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Chrysene | 0.000349 | 2 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Cresols (Includes o, m, & p)/Cresylic Acids | 0.341786 | 4 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Dibenzo[ah]anthracene | 2.9E-05 | 2 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Dioxins/Furans as 2,3,7,8-TCDD TEQs - WHO2005 | 5.87E-10 | 4 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Fluoranthene | 0.000184 | 2 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Fluorene | 0.004187 | 6 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Formaldehyde | 1.642347 | 4 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Indeno[1; 2; 3 . cd]pyrene | 0.000302 | 2 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Manganese | 0.000104 | 6 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Mercury | 4.26E-05 | 7 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Methane | 21.0102 | 4 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Methylchrysene | 4.32E-05 | 2 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Naphthalene | 0.043056 | 6 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Nickel | 1.48E-05 | 6 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Nitrogen Oxides | 1.686735 | 4 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Octachlorodibenzofuran | 1.23E-10 | 8 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Octachlorodibenzo-p-Dioxin | 4.93E-10 | 8 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Perylene | 0.000115 | 2 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Phenanthrene | 0.035288 | 6 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Phenol | 0.360281 | 4 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Primary PM10 | 14.5 | 6 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Primary PM2.5 | 14.5 | 6 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Pyrene | 0.000161 | 2 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Sulfur Dioxide | 0.295918 | 6 |
| 2104008320 | Woodstove: freestanding, EPA certified, non-catalytic | Volatile Organic Compounds | 8.877551 | 6 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 2.23E-10 | 8 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin | 2.35E-10 | 8 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 1.74E-10 | 8 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | 1,2,3,4,7,8-Hexachlorodibenzofuran | 2.65E-10 | 8 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | 1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin | 1.86E-10 | 8 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | 1,2,3,6,7,8-Hexachlorodibenzofuran | 1.64E-10 | 8 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | 1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin | 1.86E-10 | 8 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | 1,2,3,7,8,9-Hexachlorodibenzofuran | 1.48E-10 | 8 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | 1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin | 1.86E-10 | 8 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | 1,2,3,7,8-Pentachlorodibenzofuran | 3.4E-10 | 8 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | 1,2,3,7,8-Pentachlorodibenzo-p-Dioxin | 1.92E-10 | 8 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | 1,3-Butadiene | 0.145294 | 4 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | 2,3,4,6,7,8-Hexachlorodibenzofuran | 1.23E-10 | 8 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | 2,3,4,7,8-Pentachlorodibenzofuran | 4.8E-10 | 8 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | 2,3,7,8-Tetrachlorodibenzofuran | 9.31E-10 | 8 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | 2,3,7,8-Tetrachlorodibenzo-p-Dioxin | 1.7E-10 | 8 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Acenaphthene | 0.002295 | 6 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Acenaphthylene | 0.026004 | 6 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Acetaldehyde | 0.395647 | 4 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Acrolein | 0.023396 | 4 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Ammonia | 0.670588 | 4 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Anthracene | 0.003055 | 6 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Benzene | 1.090824 | 6 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Benzo[a]anthracene | 0.00043 | 2 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Benzo[a]fluoranthene | 0.000239 | 2 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Benzo[a]Pyrene | 0.00073 | 2 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Benzo[b]Fluoranthene | 0.000441 | 2 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Benzo[e]Pyrene | 0.000439 | 2 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Benzo[g,h,i,]Perylene | 0.00015 | 2 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Benzo[k]Fluoranthene | 0.000379 | 2 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Carbon Monoxide | 92.3 | 6 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Chrysene | 0.000351 | 2 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Cresols (Includes o, m, & p)/Cresylic Acids | 0.395647 | 4 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Dibenzo[ah]anthracene | 2.92E-05 | 2 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Dioxins/Furans as 2,3,7,8-TCDD TEQs - WHO2005 | 1.7E-09 | 4 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Fluoranthene | 0.000185 | 2 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Fluorene | 0.00535 | 6 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Formaldehyde | 0.731686 | 4 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Indeno[1; 2; 3 . cd]pyrene | 0.000304 | 2 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Mercury | 4.26E-05 | 7 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Methane | 19.37255 | 4 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Methylchrysene | 4.35E-05 | 2 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Naphthalene | 0.071082 | 6 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Nitrogen Oxides | 1.490196 | 6 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Octachlorodibenzofuran | 1.24E-10 | 8 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Octachlorodibenzo-p-Dioxin | 4.96E-10 | 8 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | o-Xylene | 0.138588 | 6 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Perylene | 0.000116 | 2 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Phenanthrene | 0.018329 | 6 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Phenol | 0.304 | 4 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Primary PM10 | 15.2 | 6 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Primary PM2.5 | 15.2 | 6 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Pyrene | 0.000162 | 2 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Sulfur Dioxide | 0.298039 | 6 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Toluene | 0.387451 | 6 |
| 2104008330 | Woodstove: freestanding, EPA certified, catalytic | Volatile Organic Compounds | 11.17647 | 6 |
| 2104008400 | Woodstove: pellet-fired, general | 1,3-Butadiene | 0.00095 | 4 |
| 2104008400 | Woodstove: pellet-fired, general | Acetaldehyde | 0.094 | 4 |
| 2104008400 | Woodstove: pellet-fired, general | Acrolein | 0.0101 | 4 |
| 2104008400 | Woodstove: pellet-fired, general | Ammonia | 0.3 | 4 |
| 2104008400 | Woodstove: pellet-fired, general | Benzene | 0.0289 | 4 |
| 2104008400 | Woodstove: pellet-fired, general | Benzo[a]Pyrene | 0.0067 | 4 |
| 2104008400 | Woodstove: pellet-fired, general | Carbon Monoxide | 15.9 | 4 |
| 2104008400 | Woodstove: pellet-fired, general | Chrysene | 7.52E-05 | 6 |
| 2104008400 | Woodstove: pellet-fired, general | Cresols (Includes o, m, & p)/Cresylic Acids | 0.0155 | 4 |
| 2104008400 | Woodstove: pellet-fired, general | Dioxins/Furans as 2,3,7,8-TCDD TEQs - WHO2005 | 3.8E-09 | 4 |
| 2104008400 | Woodstove: pellet-fired, general | Fluoranthene | 5.48E-05 | 6 |
| 2104008400 | Woodstove: pellet-fired, general | Formaldehyde | 0.316 | 4 |
| 2104008400 | Woodstove: pellet-fired, general | Mercury | 4.26E-05 | 7 |
| 2104008400 | Woodstove: pellet-fired, general | Methane | 0.248 | 4 |
| 2104008400 | Woodstove: pellet-fired, general | Naphthalene | 0.423 | 4 |
| 2104008400 | Woodstove: pellet-fired, general | Nitrogen Oxides | 3.8 | 4 |
| 2104008400 | Woodstove: pellet-fired, general | Phenanthrene | 3.32E-05 | 6 |
| 2104008400 | Woodstove: pellet-fired, general | Phenol | 0.025 | 4 |
| 2104008400 | Woodstove: pellet-fired, general | Primary PM10 | 3.06 | 4 |
| 2104008400 | Woodstove: pellet-fired, general | Primary PM2.5 | 3.06 | 4 |
| 2104008400 | Woodstove: pellet-fired, general | Pyrene | 4.84E-05 | 6 |
| 2104008400 | Woodstove: pellet-fired, general | Sulfur Dioxide | 0.32 | 4 |
| 2104008400 | Woodstove: pellet-fired, general | Volatile Organic Compounds | 2.198 | 4, 6 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | 1,3-Butadiene | 0.029032 | 4 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | Acetaldehyde | 0.682 | 4 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | Acrolein | 0.043792 | 4 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | Ammonia | 1.8 | 4 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | Benzene | 2.78 | 4 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | Benzo[a]Pyrene | 0.002733 | 4 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | Carbon Monoxide | 184 | 4 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | Cresols (Includes o, m, & p)/Cresylic Acids | 0.131139 | 4 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | Dioxins/Furans as 2,3,7,8-TCDD TEQs - WHO2005 | 8.33E-10 | 4 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | Formaldehyde | 0.7 | 4 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | Mercury | 4.26E-05 | 7 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | Methane | 26.1 | 4 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | Naphthalene | 0.148635 | 4 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | Nitrogen Oxides | 1.8 | 4 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | Phenol | 0.241 | 4 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | Primary PM10 | 27.6 | 4 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | Primary PM2.5 | 27.6 | 4 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | Sulfur Dioxide | 2.03 | 4 |
| 2104008510 | Furnace: Indoor, cordwood-fired, non-EPA certified | Volatile Organic Compounds | 11.7 | 4 |
| 2104008610 | Hydronic heater: outdoor | 1,3-Butadiene | 0.029032 | 4 |
| 2104008610 | Hydronic heater: outdoor | Acetaldehyde | 0.682 | 4 |
| 2104008610 | Hydronic heater: outdoor | Acrolein | 0.043792 | 4 |
| 2104008610 | Hydronic heater: outdoor | Ammonia | 1.7 | 4 |
| 2104008610 | Hydronic heater: outdoor | Benzene | 2.78 | 4 |
| 2104008610 | Hydronic heater: outdoor | Benzo[a]Pyrene | 0.002733 | 4 |
| 2104008610 | Hydronic heater: outdoor | Carbon Dioxide | 2907 | 1 |
| 2104008610 | Hydronic heater: outdoor | Carbon Monoxide | 360 | 1 |
| 2104008610 | Hydronic heater: outdoor | Cresols (Includes o, m, & p)/Cresylic Acids | 0.131139 | 4 |
| 2104008610 | Hydronic heater: outdoor | Dioxins/Furans as 2,3,7,8-TCDD TEQs - WHO2005 | 8.33E-10 | 4 |
| 2104008610 | Hydronic heater: outdoor | Formaldehyde | 0.7 | 4 |
| 2104008610 | Hydronic heater: outdoor | Mercury | 4.26E-05 | 7 |
| 2104008610 | Hydronic heater: outdoor | Methane | 26 | 4 |
| 2104008610 | Hydronic heater: outdoor | Naphthalene | 0.148635 | 4 |
| 2104008610 | Hydronic heater: outdoor | Nitrogen Oxides | 2 | 6 |
| 2104008610 | Hydronic heater: outdoor | Nitrous Oxide | 0.0188 | 1 |
| 2104008610 | Hydronic heater: outdoor | Phenol | 0.241 | 4 |
| 2104008610 | Hydronic heater: outdoor | Primary PM10 | 64 | 1 |
| 2104008610 | Hydronic heater: outdoor | Primary PM2.5 | 64 | 1 |
| 2104008610 | Hydronic heater: outdoor | Sulfur Dioxide | 2.03 | 4 |
| 2104008610 | Hydronic heater: outdoor | Volatile Organic Compounds | 67.4 | 1 |
| 2104008700 | Outdoor wood burning device, NEC | 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 3E-10 | 8 |
| 2104008700 | Outdoor wood burning device, NEC | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin | 3.16E-10 | 8 |
| 2104008700 | Outdoor wood burning device, NEC | 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 2.34E-10 | 8 |
| 2104008700 | Outdoor wood burning device, NEC | 1,2,3,4,7,8-Hexachlorodibenzofuran | 3.56E-10 | 8 |
| 2104008700 | Outdoor wood burning device, NEC | 1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin | 2.5E-10 | 8 |
| 2104008700 | Outdoor wood burning device, NEC | 1,2,3,6,7,8-Hexachlorodibenzofuran | 2.2E-10 | 8 |
| 2104008700 | Outdoor wood burning device, NEC | 1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin | 2.5E-10 | 8 |
| 2104008700 | Outdoor wood burning device, NEC | 1,2,3,7,8,9-Hexachlorodibenzofuran | 1.98E-10 | 8 |
| 2104008700 | Outdoor wood burning device, NEC | 1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin | 2.5E-10 | 8 |
| 2104008700 | Outdoor wood burning device, NEC | 1,2,3,7,8-Pentachlorodibenzofuran | 4.56E-10 | 8 |
| 2104008700 | Outdoor wood burning device, NEC | 1,2,3,7,8-Pentachlorodibenzo-p-Dioxin | 2.58E-10 | 8 |
| 2104008700 | Outdoor wood burning device, NEC | 1,3-Butadiene | 0.157 | 4 |
| 2104008700 | Outdoor wood burning device, NEC | 2,3,4,6,7,8-Hexachlorodibenzofuran | 1.65E-10 | 8 |
| 2104008700 | Outdoor wood burning device, NEC | 2,3,4,7,8-Pentachlorodibenzofuran | 6.44E-10 | 8 |
| 2104008700 | Outdoor wood burning device, NEC | 2,3,7,8-Tetrachlorodibenzofuran | 1.25E-09 | 8 |
| 2104008700 | Outdoor wood burning device, NEC | 2,3,7,8-Tetrachlorodibenzo-p-Dioxin | 2.28E-10 | 8 |
| 2104008700 | Outdoor wood burning device, NEC | Acetaldehyde | 1.07 | 4 |
| 2104008700 | Outdoor wood burning device, NEC | Acrolein | 0.123 | 4 |
| 2104008700 | Outdoor wood burning device, NEC | Ammonia | 1.8 | 4 |
| 2104008700 | Outdoor wood burning device, NEC | Benzene | 0.686 | 4 |
| 2104008700 | Outdoor wood burning device, NEC | Benzo[a]Pyrene | 0.001 | 4 |
| 2104008700 | Outdoor wood burning device, NEC | Carbon Monoxide | 149 | 4 |
| 2104008700 | Outdoor wood burning device, NEC | Cresols (Includes o, m, & p)/Cresylic Acids | 0.357 | 4 |
| 2104008700 | Outdoor wood burning device, NEC | Dioxins/Furans as 2,3,7,8-TCDD TEQs - WHO2005 | 7.87E-10 | 4 |
| 2104008700 | Outdoor wood burning device, NEC | Formaldehyde | 1.79 | 4 |
| 2104008700 | Outdoor wood burning device, NEC | Mercury | 4.26E-05 | 7 |
| 2104008700 | Outdoor wood burning device, NEC | Methane | 14.4 | 4 |
| 2104008700 | Outdoor wood burning device, NEC | Naphthalene | 0.265 | 4 |
| 2104008700 | Outdoor wood burning device, NEC | Nitrogen Oxides | 2.6 | 6 |
| 2104008700 | Outdoor wood burning device, NEC | Octachlorodibenzofuran | 1.67E-10 | 8 |
| 2104008700 | Outdoor wood burning device, NEC | Octachlorodibenzo-p-Dioxin | 6.66E-10 | 8 |
| 2104008700 | Outdoor wood burning device, NEC | Phenol | 0.472 | 4 |
| 2104008700 | Outdoor wood burning device, NEC | Primary PM10 | 23.6 | 6 |
| 2104008700 | Outdoor wood burning device, NEC | Primary PM2.5 | 23.6 | 3 |
| 2104008700 | Outdoor wood burning device, NEC | Sulfur Dioxide | 0.4 | 6 |
| 2104008700 | Outdoor wood burning device, NEC | Volatile Organic Compounds | 18.9 | 4 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Acenaphthene | 0.00168 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Acenaphthylene | 0.00748 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Anthracene | 0.00232 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Benzene | 1.068 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Benzo[a]anthracene | 0.0012 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Benzo[a]Pyrene | 0.0012 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Benzo[b]Fluoranthene | 0.00112 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Benzo[g,h,i,]Perylene | 0.00068 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Benzo[k]Fluoranthene | 0.0006 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Carbon Monoxide | 125.08 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Chrysene | 0.00188 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Dibenzo[a,h]Anthracene | 0.0006 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Fluoranthene | 0.00428 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Fluorene | 0.00548 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Indeno[1,2,3-c,d]Pyrene | 0.00068 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Naphthalene | 0.09756 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Nitrogen Oxides | 7.684 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Phenanthrene | 0.01724 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Primary PM10 | 29.32 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Primary PM2.5 | 28.4 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Pyrene | 0.00424 | 5 |
| 2104009000 | Residential Firelog Total: All Combustor Types | Volatile Organic Compounds | 39.56 | 5 |

F. Getting Started with the RWC Tool

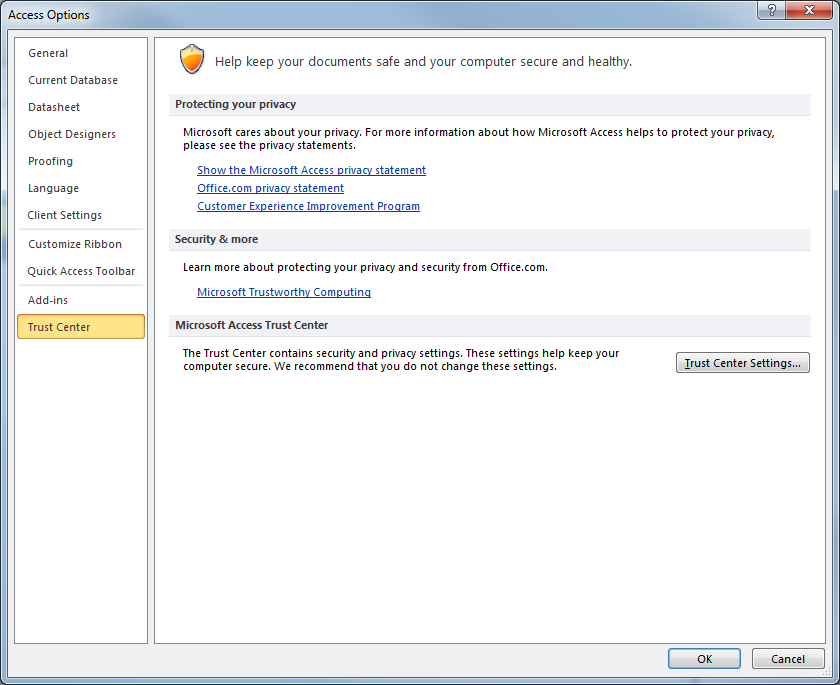
The first time you open the RWC tool, you may see a yellow ribbon stating that “Some active content has been disabled.” Click **Enable Content**. This will allow the tool to run.



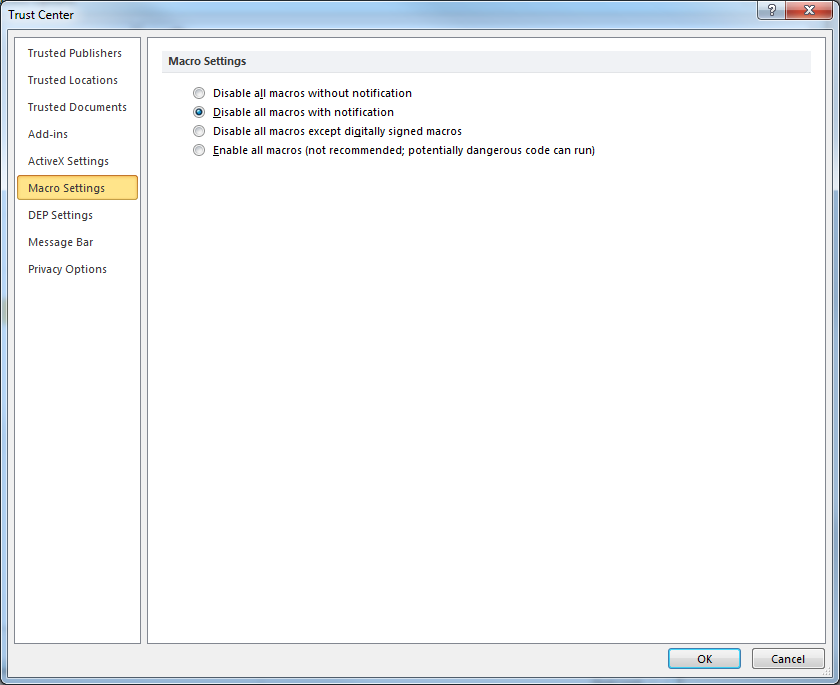
You might also need to enable macros to run. Click **File** then **Options.**



In the window that opens, click **Trust Center**, and then **Trust Center Settings.**



In the next window that opens, click **Macro Settings**, and then select **Disable all macros with notification**.



Click **OK**. You are now ready to run the RWC tool.

1. U.S. EPA. 2015. [Regulatory Impact Analysis for Residential Wood Heaters NSPS Revision](https://www.epa.gov/sites/production/files/2015-02/documents/20150204-residential-wood-heaters-ria.pdf). [↑](#footnote-ref-1)