# NON-RESIDENTIAL CONSTRUCTION

***a. Source Category Description***

Emissions from non-residential construction activity are a function of the acreage disturbed for non-residential construction.

For this source category, the following SCC was assigned:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Source Classification Code** | **SCC Level One** | **SCC Level Two** | **SCC Level Three** | **SCC Level Four** |
| 2311020000 | Industrial Processes | Construction: SIC 15 - 17 | Heavy Construction | Total |

## b. Activity Data

The activity data are the number of acres disturbed for non-residential construction and are estimated by multiplying the value of non-residential construction put in place by the number of acres disturbed per million dollars. *Annual Value of Construction Put in Place in the U.S*1contains the 2014 national value of non-residential construction. The national value of non-residential construction put in place (in millions of dollars) was allocated to counties using county-level non-residential construction employment data (NAICS Code 2362) obtained from *County Business Patterns*2 *(CBP)*. Because some counties’ employment data were withheld due to privacy concerns, the following procedure was adopted to estimate the number of county-level withheld employees:

1. State totals for the known county level employees were subtracted from the total number of employees reported in the CBP state level file.3 This results in the total number of withheld employees in the state.
2. The midpoint of the range code was used as an initial estimate (so for instance in the 1-19 employee range, an estimate of 10 employees would be used) and a state total of the withheld employees was computed.
3. A ratio of estimated employees (Step 2) to withheld employees (Step 1) was then used to adjust the county level estimates up or down so that the state total of adjusted estimates matches the state total of withheld employees (Step 1).

For the average acres disturbed per million dollars of non-residential construction, MRI reported a conversion factor of 2 acres/$1 million (in 1992 constant dollars).4 EPA adjusted the 1992 conversion factor to 2014 using the Price Deflator (Fisher) Index of New Single‐Family Houses Under Construction.5 By taking the ratio of the 2014 and 1992 Annual Index values and applying it to the 1992 factor, a value of 1.01 acres/$1 million (= 2/(113/57)) was estimated.

***c. Emission Factors***

Initial PM10 emissions from construction of non-residential buildings are calculated using an emission factor of 0.19 tons/acre-month.6 The duration of construction activity for non-residential construction is assumed to be 11 months. Since there are no condensible emissions, primary PM emissions are equal to filterable emissions. Once PM10-xx emissions are developed, PM25-xx emissions are estimated by applying a particle size multiplier of 0.10 to PM10-xx emissions.7

Regional variances in construction emissions are corrected using soil moisture level and silt content. These correction parameters are applied to initial PM10 emissions from non-residential construction to develop the final emissions inventory.

To account for the soil moisture level, the PM10 emissions are weighted using the 30-year average precipitation-evaporation (PE) values from Thornthwaite’s PE Index. Average precipitation evaporation values for each State were estimated based on PE values for specific climatic divisions within a State.4

To account for the silt content, the PM10 emissions are weighted using average silt content for each county. EPA used the National Cooperative Soil Survey Microsoft Access Soil Characterization Database to develop county-level, average silt content values for surface soil.8 This database contains the most commonly requested data from the National Cooperative Soil Survey Laboratories including data from the Kellogg Soil Survey Laboratory and cooperating universities.

The equation for PM10 emissions corrected for soil moisture and silt content is:

where: Corrected EPM10 = PM10 emissions corrected for soil moisture and silt content,

PE = precipitation-evaporation value for each State,

S = % dry silt content in soil for area being inventoried.

Once PM10 adjustments have been made, PM2.5 emissions are set to 10% of PM10.

## d. Example Calculation

EmissionsPM10 = NSpending x (Empcounty / EmpNational) x Apd x EFAdj x M

Where NSpending = National spending on nonresidential construction (million dollars)

Empcounty = County level employment in nonresidential construction

EmpNational = National level employment in nonresidential construction

Apd = Acres per million dollars (national data)

EFAdj = Adjusted PM10 emission factor (ton/acre-month)

M = duration of construction activity (months)

As an example, in Grand Traverse County, Michigan, 2014 acres disturbed and PM10 emissions from non-residential construction are calculated as follows:

EmissionsPM10 = 347,666 x $106 x (103/560,616) x 1.01 acres/$106 x EFAdj x M

= 70 acres x 0.1073 ton/acre-month x 11 months

83 tons PM10

Where EFAdj is calculated as follows:

EFAdj = 0.19 ton/acre-month \* (24/103.6 \* 21.95/9)

= 0.1073 ton/acre-month

***e. Changes from 2011 Methodology***

## The Annual Value of Construction Put in Place, employment data and the acres/$ million conversion factor were updated using the latest data from the U.S. Census Bureau. The county-level silt values were updated and are now based on soil sampling data contained in the National Cooperative Soil Survey Microsoft Access Soil Characterization Database.

***f. Puerto Rico and US Virgin Islands Emissions Calculations***

Since insufficient data exists to calculate emissions for the counties in Puerto Rico and the US Virgin Islands, emissions are based on two proxy counties in Florida: 12011, Broward County for Puerto Rico and 12087, Monroe County for the US Virgin Islands. The total emissions in tons for these two Florida counties are divided by their respective populations creating a tons per capita emission factor. For each Puerto Rico and US Virgin Island county, the tons per capita emission factor is multiplied by the county population (from the same year as the inventory’s activity data) which served as the activity data. In these cases, the throughput (activity data) unit and the emissions denominator unit are “EACH”.

## g. References

1. U.S. Census Bureau, "[Value of Construction Put in Place](https://www.census.gov/construction/c30/c30index.html)," (accessed May 2019).
2. U.S Census Bureau, [County Business Patterns](https://www.census.gov/programs-surveys/cbp.html): 2014, *"Complete County File [14.4mb zip],"* from (accessed May 2019).
3. U.S. Census Bureau, [County Business Patterns](https://www.census.gov/programs-surveys/cbp.html): 2014, *"Complete State File [9.7mb zip],"* from (accessed May 2019).
4. Midwest Research Institute. 1999. *Estimating Particulate Matter Emissions from Construction Operations, Final Report* (prepared for the Emission Factor and Inventory Group, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency).
5. U.S. Census Bureau, [Price Deflator (Fisher) Index of New Single‐Family Houses Under Construction](https://www.census.gov/construction/nrs/pdf/price_uc.pdf), (accessed May 2019).
6. Midwest Research Institute. Improvement of Specific Emission Factors (BACM Project No. 1). Prepared for South Coast Air Quality Management District. March 29, 1996.
7. Midwest Research Institute. [*Background Document for Revisions to Find Fraction Rations Used for AP-42 Fugitive Dust Emission Factors, Proposed Fine Fraction Ratios, Table 1*](https://www3.epa.gov/ttn/chief/ap42/ch13/bgdocs/b13s02.pdf) (prepared for Western Governors’ Association),
8. U.S. Department of Agriculture, [National Cooperative Soil Survey, NCSS Microsoft Access Soil Characterization Database](https://ncsslabdatamart.sc.egov.usda.gov/), (accessed May 2019).