# 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

*Annual Value of Construction Put in Place in the U.S1* has the 2011 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 (NAICS Code 2362) employment data obtained from *County Business Patterns*2 *(CBP)*. Because some counties employment data was withheld due to privacy concerns, the following procedure was adopted:

1. State totals for the known county level employees was subtracted from the number of employees reported in the state level version of CBP. This results in the total number of withheld employees in the state.
2. A starting guess of the midpoint of the range code was used (so for instance in the 1-19 employees range, a guess of 10 employees would be used) and a state total of the withheld counties was computed.
3. A ratio of guessed employees (Step 2) to withheld employees (Step 1) was then used to adjust the county level guesses up or down so the state total of adjusted guesses should match state total of withheld employees (Step 1)

In 1999 a figure of 2 acres/$106 was developed. The Bureau of Labor Statistics *Producer Price Index3* lists costs of the construction industry from 1999-2011.

2011 acres per $106 = 1999 acres per $106 x (1999 PPI / 2011 PPI)

=2 acres/$106 \* (132.9 / 229.3)

= 1.159 acres per $106

## c. Emission Factors

Initial PM10 emissions from construction of non-residential buildings are calculated using an emission factor of 0.19 tons/acre-month.4 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.

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. A data base containing county-level dry silt values was complied. These values were derived by applying a correction factor developed by the California Air Resources Board to convert wet silt values to dry silt values.5

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, 2011 acres disturbed and PM10 emissions from non-residential construction are calculated as follows:

EmissionsPM10 = 269,045 x 106 $ x (130/651,996) x 1.159 acres/106$ x EFAdj x M

= 62.2 acres x 0.059 ton/acre-month x 11 months

= 40.4 tons PM10

Where EFAdj is calculated as follows:

EFAdj = 0.19 ton/acre-month \* (24/103.6 \* 12/9)

= 0.059 ton/acre-month

## e. References

1. [Annual Value of Construction Put in Place](https://www.census.gov/const/C30/priv2011.pdf)
2. [County Business Patterns](https://www.census.gov/programs-surveys/cbp.html)
3. [Bureau of Labor Statistics](https://www.bls.gov/home.htm) Table BMNR
4. Midwest Research Institute. Improvement of Specific Emission Factors (BACM Project No. 1). Prepared for South Coast Air Quality Management District. March 29, 1996.
5. Campbell, 1996: Campbell, S.G., D.R. Shimp, and S.R. Francis. *Spatial Distribution of PM-10 Emissions from Agricultural Tilling in the San Joaquin Valley*, pp. 119-127 in Geographic Information Systems in Environmental Resources Management, Air and Waste Management Association, Reno, NV. 1996.