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FIVE-VCP-FOG-NEI17 inventory with Near Real-time Emissions Adjustment

Mobile sources: Fuel-based Inventory of Vehicle Emissions (FIVE), Harkins et al. (2021)

Harkins, C., B. C McDonald, D. K. Henze, C. Wiedinmyer (2021). "A fuel-based method for updating mobile source emissions during the COVID-19 pandemic." Environ. Res. Lett. 16.

Volatile Chemical Products: Based on McDonald et al. (2018)

McDonald, B. C., J. A., de Gouw, J. B. Gilman, S. H. Jathar, A. Akherati, C. D. Cappa, J. L. Jimenez, J. Lee-Taylor, P. L. Hayes, S. A. McKeen, Y. Y. Cui, S.-W. Kim, D. R. Gentner, G. Isaacman-VanWertz, A. H. Goldstein, R. A Harley, G. J Frost, J. M. Roberts, T. B. Ryerson, M. Trainer (2018). "Volatile chemical products emerging as largest petrochemical source of urban organic emissions." Science 359(6377): 760-764.

Oil and Gas: Fuel-based Oil & Gas (FOG) Inventory, Francoeur et al. (2021)

Francoeur, C. B., B. C. McDonald, J. B. Gilman, K. J. Zarzana, B. Dix, S. S. Brown, J. A. de Gouw, G. J. Frost, M. Li, S. A. McKeen, J. Peischl, I. B. Pollack, T. B. Ryerson, C. Thompson, C. Warneke, M. Trainer (2021). "Quantifying methane and ozone precursor emissions from oil and gas production regions across the contiguous US." Environ. Sci. Technol. 55: 9129–9139.

Other Areawide & Point Sources: US EPA National Emissions Inventory 2017 adjusted with monthly scaling factors with data sources listed in Table 1.

Table 1. Summary of Anthropogenic Emission Sectors and COVID-19 Pandemic Scaling Factor Data.

Sector	Base Inventory	SCC Codes	COVID Scaling Data	Spatial Adjustment	Ref.
On-Road					
Gasoline	FIVE18	2200000000- 2209999999	EIA Gasoline ^a	State	McDonald et al. (1)
Diesel	FIVE18	2230000000- 2239999999	EIA Diesel ^b	State & US	McDonald et al. (1)
Non-Road					
Agricultural Diesel	FIVE18	2270005000- 2270005999	EIA Diesel ^b	PADD	McDonald et al. (1)
Non-Ag Diesel	FIVE18	2270000000- 2270004999 2270006000- 2270099999	EIA Diesel ^b	PADD	McDonald et al. (1)
Gasoline (Marine)	FIVE18	2282005000- 2282005025 2282010000- 2282010025	EIA Gasoline ^a	PADD	McDonald et al. (1)
Gasoline (2-Stroke)	FIVE18	2260000000- 2260010010	EIA Gasoline ^a	PADD	McDonald et al. (1)
Gasoline (4-Stroke)	FIVE18	2265000000- 2265010010	EIA Gasoline ^a	PADD	McDonald et al. (1)
Point					
Electricity Generation					
Coal	NEI17	10100101-10100318 10100801-10100801 20100301-20100301	CEMS & EIA EGU Coal ^d	Facility & US	EPA (2)
Oil	NEI17	10100401-10100505 20100101-20100109 20100901-20100909	CEMS & EIA EGU Oil ^d	Facility & US	EPA (2)
Natural Gas	NEI17	10100601-10100712 10101001-10101002 20100201-20100209 20100702-20100707	CEMS & EIA EGU NG ^d	Facility & US	EPA (2)
Biomass	NEI17	10100901-10100912 10101101-10102101 20100801-20100809	CEMS & EIA EGU Biomass ^d	Facility & US	EPA (2)
Industrial Boilers					

Sector	Base Inventory	SCC Codes	COVID Scaling Data	Spatial Adjustment	Ref.
Coal	NEI17	10200101-10200307 10200802-10200804 39000199-39000399 39000801-39000899	EIA Industrial Coal ^e	US	Xing et al. (3)
Oil	NEI17	10200401-10200506 10500105 10500113-10500114 20200101-20200109 20200401-20200506 20200901-20200909 20201701-20201707 20400101-20400499 39000402-39000599 39900501 39901001	EIA Industrial Oil ^e	US	Xing et al. (3)
Natural Gas	NEI17	10200601-10200799 10201001-10201003 10500106-10500110 20200201-20200256 20200702-20200714 20201001-20201013 39000602-39000797 39001099 39900601-39900701	EIA Industrial NG ^e	US	Xing et al. (3)
Biomass	NEI17	10200901-10200912 10201101-10201902 20201602-20201609 39000989-39000999 39001289-39001399 39900721-39900801 39901601-39901601	EIA Industrial Biomass ^e	US	Xing et al. (3)
Commercial Boilers					
Coal	NEI17	10300101-10300306	EIA Commercial ^f	US	Xing et al. (3)
Oil	NEI17	10300401-10300505 10500205 10500213-10500214 20300101-20300109 20300301-20300401 20300901	EIA Commercial ^f	US	Xing et al. (3)

Sector	Base Inventory	SCC Codes	COVID Scaling Data	Spatial Adjustment	Ref.
Natural Gas	NEI17	10300601-10300799 10301001-10301003 10500206 10500210 20300201-20300209 20301001-20301007	EIA Commercial ^f	US	Xing et al. ⁽³⁾
Biomass	NEI17	10300811-10300912 10301101-10301303 10500209 20300701-20300809	EIA Commercial ^f	US	Xing et al. ⁽³⁾
Industrial Processes					
Chemical	NEI17	30100101-30199998 30800101-30899999 64470010-68510001	DOC Chemicals [NAICS #4246] ^g	US	--
Food	NEI17	30200101-30299998 62540023-62540024	DOC Grocery [NAICS #4244] ^g	US	--
Metals & Mining	NEI17	30300001-30599999 30900198-30999999	DOC Metals [NAICS #4235] ^g	US	--
Refinery & Bulk Terminals	NEI17	30600102-30699999 31700101-31700101 39090001-39092056 40301001-40400279 40400401-40400498 40600101-40600299 40600301-40688801 40700401-49099998	DOC Petroleum [NAICS #4247] ^g	US	--
Pulp, Paper & Construction	NEI17	30700101-30799999 31100102-31100299	DOC Lumber & Const. [NAICS #4233] ^g	US	--
Electrical Equipment	NEI17	31300500-31399999	DOC Electronics [NAICS #4236] ^g	US	--
Automotive	NEI17	31400901-31499999	DOC Motor Vehicle [NAICS #4231] ^g	US	--
Apparel	NEI17	32099997-33088801	DOC Apparel [NAICS #4243] ^g	US	--
Photographic Film	NEI17	31501001-31501002 31603001-31616006	DOC Professional Supplies [NAICS #4234] ^g	US	--
Drug Mfg.	NEI17	31502001-31503102	DOC Drug [NAICS #4242] ^g	US	--

Sector	Base Inventory	SCC Codes	COVID Scaling Data	Spatial Adjustment	Ref.
Misc. Industry	NEI17	20101020-20190099 20280001-20282599 20380001-20380001 28888801-28888801 31504001-31505002 31801001-31801030 38500101-38500110 39902001-39999999	DOC Misc. Goods [NAICS #4249] ^g	US	--
Oil & Gas Prod.	NEI17	31000101-31088811 40400300-40400340	DOC Petroleum [NAICS #4247] ^g	US	
Point VCPs					
Ind. Degreasing	VCP18	40100101-40188898	DOC Chemicals [NAICS #4246] ^g	US	5
Ind. Coatings	VCP18	40200101-40200601 40200801-40299998	DOC Chemicals [NAICS #4246] ^g	US	5
Ind. Adhesives	VCP18	40200701-40200712	DOC Chemicals [NAICS #4246] ^g	US	5
Printing Inks	VCP18	36000101-36000103 40500204-40500806	DOC Chemicals [NAICS #4246] ^g	US	5
Airports	NEI17	2265008005- 2275001000	BTS Air Carrier Traffic ^h	US	--
Railyard Equipment	NEI17	28500201-28500201	BTS Rail ^c	US	--
Area					
Industrial Boilers					
Coal	NEI17	2102001000- 2102002000	EIA Industrial Coal ^e	US	Xing et al. (3)
Oil	NEI17	2102004000- 2102005000 2102011000	EIA Industrial Oil ^e	US	Xing et al. (3)
Natural Gas	NEI17	2102006000- 2102007000 2102010000	EIA Industrial NG ^e	US	Xing et al. (3)
Biomass	NEI17	2102008000	EIA Industrial Biomass ^e	US	Xing et al. (3)
Commercial Boilers					
Coal	NEI17	2103001000- 2103002000	EIA Commercial ^f	US	Xing et al. (3)
Oil	NEI17	2103004000- 2103005000	EIA Commercial ^f	US	Xing et al. (3)

Sector	Base Inventory	SCC Codes	COVID Scaling Data	Spatial Adjustment	Ref.
		2103011000			
Natural Gas	NEI17	2103006000- 2103007000	EIA Commercial ^f	US	Xing et al. (3)
Biomass	NEI17	2103008000	EIA Commercial ^f	US	Xing et al. (3)
Residential Boilers					
Coal	NEI17	2104001000- 2104002000	EIA Residential ^l	US	Xing et al. (3)
Oil	NEI17	2104004000 2104011000	EIA Residential ^l	US	Xing et al. (3)
Natural Gas	NEI17	2104006000- 2104007000	EIA Residential ^l	US	Xing et al. (3)
Biomass	NEI17	2104008100- 2104009000	EIA Residential ^l	US	Xing et al. (3)
Industrial Processes					
Chemical	NEI17	2301000000- 2301030000 2308000000	DOC Chemicals [NAICS #4246] ^g	US	--
Food	NEI17	2302000000- 2302080002	DOC Grocery [NAICS #4244] ^g	US	--
Metals & Mining	NEI17	2304000000- 2305000000 2309000000 2325000000- 2325060000	DOC Metals [NAICS #4235] ^g	US	--
Pulp, Paper & Construction	NEI17	2307000000 2311010000- 2311030000	DOC Lumber & Const. [NAICS #4233] ^g	US	--
Machinery	NEI17	2312000000	DOC Machinery [NAICS #4238] ^g	US	--
Misc. Industry	NEI17	2306010000- 2306010100 2399000000- 2399010000	DOC Misc. Goods [NAICS #4249] ^g	US	--
Oil & Gas (onshore)	FOG18 & NEI17	2310000220- 2310001000 2310010100- 2310011600	DrillingInfo ^l for FOG emissions Average scaling of DOC Petroleum [NAICS	US	Francoeur et al. (4)

Sector	Base Inventory	SCC Codes	COVID Scaling Data	Spatial Adjustment	Ref.
		2310020000- 2310021803 2310023000- 2310111701 2310121100- 2310121700 2310300220- 2310421603	#4247 ⁹ & EIA Total Natural Gas Consumption ^{d,e,f,i} for NEI17 emissions		
Oil & Gas (offshore)	NEI17	2310002000- 2310002421 2310012000- 2310012526 2310022000- 2310022506 2310112401 2310122100	DOC Petroleum [NAICS #4247] ⁹	US	--
Storage & Transport	NEI17	2505010000- 2525000000	DOC Petroleum [NAICS #4247] ⁹	US	--
Agriculture					
Crop	NEI17	2801000000- 2801000008 2801520000- 2801700099	Unscaled	--	--
Burning	NEI17	2801500000- 2801500600	Unscaled	--	--
Livestock	NEI17	2805001000- 2807030000	Unscaled	--	--
Area VCPs					
Architectural Coatings	VCP18	2401001000 2460400000- 2460500000	Retail Building Materials [NAICS #4441] ^k	US	McDonald et al. ⁽⁵⁾
Ind. Coatings	VCP18	2401005000- 2401200000	DOC Chemicals [NAICS #4246] ⁹	US	McDonald et al. ⁽⁵⁾
Ind. Degreasing	VCP18	2415000000	DOC Chemicals [NAICS #4246] ⁹	US	McDonald et al. ⁽⁵⁾
Printing Inks	VCP18	2425000000- 2425040000	DOC Chemicals [NAICS #4246] ⁹	US	McDonald et al. ⁽⁵⁾
Ind. Adhesives	VCP18	2440020000	DOC Chemicals [NAICS #4246] ⁹	US	McDonald et al. ⁽⁵⁾

Sector	Base Inventory	SCC Codes	COVID Scaling Data	Spatial Adjustment	Ref.
Personal Care	VCP18	2460100000	Retail Health & Personal Care [NAICS #446] less Retail Pharmacy & Drug Stores [NAICS #44611] ^k	US	McDonald et al. ⁽⁵⁾
Cleaning	VCP18	2420000000- 2420000999 2460200000	Retail Health & Personal Care [NAICS #446] less Retail Pharmacy & Drug Stores [NAICS #44611] ^k	US	McDonald et al. ⁽⁵⁾
Consumer Adhesives	VCP18	2460600000	Retail Building Materials [NAICS #4441] ^k	US	McDonald et al. ⁽⁵⁾
Consumer Pesticides	VCP18	2460800000	Unscaled	US	McDonald et al. ⁽⁵⁾
Agricultural Pesticides	VCP18	2461800001- 2461850000	Unscaled	US	McDonald et al. ⁽⁵⁾
Comm. Marine Diesel	NEI17	2280002101- 2280002204	DOC Shipping Weight ^l	US	--
Comm. Marine Res.	NEI17	2280003103- 2280003204	DOC Shipping Weight ^l	US	--
Locomotives	NEI17	2285002006- 2285002010	BTS Rail ^c	US	--
Waste	NEI17	2601000000- 2680003000	Unscaled	US	--
Dust	NEI17	2294000000- 2296000000	Unscaled	US	--
Miscellaneous	NEI17	2810003000- 2862000000	DOC Misc. Goods [NAICS #4249] ^g	US	--

a. Monthly gasoline sales data can be found from the US Energy Information Administration at:

https://www.eia.gov/dnav/pet/pet_cons_prim_a_EPM0_P00_Mgalpd_m.htm

b. Monthly diesel sales data can be found from the US Energy Information Administration at:

https://www.eia.gov/dnav/pet/pet_cons_prim_a_EPD2_P00_Mgalpd_m.htm

c. Monthly Carloads + Intermodal Units from the US Bureau of Transportation Statistics: <https://data.bts.gov/stories/s/m9eb-yevh>

d. Continuous emissions monitoring data is only used for NO_x and SO₂. Other pollutants are scaled using EIA data. Continuous emissions monitoring data can be found at: <https://campd.epa.gov/data>. Monthly fuel consumption for the electricity power sector can be found from the US Energy Information Administration in Table 2.6 at: <https://www.eia.gov/totalenergy/data/monthly/index.php>

e. Monthly fuel consumption by the industrial sector can be found from the US Energy Information Administration in Table 2.4 at:

<https://www.eia.gov/totalenergy/data/monthly/index.php>

f. All commercial fuel scalings use the total fuel consumption (Coal + NG + Oil + Biomass) from the commercial sector to calculate the scaling factor. Monthly fuel consumption by the commercial sector can be found from the US Energy Information Administration in Table 2.3 at:

<https://www.eia.gov/totalenergy/data/monthly/index.php>

- g. Monthly wholesale trade data from the US Census Bureau can be found at: <https://www.census.gov/wholesale/index.html>
- h. Monthly Revenue Miles Flown (Passenger + Cargo) from the US Bureau of Transportation Statistics at: <https://www.transtats.bts.gov/TRAFFIC/>
- i. All residential fuel scalings use the total fuel consumption (Coal + NG + Oil + Biomass) from the residential sector to calculate the scaling factor. Monthly fuel consumption by the residential sector can be found from the US Energy Information Administration in Table 2.2 at: <https://www.eia.gov/totalenergy/data/monthly/index.php>
- j. Monthly Shipping Weight (Imports+Exports) from the US Census Bureau can be found at: <https://www.census.gov/data/developers/data-sets/international-trade.html>
- k. Monthly Retail Sales from the US Census Bureau can be found at: <https://www.census.gov/retail/index.html>
- l. Well-level production and drilling data from Enverus DrillingInfo database.

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