

but are not limited to, by-product recovery coke oven battery combustion stacks, blast furnace stoves, boilers, process heaters, reheat furnaces, annealing furnaces, flame suppression, ladle reheaters, and other miscellaneous combustion sources.

(b) You must report CO₂ emissions from flares according to the procedures in § 98.253(b)(1) of subpart Y (Petroleum Refineries) of this part except you must use the default CO₂ emission factors for coke oven gas and blast furnace gas from Table C-1 of subpart C in Equation Y-1 of subpart Y of this part. You must report CH₄ and N₂O emissions from flares according to the requirements in § 98.33(c)(2) using the emission factors for coke oven gas and blast furnace gas in Table C-2 of subpart C of this part.

(c) You must report process CO₂ emissions from each taconite indurating furnace; basic oxygen furnace; non-recovery coke oven battery combustion stack; coke pushing process; sinter process; EAF; argon-oxygen decarburization vessel; and direct reduction furnace by following the procedures in this subpart.

§ 98.173 Calculating GHG emissions.

You must calculate and report the annual process CO₂ emissions from each taconite indurating furnace, basic oxygen furnace, non-recovery coke oven battery, sinter process, EAF, argon-oxygen decarburization vessel, and direct reduction furnace using the

procedures in either paragraph (a) or (b) of this section. Calculate and report the annual process CO₂ emissions from the coke pushing process according to paragraph (c) of this section.

(a) Calculate and report under this subpart the process CO₂ emissions by operating and maintaining CEMS according to the Tier 4 Calculation Methodology in § 98.33(a)(4) and all associated requirements for Tier 4 in subpart C of this part (General Stationary Fuel Combustion Sources).

(b) Calculate and report under this subpart the process CO₂ emissions using the procedure in paragraph (b)(1) or (b)(2) of this section.

(1) *Carbon mass balance method.* Calculate the annual mass emissions of CO₂ for the process as specified in paragraphs (b)(1)(i) through (b)(1)(vii) of this section. The calculations are based on the annual mass of inputs and outputs to the process and an annual analysis of the respective weight fraction of carbon as determined according to the procedures in § 98.174(b). If you have a process input or output other than CO₂ in the exhaust gas that contains carbon that is not included in Equations Q-1 through Q-7 of this section, you must account for the carbon and mass rate of that process input or output in your calculations according to the procedures in § 98.174(b)(5).

(i) For taconite indurating furnaces, estimate CO₂ emissions using Equation Q-1 of this section.

$$CO_2 = \frac{44}{12} * \left[(F_s) * (C_{sf}) + (F_g) * (C_{gf}) * \frac{MW}{MVC} * 0.001 + (F_l) * (C_{lf}) * 0.001 + (O) * (C_o) - (P) * (C_p) - (R) * (C_R) \right] \quad (\text{Eq. Q-1})$$

Where:

CO₂ = Annual CO₂ mass emissions from the taconite indurating furnace (metric tons).

44/12 = Ratio of molecular weights, CO₂ to carbon.

(F_s) = Annual mass of the solid fuel combusted (metric tons).

(C_{sf}) = Carbon content of the solid fuel, from the fuel analysis (percent by weight, expressed as a decimal fraction, e.g., 95% = 0.95).

(F_g) = Annual volume of the gaseous fuel combusted (scf).

(C_{gf}) = Average carbon content of the gaseous fuel, from the fuel analysis results (kg C per kg of fuel).

MW = Molecular weight of the gaseous fuel (kg/kg-mole).

MVC = Molar volume conversion factor (849.5 scf per kg-mole at standard conditions).

0.001 = Conversion factor from kg to metric tons.

(F_l) = Annual volume of the liquid fuel combusted (gallons).

(C_{lf}) = Carbon content of the liquid fuel, from the fuel analysis results (kg C per gallon of fuel).

§ 98.173

40 CFR Ch. I (7-1-10 Edition)

(O) = Annual mass of greenball (taconite) pellets fed to the furnace (metric tons).
 (C_O) = Carbon content of the greenball (taconite) pellets, from the carbon analysis results (percent by weight, expressed as a decimal fraction).
 (P) = Annual mass of fired pellets produced by the furnace (metric tons).
 (C_P) = Carbon content of the fired pellets, from the carbon analysis results (percent by weight, expressed as a decimal fraction).

(R) = Annual mass of air pollution control residue collected (metric tons).
 (C_R) = Carbon content of the air pollution control residue, from the carbon analysis results (percent by weight, expressed as a decimal fraction).
 (ii) For basic oxygen process furnaces, estimate CO₂ emissions using Equation Q-2 of this section.

$$CO_2 = \frac{44}{12} * \left[(Iron) * (C_{Iron}) + (Scrap) * (C_{Scrap}) + (Flux) * (C_{Flux}) + (Carbon) * (C_{Carbon}) - (Steel) * (C_{Steel}) - (Slag) * (C_{Slag}) - (R) * (C_R) \right] \quad \text{(Eq. Q-2)}$$

Where:

CO₂ = Annual CO₂ mass emissions from the basic oxygen furnace (metric tons).
 44/12 = Ratio of molecular weights, CO₂ to carbon.
 (Iron) = Annual mass of molten iron charged to the furnace (metric tons).
 (C_{Iron}) = Carbon content of the molten iron, from the carbon analysis results (percent by weight, expressed as a decimal fraction).
 (Scrap) = Annual mass of ferrous scrap charged to the furnace (metric tons).
 (C_{Scrap}) = Carbon content of the ferrous scrap, from the carbon analysis results (percent by weight, expressed as a decimal fraction).
 (Flux) = Annual mass of flux materials (e.g., limestone, dolomite) charged to the furnace (metric tons).
 (C_{Flux}) = Carbon content of the flux materials, from the carbon analysis results (percent by weight, expressed as a decimal fraction).

(Carbon) = Annual mass of carbonaceous materials (e.g., coal, coke) charged to the furnace (metric tons).
 (C_{Carbon}) = Carbon content of the carbonaceous materials, from the carbon analysis results (percent by weight, expressed as a decimal fraction).
 (Steel) = Annual mass of molten raw steel produced by the furnace (metric tons).
 (C_{Steel}) = Carbon content of the steel, from the carbon analysis results (percent by weight, expressed as a decimal fraction).
 (Slag) = Annual mass of slag produced by the furnace (metric tons).
 (C_{Slag}) = Carbon content of the slag, from the carbon analysis (percent by weight, expressed as a decimal fraction).
 (R) = Annual mass of air pollution control residue collected (metric tons).
 (C_R) = Carbon content of the air pollution control residue, from the carbon analysis results (percent by weight, expressed as a decimal fraction).

(iii) For non-recovery coke oven batteries, estimate CO₂ emissions using Equation Q-3 of this section.

$$CO_2 = \frac{44}{12} * \left[(Coal) * (C_{Coal}) - (Coke) * (C_{Coke}) - (R) * (C_R) \right] \quad \text{(Eq. Q-3)}$$

Where:

CO₂ = Annual CO₂ mass emissions from the non-recovery coke oven battery (metric tons).
 44/12 = Ratio of molecular weights, CO₂ to carbon.
 (Coal) = Annual mass of coal charged to the battery (metric tons).

(C_{Coal}) = Carbon content of the coal, from the carbon analysis results (percent by weight, expressed as a decimal fraction).
 (Coke) = Annual mass of coke produced by the battery (metric tons).
 (C_{Coke}) = Carbon content of the coke, from the carbon analysis results (percent by weight, expressed as a decimal fraction).

Environmental Protection Agency

§ 98.173

(R) = Annual mass of air pollution control residue collected (metric tons).
 (C_R) = Carbon content of the air pollution control residue, from the carbon analysis results (percent by weight, expressed as a decimal fraction).

(iv) For sinter processes, estimate CO₂ emissions using Equation Q-4 of this section.

$$CO_2 = \frac{44}{12} * [(F_g) * (C_{gf}) * \frac{MW}{MVC} * 0.001 + (Feed) * (C_{Feed}) - (Sinter) * (C_{Sinter}) - (R) * (C_R)] \quad (\text{Eq. Q-4})$$

Where:

CO₂ = Annual CO₂ mass emissions from the sinter process (metric tons).
 44/12 = Ratio of molecular weights, CO₂ to carbon.
 (F_g) = Annual volume of the gaseous fuel combusted (scf).
 (C_{gf}) = Carbon content of the gaseous fuel, from the fuel analysis results (kg C per kg of fuel).
 MW = Molecular weight of the gaseous fuel (kg/kg-mole).
 MVC = Molar volume conversion factor (849.5 scf per kg-mole at standard conditions).
 0.001 = Conversion factor from kg to metric tons.
 (Feed) = Annual mass of sinter feed material (metric tons).

(C_{Feed}) = Carbon content of the mixed sinter feed materials that form the bed entering the sintering machine, from the carbon analysis results (percent by weight, expressed as a decimal fraction).
 (Sinter) = Annual mass of sinter produced (metric tons).
 (C_{Sinter}) = Carbon content of the sinter pellets, from the carbon analysis results (percent by weight, expressed as a decimal fraction).
 (R) = Annual mass of air pollution control residue collected (metric tons).
 (C_R) = Carbon content of the air pollution control residue, from the carbon analysis results (percent by weight, expressed as a decimal fraction).

(v) For EAFs, estimate CO₂ emissions using Equation Q-5 of this section.

$$CO_2 = \frac{44}{12} * [(Iron) * (C_{Iron}) + (Scrap) * (C_{Scrap}) + (Flux) * (C_f) + (Electrode) * (C_{Electrode}) + (Carbon) * (C_c) - (Steel) * (C_{Steel}) - (Slag) * (C_{Slag}) - (R) * (C_R)] \quad (\text{Eq. Q-5})$$

Where:

CO₂ = Annual CO₂ mass emissions from the EAF (metric tons).
 44/12 = Ratio of molecular weights, CO₂ to carbon.
 (Iron) = Annual mass of direct reduced iron (if any) charged to the furnace (metric tons).
 (C_{Iron}) = Carbon content of the direct reduced iron, from the carbon analysis results (percent by weight, expressed as a decimal fraction).
 (Scrap) = Annual mass of ferrous scrap charged to the furnace (metric tons).
 (C_{Scrap}) = Carbon content of the ferrous scrap, from the carbon analysis results (percent by weight, expressed as a decimal fraction).

(Flux) = Annual mass of flux materials (e.g., limestone, dolomite) charged to the furnace (metric tons).
 (C_{Flux}) = Carbon content of the flux materials, from the carbon analysis results (percent by weight, expressed as a decimal fraction).
 (Electrode) = Annual mass of carbon electrode consumed (metric tons).
 (C_{Electrode}) = Carbon content of the carbon electrode, from the carbon analysis results (percent by weight, expressed as a decimal fraction).
 (Carbon) = Annual mass of carbonaceous materials (e.g., coal, coke) charged to the furnace (metric tons).
 (C_{Carbon}) = Carbon content of the carbonaceous materials, from the carbon analysis results (percent by weight, expressed as a decimal fraction).

(Steel) = Annual mass of molten raw steel produced by the furnace (metric tons).

(C_{Steel}) = Carbon content of the steel, from the carbon analysis results (percent by weight, expressed as a decimal fraction).

(Slag) = Annual mass of slag produced by the furnace (metric tons).

(C_{Slag}) = Carbon content of the slag, from the carbon analysis results (percent by weight, expressed as a decimal fraction).

(R) = Annual mass of air pollution control residue collected (metric tons).

(C_R) = Carbon content of the air pollution control residue, from the carbon analysis results (percent by weight, expressed as a decimal fraction).

(vi) For argon-oxygen decarburization vessels, estimate CO₂ emissions using Equation Q-6 of this section.

$$CO_2 = \frac{44}{12} * (Steel) * [(C_{Steelin}) - (C_{Steelout})] - (R) * (C_R) \quad (\text{Eq. Q-6})$$

Where:

CO₂ = Annual CO₂ mass emissions from the argon-oxygen decarburization vessel (metric tons).

44/12 = Ratio of molecular weights, CO₂ to carbon.

(Steel) = Annual mass of molten steel charged to the vessel (metric tons).

(C_{Steelin}) = Carbon content of the molten steel before decarburization, from the carbon analysis results (percent by weight, expressed as a decimal fraction).

(C_{Steelout}) = Carbon content of the molten steel after decarburization, from the carbon analysis results (percent by weight, expressed as a decimal fraction).

(R) = Annual mass of air pollution control residue collected (metric tons).

(C_R) = Carbon content of the air pollution control residue, from the carbon analysis results (percent by weight, expressed as a decimal fraction).

(vii) For direct reduction furnaces, estimate CO₂ emissions using Equation Q-7 of this section.

$$CO_2 = \frac{44}{12} * \left[(F_g) * (C_{gf}) * \frac{MW}{MVC} * 0.001 + (Ore) * (C_{Ore}) \right. \\ \left. + (Carbon) * (C_{Carbon}) + (Other) * (C_{Other}) \right. \\ \left. - (Iron) * (C_{Iron}) - (NM) * (C_{NM}) - (R) * (C_R) \right] \quad (\text{Eq. Q-7})$$

Where:

CO₂ = Annual CO₂ mass emissions from the direct reduction furnace (metric tons).

44/12 = Ratio of molecular weights, CO₂ to carbon.

(F_g) = Annual volume of the gaseous fuel combusted (scf).

(C_{gf}) = Carbon content of the gaseous fuel, from the fuel analysis results (kg C per kg of fuel).

MW = Molecular weight of the gaseous fuel (kg/kg-mole).

MVC = Molar volume conversion factor (849.5 scf per kg-mole at standard conditions).

0.001 = Conversion factor from kg to metric tons.

(Ore) = Annual mass of iron ore or iron ore pellets fed to the furnace (metric tons).

(C_{Ore}) = Carbon content of the iron ore or iron ore pellets, from the carbon analysis results (percent by weight, expressed as a decimal fraction).

(Carbon) = Annual mass of carbonaceous materials (e.g., coal, coke) charged to the furnace (metric tons).

(C_{Carbon}) = Carbon content of the carbonaceous materials, from the carbon analysis results (percent by weight, expressed as a decimal fraction).

(Other) = Annual mass of other materials charged to the furnace (metric tons).

(C_{Other}) = Average carbon content of the other materials charged to the furnace, from the carbon analysis results (percent by weight, expressed as a decimal fraction).

Environmental Protection Agency

§ 98.174

- (Iron) = Annual mass of iron produced (metric tons).
- (C_{Iron}) = Carbon content of the iron, from the carbon analysis results (percent by weight, expressed as a decimal fraction).
- (NM) = Annual mass of non-metallic materials produced by the furnace (metric tons).
- (C_{NM}) = Carbon content of the non-metallic materials, from the carbon analysis results (percent by weight, expressed as a decimal fraction).
- (R) = Annual mass of air pollution control residue collected (metric tons).
- (C_R) = Carbon content of the air pollution control residue, from the carbon analysis results (percent by weight, expressed as a decimal fraction).

(2) *Site-specific emission factor method.*
 Conduct a performance test and meas-

ure CO₂ emissions from all exhaust stacks for the process and measure either the feed rate of materials into the process or the production rate during the test as described in paragraphs (b)(2)(i) through (b)(2)(iv) of this section.

(i) You must measure the process production rate or process feed rate, as applicable, during the performance test according to the procedures in §98.174(c)(5) and calculate the average rate for the test period in metric tons per hour.

(ii) You must calculate the hourly CO₂ emission rate using Equation Q-8 of this section and determine the average hourly CO₂ emission rate for the test.

$$CO_2 = 5.18 \times 10^{-7} \star C_{CO_2} \star Q \star \left(\frac{100 - \%H_2O}{100} \right) \quad (\text{Eq. Q-8})$$

Where:

- CO₂ = CO₂ mass emission rate, corrected for moisture (metric tons/hr).
- 5.18 × 10⁻⁷ = Conversion factor (metric tons/scf-% CO₂).
- C_{CO₂} = Hourly CO₂ concentration, dry basis (% CO₂).
- Q = Hourly stack gas volumetric flow rate (scfh).
- %H₂O = Hourly moisture percentage in the stack gas.

(iii) You must calculate a site-specific emission factor for the process in metric tons of CO₂ per metric ton of feed or production, as applicable, by dividing the average hourly CO₂ emission rate during the test by the average hourly feed or production rate during the test.

(iv) You must calculate CO₂ emissions for the process by multiplying the emission factor by the total amount of feed or production, as applicable, for the reporting period.

(c) You must determine emissions of CO₂ from the coke pushing process in mtCO₂e by multiplying the metric tons of coal charged to the coke ovens during the reporting period by 0.008.

(d) If GHG emissions from a taconite indurating furnace, basic oxygen furnace, non-recovery coke oven battery, sinter process, EAF, argon-oxygen

decarburization vessel, or direct reduction furnace are vented through the same stack as any combustion unit or process equipment that reports CO₂ emissions using a CEMS that complies with the Tier 4 Calculation Methodology in subpart C of this part (General Stationary Fuel Combustion Sources), then the calculation methodology in paragraph (b) of this section shall not be used to calculate process emissions. The owner or operator shall report under this subpart the combined stack emissions according to the Tier 4 Calculation Methodology in §98.33(a)(4) and all associated requirements for Tier 4 in subpart C of this part (General Stationary Fuel Combustion Sources).

§98.174 Monitoring and QA/QC requirements.

(a) If you operate and maintain a CEMS that measures CO₂ emissions consistent with subpart C of this part, you must meet the monitoring and QA/QC requirements of §98.34(c).

(b) If you determine CO₂ emissions using the carbon mass balance procedure in §98.173(b)(1), you must:

(1) Except as provided in paragraph (b)(4) of this section, determine the