Draft Regulations

Draft Regulation

Youth Protection Act
(R.S.Q., c. P-34.1)

Financial assistance to facilitate tutorship to a child
— Amendment

Notice is hereby given, in accordance with sections 10 and 11 of the Regulations Act (R.S.Q., c. R-18.1) and the second paragraph of section 132 of the Youth Protection Act (R.S.Q., c. P-34.1), that the Regulation to amend the Regulation respecting financial assistance to facilitate tutorship to a child, appearing below, may be made by the Government on the expiry of 60 days following this publication.

The draft Regulation corrects an error that occurred when the Regulation was made.

The Regulation has no impact on enterprises, including small and medium-sized businesses.

Further information may be obtained by contacting Chantal Maltais, Direction générale des services sociaux, Ministère de la Santé et des Services sociaux, 1075, chemin Sainte-Foy, 6e étage, Québec (Québec) G1S 2M1; telephone: 418 266-6840; fax: 418 266-6807; e-mail: chantal.maltais@msss.gouv.qc.ca

Any person wishing to comment on the draft Regulation is requested to submit written comments within the 45-day period to the Minister of Health and Social Services, 1075, chemin Sainte-Foy, 15e étage, Québec (Québec) G1S 2M1.

Yves Bolduc,
Minister of Health
and Social Services

Lise Thériault,
Minister for Social Services

Regulation to amend the Regulation respecting financial assistance to facilitate tutorship to a child[*]

Youth Protection Act
(R.S.Q., c. P-34.1, s. 132, par. *i*)

1. The Regulation respecting financial assistance to facilitate tutorship to a child is amended

(1) by replacing “20” in the first paragraph of section 4 by “21”;

(2) by replacing “20” in subparagraph 2 of the first paragraph of section 10 by “21”.

2. This Regulation comes into force on the fifteenth day following the date of its publication in the *Gazette officielle du Québec*.

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Draft Regulation

Erratum

Environment Quality Act
(R.S.Q., c. Q-2)

Mandatory reporting of certain emissions of contaminants into the atmosphere
— Amendments

Notice is hereby given, in accordance with sections 10 and 11 of the Regulations Act (R.S.Q., c. R-18.1) and sections 2.2 and 46.2 of the Environment Quality Act (R.S.Q., c. Q-2), that the Regulation to amend the Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere, appearing below, may be made by the Minister of Sustainable Development, Environment and Parks on the expiry of 60 days following this publication.

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[*] The Regulation respecting financial assistance to facilitate tutorship to a child, made by Order in Council 591-2008 dated 11 June 2008 (2008, *G.O.* 2, 2459), has not been amended.

The purpose of the draft Regulation is to make the reporting of greenhouse gas emissions compulsory. To that end, it determines the thresholds at which emitters must file an emissions report with the Minister, along with a verification report completed by an accredited organization. It also specifies the information that must be included, and the calculation methods that must be used to measure emissions of greenhouse gases. In addition, the draft Regulation provides that the obligation to use the prescribed calculation methods and have emissions reports verified applies only as of report year 2011.

Further information may be obtained by contacting Vicky Leblond, Direction des politiques de la qualité de l'atmosphère, Ministère du Développement durable, de l'Environnement et des Parcs; telephone: 418 521-3813, extension 4386; e-mail: vicky.leblond@mddep.gouv.qc.ca; fax: 418 646-0001.

Any person wishing to comment on the draft Regulation is requested to submit written comments within the 60-day period to Michel Goulet, Director, Direction des politiques de la qualité de l'atmosphère, Ministère du Développement durable, de l'Environnement et des Parcs, édifice Marie-Guyart, 675, boulevard René-Lévesque Est, 5^e^ étage, boîte 30, Québec (Québec) G1R 5V7.

LINE BEAUCHAMP,
Minister of Sustainable Development,
Environment and Parks

Regulation to amend the Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere*

Environment Quality Act
(R.S.Q., c. Q-2, ss. 2.2, 46.1 and 46.2)

1. The Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere is amended in section 1 by replacing "in Schedule A" in the first paragraph by "in Schedules A and A.1".

2. Section 2 is amended by inserting "and of drawing up an inventory of certain contaminants emitted into the atmosphere," after "toxic pollution,".

3. Section 3 is amended

(1) by inserting the following before paragraph 1:

"(0.1) "biomass fuels" means any fuel whose entire heat generating capacity is derived from biomass;

(0.2) "biomass" means a non-fossilized plant or part of a plant, an animal carcass or part of an animal, manure, a micro-organism and any other product derived from such matters;

(0.3) "standard conditions" means a temperature of 20 °C and a pressure of 101.325 kPa;

(0.4) "flexigas" means a gaseous fuel with a low calorific value produced through the gasification of coke;";

(2) by inserting the following after paragraph 1:

"(1.1) "associated gas" means a natural gas which is found in association with crude oil, either dissolved in crude oil or as a cap of free gas above the crude oil;";

(3) by striking out "the Minister under the provisions of this Regulation, or to the Minister of the Environment of Canada under subsection 5 of section 46 of the Canadian Environmental Protection Act (1999) (S.C. 1999, c. 33)" in paragraph 4.

4. The heading of Division II is replaced by the following: "STANDARDS FOR THE MANDATORY REPORTING OF EMISSIONS OF CERTAIN CONTAMINANTS RESPONSIBLE FOR TOXIC POLLUTION, ACID RAIN AND SMOG INTO THE ATMOSPHERE".

5. Section 4 is amended

(1) by inserting "by electronic means" after "communicate to the Minister" in the first paragraph;

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* The Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere, approved by Minister's Order M.O. 2007 dated 26 September 2007 (2007, *G.O.* 2, 2833), has not been amended since its making.

(2) by replacing "each of them" in the last paragraph by "each establishment that exceeds the reporting threshold";

(3) by adding the following at the end:

"In addition, when an enterprise, a facility or an establishment changes operator during a year, the report must be made by the new operator. The previous operator must provide the new operator with all the data required for the report for the period of the year for which the enterprise, facility or establishment was under his or her responsibility.".

6. Section 5 is amended by inserting "by electronic means" after "transmit to the Minister" in the first paragraph.

7. Section 6 is amended by replacing subparagraphs 1 to 6 of the second paragraph by the following:

"(1) a continuous emission monitoring and recording system;

(2) a mass balance;

(3) a technical calculation using an emission factor published in scientific documents; or

(4) a technical calculation using an emission factor resulting from an emissions sampling.".

8. The following is inserted after section 6:

"DIVISION II.1
STANDARDS FOR THE MANDATORY REPORTING OF CERTAIN EMISSIONS OF GREENHOUSE GASES INTO THE ATMOSPHERE

6.1. Every person or municipality operating an enterprise, facility or establishment that, during a calendar year, emits into the atmosphere greenhouse gases mentioned in Schedule A.1 in a quantity equal to or greater than 10,000 metric tons CO_2 equivalent must report those emissions to the Minister in accordance with this Division until such time as the emissions have been below the reporting threshold for 3 consecutive years.

However, when an emitter referred to in the first paragraph is required to cover greenhouse gas emissions pursuant to section 46.6 of the Environment Quality Act (R.S.Q., c. Q-2) for a period determined pursuant to that section, and where the last year of the report referred to in the first paragraph occurs during that period, the emitter must report greenhouse gas emissions up to the end of that period.

If an enterprise has several establishments, a separate report must be made for each establishment that exceeds the reporting threshold. If an establishment has more than 1 facility, the data pertaining to each facility must be identified separately.

In addition, when an enterprise, a facility or an establishment changes operator during a year, the declaration must be made by the new operator. The previous operator must provide the new operator with all the data required for the report for the period of the year for which the enterprise, facility or establishment was under his or her responsibility.

For the purposes of this Regulation with respect to greenhouse gas emissions, the person or municipality operating an enterprise, a facility or an establishment that acquires electricity produced outside Québec for its own consumption or for sale in Québec is considered an emitter.

6.2. An emitter referred to in section 6.1 must, not later than 1 June each year, communicate electronically to the Minister a greenhouse gas emissions report for the preceding calendar year, including

(1) the total quantity of the emitter's CO_2 equivalent greenhouse gas emissions, calculated using the following equation:

$$CO_2e = \sum_{i=1}^{n} GHG_i \times GWP_i$$

Where:

CO_2e = Annual greenhouse gas emissions, in metric tons of carbon dioxide equivalent;

GHG_i = Annual emissions of each greenhouse gas emitted, in metric tons;

GWP_i = Global warming potential indicated in Schedule A.1 for each greenhouse gas emitted;

n = Number of greenhouse gases emitted;

i = Type of greenhouse gas emitted.

The total quantity of CO_2 equivalent calculated pursuant to this subparagraph must be rounded up to the next highest whole number;

(2) the quantity of emissions of each type of greenhouse gas referred to in Schedule A.1 attributable to the operation of each type of enterprise, facility and establishment and, where applicable, attributable to the pursuit of each type of activity or the use of each type of process or equipment, excluding CO_2 emissions attributable to the combustion of biomass or biomass fuels and those that have been captured, stored or eliminated;

(3) all information prescribed in Schedule A.2 concerning the type of the emitter's enterprise, facility or establishment and, where applicable, the type of activity pursued and the type of process or equipment used;

(4) the total quantity of CO_2 emissions attributable to the combustion of biomass and biofuels;

(5) the total quantity of CO_2 emissions that is captured, stored, re-used, eliminated or transferred out of the establishment, the quantity of emissions generated by each operation and the location of each operating or transfer site;

(6) the calculation methods used in accordance with section 6.3 and, where applicable, the quantity of greenhouse gas emissions in CO_2 equivalent and the emission sources for which a calculation method was used pursuant to the second paragraph of that section;

(7) the emission factors used.

The greenhouse gas emissions report referred to in the first paragraph must be signed by the person responsible for the report at the enterprise, facility or establishment, who must also attest to the veracity of the information communicated.

6.3. The quantities of greenhouse gas emissions reported under the first paragraph of section 6.2 must be calculated using one of the calculation methods prescribed in Schedule A.2 corresponding to the type of enterprise, facility or establishment operated and, where applicable, the type of activity pursued and the process or equipment used.

Notwithstanding the first paragraph, an emitter may use one of the calculation or assessment methods referred to in the second paragraph of section 6

(1) to calculate the greenhouse gas emissions from one or more sources of emissions when the emissions attributable to them represent no more than 3% of the emitter's total emissions in CO_2 equivalent, up to a maximum of 20,000 metric tons CO_2 equivalent; or

(2) if no calculation method is prescribed in Schedule A.2 for the type of enterprise, facility or establishment operated, for the type of activity pursued, for the type of process or equipment used or for the type of greenhouse gas emitted.

The emitter must use the same calculation methods for each annual report.

Notwithstanding the second and third paragraphs, when the emitter's enterprise, facility or establishment is equipped with a continuous emission monitoring and recording system to measure the parameters needed to calculate greenhouse gas emissions or when such a system is installed during their operation, the emitter must used use the calculation methods applicable to that system.

6.4. An emitter referred to in section 6.1 must submit, with the information communicated pursuant to section 6.2, the following information:

(1) the name and address of the enterprise, facility or establishment as well as the name of and contact information for its representative;

(2) the emitter's telephone and fax numbers and electronic address;

(3) the business number assigned to the emitter under the Act respecting the legal publicity of sole proprietorships, partnerships and legal persons (R.S.Q., c. P-45) as well as the ID number assigned under the National Pollutant Release Inventory of the Government of Canada;

(4) the type of enterprise, facility or establishment operated and, where applicable, the activities pursued and processes and equipment used as well as, where applicable, the six-digit code under the North American Industry Classification System (NAICS Canada);

(5) the name of and contact information for the person responsible for the greenhouse gas emissions report for the enterprise, facility or establishment.

6.5. An emitter whose annual greenhouse gas emissions report includes one or more errors or omissions must, as soon as possible, communicate a revised emissions report electronically to the Minister, along with a notice of correction detailing

(1) the difference between the initial report and revised report;

(2) the circumstances that led to the errors or omissions and, where applicable, the corrections made;

(3) the quantity of greenhouse gas emissions represented by the errors or omissions, calculated using the equation referred to in subparagraph 1 of the first paragraph of section 6.7.

6.6. The greenhouse gas emissions report of any emitter who, in accordance with section 6.2, reports annual emissions equal to or greater than 25,000 metric tons CO_2 equivalent, excluding CO_2 emissions attributable to the combustion of biomass and biofuels, must include a verification report carried out by an organization accredited to ISO 14065 by a member of the International Accreditation Forum.

The emitter must have the annual report verified by a verifying organization that

(1) has not acted as a consultant to the emitter for the quantification or greenhouse gas emissions report during the 3 preceding years; and

(2) has not verified more than 6 consecutive annual reports, unless at least 3 years have elapsed since the last verification.

An emitter must have the emitter's annual report verified until such time as the emitter's greenhouse gas emissions fall below the verification threshold provided for in the first paragraph for 3 consecutive years.

Notwithstanding the third paragraph, where the emitter is required to cover greenhouse gas emissions pursuant to section 46.6 of the Environment Quality Act for a period determined pursuant to that section, and where the last year of verification referred to in the first paragraph occurs during that period, the emitter must have the greenhouse gas emissions reports verified up to the end of that period.

6.7. A revised emissions report referred to in section 6.5 must include a verification report completed in accordance with this Regulation where

(1) the emissions initially reported were equal to or greater than 25,000 metric tons CO_2 equivalent and where the errors or omissions represented over 5% of those emissions based on the following equation:

$$PE = \left(\frac{SEO}{TER} \times 100 \right)$$

Where:

PE = Percentage of error;

SEO = Sum of CO_2 equivalent emissions erroneously calculated or omitted, in metric tons;

TER = Total CO_2 equivalent emissions initially reported, in metric tons; or

(2) after correction of the errors or omissions, the total greenhouse gas emissions are equal to or greater than 25,000 metric tons CO_2 equivalent.

In the case referred to in subparagraph 2 of the first paragraph, the verification report for the emissions report must also cover the initial emissions report.

6.8. The verification of an initial or revised greenhouse gas emissions report must

(1) be carried out in accordance with the ISO 14064-3 standard and using procedures that allow a reasonable level of assurance within the meaning of that standard;

(2) include at least 1 visit of the enterprise, facility or establishment covered by the report by the verifier designated by the verification organization.

6.9. In addition to the information prescribed by the standards ISO 14064-3 and ISO 14065, the verification report must include

(1) the name of and contact information for the verification organization as well as the name of and contact information for the verifier designated by the organization to carry out the verification;

(2) the name of and contact information for the member of the International Accreditation Forum that accredited the verification organization, and the date of the accreditation;

(3) the dates of the period during which the verification took place and the date of any visit to the enterprise, facility or establishment;

(4) a description of any error or omission observed in the emissions report or relating to the data, information or methods used;

(5) an assessment of the errors or omissions referred to in paragraph 4, calculated using the equation referred to in subparagraph 1 of the first paragraph of section 6.7;

(6) where applicable, the corrections made to the emissions report following the verification;

(7) the total quantity of the emitter's CO_2 equivalent emissions for the report year, as well as the total quantity of CO_2 emissions attributable to the combustion of biomass and biofuels; and

(8) the conclusions of the verification concerning the accuracy and reliability of the emissions report.

DIVISION II.2
RETENTION OF INFORMATION AND DATA".

9. Section 7 is amended by replacing "5 years" by "7 years".

10. The following is inserted after section 7:

"**7.1.** Any device, system or equipment required under this Regulation must be maintained in good working order and operate optimally during operating hours.".

11. Part II of Schedule A is amended by striking out the portion relating to the types of contaminants that cause increased greenhouse gas effect.

12. The following is inserted after Schedule A:

"SCHEDULE A.1
(ss. 1, 6.1 and 6. 2)

GREENHOUSE GASES AND GLOBAL WARMING POTENTIALS

Greenhouse gas identification	CAS[1]	Global warming potential (GWP)
— Carbon dioxide (CO_2)	124-38-9	1
— Methane (CH_4)	74-82-8	21
— Nitrous oxide (N_2O)	10024-97-2	310
— Sulphur hexafluoride (SF_6)	2551-62-4	23 900
— Hydrofluorocarbons (HFCs)		
– HFC-23 (CHF_3)	75-46-7	11 700
– HFC-32 (CH_2F_2)	75-10-5	650
– HFC-41 (CH_3F)	593-53-3	150
– HFC-43-10mee ($C_5H_2F_{10}$)	138495-42-8	1 300
– HFC-125 (C_2HF_5)	354-33-6	2 800
– HFC-134 (CHF_2CHF_2)	359-35-3	1 000
– HFC-134a (CH_2FCF_3)	811-97-2	1 300
– HFC-143 (CHF_2CH_2F)	430-66-0	300
– HFC-143a (CF_3CH_3)	420-46-2	3800
– HFC-152a (CH_3CHF_2)	75-37-6	43
– HFC-161 (C_2H_5F)	353-36-6	12
– HFC-227ea (C_3HF_7)	431-89-0	2 900
– HFC-236cb ($C_3H_2F_6$)	677-565	1 300
– HFC-236ea ($C_3H_2F_6$)	431-63-0	1 200
– HFC-236fa ($C_3H_2F_6$)	690-39-1	6 300
– HFC-245ca ($C_3H_3F_5$)	679-86-7	560
– HFC-245fa ($C_3H_3F_5$)	460-73-1	950
– HFC-365mfc ($C_4H_5F_5$)	406-58-6	890

Greenhouse gas identification	CAS[1]	Global warming potential (GWP)
— Perfluorocarbons (PFCs)		
– Perfluoromethane (CF_4)	75-73-0	6 500
– Perfluoroethane (C_2F_6)	76-16-4	9 200
– Perfluoropropane (C_3F_8)	76-19-7	7 000
– Perfluorobutane (C_4F_{10})	355-25-9	7 000
– Perfluorocyclobutane (c-C_4F_8)	115-25-3	8 700
– Perfluoropentane (C_5F_{12})	678-26-2	7 500
– Perfluorohexane (C_6F_{14})	355-42-0	7 400
— Nitrogen trifluoride (NF_3)	7783-54-2	8 000

1. The numbers entered in respect of the contaminants listed in this Schedule correspond to the identification code assigned by the Chemical Abstract Services division of the American Chemical Society.

SCHEDULE A.2
(ss. 1, 6.1 and 6.3)

Information to be communicated and methods to be used in calculating greenhouse gas emissions depending on the type of enterprise, facility or establishment operated, the type of activity pursued, and the type of process or equipment used.

QC.1. STATIONARY COMBUSTION

QC.1.1. Covered sources

The covered sources are stationary combustion units such as boilers, combustion turbines, engines, incinerators, and process heaters, and any other stationary combustion unit for which this Schedule prescribes no specific requirements.

QC.1.2. Greenhouse gas reporting requirements

The greenhouse gas emissions report referred to in section 6.2 must include the following information:

(1) the annual greenhouse gas emissions attributable to the combustion of fossil fuels and biomass fuels, in metric tons, indicating for each type of fuel:

(a) CO_2 emissions;

(b) CH_4 emissions; and

(c) N_2O emissions;

(2) the annual consumption of each type of fuel, expressed

(a) in cubic metres at standard conditions, for gases;

(b) in kilolitres, for liquids;

(c) in metric tons, for solids other than biomass solid fuels; and

(d) in bone dry metric tons, for biomass solid fuels;

(3) where carbon content is used to calculate CO_2 emissions, the average carbon content of each type of fuel, in kilograms of carbon per kilogram of fuel;

(4) where high heat value is used to calculate CO_2 emissions, the average high heat value of each type of fuel, expressed

(a) in gigajoules per metric ton, for solid fuels;

(b) in gigajoules per kilolitre, for liquid fuels; and

(c) in gigajoules per cubic metre, for gaseous fuels;

(5) for stationary combustion units that burn biomass, biomass fuels or municipal solid waste, the annual steam generation in kilograms, where it is used to calculate emissions.

QC.1.3. Calculation methods for CO_2 emissions

The annual CO_2 emissions attributable to the combustion of fuels in stationary units must be calculated, for each type of fuel, using one of the four calculation methods specified in QC.1.3.1 to QC.1.3.4.

QC.1.3.1. Calculation method using the fuel-specific default CO_2 emission factor, the default high heat value and the annual fuel consumption

The annual CO_2 emissions attributable to the combustion of fuels in stationary units may be calculated using equation 1-1 for any type of fuel for which an emission factor is specified in Table 1-2, 1-3, 1-4 or 1-5 specified in QC.1.6 and a high heat value is specified in Table 1-1. However, when an emitter to whom section 6.6 of this Regulation applies uses stationary combustion units combusting natural gas with a high heat value that is less than 36.3 MJ/m^3 or greater than 40.98 MJ/m^3, the emitter's CO_2 emissions must be calculated using equation 1-7.

Equation 1-1

$$CO_2 = Fuel \times HHV \times EF \times 0.001$$

Where:

CO_2 = Annual CO_2 emissions attributable to the combustion of each type of fuel, in metric tons;

Fuel = Mass or volume of the fuel combusted during the year, expressed

— as a mass in metric tons, for solid fuels;

— as a volume in cubic metres at standard conditions, for gaseous fuels;

— as a volume in kilolitres, for liquid fuels;

HHV = High heat value of the fuel specified in Table 1-1, expressed

— in gigajoules per metric ton, for solid fuels;

— in gigajoules per kilolitre, for liquid fuels;

— in gigajoules per cubic metre, for gaseous fuels;

EF = CO_2 emission factor for the fuel specified in Table 1-2, 1-3, 1-5 or 1-7, in kilograms of CO_2 per gigajoule;

0.001 = Conversion factor, kilograms to metric tons.

QC.1.3.2. Calculation method using the fuel-specific default CO_2 factor and the high heat value indicated by the fuel supplier or determined by the emitter

With the exception of an emitter to whom section 6.6 of this Regulation applies who uses stationary combustion units combusting natural gas with a high heat value that is less than 36.3 MJ/m^3 or greater than 40.98 MJ/m^3 and who must calculate CO_2 emissions using equation 1-7, the annual CO_2 emissions may be calculated using equations 1-2 and 1-3:

(1) for any type of fuel for which an emissions factor is specified in Table 1-2, 1-3, 1-5 or 1-7 specified in QC.1.6, the emitter may use equation 1-2:

Equation 1-2

$$CO_2 = \sum_{i=1}^{n} Fuel_i \times HHV_i \times EF \times 0.001$$

Where:

CO_2 = Annual CO_2 emissions attributable to the combustion of each type of fuel, in metric tons;

n = Number of measurements of high heat value required annually as specified in QC.1.5.1;

i = Measurement period;

$Fuel_i$ = Mass or volume of fuel combusted during measurement period *i*, expressed

— as a mass in metric tons, for solid fuels;

— as a volume in cubic metres at standard conditions, for gaseous fuels;

— as a volume in kilolitres, for liquid fuels;

HHV_i = High heat value of the fuel for the measurement period *i*, expressed

— in gigajoules per metric ton, for solid fuels;

— in gigajoules per kilolitre, for liquid fuels;

— in gigajoules per cubic metre, for gaseous fuels;

EF = CO_2 emission factor for the fuel specified in Table 1-2, 1-3, 1-5 or 1-7, in kilograms of CO_2 per gigajoule;

0.001 = Conversion factor, kilograms to metric tons;

(2) for biomass solid fuels and municipal solid waste, the emitter may use equation 1-2 or, when steam is generated, equation 1-3:

Equation 1-3

$$CO_2 = Steam \times B \times EF \times 0.001$$

Where:

CO_2 = Annual CO_2 emissions attributable to the combustion of each type of biomass solid fuel or municipal solid waste, in metric tons;

Steam = Total quantity of steam produced during the year by the combustion of biomass solid fuel or municipal solid waste, in metric tons;

B = Ratio of the boiler's design rated heat input capacity to its design rated steam output capacity, in gigajoules per metric ton of steam;

EF = CO_2 emission factor for biomass solid fuel or municipal solid waste specified in Table 1-2 or 1-7 specified in QC.1.6, in kilograms of CO_2 per gigajoule;

0.001 = Conversion factor, kilograms to metric tons.

QC.1.3.3. Calculation method using the quantity of fuel combusted and the carbon content indicated by the fuel supplier or measured by the emitter

The annual CO_2 emissions may be calculated using equations 1-4 to 1-7, depending on the type of fuel:

(1) for solid fuels, the emitter must use equation 1-4:

Equation 1-4

$$CO_2 = \sum_{i=1}^{n} Fuel_i \times CC_i \times 3.664$$

Where:

CO_2 = Annual CO_2 emissions attributable to the combustion of each type of solid fuel, in metric tons;

n = Number of measurements of carbon content required annually as specified in QC.1.5.1;

i = Measurement period;

$Fuel_i$ = Mass of solid fuel combusted during measurement period *i*, in metric tons;

CC_i = Average carbon content of the solid fuel, from the fuel analysis results for the measurement period *i* indicated by the fuel supplier or measured by the emitter in accordance with QC.1.5.5, in kilograms of carbon per kilogram of solid fuel;

3.664 = Ratio of molecular weights, CO_2 to carbon.

(2) for biomass solid fuel or municipal solid waste, the emitter must use equation 1-4 or, when steam is generated, equation 1-5:

Equation 1-5

$$CO_2 = Steam \times B \times EF \times 0.001$$

Where:

CO_2 = Annual CO_2 emissions attributable to the combustion of each type of biomass solid fuel or municipal solid waste, in metric tons;

Steam = Total quantity of steam produced during the year by the combustion of biomass solid fuel or municipal solid waste, in metric tons;

B = Ratio of the boiler's design rated heat input capacity to its design rated steam output capacity, in gigajoules per metric ton of steam;

EF = CO_2 emission factor of biomass solid fuel or municipal solid waste indicated by the fuel supplier, established by the emitter in accordance with QC.1.5.3 or specified in Table 1-2 or 1-7 specified in QC.1.6, in kilograms of CO_2 per gigajoule;

0.001 = Conversion factor, kilograms to metric tons.

(3) for liquid fuels, the emitter must use equation 1-6:

Equation 1-6

$$CO_2 = \sum_{i=1}^{n} Fuel_i \times CC_i \times 3.664$$

Where:

CO_2 = Annual CO_2 emissions attributable to the combustion of each type of liquid fuel, in metric tons;

n = Number of measurements of carbon content required annually as specified in QC.1.5.1;

i = Measurement period;

$Fuel_i$ = Volume of liquid fuel combusted during the measurement period *i*, in kilolitres;

CC_i = Average carbon content of the liquid fuel, from the fuel analysis results for the measurement period *i* indicated by the fuel supplier or measured by the emitter in accordance with QC.1.5.5, in metric tons of carbon per kilolitre of fuel;

3.664 = Ratio of molecular weights, CO_2 to carbon.

(4) for gaseous fuels, the emitter must use equation 1-7:

Equation 1-7

$$CO_2 = \sum_{i=1}^{n} Fuel_i \times CC_i \times \frac{MW}{MVC} \times 3.664 \times 0.001$$

Where:

CO_2 = Annual CO_2 emissions attributable to the combustion of each type of gaseous fuel, in metric tons;

n = Number of measurements of carbon content and molecular weight required annually, as specified in QC.1.5.1;

i = Measurement period;

$Fuel_i$ = Volume of gaseous fuel combusted during measurement period *i*, in cubic metres at standard conditions;

CC_i = Average carbon content of the gaseous fuel, from the fuel analysis results for the measurement period *i* indicated by the fuel supplier or measured by the emitter in accordance with QC.1.5.5, in kilograms of carbon per kilogram of fuel;

MW = Molecular weight of the gaseous fuel, established in accordance with QC.1.5.5 from the fuel analysis results, in kilograms per kilomole;

MVC = Molar volume conversion factor (24.06 m^3 per kilomole at standard conditions);

3.664 = Ratio of molecular weights, CO_2 to carbon;

0.001 = Conversion factor, kilograms to metric tons.

QC.1.3.4. Calculation method using data from a continuous emission monitoring and recording system

The annual CO_2 emissions attributable to the combustion any type of fuel used in stationary combustion units may be calculated using data from a continuous emission monitoring and recording system including a stack gas volumetric flow rate monitor and a CO_2 concentration monitor, in accordance with the EPS 1/PG/7 protocol entitled "Protocols and performance specifications for continuous monitoring of gaseous emissions from thermal power generation" published in November 2005 by Environment Canada.

When a continuous emission monitoring and recording system is used, the emitter is relieved of the requirement to separately report process emissions from combustion emissions for that unit or to report emissions separately for different fossil fuels for that unit when only fossil fuels are combusted. In this circumstance, the emitter must still report fuel use by fuel type in accordance with QC.1.2.

The use of a continuous emission monitoring and recording system must take into account the particularities of each type of fuel used and meet the following requirements:

(1) for units that combust fossil fuels or biomass fuels, the emitter must

(a) use CO_2 or oxygen concentrations and flue gas flow measurements to determine hourly CO_2 emissions;

(b) report annual CO_2 emissions, in metric tons, based on the sum of hourly CO_2 emissions over the year;

(c) if the emitter combusts biomass fuels in the units and uses oxygen concentrations to calculate CO_2 concentrations, demonstrate that the CO_2 concentrations calculated correspond to the CO_2 concentrations measured;

(2) for units that combust waste-derived fuels, the emitter must

(a) use CO_2 concentrations and flue gas flow measurements to determine hourly CO_2 emissions;

(b) report annual CO_2 emissions, in metric tons, based on the sum of hourly CO_2 emissions over the year;

(c) determine separately the portion of total CO_2 emissions attributable to the combustion of biomass when the fuels contain over 5% of biomass by weight or when the waste-derived fuels constitute over 30% by weight of the total fuel combusted over the year; for that purpose the emitter must

i. when the biomass percentage is known, use the applicable equations in QC.1.3.1 to QC.1.3.3 to determine the percentage of CO_2 emissions attributable to the combustion of fossil fuels and the percentage of CO_2 emissions attributable to the combustion of biomass by subtracting the portion of CO_2 emissions attributable to the combustion of fossil fuels from the total emissions;

ii. when the biomass percentage is not known, measure that percentage using the method in QC.1.5.6;

(3) for units that combust both fossil fuels and biomass fuels or waste-derived fuels that are partly biomass, the emitter must

(a) use the CO_2 concentrations and flue gas flow measurements to determine hourly CO_2 emissions;

(b) report annual CO_2 emissions, in metric tons, based on the sum of hourly CO_2 emissions over the year;

(c) determine separately the percentage of total CO_2 emissions attributable to the fossil fuels and the emissions attributable to biomass when the fuels contain over 5% of biomass by weight or when the waste-derived fuels constitute over 30% by weight of the total fuel combusted over the year; for that purpose the emitter must

i. when the biomass percentage is known, use the applicable equations in QC.1.3.1 to QC.1.3.3 to determine the percentage of CO_2 emissions attributable to the combustion of fossil fuels and the percentage of CO_2 emissions attributable to the combustion of biomass by subtracting the percentage of CO_2 emissions attributable to the combustion of fossil fuels from the total emissions;

ii. when the biomass percentage is not known, measure that percentage using the method in QC.1.5.6;

(d) may, when the units combust both pure biomass fuels, in other words fuels constituted of the same substance for at least 97% of their total weight, and fossil fuels, calculate the CO_2 emissions attributable to the fossil fuels using the calculation methods in QC.1.3.1 or QC.1.3.2 (1) taking the type of fuel into account, and then calculate the CO_2 emissions attributable to the biomass fuels by subtracting the CO_2 emissions attributable to the fossil fuels from the total CO_2 emissions determined by the continuous emission monitoring and recording system.

QC.1.4. Calculation methods for CH_4 and N_2O emissions

The annual CH_4 and N_2O emissions attributable to the combustion of fuels in stationary units must be calculated, for each type of fuel, using the methods in QC.1.4.1 to QC.1.4.3.

QC.1.4.1. Calculation method using a default CH_4 and N_2O emission factor and the default high heat value for the fuel

Except for an emitter who uses stationary combustion units combusting natural gas with a high heat value that is less than 36.3 MJ/m^3 or greater than 40.98 MJ/m^3, and who must calculate CH_4 and N_2O emissions using equation 1-10, when the high heat value of a fuel is not determined from the measurements made to calculate CO_2 emissions, the CH_4 and N_2O emissions for fuels for which an emission factor is specified in Table 1-2, 1-6 or 1-7 specified in QC.1.6 and a high heat value is provided in Table 1-3 must be calculated using equation 1-8, subject to the emissions attributable to the combustion of coal which must be calculated using equation 1-9:

Equation 1-8

$$CH_4 \; or \; N_2O = Fuel \times HHV \times EF \times 0.000001$$

Where:

CH_4 or N_2O = Annual CH_4 or N_2O emissions attributable to the combustion of each type of fuel, in metric tons;

Fuel = Mass or volume of the fuel combusted during the year, expressed

— as a mass in metric tons, for solid fuels;

— as a volume in cubic metres at standard conditions, for gaseous fuels;

— as a volume in kilolitres, for liquid fuels;

HHV = High heat value of the fuel specified in Table 1-1, expressed

— in gigajoules per metric ton, for solid fuels;

— in gigajoules per kilolitre, for liquid fuels;

— in gigajoules per cubic metre, for gaseous fuels;

EF = CH_4 or N_2O emission factor for the fuel established by the emitter in accordance with QC.1.5.3 or emission factor for the fuel specified in Table 1-2 or 1-6, in grams of CH_4 or N_2O per gigajoule;

0.000001 = Conversion factor, grams to metric tons.

Equation 1-9

$$CH_4 \, or \, N_2O = Fuel \times EF_c \times 0.000001$$

Where:

CH_4 or N_2O = Annual CH_4 or N_2O emissions attributable to the combustion of coal, in metric tons;

Fuel = Mass of the coal combusted during the year, in metric tons;

EF_c = CH_4 or N_2O emission factor for the coal established by the emitter in accordance with QC.1.5.3 or emission factor for the coal specified in Table 1-7, in grams of CH_4 or N_2O per metric ton of coal;

0.000001 = Conversion factor, grams to metric tons.

QC.1.4.2. Calculation method using a high heat value determined from data provided by the fuel supplier or measurements made by the emitter

When the high heat value of the fuel is determined from data provided by the fuel supplier or measurements made by the emitter in order to estimate CO_2, the annual CH_4 and N_2O emissions for the fuels must be calculated using equation 1-10, subject to the emissions attributable to the combustion of coal which must be calculated using equation 1-11:

Equation 1-10

$$CH_4 \, or \, N_2O = \sum_{i=1}^{n} Fuel_i \times HHV_i \times EF \times 0.000001$$

Where:

CH_4 or N_2O = Annual CH_4 or N_2O emissions attributable to each type of fuel, in metric tons;

n = Number of measurements of high heat value required annually as specified in QC.1.5.1;

i = Measurement period;

$Fuel_i$ = Mass or volume of fuel combusted during measurement period *i*, expressed

— as a mass in metric tons, for solid fuels;

— as a volume in cubic metres at standard conditions, for gaseous fuels;

— as a volume in kilolitres, for liquid fuels;

HHV_i = High heat value determined from data provided by the fuel supplier or measurements made by the emitter for the measurement period *i* in accordance with QC.1.5.4, for each type of fuel, expressed

— in gigajoules per metric ton, for solid fuels;

— in gigajoules per kilolitre, for liquid fuels;

— in gigajoules per cubic metre, for gaseous fuels;

EF = CH_4 or N_2O emission factor for the fuel established by the emitter in accordance with QC.1.5.3 or emission factor for the fuel specified in Table 1-2 or 1-4, in grams of CH_4 or N_2O per gigajoule;

0.000001 = Conversion factor, grams to metric tons.

Equation 1-11

$$CH_4 \, or \, N_2O = \sum_{i=1}^{n} Fuel_i \times EF_c \times 0.000001$$

Where:

CH_4 or N_2O = Annual CH_4 or N_2O emissions attributable to the combustion of coal, in metric tons;

n = Number of measurements of high heat value required annually as specified in QC.1.5.1;

i = Measurement period;

$Fuel_i$ = Mass of the coal combusted during the measurement period *i*, in metric tons;

EF_c = CH_4 or N_2O emission factor for the coal, indicated by the fuel supplier or established by the emitter in accordance with QC.1.5.3, in grams of CH_4 or N_2O per metric ton of coal;

0.000001 = Conversion factor, grams to metric tons.

QC.1.4.3. Calculation method for emissions attributable to the combustion of biomass, biomass fuels or municipal solid waste

The annual CH_4 and N_2O emissions attributable to the combustion of biomass, biomass fuels or municipal solid waste must be calculated using equation 1-12:

Equation 1-12

$$CH_4 \text{ or } N_2O = Steam \times B \times EF \times 0.000001$$

Where:

CH_4 or N_2O = Annual CH_4 or N_2O emissions attributable to the combustion of biomass, biomass fuels or municipal solid waste, in metric tons;

Steam = Total quantity of steam produced during the year by the combustion of biomass, biomass fuels or municipal solid waste, in metric tons;

B = Ratio of the boiler's design rated heat input capacity to its design rated steam output capacity, in gigajoules per metric ton of steam;

EF = CH_4 or N_2O emission factor for the biomass, biomass fuel or municipal solid waste established by the emitter in accordance with QC.1.5.3 or emission factor for the fuel specified in Table 1-2, 1-4 or 1-6 specified in QC.1.6, in grams of CH_4 or N_2O per gigajoule;

0.000001 = Conversion factor, grams to metric tons.

QC.1.5. Sampling, analysis and measurement requirements

QC.1.5.1. Frequency of fuel sampling

To determine the carbon content, high heat value and emission factors of a fuel, an emitter who operates an enterprise, facility or establishment where a stationary combustion unit is used must sample the fuel or obtain sampling results from the supplier for the fuel

(1) at each fuel delivery, or on a monthly basis for middle distillates such as diesel, gasoline, fuel oil and kerosene, residual oil, liquid waste-derived fuels and liquefied petroleum gases such as ethane, propane, isobutene, n-butane and other unspecified liquefied petroleum gases;

(2) monthly, for natural gas;

(3) monthly, for gases derived from biomass and biogas produced from landfill gas or from wastewater treatment or agricultural processes;

(4) monthly, for solid fuels, as specified below:

(a) the sample is a monthly composite of four weekly samples of equal mass, collected each week during the month of operation, which samples are taken after all fuel treatment operations but before fuel mixing to ensure that the samples are representative of the chemical and physical characteristics of the fuel immediately prior to combustion;

(b) the monthly composite sample is homogenised and well mixed prior to withdrawal and analysis;

(c) one in twelve monthly composite samples is randomly selected for additional analysis of its discrete constituent samples to ensure the homogeneity of the composite sample.

QC.1.5.2. Fuel consumption

An emitter who operates an enterprise, facility or establishment where a stationary combustion unit is used must

(1) calculate fuel consumption by fuel type

(a) by measuring it directly;

(b) using recorded fuel purchases or sales invoices for each type of combustible measuring any stock change, in megajoules, litres, millions of cubic metres at standard conditions, metric tons or bone dry metric tons, using the following equation:

Fuel Consumption in a given Report Year = Total Fuel Purchases – Total Fuel Sales + Amount Stored at Beginning of Year – Amount Stored at Year End

(c) for fuel oil, tank drop measurements may also be used;

(2) convert fuel consumption in megajoules into one of the measurement units given in subparagraph *b* of paragraph 1 using the high heat value of the fuel determined using measurements carried out in accordance with QC.1.5.4, the high heat value indicated by the supplier or the high heat value specified in Table 1-1 specified in QC.1.6;

(3) calibrate all flowmeters for liquid and gaseous fuels, except those used to bill gas, using one of the flow meter tests listed in Table 1-8 or the calibration procedures specified by the flow meter manufacturer, either annually or at the minimum frequency specified by the manufacturer for the subsequent years.

QC.1.5.3. Fuel emission factors

The emitter must establish emission factors using the following methods:

(1) when CO_2 emissions are calculated using the method in QC.1.3.3 (2), the emission factor must be established in kilograms of CO_2 per megajoule and adjusted at least every 3 years through a stack test measurement of CO_2 and use of the applicable ASME Performance Test Code published by the American Society of Mechanical Engineers (ASME) to determine heat input from all heat outputs, including the steam, flue gases, ash and losses;

(2) when CH_4 or N_2O emissions are calculated using emission factors based on source tests, the source test procedures must be repeated in subsequent years to update the emissions factors for the stationary combustion unit.

QC.1.5.4. High heat value of the fuel

The emitter must determine high heat value using the sampling and analysis results indicated by the fuel supplier or the results of the sampling conducted by the emitter and using one of the following methods:

(1) for gases:

(a) in accordance with ASTM D1826-94 (2003) "Standard Test Method for Calorific (Heating) Value of Gases in Natural Gas Range by Continuous Recording Calorimeter"[1], ASTM D3588-98 (2003) "Standard Practice for Calculating Heat Value, Compressibility Factor, and Relative Density of Gaseous Fuels", ASTM D4891-89 (2006) "Standard Test Method for Heating Value of Gases in Natural Gas Range by Stoichiometric Combustion" and GPA 2261-00 "Analysis for natural gas and similar gaseous mixtures by gas chromatography" published by the Gas Processors Association (GPA);

(b) by determining high heat value to within ± 5% using a continuous emission monitoring and recording system;

(c) when the continuous emission monitoring and recording system provides only low heat value, by converting the value to high heat value using equation 1-13:

Equation 1-13

$$HHV = LHV \times CF$$

Where:

HHV = High heat value of the fuel or fuel mixture, in megajoules per cubic metre at standard conditions;

LHV = Low heat value of the fuel or fuel mixture, in megajoules per cubic metre at standard conditions;

CF = Conversion factor for converting low heat value to high heat value, established as follows:

(a) for natural gas, the emitter must use a CF of 1.11;

(b) for refinery fuel gas, flexigas, associated gas or gas mixtures, the emitter must establish the weekly average FC as follows:

— using the low heat value measurements and the high heat value obtained by the continuous emission monitoring and recording system or by laboratory analysis as part of the daily carbon content determination;

— using the HHV/LHV ratio obtained from the laboratory analysis of the daily samples;

(2) for middle distillates, fuel oil and liquid waste-derived fuels, in accordance with ASTM D240-09 "Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter" or ASTM D4809-09a "Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (Precision Method)";

(3) for biomass solid fuel, in accordance with ASTM D5865-07a "Standard Test Method for Gross Calorific Value of Coal and Coke";

(4) for waste-derived fuels, in accordance with ASTM D5865-07a or ASTM D5468-02 (2007) "Standard Test Method for Gross Calorific and Ash Value of Waste Materials" and, when the waste-derived fuels are not pure biomass fuels, by calculating the biomass fuel portion of CO_2 emissions in accordance with QC.1.3.4 (3).

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[1] The ASTM standards mentioned in this Schedule are published by the American Society of Testing and Materials (ASTM International).

QC.1.5.5. Carbon content, molecular weight and molar fraction of fuel

The emitter must determine the carbon content and molecular weight or molar fraction of gaseous fuels using the sampling and analysis results indicated by the fuel supplier or the results of the sampling conducted by the emitter using one of the following methods:

(1) for solid fuels, namely coal, coke, biomass solid fuels and waste-derived fuels, in accordance with ASTM 5373-08 "Standard Test Methods for Instrumental Determination of Carbon, Hydrogen, and Nitrogen in Laboratory Samples of Coal"; carbon content must be measured each year;

(2) for petroleum-based liquid fuels and liquid waste-derived fuels, in one of the following ways:

(a) in accordance with ASTM D5291-02 (2007) "Standard Test Methods for Instrumental Determination of Carbon, Hydrogen, and Nitrogen in Petroleum Products and Lubricants";

(b) by applying the elementary analysis method;

(c) in accordance with ASTM D3238-95 (2005) "Standard Test Method for Calculation of Carbon Distribution and Structural Group Analysis of Petroleum Oils by n-d-M Method" and either ASTM D2502-04 "Standard Test Method for Estimation of Molecular Weight (Relative Molecular Mass) of Petroleum Oils from Viscosity Measurements" or ASTM D2503-92 (2007) "Standard Test Method for Relative Molecular Mass (Molecular Weight) of Hydrocarbons by Thermoelectric Measurements of Vapor Pressure";

(3) for gaseous fuels, by applying ASTM D1945-03 "Standard Test Method for Analysis of Natural Gas by Gas Chromatography" or ASTM D1946-90 (2006) "Standard Practice for Analysis of Reformed Gas by Gas Chromatography" or by measuring the carbon content of the fuel to within ± 5% using data from a continuous emission monitoring and recording system.

QC.1.5.6. Measurement of the biomass portion of a fuel or mixture of fuels

An emitter who uses stationary combustion units that combust fuels or mixtures of fuels must, when the biomass portion is not known, determine the biomass portion of CO_2 emissions in accordance with ASTM D6866-08 "Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis", by

(1) conducting, at least every 3 months, an analysis on a representative fuel or exhaust gas sample in accordance with ASTM D6866-08 and collecting exhaust gas samples over a period of at least 24 consecutive hours in accordance with ASTM D7459-08 "Standard Practice for Collection of Integrated Samples for the Speciation of Biomass (Biogenic) and Fossil-Derived Carbon Dioxide Emitted from Stationary Emissions Sources";

(2) dividing total CO_2 emissions between CO_2 emissions attributable to the combustion of biomass fuels and CO_2 emissions attributable to the combustion of non-biomass fuels using the average proportions of the samples analyzed during the year; and

(3) making the measurements in accordance with ASTM D6866-08 on the stationary combustion unit of the emitter's choice if there is a common fuel source for multiple units.

QC.1.5.7. Missing data

When the emission calculation methods require the periodic measurement or collection of data for an emissions source, the emitter must obtain a measurement and data collection rate of 100% for each report year, subject to the following:

(1) when, in sampling fuels, the emitter is unable to obtain fuel analytical data covering at least 80% of the emitter's emissions, the emissions from that source must be considered unverifiable for the report year;

(2) when, in sampling fuels, the emitter's fuel analytical data capture rate is at least 80% but less than 100% for any emissions source to which this Schedule applies, the emitter must use the mean of the fuel analytical data results captured to substitute for the missing values for the period of missing data.

QC.1.5.8. Interim method for fuel sampling

When an emission calculation method requires the continuous measurement of emissions or periodic sampling, and when the necessary equipment is not operational, the emitter may use an interim method for fuel sampling until the equipment is repaired or replaced, if

(1) the breakdown may result in a loss of more than 20% of the source's fuel data, such that emissions for the affected source cannot be verified pursuant to section 6.6 of this Regulation;

(2) the fuel sampling equipment cannot be promptly repaired or replaced without shutting down the stationary combustion unit concerned, or without significantly affecting facility operations.

QC.1.6. Tables

Table 1-1. Carbon content and high heat value by fuel type

(QC.1.3.1, QC.1.5.2(2), QC.17.3.1(2))

Liquid fuels	**Carbon content (kg C/GJ)**	**High heat value (GJ/kL)**
Asphalt & Road Oil	19.80	44.46
Aviation Gasoline	19.25	33.52
Diesel	19.06	38.30
Aviation Turbo Fuel	18.67	37.40
Kerosene	18.53	37.68
Propane	16.35	25.31
Ethane	15.61	17.22
Butane	16.67	28.44
Lubricants	19.66	39.16
Motor Gasoline - Off-Road	18.02	35.00
Light Fuel Oil	19.35	38.80
Residual Fuel Oil (#5 & 6)	20.07	42.50
Crude Oil	19.80	38.32
Naphtha	19.33	35.17
Petrochemical Feedstocks	19.33	35.17
Petroleum Coke - Refinery Use	22.71	46.35
Petroleum Coke - Upgrader Use	22.71	40.57
Solid fuels	**Carbon content (kg C/GJ)**	**High heat value (GJ/metric ton)**
Anthracite Coal	23.74	27.70
Bituminous Coal	20.97	26.33
Foreign Bituminous Coal	21.79	29.82
Sub-Bituminous Coal	25.05	19.15
Lignite	29.97	15.00
Coal Coke	23.69	28.83
Solid Wood Waste	28.41	18.00
Spent Puling Liquor	N/A	14.00
Gaseous fuels	**Carbon content (kg C/GJ)**	**High heat value (GJ/m^3)**
Natural Gas	14.12	0.03832
Coke Oven Gas	23.03	0.01914
Still Gas - Refineries	13.34	0.03608
Still Gas - Upgraders	13.34	0.04324
Landfill Gas	14.97	0.03590

Table 1-2. Emission factors by fuel type

(QC.1.3.1, QC.1.3.2(1), QC.1.4.1, QC.17.3.1(2))

Liquid fuels	**CO_2 (kg/L)**	**CO_2 (kg/ GJ)**	**CH_4 (g/L)**	**CH_4 (g/GJ)**	**N_2O (g/L)**	**N_2O (g/GJ)**
Aviation Gasoline	2.342	69.87	2.200	65.630	0.230	6.862
Diesel	2.663	69.53	0.133	3.473	0.400	10.44
Aviation Turbo Fuel	2.534	67.75	0.080	2.139	0.230	6.150
Kerosene						
- Electric Utilities	2.534	67.25	0.006	0.159	0.031	0.823
- Industrial	2.534	67.25	0.006	0.159	0.031	0.823
- Producer Consumption	2.534	67.25	0.006	0.159	0.031	0.823
- Forestry, Construction, and Commercial/Institutional	2.534	67.25	0.026	0.690	0.031	0.823
Propane						
- Residential	1.510	59.66	0.027	1.067	0.108	4.267
- All other uses	1.510	59.66	0.024	0.948	0.108	4.267
Ethane	0.976	56.68	N/A	N/A	N/A	N/A
Butane	1.730	60.83	0.024	0.844	0.108	3.797
Lubricants	1.410	36.01	N/A	N/A	N/A	N/A
Motor Gasoline - Off-Road	2.289	65.40	2.700	77.140	0.050	1.429
Light Fuel Oil						
- Electric Utilities	2.725	70.23	0.180	4.639	0.031	0.799
- Industrial	2.725	70.23	0.006	0.155	0.031	0.799
- Producer Consumption	2.643	68.12	0.006	0.155	0.031	0.799
- Forestry, Construction, and Commercial/Institutional	2.725	70.23	0.026	0.670	0.031	0.799
Residual Fuel Oil (#5 & 6)						
- Electric Utilities	3.124	73.51	0.034	0.800	0.064	1.506
- Industrial	3.124	73.51	0.12	2.824	0.064	1.506
- Producer Consumption	3.158	74.31	0.12	2.824	0.064	1.506
- Forestry, Construction, and Commercial/Institutional	3.124	73.51	0.057	1.341	0.064	1.820
Naphtha	0.625	17.77	N/A	N/A	N/A	N/A
Petrochemical Feedstocks	0.500	14.22	N/A	N/A	N/A	N/A
Petroleum Coke - Refinery Use	3.826	82.55	0.12	2.589	0.0265	0.572
Petroleum Coke - Upgrader Use	3.494	86.12	0.12	2.958	0.0231	0.569
Biomass and other solid fuels	**CO_2 (kg/kg)**	**CO_2 (kg/GJ)**	**CH_4 (g/kg)**	**CH_4 (g/GJ)**	**N_2O (g/kg)**	**N_2O (g/GJ)**
Landfill gas	29.890	833.0	0.60	16.700	0.06	1.671
Wood Waste with 50% H_2O content	0.950	52.8	0.05	2.778	0.02	1.111
Spent Pulping Liquor	1.428	102.0	0.05	3.571	0.02	1.429
Coal Coke	2.480	86.02	0.03	1.041	0.02	0.694
Tires	N/A	85.0	N/A	N/A	N/A	N/A
Gaseous fuels	**CO_2 (kg/m^3)**	**CO_2 (kg/GJ)**	**CO_2 (g/m^3)**	**CH_4 (g/GJ)**	**N_2O (g/m^3)**	**N_2O (g/GJ)**
Coke Oven Gas	1.60	83.60	0.037	1.933	0.0350	1.829
Still Gas - Refineries	1.75	48.50	N/A	N/A	0.0222	0.615
Still Gas - Upgraders	2.14	49.49	N/A	N/A	0.0222	0.513

Table 1-3. CO_2 emission factors for natural gas

(QC.1.3.1, QC.1.3.2(1), QC.1.4.1, QC.17.3.1(2))

Marketable gas (kg CO_2/m^3)	**Marketable gas (kg CO_2/GJ)**
1.878	49.01

Table 1-4. CO_2 emission factors for coal

(QC.1.3.1, QC.17.3.1(2))

Source	**Emission factor (kg CO_2/kg)**	**Emission factor (kg CO_2/GJ)**
- Canadian bituminous	2.25	85.5
- U.S. bituminous	2.34	88.9
- Anthracite	2.39	86.3

Table 1-5. Other emission factors

(QC.1.3.1, QC.17.3.1(2))

Source	**CO_2 emission factor (kg/GJ)**	**CH_4 emission factor (g/GJ)**	**N_2O emission factor (g/GJ)**
Municipal Solid Waste	91.7	30	4.0
Peat	103.0	1	1.5

Table 1-6. CH_4 and N_2O emission factors for natural gas by use

(QC.1.4.1)

Uses	**CH_4 (g/m^3)**	**CH_4 (g/GJ)**	**N_2O (g/m^3)**	**N_2O (kg/GJ)**
Electric Utilities	0.490	12.790	0.049	1.279
Industrial	0.037	0.966	0.033	0.861
Producer Consumption (Non-marketable)	6.500	169.600	0.060	1.566
Pipelines	1.900	49.580	0.050	1.305
Cement	0.037	0.966	0.034	0.887
Manufacturing Industries	0.037	0.966	0.033	0.861
Residential, Construction, Commercial/Institutional, Agriculture	0.037	0.966	0.035	0.913

Table 1-7. CH_4 and N_2O emission factors for coal by use

(QC.1.4.1)

Uses	**Emission factor (g CH_4/kg coal)**	**Emission factor (g NO_2/kg coal)**
- Electric Utilities	0.022	0.032
- Industry and Heat and Steam Plants	0.030	0.020
- Residential, Public Administration	4.000	0.020

Table 1-8. Flow meter tests

(QC.1.5.1(3))

Standardization organization	**Method**	
	Number	**Title**
American Society of Mechanical Engineers (ASME)	ASME MFC-3M-2004	Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi
	ASME MFC-4M-1986 (Reconduite en 2008)	Measurement of Gas Flow by Turbine Meters
	ASME MFC-5M-1985 (Reconduite en 2006)	Measurement of Liquid Flow in Closed Conduits Using Transit-Time Ultrasonic Flowmeters
	ASME MFC-6M-1998 (Reconduite en 2005)	Measurement of Fluid Flow in Pipes Using Vortex Flowmeters
	ASME MFC-7M-1987 (Reconduite en 2006)	Measurement of Gas Flow by Means of Critical Flow Venturi Nozzles
	ASME MFC-9M-1988 (Reconduite en 2006)	Measurement of Liquid Flow in Closed Conduits by Weighing Method
International Organization for Standardization (ISO)	ISO 8316: 1987	Measurement of Liquid Flow in Closed Conduits - Method by Collection of the Liquid in a Volumetric Tank
American Gas Association (AGA)	AGA Report No. 3	Orifice Metering of Natural Gas Part 1: General Equations & Uncertainty Guidelines (1990)
	AGA Report No. 3	Orifice Metering of Natural Gas Part 2: Specification and Installation Requirements (2000)
	AGA Report No. 7	Measurement of Natural Gas by Turbine Meter (2006)
American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)	ASHRAE 41.8-1989	Standard Methods of Measurement of Flow of Liquids in Pipes Using Orifice Flowmeters

QC.2. REFINERY FUEL GAS COMBUSTION

QC.2.1. Covered sources

The covered sources are stationary combustion units located at a petroleum refinery that combust gaseous fuels such as refinery fuel gas, flexigas or associated gas.

QC.2.2. Greenhouse gas reporting requirements

The greenhouse gas emissions report referred to in section 6.2 must include the following information for each type of gaseous fuel (refinery fuel gas, flexigas and associated gas):

(1) the annual CO_2, CH_4 and N_2O emissions, in metric tons;

(2) the annual consumption of gaseous fuel, in millions of cubic metres at standard conditions;

(3) the average carbon content of each gaseous fuel when used to calculate CO_2 emissions, in kilograms of carbon per kilogram of gaseous fuel;

(4) the average high heat value of each gaseous fuel when used to calculate CO_2 emissions, in megajoules per cubic metre of gaseous fuel at standard conditions;

(5) the daily molecular weight of refinery fuel gas and flexigas when used to calculate CO_2 emissions, in kilograms per kilomole.

Subparagraphs 3, 4 and 5 of the first paragraph do not apply to the CO_2 emissions of an emitter who calculates emissions using data from a continuous emission monitoring and recording system.

QC.2.3. Calculation methods for CO_2, CH_4 and N_2O emissions

The annual CO_2 emissions attributable to stationary combustion units located at a petroleum refinery must be calculated by adding together the daily CO_2 emissions for each supply system for refinery fuel gas, flexigas and associated gas, which emissions must be calculated using one of the calculation methods in QC.2.3.1 to QC.2.3.4.

The annual CH_4 and N_2O emissions attributable to stationary combustion units located at a petroleum refinery that uses refinery fuel gas, flexigaz and associated gas must be calculated using the calculation method in QC.2.3.5.

QC.2.3.1. Use of a continuous emission monitoring and recording system

The annual CO_2 emissions attributable to the combustion of gaseous fuels may be calculated using data from a continuous emission monitoring and recording system in accordance with QC.1.3.4.

QC.2.3.2. Calculation of CO_2 emissions for each supply system for refinery fuel gas and flexigas

The annual CO_2 emissions for each supply system for refinery fuel gas and flexigas must be calculated in accordance with one of the following methods:

(1) based on the carbon content and molecular weight of the refinery fuel gas or flexigas, using equation 2-1:

Equation 2-1

$$CO_2 = \sum_{i=1}^{n} \sum_{j=1}^{m} \left(Fuel_{ij} \times CC_{ij} \times \frac{MW_{ij}}{MVC} \right) \times 3.664 \times 0.001$$

Where:

CO_2 = Annual CO_2 emissions attributable to the combustion of refinery fuel gas or flexigas, in metric tons;

n = Number of days of operation in the year;

m = Number of supply systems;

i = Day;

j = Supply system;

$Fuel_{ij}$ = Consumption of refinery fuel gas or flexigas in supply system *j* for day *i*, in cubic metres at standard conditions;

CC_{ij} = Carbon content of the sample of refinery fuel gas or flexigas in supply system *j* for day *i*, measured in accordance with QC.2.4.2, in kilograms of carbon per kilogram of fuel;

MW_{ij} = Molecular weight of the sample of refinery fuel gas or flexigas in supply system *j* for day *i*, in kilograms per kilomole;

MVC = Molar volume conversion factor (24.06 m^3 per kilomole at standard conditions);

3.664 = Ratio of molecular weights, CO_2 to carbon;

0.001 = Conversion factor, kilograms to metric tons;

(2) based on the daily average high heat value of the refinery fuel gas or flexigas, determined with data from a continuous emission monitoring and recording system, using equations 2-2 and 2-3:

Equation 2-2

$$CO_2 = \sum_{i=1}^{n} \sum_{j=1}^{m} \left(HHV_{ij} \times Fuel_{ij} \times EF_{CO2,ij}\right)$$

Where:

CO_2 = Annual CO_2 emissions attributable to the combustion of refinery fuel gas or flexigas in supply system *j*, in metric tons;

n = Number of days of operation in the year;

m = Number of supply systems;

i = Day;

j = Supply system;

HHV_{ij} = Average high heat value of the refinery fuel gas or flexigas in supply system *j* for day *i*, determined by a continuous emission monitoring and recording system, in megajoules per cubic metre at standard conditions;

$Fuel_{ij}$ = Consumption of refinery fuel gas and flexigas in supply system *j* for day *i*, in cubic metres at standard conditions;

$EF_{CO2,ij}$ = CO_2 emission factor for the refinery fuel gas or flexigas in supply system *j* for day *i*, calculated using equation 2-3, in metric tons of CO_2 per megajoule.

Equation 2-3

$$EF_{CO2,ij} = \frac{CC_{ij}}{HHV_{ij}} \times \frac{MW_{ij}}{MVC} \times 3.664 \times 0.001$$

Where:

$EF_{CO2,ij}$ = CO_2 emission factor for the refinery fuel gas and flexigas in supply system *j* for day *i*, in metric tons of CO_2 per megajoule;

CC_{ij} = Carbon content of the sample of refinery fuel gas and flexigas in supply system *j* for day *i*, measured in accordance with QC.2.4.2, in kilograms of carbon per kilogram of refinery fuel gas and flexigas;

HHV_{ij} = High heat value of the sample of refinery fuel gas and flexigas in supply system *j* for day *i*, determined in accordance with QC.2.4.3, in megajoules per cubic metre at standard conditions;

MW_{ij} = Molecular weight (molecular mass) of the refinery fuel gas or flexigas in supply system *j* for day *i*, in kilograms per kilomole;

MVC = Molar volume conversion factor (24.06 m^3 per kilomole at standard conditions);

3.664 = Ratio of molecular weights, CO_2 to carbon;

0.001 = Conversion factor, kilograms to metric tons.

QC.2.3.3. Calculation of CO_2 emissions for associated gas

The annual CO_2 emissions for associated gas may be calculated using the calculation method in QC.1.3.3 or, with the exception of an emitter to whom section 6.6 of this Regulation applies, using the method in QC.1.3.2.

QC.2.3.4. Calculation of CO_2 emissions for gases mixed prior to combustion

In addition to the methods in QC.2.3.1 and QC.2.3.2, for gases mixed prior to combustion, the emitter may calculate the annual CO_2 emissions for each gas before mixing. In this case, the emitter must

(1) measure the flow rate of each fuel stream;

(2) determine the carbon content and the high heat value of each fuel stream before mixing;

(3) calculate the CO_2 emissions for each fuel stream using the following methods:

(a) for low heat content gas and associated gas, in accordance with QC.1.3.3 or, with the exception of an emitter to whom section 6.6 of this Regulation applies, with QC.1.3.2;

(b) for flexigas and refinery fuel gas, in accordance with QC.2.3.2;

(4) add together the CO_2 emissions for each stream to determine the total emissions for the mixture.

QC.2.3.5. Calculation of CH_4 and N_2O emissions attributable to the combustion of gaseous fuels

The annual CH_4 and N_2O emissions attributable to the combustion of gaseous fuels must be calculated using the method in QC.1.4.

QC.2.4. Sampling, analysis and measurement requirements

QC.2.4.1. Consumption of gaseous fuels

The consumption of gaseous fuels must be calculated daily using the methods in QC.1.5.2.

QC.2.4.2. Carbon content of gaseous fuels

The carbon content of gaseous fuels must be measured, in accordance with QC.1.5.5,

(1) once every 8 hours using continuous measuring equipment or discrete laboratory analysis, for refinery fuel gas;

(2) once per day, for flexigas;

(3) once per month, for associated gas.

QC.2.4.3. High heat value of gaseous fuels

The high heat value of gaseous fuels must be determined in accordance with QC.1.5.4 and using one of the following methods:

(1) from the same sample used to conduct the carbon content analysis;

(2) using a continuous emission monitoring and recording system and the hourly average value that coincides with the same hour in which the carbon content was determined.

QC.2.4.4. Refinery with a daily crude oil throughput capacity equal to or less than 8,744 kl

An emitter who operates an enterprise, facility or establishment with a daily crude oil throughput capacity equal to or less than 8,744 kl may conduct on a weekly basis the measurements prescribed in QC.2.4.1 to QC.2.4.3 that are necessary to calculate emissions in accordance with equations 2-2 and 2-3.

QC.3. ALUMINUM PRODUCTION

QC.3.1. Covered sources

The covered sources are all the processes used for primary aluminum production.

QC.3.2. Reporting requirements for greenhouse gas emissions

The greenhouse gas emissions report referred to in section 6.2 must include the following information:

(1) the annual CO_2 emissions attributable to anode consumption from prebaked and Søderberg electrolysis cells, in metric tons;

(2) the annual CO_2 emissions attributable to anode and cathode baking, in metric tons;

(3) the annual CF_4 and C_2F_6 emissions attributable to anode effects, in metric tons;

(4) the annual CO_2 emissions attributable to green coke calcination, in metric tons;

(5) the annual SF_6 emissions attributable to cover gas consumption, in metric tons;

(6) the annual CO_2, CH_4 and N_2O emissions attributable to the use of stationary combustion units, calculated in accordance with QC.1, in metric tons;

(7) the monthly aluminum production, in metric tons;

(8) for the use of the prebaked anodes process:

(a) the monthly net prebaked anode consumption for aluminum production, in metric tons of anodes per metric ton of aluminum;

(b) the monthly net sulphur content in prebaked anodes, in kilograms of sulphur per kilogram of prebaked anodes;

(c) the monthly ash content in prebaked anodes, in kilograms of ash per kilogram of prebaked anodes;

(d) the monthly content of impurities, other than sulphur and ash, in the prebaked anodes, in kilograms of impurities per kilogram of prebaked anodes;

(9) for the use of the Søderberg anodes process:

(a) the monthly anode paste consumption, in metric tons of paste per metric ton of aluminum;

(b) the monthly emissions of benzene-soluble matter (BSM), in kilograms of BSM per metric ton of aluminum;

(c) the monthly average pitch content in paste, in kilograms of pitch per kilogram of paste;

(d) the monthly sulphur content in the pitch, in kilograms of sulphur per kilogram of pitch;

(e) the monthly ash content in the pitch, in kilograms of ash per kilogram of pitch;

(f) the monthly hydrogen content in the pitch, in kilograms of hydrogen per kilogram of pitch;

(g) the monthly sulphur content of the calcinated coke, in kilograms of sulphur per kilogram of calcinated coke;

(h) the monthly ash content of the calcinated coke, in kilograms of ash per kilogram of calcinated coke;

(i) the monthly reported carbon present in the dust from Søderberg electrolysis cells, in kilograms of carbon per kilogram of aluminum produced;

(10) for the use of the baking process for prebaked anodes or cathodes:

(a) the monthly consumption of packing material, in metric tons of packing material per metric ton of baked anodes or cathodes;

(b) the monthly production of baked anodes or cathodes, in metric tons;

(c) the monthly ash content in the packing material, in kilograms of ash per kilogram of packing material;

(d) the monthly sulphur content in the packing material, in kilograms of sulphur per kilogram of packing material;

(e) the monthly content of impurities, other than sulphur and ash, in the packing material, in kilograms of impurities per kilogram of packing material;

(f) the monthly consumption of green anodes or cathodes, in metric tons;

(g) the monthly pitch content of green anodes or cathodes, in kilograms of pitch per kilogram of green anodes or cathodes;

(h) the monthly quantity of tar recovered from the baking of anodes or cathodes, in metric tons;

(11) for the use of the coke calcination process:

(a) the monthly consumption of green coke, in metric tons;

(b) the monthly humidity content in the green coke, in kilograms of water per kilogram of green coke;

(c) the monthly volatiles content of the green coke, in kilograms of volatiles per kilogram of green coke;

(d) the monthly sulphur content of the green coke, in kilograms of sulphur per kilogram of green coke;

(e) the monthly sulphur content of the calcinated coke, in kilograms of sulphur per kilogram of calcinated coke;

(f) the monthly quantity of calcinated coke produced, in metric tons;

(g) the monthly quantity of under-calcinated coke produced, in metric tons;

(h) the monthly emissions of coke dust, in metric tons;

(12) for CF_4 or C_2F_6 emissions attributable to anode effects:

(a) the slope determined in accordance with the method in QC.3.4.2, in metric tons of CF_4 or C_2F_6 per metric ton of aluminium, per anode effect minute, per pot and per day for each series of pots;

(b) the anode effect frequency, in other words the number of anode effects per pot per day for each series of pots;

(c) the anode effect duration, in minutes per anode effect for each series of pots;

(d) the aluminum production per day, in metric tons for each series of pots;

(e) the number of operating days per year for each series of pots;

(f) the overvoltage coefficient determined in accordance with the method in QC.3.6.1, in metric tons of CF_4 or C_2F_6 per metric ton of aluminium, per millivolt for each series of pots;

(g) the daily anode effect overvoltages, in millivolts per pot for each series of pots;

(h) the current efficiency of the aluminum production process, expressed as a fraction for each series of pots;

(13) for emissions of SF_6 used as a cover gas:

(a) the annual quantity of SF_6 purchased, in metric tons;

(b) the quantity of SF_6 shipped out of the establishment during the year, in metric tons;

(c) the quantity of SF_6 in storage at the beginning of the year, in metric tons;

(d) the quantity of SF_6 in storage at the end of the year, in metric tons;

(e) the monthly quantity of cover gas input to electrolysis cells, in metric tons;

(f) the monthly SF_6 concentration in the gas input to the electrolysis cells, in metric tons;

(g) the monthly quantity of gas containing SF_6 collected and shipped out of the establishment, in metric tons;

(h) the monthly concentration of SF_6 in the gas collected and shipped out of the establishment, in metric tons.

Subparagraph 12 of the first paragraph does not apply to the CF_4 or C_2F_6 emissions of an emitter who calculates emissions using data from a continuous emission monitoring and recording system.

QC.3.3. Calculation methods for CO_2 emissions

QC.3.3.1. Calculation of CO_2 emissions attributable to the consumption of prebaked anodes

The annual CO_2 emissions attributable to the consumption of prebaked anodes must be calculated using equation 3-1:

Equation 3-1

$$CO_2 = \sum_{i=1}^{12}\left[NCC \times MP \times \frac{(100 - S_a - Ash_a - Imp_a)}{100} \times 3.664\right]_i$$

Where:

CO_2 = Annual CO_2 emissions attributable to the consumption of prebaked anodes, in metric tons;

i = Month;

NCC = Net anode consumption for aluminum production for month *i*, in metric tons of anodes per metric ton of aluminum;

MP = Production of aluminum for month *i*, in metric tons;

S_a = Sulphur content in the prebaked anodes for month *i*, in kilograms of sulphur per kilogram of prebaked anodes;

Ash_a = Ash content in the prebaked anodes for month *i*, in kilograms of ash per kilogram of prebaked anodes;

Imp_a = Content of impurities, other than sulphur and ash, in the prebaked anodes for month *i*, in kilograms of impurities per kilogram of prebaked anodes. When this element is not measured, the value is zero;

3.664 = Ratio of molecular weights, CO_2 to carbon.

QC.3.3.2. Calculation of CO_2 emissions attributable to anode consumption from Søderberg electrolysis cells

The annual CO_2 emissions attributable to anode consumption from Søderberg electrolysis cells must be calculated using equation 3-2:

Equation 3-2

$$CO_2 = \sum_{i=1}^{12} \left[\begin{array}{l} (PC \times MP) - \left(BSM \times \frac{MP}{1000} \right) - \left(\frac{BC}{100} \times PC \times MP \times \left(\frac{S_b + Ash_p + H_b}{100} \right) \right) \\ - \left(\frac{100 - BC}{100} \times PC \times MP \times \frac{S_c + Ash_c}{100} \right) - (MP \times CP) \end{array} \right]_i \times 3.664$$

Where:

CO_2 = Annual CO_2 emissions attributable to anode consumption from Søderberg electrolysis cells, in metric tons;

i = Month;

PC = Anode paste consumption for month *i*, in metric tons of paste per metric ton of aluminum;

MP = Production of aluminum for month *i*, in metric tons;

BSM = Emissions of benzene-soluble matter (BSM), in kilograms of BSM per metric ton of aluminum;

BC = Average pitch content in paste for month *i*, in kilograms of pitch per kilogram of paste;

S_b = Sulphur content in pitch for month *i*, in kilograms of sulphur per kilogram of pitch;

Ash_p = Ash content in pitch, in kilograms of ash per kilogram of pitch;

H_b = Hydrogen content in pitch, in kilograms of hydrogen per kilogram of pitch;

S_c = Sulphur content in calcinated coke, in kilograms of sulphur per kilogram of calcinated coke;

Ash_c = Ash content in calcinated coke, in kilograms of ash per kilogram of calcinated coke;

CP = Monthly reported carbon present in the dust from Søderberg electrolysis cells, in kilograms of carbon per kilogram of aluminum produced;

3.664 = Ratio of molecular weights, CO_2 to carbon.

QC.3.3.3. Calculation of CO_2 emissions attributable to anode and cathode baking

The annual CO_2 emissions attributable to anode and cathode baking must be calculated using the following calculation methods:

(1) for annual CO_2 emissions, using equation 3-3:

Equation 3-3

$$CO_2 = CO_{2\ PM} + CO_{2\ P}$$

Where:

CO_2 = Annual CO_2 emissions attributable to anode and cathode baking, in metric tons;

$CO_{2\ PM}$ = Annual CO_2 emissions attributable to packing material calculated in accordance with equation 3-4, in metric tons;

$CO_{2\ P}$ = Annual CO_2 emissions attributable to pitch coking calculated in accordance with equation 3-5, in metric tons;

(2) for emissions of CO_2 attributable to packing material, using equation 3-4:

Equation 3-4

$$CO_{2\ PM} = \sum_{i=1}^{12} \left(PM \times BAC \times \frac{100 - Ash_{pm} - S_{pm} - Imp_{pm}}{100} \right)_i \times 3.664$$

Where:

$CO_{2\ PM}$ = Annual CO_2 emissions attributable to packing material, in metric tons;

i = Month;

PM = Consumption of packing material for month *i*, in metric tons of packing material per metric ton of baked anodes or cathodes;

BAC = Production of baked anodes or cathodes for month *i*, in metric tons;

Ash_{pm} = Ash content of packing material for month *i*, in kilograms of ash per kilogram of packing material;

S_{pm} = Sulphur content of packing material for month *i*, in kilograms of sulphur per kilogram of packing material;

Imp_{pm} = Content of impurities, other than sulphur and ash, of the packing material for month *i*, in kilograms of impurities per kilogram of packing material. When this element is not measured, the value is zero;

3.664 = Ratio of molecular weights, CO_2 to carbon;

(3) for emissions of CO_2 attributable to pitch coking, using equation 3-5:

Equation 3-5

$$CO_{2P} = \sum_{i=1}^{12} \left(GAW - BAC - \left(\frac{H_p}{100} \times \frac{PC}{100} \times GAW \right) - RT \right)_i \times 3.664$$

Where:

$CO_{2\,P}$ = Annual CO_2 emissions attributable to pitch coking, in metric tons;

i = Month;

GAW = Consumption of green anodes or cathodes for month *i*, in metric tons;

BAC = Production of baked anodes or cathodes for month *i*, in metric tons;

H_p = Hydrogen content in pitch for month *i*, in kilograms of hydrogen per kilogram of pitch;

PC = Pitch content of green anodes or cathodes for month *i*, in kilograms of pitch per kilogram of green anodes or cathodes;

RT = Recovered tar for month *i*, in metric tons;

3.664 = Ratio of molecular weights, CO_2 to carbon.

QC.3.3.4. Calculation of CO_2 emissions attributable to green coke calcination

The annual CO_2 emissions attributable to green coke calcination must be calculated using equation 3-6:

Equation 3-6

$$CO_2 = \sum_{i=1}^{12} \left[\begin{aligned} & \left[GC \times \frac{(100 - H_2O_{GC} - V_{GC} - S_{GC})}{100} - (CC + UCC + DE) \times \frac{(100 - S_{CC})}{100} \right] \times 3.664 \\ & + (CCV \times 0.035 \times 2.75) \end{aligned} \right]_i$$

Where:

CO_2 = Annual CO_2 emissions attributable to green coke calcination, in metric tons;

i = Month;

GC = Consumption of green coke for month *i*, in metric tons;

H_2O_{gc} = Humidity content of green coke for month *i*, in kilograms of water per kilogram of green coke;

V_{gc} = Volatiles content of green coke for month *i*, in kilograms of volatiles per kilogram of green coke;

S_{gc} = Sulphur content of green coke for month *i*, in kilograms of sulphur per kilogram of green coke;

CC = Calcinated coke produced for month *i*, in metric tons;

UCC = Under-calcinated coke produced for month *i*, in metric tons;

DE = Emissions of coke dust for month *i*, in metric tons;

S_{cc} = Sulphur in calcinated coke, in kilograms of sulphur per kilogram of calcinated coke;

3.664 = Ratio of molecular weights, CO_2 to carbon;

0.035 = CH_4 and tar content in coke volatiles contributing to CO_2 emissions;

2.75 = Conversion factor, CH_4 to CO_2.

QC.3.4. Calculation methods for CF_4 and C_2F_6 emissions attributable to anode effects

The annual CF_4 and C_2F_6 emissions attributable to anode effects must be calculated using one of the calculation methods in QC.3.4.1 to QC.3.4.3.

QC.3.4.1. Use of a continuous emission monitoring and recording system

The annual CF_4 and C_2F_6 emissions may be calculated using data from a continuous emission monitoring and recording system in accordance with QC.3.6.1.

QC.3.4.2. Slope method

The annual CF_4 and C_2F_6 emissions attributable to anode effects may be calculated for each series of pots using the slope method in equation 3-7:

Equation 3-7

$$E_{CF4,C2F6} = \sum_{j=1}^{m} \left[\sum_{i=1}^{n} [slope_{CF4,C2F6} \times AEF \times AED \times MP]_i \right]_j$$

Where:

$E_{CF4,C2F6}$ = Annual CF_4 or C_2F_6 emissions attributable to anode effects, in metric tons;

m = Number of series of pots;

j = One series of pots;

n = Number of operating days per year;

i = Day;

$slope_{CF4,C2F6}$ = Slope determined in accordance with the method in QC.3.6.1, in metric tons of CF_4 or C_2F_6 per metric ton of aluminium, per anode effect minute, per pot and per day;

AEF = Anode effect frequency, in other words the number of anode effects per pot per day;

AED = Anode effect duration, in minutes per anode effect;

MP = Aluminum production per day, in metric tons.

QC.3.4.3. Péchiney method

The annual CF_4 and C_2F_6 emissions attributable to anode effects may be calculated for each series of pots using the Péchiney method in equation 3-8:

Equation 3-8

$$E_{CF4,C2F6} = \sum_{j=1}^{m} \left[\sum_{i=1}^{n} \left[OVC_{CF4,C2F6} \times \frac{AEO}{CE} \times MP \right]_i \right]_j$$

Where:

$E_{CF4,C2F6}$ = Annual CF_4 or C_2F_6 emissions attributable to anode effects, in metric tons;

m = Number of series of pots;

j = One series of pots;

n = Number of operating days per year;

i = Day;

$OVC_{CF4,C2F6}$ = Overvoltage coefficient determined in accordance with the method in QC.3.6.1, in metric tons of CF_4 or C_2F_6 per metric ton of aluminium per millivolt;

AEO = Anode effect overvoltages for a given day, in millivolts per pot;

CE = Current efficiency of the aluminum production process, expressed as a fraction;

MP = Aluminum production per day, in metric tons.

QC.3.5. Calculation method for emissions of SF_6 used as a cover gas

The annual emissions of SF_6 used as a cover gas must be calculated using one of the calculation methods in QC.3.5.1 and QC.3.5.2.

QC.3.5.1. Calculation based on change in inventory

The annual SF_6 emissions may be calculated based on the change in inventory using equation 3-9:

Equation 3-9

$$SF_6 = S_{Inv-Begin} - S_{Inv-End} + S_{Purchased} - S_{Shipped}$$

Where:

SF_6 = Annual emissions of SF_6 used as a cover gas, in metric tons;

$S_{Inv-Begin}$ = Quantity of SF_6 in storage at the beginning of the year, in metric tons;

$S_{Inv\text{-}End}$ = Quantity of SF_6 in storage at the end of the year, in metric tons;

$S_{Purchased}$ = Quantity of SF_6 purchases for the year, in metric tons;

$S_{Shipped}$ = Quantity of SF_6 shipped out of the establishment during the year, in metric tons.

QC.3.5.2. Calculation based on direct measurement

The annual SF_6 emissions may be calculated based on direct measurement using equation 3-10:

Equation 3-10

$$SF_6 = \sum_{i=1}^{12}[(Q_{Input} \times C_{Input}) - (Q_{Output} \times C_{Output})]_i$$

Where:

SF_6 = Annual emissions of SF_6 used as a cover gas, in metric tons;

i = Month;

Q_{Input} = Quantity of cover gas entering the electrolysis cells for month *i*, in metric tons;

C_{Input} = Concentration de SF_6 in the cover gas entering the electrolysis cells for month *i*, in metric tons;

Q_{Output} = Quantity of gas containing SF_6 collected and shipped out of the establishment for month *i*, in metric tons;

C_{Output} = Concentration of SF_6 in the gas collected and shipped out of the establishment for month *i*, in metric tons.

QC.3.6. Sampling, analysis and measurement requirements

An emitter who operates an enterprise, facility or establishment that produces aluminum must measure all parameters monthly, with the exception of the parameters concerning CF_4 and C_2F_6 emissions from anode effects in QC.3.4 and the parameters concerning SF_6 use in QC.3.5, which must be measured in accordance with QC.3.6.1 and QC.3.6.2.

QC.3.6.1. CF_4 and C_2F_6 emissions from anode effects

An emitter who uses a continuous emission monitoring and recording system for CF_4 and C_2F_6 emissions attributable to anode effects must comply with the guidelines in the document "Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories" published by the Intergovernmental Panel on Climate Change.

An emitter who uses the slope method or Péchiney method must conduct performance tests to calculate the slope or Péchiney coefficients for each series of pots using the *Protocol for Measurement of Tetrafluoromethane and Hexafluoroethane Emissions from Primary Aluminum Production* published in April 2008 by the U.S. Environmental Protection Agency (USEPA) and the International Aluminum Institute.

The tests must be conducted again whenever

(1) 36 months have passed since the last tests;

(2) a change occurs in the control algorithm that affects the intensity or duration of the anode effects or the nature of the anode effect termination routine; or

(3) changes occur in the distribution or duration of anode effects, for example when the percentage of manual kills changes or when, over time, the number of anode effects decreases and results in anode effects of shorter duration, or when the algorithm for bridge movements and anode effect overvoltage accounting changes.

QC.3.6.2. Emissions of SF_6 used as a cover gas

An emitter who uses the direct measurement method in equation 3-10 in QC.3.5.2 to calculate SF_6 emissions attributable to the consumption of cover gas must measure monthly the quantity of SF_6 entering the electrolysis cells and the quantity and SF_6 concentration of any residual gas collected and shipped out of the establishment.

QC.4. CEMENT PRODUCTION

QC.4.1. Covered sources

The covered sources are all the processes used to produce Portland, natural, masonry, pozzolanic, or other hydraulic cements.

QC.4.2. Greenhouse gas emissions reporting requirements

The greenhouse gas emissions report referred to in section 6.2 must include the following information:

(1) the annual CO_2, CH_4 and N_2O emissions, in metric tons;

(2) the annual CO_2 emissions attributable to the calcination process, in metric tons;

(3) for each cement kiln:

(a) the monthly CO_2 emission factors, in metric tons of CO_2 per metric ton of clinker;

(b) the monthly quantity of clinker produced, in metric tons;

(c) the monthly content of calcium oxide in the clinker, in metric tons of calcium oxide per metric ton of clinker;

(d) the monthly content of magnesium oxide in the clinker, in metric tons of magnesium oxide per metric ton of clinker;

(e) the monthly quantity of non-carbonate raw material, in metric tons;

(f) the monthly content of calcium oxide in the non-carbonate raw material, in metric tons of calcium oxide per metric ton of non-carbonate raw material;

(g) the monthly content of magnesium oxide in the non-carbonate raw material, in metric tons of magnesium oxide per metric ton of non-carbonate raw material;

(h) the monthly CO_2 emission factors for the dust discarded that is not recycled to the cement kiln, in metric tons of CO_2 per metric ton of dust;

(i) the monthly quantity of the dust discarded that is not recycled to the cement kiln, in metric tons;

(4) the degree of calcination of the dust discarded that is not recycled to the cement kiln;

(5) the annual CO_2 emissions attributable to the oxidation of organic carbon, in metric tons;

(6) for each type of raw material:

(a) the quantity of raw material consumed during the year, in metric tons;

(b) the total organic carbon content of the raw material, in metric tons of organic carbon per metric ton of raw material;

(7) the annual CO_2, CH_4 and N_2O emissions attributable to fuel combustion in all cement kilns, calculated and reported in accordance with QC.4.3.2(2), in metric tons;

(8) the annual CO_2, CH_4 and N_2O emissions attributable to the use of stationary combustion units, with the exception of cement kilns, calculated and reported in accordance with QC.1, in metric tons.

Subparagraphs 2, 3, 4 and 6 of the first paragraph do not apply to the CO_2 emissions of an emitter who calculates emissions using data from a continuous emission monitoring and recording system. The emitter must, however, report the quantity of each fuel used in each cement kiln.

QC.4.3. Calculation method for CO_2 emissions from the use of cement kilns

The annual CO_2 emissions attributable from the use of cement kilns must be calculated using one of the two calculation methods in QC.4.3.1 and QC.4.3.2.

QC.4.3.1. Use of a continuous emission monitoring and recording system

The annual CO_2 emissions may be calculated using data from a continuous emission monitoring and recording system in accordance with QC.1.3.4.

QC.4.3.2. Calculation by mass balance

The annual CO_2 emissions may be calculated using the following calculation methods:

(1) the CO_2 emissions from cement kilns must be calculated by adding together the CO_2 emissions attributable to calcination and the CO_2 emissions attributable to the oxidation of the organic carbon present in the raw material, calculated in accordance with the following methods:

(a) CO_2 emissions attributable to calcination must be calculated using equations 4-1 to 4-4:

Equation 4-1

$$CO_{2-C} = \sum_{i=1}^{12} \left[\left(Cli \times EF_{Cli} \right) + \left(Q_{CKD} \times EF_{CKD} \right) \right]_i$$

Where:

CO_{2-C} = CO_2 emissions attributable to calcination, in metric tons;

i = Month;

Cli = Production of clinker, in metric tons;

EF_{Cli} = Monthly CO_2 emission factor for the clinker, established using equation 4-2, in metric tons of CO_2 per metric ton of clinker;

Q_{CKD} = Monthly quantity of dust discarded that is not recycled to the cement kiln, in metric tons;

EF_{CKD} = Monthly CO_2 emission factor for the dust discarded that is not recycled to the cement kiln, established using equation 4-3, in metric tons of CO_2 per metric ton of dust discarded and not recycled.

Equation 4-2

$$EF_{\mathrm{Cli}} = \left[CaO_{Cli} - \left(\frac{CaO_{NCRM} \times NCRM}{Cli} \right) \right] \times 0.785 + \left[MgO_{Cli} - \left(\frac{MgO_{NCRM} \times NCRM}{Cli} \right) \right] \times 1.092$$

Where:

EF_{Cli} = Monthly CO_2 emission factor for the clinker, established on the basis of the complete calcination of all the carbonates present in the raw material, in metric tons of CO_2 per metric ton of clinker;

CaO_{Cli} = Monthly content of calcium oxide in the clinker, in metric tons of calcium oxide per metric ton of clinker;

CaO_{NCRM} = Monthly content of calcium oxide in the non-carbonate raw material, in metric tons of calcium oxide per metric ton of non-carbonate raw material;

NCRM = Monthly quantity of non-carbonate raw material, in metric tons;

Cli = Monthly production of clinker, in metric tons;

0.785 = Ratio of molecular weights, CO_2 to calcium oxide;

MgO_{Cli} = Monthly content of magnesium oxide in the clinker, in metric tons of magnesium oxide per metric ton of clinker;

MgO_{NCRM} = Monthly content of magnesium oxide in the non-carbonate raw material, in metric tons of magnesium oxide per metric ton of non-carbonate raw material;

1.092 = Ratio of molecular weights, CO_2 to magnesium oxide.

Equation 4-3

$$EF_{CKD} = \frac{\dfrac{EF_{Cli}}{1 + EF_{Cli}} \times d}{1 - \left(\dfrac{EF_{Cli}}{1 + EF_{Cli}} \times d \right)}$$

Where:

EF_{CKD} = Monthly CO_2 emission factor for the dust discarded that is not recycled to the cement kiln, in metric tons of CO_2 per metric ton of dust discarded and not recycled;

EF_{Cli} = Monthly CO_2 emission factor for the clinker, established using equation 4-2, in metric tons of CO_2 per metric ton of clinker;

d = Degree of calcination of the dust discarded that is not recycled to the cement kiln, determined using equation 4-4.

Equation 4-4

$$d = 1 - \frac{TCO_{2,CKD} \times (1 - TCO_{2,RM})}{(1 - TCO_{2,CKD}) \times TCO_{2,RM}}$$

Where:

d = Degree of calcination of the dust discarded that is not recycled to the cement kiln;

$TCO_{2,CKD}$ = Carbonated CO_2 content of the dust discarded and not recycled to the cement kiln, in metric tons of carbonated CO_2 per metric ton of the dust discarded that is not recycled to the cement kiln;

$TCO_{2,RM}$ = Carbonated CO_2 content of the raw material, in metric tons of carbonated CO_2 per metric ton of raw material.

(b) the CO_2 emissions attributable to the oxidation of the organic carbon present in the raw material must be calculated using equation 4-5:

Equation 4-5

$$CO_{2,RM} = TOC_{RM} \times RM \times 3.664$$

Where:

$CO_{2,RM}$ = CO_2 emissions resulting from the oxidation of the raw material, in metric tons;

TOC_{RM} = Total organic carbon content in raw material, measured using the method in QC.4.4 (3), or using a default value of 0.02 metric tons of total organic carbon content per metric ton of raw material;

RM = Quantity of raw material in metric tons;

3.664 = Ratio of molecular weights, CO_2 to carbon.

(2) the CO_2, CH_4 and N_2O emissions from fuel combustion in cement kilns must be calculated using the calculation methods in QC.1. When pure biomass fuels, in other words fuels constituted of the same substance for at least 97% of their total weight, are combusted only during start-up, shut-down, or malfunction operating periods for the apparatus or units, the emitter may calculate CO_2 emissions using the calculation method in QC.1.3.1.

QC.4.4. Sampling, analysis and measurement requirements

An emitter who operates an enterprise, facility or establishment that produces cement must

(1) calculate the monthly content of calcium oxide and magnesium oxide for the clinker and the non-carbonate raw material in accordance with standard ASTM C114-09b "Standard Test Methods for Chemical Analysis of Hydraulic Cement";

(2) calculate the carbonate CO_2 content of the dust discarded and not recycled to the cement kiln and in the raw material in accordance with ASTM C114-09b;

(3) take samples for each category of raw material in bulk storage and calculate the total organic carbon content in the raw material in accordance with ASTM C114-09;

(4) calculate the quantity of clinker produced, the quantity of dust discarded and not recycled to the cement kiln, and the quantity of raw material consumed by direct weight measurement using the same plant instruments used for inventory purposes, such as weigh hoppers or belt weigh feeders.

QC.5. COAL STORAGE

QC.5.1. Covered sources

The covered sources are all activities involving coal storage, in other words all post-mining activities such as preparation, handling, processing, transportation and storage.

QC.5.2. Greenhouse gas reporting requirements

The greenhouse gas emissions report referred to in section 6.2 must include the following information:

(1) the annual CH_4 emissions in metric tons;

(2) the annual coal purchases, in metric tons;

(3) the source of coal purchases:

(a) name of coal basin;

(b) source province or state;

(c) coal mine type (surface or underground).

QC.5.3. Calculation methods for CH_4 emissions

The annual CH_4 emissions from coal storage must be calculated in accordance with the following calculation methods:

(1) CH_4 emissions from coal storage must be calculated using equation 5-1:

Equation 5-1

$$CH_4 = \sum_i (PC_i \times EF_i) \times 0.6772 \times 0.001$$

Where:

CH_4 = Annual fugitive emissions from coal storage, for each type of coal *i*, in metric tons;

i = Type of coal;

PC_i = Annual purchases of each type of coal *i*, in metric tons;

EF_i = CH_4 emission factor for type of coal *i*, established in accordance with paragraph 2, in cubic metres of CH_4 per metric ton of coal for each type of coal;

0.6772 = Conversion factor, cubic metres to kilograms of CH_4;

0.001 = Conversion factor, kilograms to metric tons;

(2) the CH_4 emission factor (EF_i) must be based on the location and mine type where the coal was mined, in accordance with the following requirements:

(a) when the coal comes from a location in the United States, the emission factor is provided in Table 5-1 in QC.5.5;

(b) when the coal comes from a location in Canada, the emission factor is provided in Table 5-2 in QC.5.5;

(c) when the coal comes from a location outside Canada and the United States, the emitter must select an emission factor from Table 5-1 or 5-2 that corresponds to the type of coal used.

QC.5.4. Sampling, analysis and measurement requirements

An emitter who operates an enterprise, facility or establishment that stores coal must determine the total quantity of coal purchased

(1) by using invoices for coal purchases; or

(2) by weighing the coal using the same plant instruments used for inventory purposes, such as weigh hoppers or belt weigh feeders.

QC.5.5. Tables

Table 5-1. CH_4 emission factors for post-mining activities involving the storage or handling of coal from the United States

(QC.5.3(2)*(a)(b)*)

Coal origin		**CH_4 emission factor by coal mine type (cubic metres /metric ton)**	
State	**Coal basin**	**Surface mine**	**Underground mine**
Maryland, Ohio, Pennsylvania, West Virginia North	Northern Appalachia	0.6025	1.4048
Tennessee, West Virginia South	Central Appalachia (WV)	0.2529	1.3892
Virginia	Central Appalachia (VA)	0.2529	4.0490
East Kentucky	Central Appalachia (E KY)	0.2529	0.6244
Alabama, Mississippi	Warrior	0.3122	2.7066
Illinois, Indiana, Kentucky West	Illinois	0.3465	0.6525
Arizona, California, Colorado, New Mexico, Utah	Rockies (Piceance Basin)	0.3372	1.9917
	Rockies (Uinta Basin)	0.1623	1.0083
	Rockies (San Juan Basin)	0.0749	1.0645
	Rockies (Green River Basin)	0.3372	2.5068
	Rockies (Raton Basin)	0.3372	1.2987
Montana, North Dakota, Wyoming	N. Great Plains	0.0562	0.1592
Arkansas, Iowa, Kansas, Louisiana, Missouri, Oklahoma, Texas	West Interior (Forest City, Cherokee Basins)	0.3465	0.6525
	West Interior (Arkoma Basin)	0.7555	3.3591
	West Interior (Gulf Coast Basin)	0.3372	1.2987
Alaska	Northwest (AK)	0.0562	1.6233
Washington	Northwest (WA)	0.0562	0.5900

Table 5-2. CH_4 emission factors for post-mining activities involving the storage or handling of coal from Canada

(QC.5.3(2)(*b*)(*c*))

Coal origin		**CH_4 emission factor by mine type (cubic metres/ metric ton)**	
Province	**Coal basin**	**Surface mine**	**Underground mine**
British Colombia	Comox	0.500	N/A
	Crowness	0.169	N/A
	Elk Valley	0.900	N/A
	Peace River	0.361	N/A
	Province average	0.521	N/A
Alberta	Battle River	0.067	N/A
	Cadomin-Luscar	0.709	N/A
	Coalspur	0.314	N/A
	Obed Mountain	0.238	N/A
	Sheerness	0.048	N/A
	Smokey River	0.125	0.067
	Wabamun	0.176	N/A
	Province average	0.263	0.067
Saskatchewan	Estavan	0.055	N/A
	Willow Bunch	0.053	N/A
	Province average	0.054	N/A
New Brunswick	Province average	0.060	N/A
Nova Scotia	Province average	N/A	2.923

QC.6. HYDROGEN PRODUCTION

QC.6.1. Covered sources

The covered sources are all the processes used to produce hydrogen.

QC.6.2. Greenhouse gas reporting requirements

The greenhouse gas emissions report referred to in section 6.2 must include the following information:

(1) the annual CO_2 emissions attributable to hydrogen production processes, in metric tons;

(2) the annual feedstock consumption by feedstock type, including petroleum coke, expressed

(a) in millions of cubic metres at standard conditions, for gases;

(b) in kilolitres, for liquids;

(c) in metric tons for non-biomass solids;

(d) in bone dry metric tons, for biomass-derived solid fuels;

(3) the annual hydrogen produced, in millions of cubic metres at standard conditions;

(4) the carbon content of each feedstock type;

(5) the annual CO_2, CH_4 and N_2O emissions attributable to combustion, calculated in accordance with QC.1, in metric tons.

Subparagraph 4 of the first paragraph does not apply to the CO_2 emissions of an emitter who calculates emissions using data from a continuous emission monitoring and recording system.

QC.6.3. Calculation methods for CO_2 emissions

CO_2 emissions from the production of hydrogen must be calculated using one of the calculation methods in QC.6.3.1 and QC.6.3.2.

QC.6.3.1. Use of a continuous emission monitoring and recording system

The annual CO_2 emissions from the production of hydrogen may be calculated using data from a continuous emission monitoring and recording system in accordance with QC.1.3.4.

QC.6.3.2. Calculation by feedstock material balance

The annual CO_2 emissions from the production of hydrogen may be calculated by feedstock material balance using equation 6-1:

Equation 6-1

$$CO_2 = \sum_{i=1}^{n} \sum_{j=1}^{m} \left[\left(FS_j \times CF_j \right) - S_j \right] \times 3.664 \times 0.001$$

Where:

CO_2 = Annual CO_2 emissions from the production of hydrogen, in metric tons;

n = Number of operating days per year;

i = Day;

m = Total number of feedstocks;

j = Type of feedstock;

FS_j = Quantity of feedstock *j* consumed daily, in cubic metres at standard conditions;

CF_j = Carbon content of feedstock *j*, in kilograms of carbon per cubic metre of feedstock at standard conditions;

S_j = Daily emissions of carbon from sources other than hydrogen production, in kilograms of carbon;

This coefficient must be used only for CO_2 or CH_4 emissions that are calculated and reported in accordance with this Regulation. For example, carbon species in unconverted feedstock contained in PSA off-gas and hydrogen plant product that is diverted to fuel gas systems, fed to downstream units, or diverted to flare may be included provided the related CO_2 or CH_4 emissions are calculated and reported in accordance with this Regulation.

3.664 = Ratio of molecular weights, CO_2 to carbon;

0.001 = Conversion factor, kilograms to metric tons.

QC.6.4. Sampling, analysis and measurement requirements

An emitter who uses the calculation method in QC.6.3.2 must

(1) measure the feedstock consumption rate daily;

(2) collect samples of each type of feedstock consumed and analyze each sample for carbon content using the methods specified in QC.1.5.5,

(a) daily, for all feedstocks except natural gas, by collecting the sample from a location that provides samples representative of the feedstock consumed in the hydrogen production process;

(b) monthly, when natural gas is used as a feedstock and not mixed with another feedstock prior to consumption;

(3) measure hydrogen produced daily.

QC.7. IRON AND STEEL PRODUCTION

QC.7.1. Covered sources

The covered sources are primary processes to produce both iron and steel, secondary steelmaking processes, iron production processes, and metallurgical coke production processes.

QC.7.2. Greenhouse gas reporting requirements

The greenhouse gas emissions report referred to in section 6.2 must include the following information:

(1) for all types of facility:

(a) the annual CO_2, and CH_4 emissions calculated for each facility, in metric tons;

(b) the annual CO_2, CH_4 and N_2O emissions attributable to the use of stationary combustion units, calculated in accordance with QC.1, in metric tons;

(2) for metallurgical coke production:

(a) the annual CO_2 and CH_4 emissions attributable to the production of metallurgical coke, in metric tons;

(b) the annual consumption of coking coal used in the production of metallurgical coke, in metric tons;

(c) the annual consumption of process materials other than coking coal used in the production of metallurgical coke, in metric tons;

(d) the annual consumption of blast furnace gas used in the production of metallurgical coke, in metric tons;

(e) the annual production of metallurgical coke, in metric tons;

(f) the quantity of coke oven gas transferred out of the establishment during the year, in metric tons;

(g) the quantity of other coke oven by-products, such as coal tar, light oil and coke breeze, transferred out of the establishment during the year, in metric tons;

(h) the carbon content of the material inputs for the production of metallurgical coke listed in subparagraphs *b* to *g* and of the material outputs, in metric tons of carbon per metric ton of material;

(3) for iron and steel production:

(a) the annual CO_2 and CH_4 emissions attributable to the production of iron and steel, in metric tons;

(b) the annual consumption of coke used in the production of iron and steel, excluding sinter production, in metric tons;

(c) the annual consumption of on-site coke oven by-products, such as coal tar, light oil or coke breeze, consumed in the blast furnace, in metric tons;

(d) the annual quantity of coal injected directly into the blast furnace, in metric tons;

(e) the annual quantity of limestone injected directly into the blast furnace, in metric tons;

(f) the annual quantity of dolomite injected directly into the blast furnace, in metric tons;

(g) the annual consumption of carbon electrodes consumed in the electric arc furnace, in metric tons;

(h) the annual quantity of direct reduced iron introduced to an electric arc furnace or basic oxygen furnace, in metric tons;

(i) the annual consumption of materials, other than those expressly mentioned in this paragraph, consumed in iron and steel production, in metric tons;

(j) the annual consumption of coke oven gas in a blast furnace, in metric tons;

(k) the annual quantity of steel produced, in metric tons;

(l) the annual quantity of iron produced and not transformed into steel, in metric tons;

(m) the quantity of blast furnace gas transferred out of the establishment during the year, in metric tons;

(n) the carbon content of the material inputs for iron and steel production listed in subparagraphs *b* to *m* and of the material outputs, in metric tons of carbon per metric ton of material;

(4) for sinter production:

(a) the annual CO_2 and CH_4 emissions from sinter production, in metric tons;

(b) the annual quantity of coke breeze consumed in sinter production, in metric tons;

(c) the annual quantity of coke oven gas consumed in a blast furnace in sinter production, in metric tons;

(d) the annual quantity of gases other than the gas referred to in subparagraph *c* consumed in sinter production, in metric tons;

(e) the annual quantity of process materials other than those expressly mentioned in this paragraph consumed in sinter production, in metric tons;

(f) the quantity of sinter off gas transferred out of the establishment during the year, in metric tons;

(g) the carbon content of the material inputs for sinter production listed in subparagraphs *b* to *f* and of the material outputs, in metric tons of carbon per metric ton of material;

(5) for direct reduced iron production:

(a) the annual CO_2 and CH_4 emissions attributable to direct reduced iron production, in metric tons;

(b) the annual energy from natural gas used in direct reduced iron production, in gigajoules;

(c) the annual energy from coke breeze used in direct reduced iron production, in gigajoules;

(d) the annual energy from metallurgical coke used in direct reduced iron production, in gigajoules;

(e) the annual quantity of direct reduced iron produced, in metric tons;

(f) the carbon content of the material inputs for direct reduced iron production listed in subparagraphs *b* to *d*, in metric tons of carbon per gigajoule;

(g) the carbon content of the direct reduced iron production referred to in subparagraph *e*, in metric tons of carbon per metric ton of material.

Subparagraph *h* of subparagraph 2, subparagraph *n* of subparagraph 3, subparagraph *g* of subparagraph 4 and subparagraphs *f* and *g* of subparagraph 5 of the first paragraph do not apply to the CO_2 emissions of an emitter who calculates emissions using data from a continuous emission monitoring and recording system.

QC.7.3. Calculation methods for CO_2 and CH_4 emissions

An emitter must calculate the annual CO_2 and CH_4 emissions attributable to primary processes to produce both iron and steel, secondary steelmaking processes, iron production processes and metallurgical coke production processes using one of the calculation methods in QC.7.3.1 to QC.7.3.3.

QC.7.3.1. Use of a continuous emission monitoring and recording system

The annual CO_2 and CH_4 emissions attributable to primary processes to produce both iron and steel, secondary steelmaking processes, iron production processes and metallurgical coke production processes may be calculated using data from a continuous emission monitoring and recording system in accordance with QC.1.3.4.

QC.7.3.2. Calculation by mass balance

The annual CO_2 emissions attributable to primary processes to produce both iron and steel, secondary steelmaking processes, iron production processes and metallurgical coke production processes must be calculated using the methods in subparagraphs 1 to 5 depending on the process used and the type of production, expressed

(1) for primary processes to produce both iron and steel, secondary steelmaking processes, iron production processes and metallurgical coke production processes, using equation 7-1:

Equation 7-1

$$CO_2 = CO_{2,COKE} + CO_{2,IRON,STEEL} + CO_{2\,SINTER} + CO_{2,DRI}$$

Where:

CO_2 = Annual CO_2 emissions attributable to primary processes to produce both iron and steel, secondary steelmaking processes, iron production processes and metallurgical coke production processes, in metric tons;

$CO_{2,\,COKE}$ = Annual emissions attributable to the production of metallurgical coke, calculated in accordance with equation 7-2, in metric tons;

$CO_{2,\,IRON,\,STEEL}$ = Annual emissions attributable to the production of iron and steel, calculated in accordance with equation 7-3, in metric tons;

$CO_{2,\,SINTER}$ = Annual emissions attributable to sinter production, calculated in accordance with equation 7-4, in metric tons;

$CO_{2,\,DRI}$ = Annual emissions attributable to direct reduced iron production, in metric tons.

(2) for the production of coke, using equation 7-2:

Equation 7-2

$$CO_{2,\,COKE} = \left[\left(CC \times C_{CC}\right) + \sum_{i=1}^{n}\left(PM_i \times C_{PMi}\right) + \left(COG \times C_{COG}\right) - \left(MC \times C_{MC}\right) - \left(BFG \times C_{BFG}\right) - \sum_{j=1}^{m}\left(COB_j \times C_{COBj}\right) \right] \times 3.664$$

Where:

$CO_{2,\,COKE}$ = Annual CO_2 emissions attributable to the production of metallurgical coke, in metric tons;

CC = Annual consumption of coking coal, in metric tons;

C_{CC} = Carbon content of coking coal used in the production of metallurgical coke or other by-products;

n = Number of process materials;

i = Type of process material, other than coking coal, used in metallurgical coke production, such as natural gas or fuel oil;

PM_i = Annual consumption of process material *i*, other than coking coal, used in metallurgical coke production, such as natural gas or fuel oil, in metric tons;

C_{PMi} = Carbon content of process material *i*, other than coking coal, used in metallurgical coke production, such as natural gas or fuel oil, in metric tons of carbon per metric ton of process material *i*;

COG = Quantity of coke oven gas transferred out of the establishment during the year, in metric tons;

C_{COG} = Carbon content of the coke oven gas transferred out of the establishment during the year, in metric tons of carbon per metric ton of coke oven gas;

MC = Annual production of metallurgical coke, in metric tons;

C_{MC} = Carbon content of the metallurgical coke produced, in metric tons of carbon per metric ton of metallurgical coke;

BFG = Annual consumption of blast furnace gas, in metric tons;

C_{BFG} = Carbon content of blast furnace gas, in metric tons of carbon per metric ton of blast furnace gas;

COB_j = Quantity of coke oven by-product *j* transferred out of the establishment during the year, in metric tons;

C_{COBj}= Carbon content of coke oven by-product *j* transferred out of the establishment during the year, in metric tons of carbon per metric ton of by-product *j*;

m = Number of coke oven by-products transferred out of the establishment during the year;

j = Type of by-product;

3.664 = Ratio of molecular weights, CO_2 to carbon.

(3) for the production of iron and steel, using equation 7-3:

Equation 7-3

$$CO_{2\ IRON,STEEL} = \Big[(MC \times C_{MC}) + \sum_{i=1}^{n} (COB_i \times C_{COBi}) + (CI \times C_{CI}) + (L \times C_L) + (D \times C_D) + (CE \times C_{CE}) + (DRI \times C_{DRI}) + \sum_{j=1}^{m} (O_j \times C_{Oj}) + (COG \times C_{COG}) - (S \times C_S) - (IP \times C_{IP}) - (BFG \times C_{BFG}) \Big] \times 3.664$$

Where:

$CO_{2\ IRON,\ STEEL}$ = Annual CO_2 emissions attributable to the production of iron and steel, in metric tons;

CO = Annual consumption of metallurgical coke, excluding sinter, in metric tons;

MC_{MG} = Carbon content of metallurgical coke, excluding sinter, in metric tons of carbon per metric ton of metallurgical coke;

n = Number of coke oven by-products consumed in the blast furnace;

i = Type of by-product;

COB_i = Annual consumption of by-product *i* of coke oven consumed in the blast furnace, in metric tons;

C_{COBi} = Carbon content of coke oven by-product *i* consumed in the blast furnace, in metric tons of carbon per metric ton of by-product *i*;

CI = Annual quantity of coal injected directly into the blast furnace, in metric tons;

C_{CI} = Carbon content of coal injected directly into the blast furnace, in metric tons of carbon per metric ton of coal;

L = Annual consumption of limestone, in metric tons;

C_L = Carbon content of limestone, in metric tons of carbon per metric ton of limestone;

D = Annual consumption of dolomite, in metric tons;

C_D = Carbon content of dolomite, in metric tons of carbon per metric ton of dolomite;

CE = Annual consumption of carbon electrodes in the electric arc furnace, in metric tons;

C_{CE} = Carbon content of carbon electrodes consumed in the electric arc furnace, in metric tons of carbon per metric ton of carbon electrodes;

DRI = Annual quantity of direct reduced iron introduced to an electric arc furnace or basic oxygen furnace, in metric tons;

C_{DRI} = Carbon content of direct reduced iron introduced to an electric arc furnace or basic oxygen furnace, in metric tons of carbon per metric ton of direct reduced iron;

m = Number of process materials, other than those expressly mentioned in the equation, used in production, such as sinter or waste plastic;

j = Type of process material;

O_j = Annual quantity of process material *j*, other than the materials expressly mentioned in the equation, used in production, such as sinter or waste plastic, in metric tons;

C_{Oj} = Carbon content of process material *j*, other than the materials specified in the equation, used in production, in metric tons of carbon per metric ton of process material *j*;

COG = Annual consumption of coke oven gas consumed in the blast furnace, in metric tons;

C_{COG} = Carbon content of coke oven gas consumed in the blast furnace, in metric tons of carbon per metric ton of coke oven gas;

S = Annual production of steel, in metric tons;

C_S = Carbon content of the steel produced, in metric tons of carbon per metric ton of steel;

IP = Annual quantity of iron produced but not transformed into steel, in metric tons;

C_{IP} = Carbon content of iron produced but not transformed into steel, in metric tons of carbon per metric ton of iron;

BFG = Quantity of blast furnace gas transferred out of the establishment during the year, in metric tons;

C_{BFG} = Carbon content of blast furnace gas transferred out of the establishment during the year, in metric tons of carbon per metric ton of blast furnace gas;

3.664 = Ratio of molecular weights, CO_2 to carbon.

(4) for sinter production, using equation 7-4:

Equation 7-4

$$CO_{2\ SINTER} = \left[\left(CBR \times C_{CBR}\right) + \left(BG \times C_{BG}\right) + \left(COG \times C_{COG}\right) + \sum_{i=1}^{n} \left(PM_i \times C_{PM\ i}\right) - \left(SOG \times C_{SOG}\right) \right] \times 3.664$$

Where:

$CO_{2\ SINTER}$ = Annual CO_2 emissions attributable to sinter production, in metric tons;

CBR = Annual quantity of coke breeze used in sinter production, in metric tons;

C_{CBR} = Carbon content of the coke breeze used in sinter production, in metric tons of carbon per metric ton of coke breeze;

BG = Annual consumption of the blast furnace gas used in sinter production, in metric tons;

C_{BG} = Carbon content of the blast furnace gas used in sinter production, in metric tons of carbon per metric ton of blast furnace gas;

COG = Annual consumption of coke oven gas consumed in the blast furnace for sinter production, in metric tons;

C_{COG} = Carbon content of the coke oven gas consumed in the blast furnace for sinter production, in metric tons of carbon per metric ton of coke oven gas;

n = Number of process materials other than those expressly mentioned per equation;

i = Type of process material, other than the materials expressly mentioned in the equation, used in sinter production, such as natural gas or fuel oil;

PM_i = Annual consumption of process material *i*, other than the materials expressly mentioned in the equation, used in sinter production, such as natural gas or fuel oil, in metric tons;

C_{PMi} = Carbon content of process material *i*, other than the materials expressly mentioned in the equation, used in sinter production, in metric tons of carbon per metric ton of process material *i*;

SOG = Quantity of sinter off gas transferred out of the establishment during the year, in metric tons;

C_{SOG} = Carbon content of sinter off gas transferred out of the establishment during the year, in metric tons of carbon per metric ton of sinter off gas;

3.664 = Ratio of molecular weights, CO_2 to carbon.

(5) for direct reduced iron production, using equation 7-5:

Equation 7-5

$$CO_{2DRI} = \left[\left(DRI_{NG} \times C_{NG}\right) + \left(DRI_{BZ} \times C_{BZ}\right) + \left(DRI_{CK} \times C_{CK}\right) - \left(DRI \times C_{DRI}\right)\right] \times 3.664$$

Where:

$CO_{2\,DRI}$ = Annual CO_2 emissions attributable to direct reduced iron production, in metric tons;

DRI_{NG} = Annual energy from natural gas used in direct reduced iron production, in gigajoules;

C_{NG} = Carbon content of natural gas, in metric tons of carbon per gigajoule;

DRI_{BZ} = Annual energy from coke breeze used in direct reduced iron production, in gigajoules;

C_{BZ} = Carbon content of coke breeze, in metric tons of carbon per gigajoule;

DRI_{CK} = Annual energy from metallurgical coke in direct reduced iron production, in gigajoules;

C_{CK} = Carbon content of the metallurgical coke used in direct reduced iron production, in metric tons of carbon per gigajoule;

DRI = Annual direct reduced iron production, in metric tons;

C_{DRI} = Carbon content of direct reduced iron produced, in metric tons of carbon per metric ton of direct reduced iron produced;

3.664 = Ratio of molecular weights, CO_2 to carbon.

QC.7.4. Sampling, analysis and measurement requirements

QC.7.4.1. Carbon content

An emitter who operates an enterprise, facility or establishment that produces steel or ferrous metals must measure the carbon content

(1) of fossil fuels, in accordance with QC.1.5;

(2) of by-products consumed in iron and steel production, such as blast furnace gas, coke oven gas, coal tar, light oil, coke breeze and sinter off gas, using the appropriate method for each by-product;

(3) of the limestone and dolomite consumed in iron and steel production, in accordance with ASTM C25-06 “Standard Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime”;

(4) of carbon electrodes used in electric arc furnaces, using the data provided by the supplier of carbon electrodes;

(5) of finished products from all iron and steel production processes, such as steel, iron not transformed into steel and direct reduced iron, in accordance with ASTM E1019-08 “Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel, Iron, Nickel, and Cobalt Alloys by Various Combustion and Fusion Techniques” or ASTM E351-93 (2006) “Standard Test Methods for Chemical Analysis of Cast Iron-All Types”.

QC.7.4.2. Consumption of process materials

The emitter must determine the quantity of solid, liquid and gaseous process inputs and outputs and the quantity of by-products used in the production of iron and steel using the same plant instruments used for inventory purposes, such as weigh hoppers or belt weigh feeders.

QC.8. LIME PRODUCTION

QC.8.1. Covered sources

The covered sources are all the processes used in the production of quick lime.

QC.8.2. Greenhouse gas reporting requirements

The greenhouse gas emissions report referred to in section 6.2 must include the following information:

(1) the annual CO_2, CH_4 and N_2O emissions in metric tons;

(2) the annual CO_2 emissions attributable to the quick lime production process, in metric tons;

(3) for each type of lime produced:

(a) the monthly CO_2 emission factor, in metric tons of CO_2 per metric ton of lime;

(b) the monthly production, in metric tons;

(c) the monthly content of calcium oxide in the lime, in metric tons of calcium oxide per metric ton of lime;

(d) the monthly content of magnesium oxide in the lime, in metric tons of magnesium oxide per metric ton of lime;

(4) for each type of calcined by-product or waste:

(a) the quarterly emission factors, in metric tons of CO_2 per metric ton of calcined by-products or wastes;

(b) the quarterly production of calcined by-products or wastes, in metric tons;

(c) the quarterly content of calcium oxide in calcined by-products and wastes, in metric tons of calcium oxide per metric ton of calcined by-products or wastes;

(d) the quarterly content of magnesium oxide in calcined by-products and wastes, in metric tons of magnesium oxide per metric ton of calcined by-products or wastes;

(5) the annual CO_2, CH_4 and N_2O emissions attributable to fuel combustion in all kilns, calculated and reported in accordance with QC.8.3.2, (2), in metric tons;

(6) the annual CO_2, CH_4 and N_2O emissions attributable to the use of stationary combustion units, with the exception of lime kilns, calculated and reported in accordance with QC.1, in metric tons;

Subparagraphs 2, 3, 4 and 5 of the first paragraph do not apply to the CO_2 emissions of an emitter who calculates kiln emissions using data from a continuous emission monitoring and recording system. The emitter must, however, report the quantity of each fuel used for each kiln.

QC.8.3. Calculation methods for CO_2 emissions from kilns

The annual CO_2 emissions from kilns must be calculated in according with one of the two calculation methods specified in QC.8.3.1 and QC.8.3.2.

QC.8.3.1. Use of a continuous emission monitoring and recording system

The annual CO_2 emissions may be calculated using data from a continuous emission monitoring and recording system in accordance with QC.1.3.4.

QC.8.3.2. Calculation by mass balance

The annual CO_2 emissions may be calculated using the following methods:

(1) The CO_2 emissions from kilns must be calculated, for each type of quick lime, using equation 8-1:

Equation 8-1

$$CO_2 = \sum_{i}^{12} \sum_{j}^{y} \left[QL_{ij} \times EF_{QL_{ij}} \right] + \sum_{k}^{4} \sum_{l}^{z} \left[CBP_{kl} \times EF_{CBP_{kl}} \right]$$

Where:

CO_2 = Emissions of CO_2 from kilns, in metric tons;

i = Month;

y = Number of types of lime;

j = Type of lime;

QL_{ij} = Production of quick lime *j* for month *i*, in metric tons;

EF_{QLij} = CO_2 emission factor of quick lime *j* for month *i*, calculated in accordance with equation 8-2, in metric tons of CO_2 per metric ton of quick lime;

k = Quarter

z = Number of types of calcined by-products and wastes;

l = Type of calcined by-products or wastes;

CBP_{kl} = Production of calcined by-products and wastes *l* in quarter *k*, including lime kiln dust, scrubber sludge and other calcined wastes, in metric tons;

EF_{CBRkl} = CO_2 emission factor for calcined by-products or wastes *l* for quarter *k*, calculated in accordance with equation 8-3, in metric tons of CO_2 per metric ton of calcined by-products or wastes.

(a) the monthly CO_2 emission factor for quick lime (EF_{QL}) must be calculated, for each type of quick lime, using equation 8-2:

Equation 8-2

$$EF_{QL} = (CaO_{QL} \times 0.785) + (MgO_{QL} \times 1.092)$$

Where:

EF_{QL} = Monthly CO_2 emission factor for quick lime, in metric tons of CO_2 per metric ton of quick lime;

CaO_{QL} = Monthly content of calcium oxide in the quick lime, in metric tons of calcium oxide per metric ton of quick lime;

0.785 = Ratio of molecular weights, CO_2 to calcium oxide;

MgO_{QL} = Monthly content of magnesium oxide in the quick lime, in metric tons of magnesium oxide per metric ton of quick lime;

1.092 = Ratio of molecular weights, CO_2 to magnesium oxide;

(b) the quarterly CO_2 emission factor for calcined by-products and wastes (EF_{CBP}) must be calculated, for each type of calcined by-products and wastes, using equation 8-3:

Equation 8-3

$$EF_{CBP} = (CaO_{CBP} \times 0.785) + (MgO_{CBP} \times 1.092)$$

Where:

EF_{CBP} = Quarterly CO_2 emission factor for calcined by-products and wastes, in metric tons of CO_2 per metric ton of calcined by-products and wastes;

CaO_{CBP} = Quarterly content of calcium oxide in calcined by-products and wastes, in metric tons of calcium oxide per metric ton of calcined by-products and wastes;

0.785 = Ratio of molecular weights, CO_2 to calcium oxide;

MgO_{CBP} = Quarterly content of magnesium oxide in calcined by-products and wastes, in metric tons of magnesium oxide per metric ton of calcined by-products and wastes;

1.092 = Ratio of molecular weights, CO_2 to magnesium oxide.

(2) The CO_2, CH_4 and N_2O emissions attributable to the combustion of fuels in kilns must be calculated in accordance with the calculation methods in QC.1. When pure biomass fuels, in other words fuels constituted of the same substance for at least 97% of their total weight, are consumed only during start-up, shut-down, or malfunction operating periods for the apparatus or units, the emitter may calculate CO_2 emissions using the calculation method in QC.1.3.1.

QC.8.4. Sampling, analysis and measurement requirements

An emitter who operates an enterprise, facility or establishment that produces lime must:

(1) collect at least one sample each month for each type of lime produced during the month and determine the monthly content of calcium oxide and of magnesium oxide in each type of lime using ASTM C25-06 "Standard Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime", ASTM C1301-95 (2009) e1 "Standard Test Method for Major and Trace Elements in Limestone and Lime by Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP) and Atomic Absorption (AA)" or ASTM C1271-99 (2006) "Standard Test Method for X-ray Spectrometric Analysis of Lime and Limestone";

(2) collect at least one sample each quarter for each type of calcined by-products or wastes produced during the quarter and determine the quarterly content of calcium oxide and of magnesium oxide in each type of calcined by-products or wastes in accordance with the standards in subparagraph 1;

(3) complete a monthly estimate of the quantity of lime produced and sold using the data on lime sales for each type of lime; the quantity must be adjusted to take into account the difference in beginning and end-of-period inventories of each type of lime;

(4) complete a quarterly estimate of the quantity of calcined by-products and wastes sold, using the data on sales for each type of calcined by-products or wastes; the quantity must be adjusted to take into account the difference in beginning- and end-of-period inventories, over a maximum period of one year, for each type of calcined by-products and wastes;

(5) determine, at least quarterly, the quantity of calcined by-products and wastes not sold for each type of calcined by-products and wastes, using the sales data or the production rate for calcined by-products and wastes compared to lime production.

QC.9. PETROLEUM REFINERIES

QC.9.1. Covered sources

The covered sources are all the processes used to produce gasoline, aromatics, kerosene, distillate fuel oils, residual fuel oils, lubricants, asphalt, or other products through distillation of petroleum or through redistillation, cracking, rearrangement or reforming of unfinished petroleum derivatives.

QC.9.2. Greenhouse gas reporting requirements

The greenhouse gas emissions report referred to in section 6.2 must include the following information:

(1) the annual CO_2, CH_4 and N_2O emissions attributable to the combustion of refinery fuel gas, flexigas or associated gas, calculated in accordance with QC.2, in metric tons;

(2) the annual CO_2 emissions attributable to catalyst regeneration, calculated in accordance with QC.9.3.1, in metric tons;

(3) the annual CO_2, CH_4 and N_2O emissions from process vents, calculated in accordance with QC.9.3.2, in metric tons;

(4) the annual CO_2 and CH_4 emissions attributable to asphalt production, calculated in accordance with QC.9.3.3, in metric tons;

(5) the annual CO_2 emissions attributable to sulphur recovery, calculated in accordance with QC.9.3.4, in metric tons;

(6) the annual CO_2, CH_4 and N_2O emissions attributable to the use of stationary combustion units other than flares and antipollution devices, calculated in accordance with QC.1.3 and QC.1.4, in metric tons;

(7) the annual CO_2, CH_4 and N_2O emissions from flares and antipollution devices, calculated in accordance with QC.9.3.5, in metric tons;

(8) the annual CH_4 emissions from above-ground storage tanks, calculated in accordance with QC.9.3.6, in metric tons;

(9) the annual CH_4 and N_2O emissions attributable to wastewater treatment, calculated in accordance with QC.9.3.7, in metric tons;

(10) the annual CH_4 emissions from oil-water separators, calculated in accordance with QC.9.3.8, in metric tons;

(11) the annual CH_4 emissions from equipment leaks, calculated in accordance with QC.9.3.9, in metric tons;

(12) the annual consumption of each type of feedstock that emits CO_2, CH_4 or N_2O, including petroleum coke, expressed

(a) in millions of cubic metres at standard conditions, for gases;

(b) in kilolitres, for liquids;

(c) in metric tons for non-biomass solids;

(d) in bone dry metric tons, for biomass-derived solid fuels;

(13) the annual consumption of each type of fuel that emits CO_2, CH_4 or N_2O, expressed

(a) in millions of cubic metres at standard conditions, for gases;

(b) in kilolitres, for liquids;

(c) in metric tons for non-biomass solids;

(d) in bone dry metric tons, for biomass-derived solid fuels.

QC.9.3. Calculation methods for CO_2, CH_4 and N_2O emissions

The annual CO_2, CH_4 and N_2O emissions attributable to the operation of a petroleum refinery must be calculated in accordance with one of the calculation methods in QC.9.3.1 to QC.9.3.9.

QC.9.3.1. Calculation of CO_2 emissions attributable to catalyst regeneration

The annual CO_2 emissions attributable to catalyst regeneration for a unit equipped with a continuous emission monitoring and recording system must be calculated in accordance with QC.1.3.4 or, in the absence of such a system, in accordance with the following methods, depending on the process involved:

(1) for the continuous regeneration of catalyst material in fluid catalytic cracking units and fluid cokers, using equations 9-1, 9-2 and 9-3:

Equation 9-1

$$CO_2 = \sum_{j=1}^{n} CR_j \times CF \times 3.664 \times 0.001$$

Where:

CO_2 = Annual CO_2 emissions attributable to the continuous regeneration of catalyst material in fluid catalytic cracking units and fluid cokers, in metric tons;

n = Number of days of operation during the year;

j = Day;

CR_j = Daily average coke burn for day *j*, calculated in accordance with equation 9-2, in kilograms;

CF = Carbon faction in coke burned, in kilograms of carbon per kilogram of coke burned;

3.664 = Ratio of molecular weights, CO_2 to carbon;

0.001 = Conversion factor, kilograms to metric tons.

Equation 9-2

$$CR_j = \frac{1}{n}\left[\sum_{i=1}^{n}\left[K_1 Q_r \times (\%CO_2 + \%CO) + K_2 Q_a - K_3 Q_r \times [\%CO/2 + \%CO_2 + \%O_2] + K_3 Q_{oxy} \times (\%O_{2Qoxy})\right]_i\right]$$

Where:

CR_j = Daily average coke burn rate, in kilograms;

n = Number of hours of operation per day;

i = Hour;

K_1, K_2, K_3 = Material balance and conversion factors (K_1, K_2, and K_3) from Table 9-1 in QC.9.5;

Q_r = Volumetric flow of exhaust gas before entering the antipollution system, calculated in accordance with equation 9-3, in cubic metres per minute, at standard conditions and on a dry basis;

$\%CO_2$ = CO_2 concentration in regenerator exhaust, in cubic metres of CO_2 per cubic metre of exhaust gas on a dry basis, expressed as a percentage;

%CO = Concentration of carbon monoxide in regenerator exhaust, in cubic metres of carbon monoxide per cubic metre of exhaust gas on a dry basis, expressed as a percentage;

Q_a = Volumetric flow of air to regenerator, in cubic metres per minute, at standard conditions and on a dry basis;

$\%O_2$ = Concentration of oxygen in regenerator exhaust, in cubic metres of oxygen per cubic metre of exhaust gas on a dry basis, expressed as a percentage;

Q_{oxy} = Volumetric flow of oxygen to regenerator, in cubic metres per minute, at standard conditions and on a dry basis;

$\%O_{2Qoxy}$ = Concentration of oxygen in enriched air stream inlet to regenerator, percentage by volume on a dry basis.

Equation 9-3

$$Q_r = \frac{\left\lfloor 79 \times Q_a + (100 - \%O_{2\,Qoxy}) \times Q_{oxy} \right\rfloor}{\left[100 - \%CO_2 - \%CO - \%O_2\right]}$$

Where:

Q_r = Volumetric flow of exhaust gas from regenerator before entering the antipollution system, in cubic metres per minute, at standard conditions and on a dry basis;

79 = Nitrogen concentration in air, expressed as a percentage;

Q_a = Volumetric flow of air to regenerator, in cubic metres per minute, at standard conditions and on a dry basis;

$\%O_{2Qoxy}$ = Concentration of oxygen at O_2 enriched air stream inlet, in cubic metres of oxygen per cubic metre of air stream on a dry basis, expressed as a percentage;

Q_{oxy} = Volumetric flow of oxygen in O_2 enriched air stream inlet, in cubic metres per minute, at standard conditions and on a dry basis;

$\%CO_2$ = Concentration of CO_2 in regenerator exhaust, in cubic metres of CO_2 per cubic metre of exhaust gas on a dry basis, expressed as a percentage;

%CO = Concentration of carbon monoxide in regenerator exhaust, in cubic metres of carbon monoxide per cubic metre of exhaust gas on a dry basis, expressed as a percentage.

When no auxiliary fuel is burned and the emitter does not use a continuous CO monitoring and recording system, the percentage is zero;

$\%O_2$ = Concentration of oxygen in regenerator exhaust, in cubic metres of oxygen per cubic metre of exhaust gas on a dry basis, expressed as a percentage.

(2) for periodic catalyst regeneration processes, using equation 9-4:

Equation 9-4

$$CO_2 = \sum_{i=1}^{n} CRR \times \left(CF_{spent} - CF_{regen}\right)_i \times 3.664 \times 0.001$$

Where:

CO_2 = Annual CO_2 emissions attributable to periodic catalyst regeneration processes, in metric tons;

n = Number of regeneration cycles during the year;

i = Regeneration cycle;

CRR = Mass of catalyst regenerated, in kilograms per regeneration cycle;

CF_{spent} = Carbon content of spent catalyst, in kilograms of carbon per kilogram of spent catalyst;

CF_{regen} = Carbon content of regenerated catalyst, in kilograms of carbon per kilogram of regenerated catalyst.

If no carbon content in the regenerated catalyst is detected, the carbon content of the catalyst is zero;

3.664 = Ratio of molecular weights, CO_2 to carbon;

0.001 = Conversion factor, kilograms to metric tons.

(3) for continuous catalyst regeneration material in catalysers used for operations other than fluid catalytic cracking and fluid coking, using equation 9-5:

Equation 9-5

$$CO_2 = CC \times (CF_{spent} - CF_{regen}) \times H \times 3.664$$

Where:

CO_2 = Annual CO_2 emissions attributable to continuous catalyst regeneration in catalysers used for operations other than fluid catalytic cracking and fluid coking, in metric tons;

CC = Average catalyst regeneration rate, in metric tons per hour;

CF_{spent} = Carbon content of spent catalyst, in kilograms of carbon per kilogram of spent catalyst;

CF_{regen} = Carbon content of regenerated catalyst, in kilograms of carbon per kilogram of regenerated catalyst.

If no carbon content in the regenerated catalyst is detected, the carbon content of the catalyst is zero;

H = Number of hours of operation of regenerator during the year;

3.664 = Ratio of molecular weights, CO_2 to carbon.

QC.9.3.2. Calculation of CO_2, CH_4 and N_2O emissions from process vents

The annual CO_2, CH_4 and N_2O emissions from process vents, other than emissions required for the process, must be calculated using equation 9-6:

Equation 9-6

$$E_x = \sum_{i=1}^{n} VR_i \times F_{xi} \times \frac{MX_x}{MVC} \times VT_i \times 0.001$$

Where:

E_x = Annual emissions of *x*, where x = CO_2, CH_4 or N_2O, from process vents, in metric tons;

n = Number of venting events during the year;

i = Venting event;

VR_i = Vent rate for venting event *i*, in cubic metres per unit of time at standard conditions;

F_{xi} = Molar fraction of *x* in vent gas stream during venting event *i*, in kilomoles of *x* per kilomole of gas;

MW_x = Molecular weight (molecular mass) of *x* in kilograms per kilomole;

MVC = Molar volume conversion factor (24.06 m^3 per kilomole, at standard conditions);

VT_i = Duration of venting event *i*, using the same units of time as for VR_i;

0.001 = Conversion factor, kilograms to metric tons.

QC.9.3.3. Calculation of CO_2 and CH_4 emissions attributable to asphalt blowing activities

The annual CO_2 and CH_4 emissions attributable to asphalt production must be calculated using equations 9-7 and 9-8:

Equation 9-7

$$CO_2 = M_A \times EF \times \frac{MW_{CH4}}{MVC} \times DE \times 2.743 \times 0.001$$

Where:

CO_2 = Annual CO_2 emissions attributable to asphalt production, in metric tons;

M_A = Quantity of asphalt blown during the year, in thousands of barrels;

EF = Emission factor of 72.35 m^3 of CH_4 per thousand barrels at standard conditions;

MW_{CH4} = Molecular weight (molecular mass) of CH_4, 16.04 kg per kilomole;

MVC = Molar volume conversion factor of 24.06 m^3 per kilomole, at standard conditions;

DE = Control measure destruction efficiency of 98 %, expressed as a decimal, 0.98;

2.743 = Ratio of molecular weights, CO_2 to CH_4;

0.001 = Conversion factor, kilograms to metric tons.

Equation 9-8

$$CH_4 = M_A \times EF \times \frac{MW_{CH4}}{MVC} \times (1 - DE) \times 0.001$$

Where:

CH_4 = Annual CH_4 emissions CH_4 attributable to asphalt production, in metric tons;

M_A = Quantity of asphalt blown during the year, in thousands of barrels;

EF = Emission factor of 72.35 m^3 of CH_4 per thousand barrels at standard conditions;

MW_{CH4} = Molecular weight of CH_4 of 16.04 kg per kilomole;

MVC = Molar volume conversion factor (24.06 m^3 per kilomole at standard conditions);

DE = Control measure destruction efficiency of 98%, expressed as a decimal, 0.98;

0.001 = Conversion factor, kilograms to metric tons.

QC.9.3.4. Calculation of CO_2 emissions from sulphur recovery units

The annual CO_2 emissions from sulphur recovery units must be calculated using equation 9-9:

Equation 9-9

$$CO_2 = FR \times \frac{MW_{CO2}}{MVC} \times MF \times 0.001$$

Where:

CO_2 = Annual CO_2 emissions from sulphur recovery units, in metric tons;

FR = Annual volumetric flow of gas to sulphur recovery units, in cubic metres at standard conditions;

MW_{CO2} = Molecular weight of CO_2 of 44 kg per kilomole;

MVC = Molar volume conversion factor (24.06 m^3 per kilomole at standard conditions);

MF = Molecular fraction of CO_2 in hydrogen sulphide obtained by sampling at source and analyzing annually, in a percentage expressed as a decimal, or as a factor of 20% or 0.20;

0.001 = Conversion factor, kilograms to metric tons.

QC.9.3.5. Calculation methods for CO_2, CH_4 and N_2O emissions attributable to combustion in flares and antipollution devices

The annual CO_2, CH_4 and N_2O emissions attributable to combustion in flares and antipollution devices must be calculated in accordance with the calculation methods in QC.1.

The CO_2 emissions attributable to the combustion of hydrocarbons in flares must be calculated based on the type of equipment used in accordance with the following methods:

(1) for a flare equipped with a continuous monitoring and recording system to measure the flow and the parameters used to determine the high heat value of the gas, using equation 9-10:

Equation 9-10

$$CO2 = Flare_n \times HHV \times EmF \times 0.001$$

Where:

CO_2 = Annual CO_2 emissions attributable to the combustion of hydrocarbons in flares, in metric tons;

$Flare_n$ = Annual volume of gas at flare *n*, in cubic metres at standard conditions;

HHV = High heat value for flare gas *n*, in gigajoules per cubic metre;

EmF = CO_2 emission factor of 57.6 kg per gigajoule.

0.001 = Conversion factor, kilograms to metric tons;

(2) for a flare equipped with a continuous monitoring and recording system to measure the flow and the parameters used to determine the carbon content, using equation 9-11:

Equation 9-11

$$CO_2 = Flare_n \times CC_n \times \frac{MW_n}{MVC} \times 3.664 \times 0.001$$

Where:

CO_2 = Annual CO_2 emissions attributable to the combustion of hydrocarbons in flares, in metric tons;

$Flare_n$ = Annual volume of gas at flare *n*, in cubic metres at standard conditions;

CC_n = Carbon content of gas at flare *n*, in kilograms of carbon per kilogram of fuel;

MW_n = Molecular weight of gas at flare *n*, in kilograms per kilomole;

MVC = Molar volume conversion factor (24.06 m^3 per kilomole at standard conditions);

3.664 = Ratio of molecular weights, CO_2 to carbon;

0.001 = Conversion factor, kilograms to metric tons.

(3) for a flare that is not equipped with a continuous monitoring and recording system to measure the flow and the parameters used to determine the high heat value or carbon content, using equation 9-12:

Equation 9-12

$$CO2 = RFT \times EF_{NMHC} \times CF_{NMHC} \times 3.664 \times 0.001$$

Where:

CO_2 = Annual CO_2 emissions attributable to the combustion of hydrocarbons in flares, in metric tons;

RFT = Annual input of refinery fuel gas in cubic metres;

EF_{NMHC} = Emission factor for hydrocarbons other than CH_4, namely 0.002 kg per cubic metre at standard conditions;

CF_{NMHC} = Conversion factor, hydrocarbons other than CH_4 to carbon, namely 0.6;

3.664 = Ratio of molecular weights, CO_2 to carbon;

0.001 = Conversion factor, kilograms to metric tons.

(4) for the use of devices other than flares to destroy gases with a low calorific value, using equation 9-13:

Equation 9-13

$$CO_2 = \sum_{i=1}^{n}\left[GV_i \times CC_i \times \frac{MW_i}{MVC}\right] \times 3.664 \times 0.001$$

Where:

CO_2 = Annual CO_2 emissions attributable to the combustion of hydrocarbons by devices other than a flare, in metric tons;

n = Number of gases with a low calorific value;

i = Type of gas;

GV_i = Volume of gas *i* destroyed annually, in cubic metres at standard conditions;

CC_i = Average annual carbon content of gas *i*, measured using quarterly data obtained in accordance with QC.1.5.5, in kilograms of carbon per kilogram of fuel;

MW_i = Average annual molecular weight of gas *i*, in kilograms per kilomole*;*

MVC = Molar volume conversion factor (24.06 m^3 per kilomole, at standard conditions);

3.664 = Ratio of molecular weights, CO_2 to carbon;

0.001 = Conversion factor, kilograms to metric tons.

QC.9.3.6. Calculation of CH_4 emissions from above-ground storage tanks

The annual CH_4 emissions from above-ground storage tanks containing crude oil, asphalt, naphtha or distillate oils that are not equipped with vapour recovery technology, must be calculated using version 4.09D of the TANKS model published by the United States Environmental Protection Agency (USEPA). For the purposes of the calculation, the emitter must

(1) for crude oil, fuel oil and distillate oils, use RVP 5 data for crude oil, No. 2 data for fuel oil, and JP4 data for naphtha-type fuels;

(2) for asphalt, use the data from Table 9-2 in QC.9.5;

(3) the annual throughput for each storage tank must be distributed equally across the twelve months of the year and the single-component liquid option selected;

(4) the total volatile organic compound (VOC) emission values generated by the model must be converted to methane emissions using:

(a) a VOC to CH_4 conversion factor of 0.6; or

(b) a species specific conversion factor determined by storage tank headspace vapour analysis.

QC.9.3.7. Calculation of CH_4 and N_2O emissions attributable to wastewater treatment

The annual emissions attributable to wastewater treatment must be calculated

(1) for emissions of CH_4, using equation 9-14:

Equation 9-14

$$CH_4 = [(Q \times COD_{qave}) - S] \times B \times MFC \times 0.001$$

Where:

CH_4 = Annual CH_4 emissions attributable to wastewater treatment, in metric tons;

Q = Quantity of wastewater treated annually, in cubic metres;

COD_{qave} = Average quarterly chemical oxygen demand of the wastewater, in kilograms per cubic metre;

S = Quantity of organic components removed annually as sludge, in kilograms of chemical oxygen demand;

B = CH_4 generation capacity, namely 0.25 kg of CH_4 per kilogram of chemical oxygen demand;

MFC = CH_4 conversion factor, specified in Table 9-3 in QC.9.5 by process;

0.001 = Conversion factor, kilograms to metric tons.

(2) for emissions of N_2O, using equation 9-15:

Equation 9-15

$$N_2O = Q \times N_{qave} \times EF_{N2O} \times 1.571 \times 0.001$$

Where:

N_2O = Annual emissions of N_2O attributable to wastewater treatment, in metric tons;

Q = Quantity of wastewater treated annually, in cubic metres;

N_{qave} = Average of quarterly determinations of nitrogen in effluent, in kilograms per cubic metre;

EF_{N2O} = N_2O emission factor for wastewater, 0.005 kg of nitrogen produced by the decomposition of nitrous oxide (N_2O-N) per kilogram of total nitrogen;

1.571 = Conversion factor, kilograms of N_2O-N to kilograms of N_2O;

0.001 = Conversion factor, kilograms to metric tons.

QC.9.3.8. Calculation of CH_4 emissions from oil-water separators

The annual CH_4 emissions from oil-water separators must be calculated using equation 9-16:

Equation 9-16

$$CH_4 = EF_{sep} \times Q_{water} \times CF_{NMHC} \times 0.001$$

Where:

CH_4 = Annual emissions of CH_4 from oil-water separators, in metric tons;

EF_{sep} = Emission factor for hydrocarbons other than CH_4 as specified in Table 9-4 in QC.9.5, in kilograms per cubic metre;

Q_{water} = Quantity of wastewater treated annually by the separator, in cubic metres;

CF_{NMHC} = Conversion factor, CH_4 to hydrocarbons other than CH_4, obtained by sampling and analysis at each separator or, if no representative data is available, using the factor 0.6;

0.001 = Conversion factor, kilograms to metric tons.

QC.9.3.9. Calculation methods for CH_4 leaks from components

The annual fugitive emissions of CH_4 from all components in natural gas, refinery gas and pressure swing adsorption (PSA) systems must be calculated using the VOC measurements made in accordance with QC.9.4.9 and the following methods:

(1) the annual CH_4 emissions must be calculated using equation 9-17:

Equation 9-17

$$CH_4 = \sum_{1}^{n} \left(E_{VOC-0} + E_{VOC-LC} + E_{VOCP} \right)_n \times CF_{VOC} \times 0.001$$

Where:

CH_4 = Annual CH_4 emissions attributable to leaks from system components, in metric tons;

n = Number of detections per year;

E_{VOC-0} = VOC emissions from components with a screening value of zero; calculated using equation 9-18, in kilograms per screening period;

E_{VOC-LC} = VOC emissions from components with a screening value between the average concentrations present in the atmosphere and 9,999 ppmv, calculated using equation 9-19, in kilograms per screening period;

E_{VOCP} = VOC emissions from components with a screening value greater than 9,999 ppmv, calculated using equation 9-20, in kilograms per screening period;

CF_{VOC} = Specific VOC to CH_4 conversion factor obtained by sampling and analysis at source or, if no representative data is available, a factor of 0.6;

0.001 = Conversion factor, kilograms to metric tons.

(2) COV emissions from components with a screening value of zero when corrected for the average concentrations present in the atmosphere must be calculated using equation 9-18:

Equation 9-18

$$E_{VOC-0} = \sum_{i=1}^{6} CC_i \times ZF_{zi} \times t$$

Where:

E_{VOC-0} = Emissions from components with a VOC screening value of zero, in kilograms per screening period;

i = Component type (1 = valve, 2 = pump seal, 3 = other component, 4 = connector, 5 = flange, 6 = open-ended line);

CC_i = Number of components of type *i* where the screening value is zero;

ZF_{zi} = Zero VOC emission factor specified in Table 9-5 in QC.9.5 for components *i*, in kilograms per hour;

t = Time since last screening, in hours per screening period.

(3) VOC emissions from components with a screening value between the average concentrations present in the atmosphere and 9,999 ppmv must be calculated using equation 9-19:

Equation 9-19

$$E_{VOCL-C} = \sum_{i=1}^{6} \sum_{j=1}^{n} \left(\sigma_i \times SV_{i,j}^{\;\beta i} \times t_{i,j} \right)$$

Where:

E_{VOCL-C} = VOC emissions from components with a screening value between the average concentrations present in the atmosphere and 9 999 ppmv, in kilograms per screening period;

i = Type of component (1 = valve, 2 = pump seal, 3 = other component, 4 = connector, 5 = flange, 6 = open-ended line);

n = Number of components of type *i*;

j = Component of type *i*;

ó$_i$ = Correlation equation coefficient specified in Table 9-5 in QC.9.5 for components of type *i*, in kilograms per hour;

$SV_{i,j}$ = Screening value for component *j* of type *i*;
ßi = Correlation equation exponent specified in Table 9-5 in QC.9.5 for components of type *i*, in kilograms per hour;

$t_{i,j}$ = Time component *j* of type *i* has been leaking in hours or, if the time when the leak began is unknown, the time since the last screening, in hours.

(4) VOC emissions from components with a screening value greater than 9,999 ppmv must be calculated using equation 9-20:

Equation 9-20

$$E_{VOCP} = \sum_{i=1}^{6} CC_i \times PF_i \times t$$

Where:

E_{VOCP} = VOC emissions from components with a screening value greater than 9,999 ppmv, in kilograms per screening period;

i = Type of component (1 = valve, 2 = pump seal, 3 = other component, 4 = connector, 5 = flange, 6 = open-ended line);

CC_i = Number of components of type *i* with a screening value greater than 9,999 ppmv;

PF_i = VOC emission factor for components of type *i* as specified in Table 9-5 with a screening value greater than 9,999 ppmv, in kilograms of VOC per hour;

t = Time since the last screening, in hours.

QC.9.4. Sampling, analysis and measurement requirements

QC.9.4.1. Catalyst regeneration

For catalyst regeneration, the emitter must:

(1) for fluid catalytic cracking units and fluid cokers:

(a) measure the daily concentration of oxygen in the oxygen-enriched air stream inlet to the regenerator;

(b) measure the volumetric flow of air and oxygen-enriched air to the regenerator, on a continuous basis;

(c) measure the CO_2, carbon monoxide and oxygen concentrations in the exhaust gas from the regenerator, on a continuous basis or weekly;

(d) measure the daily carbon content of the coke combusted;

(e) measure the number of days of operation;

(2) for periodic catalyst regeneration:

(a) measure the quantity of catalyst regenerated in each regeneration cycle;

(b) measure the carbon content of the catalyst prior to and after regeneration;

(3) for continuous catalyst regeneration in operations other than fluid catalytic cracking and fluid coking:

(a) measure the hourly catalyst regeneration rate;

(b) measure the carbon content of the catalyst, prior to and after regeneration;

(c) measure the number of hours of operation.

QC.9.4.2. Process vents

For process vents, the emitter must, for each process venting event, measure the following parameters:

(1) the flow rate for each venting event;

(2) the molar fraction of CO_2, CH_4 and N_2O in the vent gas stream during each venting event;

(3) the duration of each venting event.

QC.9.4.3. Asphalt production

For asphalt production, the emitter must measure the quantity of asphalt blown.

QC.9.4.4. Sulphur recovery

For sulphur recovery, the emitter must measure the volumetric flow rate of acid gas to the sulphur recovery units.

If using a source specific molecular faction value instead of the default factor, the emitter must conduct an annual test of the CO_2 content in the hydrogen sulphide.

QC.9.4.5. Flares and other antipollution devices

For flares and other antipollution devices, the emitter must:

(1) if using the method specified in QC.9.3.5 (1), continuously monitor the flow rate and the parameters used to determine the high heat value of the flare gas;

(2) if using the method specified in QC.9.3.5 (2), continuously monitor the flow rate and the parameters used to determine the carbon content of the flare gas;

(3) if using the method specified in QC.9.3.5 (3), measure the volume of gas destroyed annually (determine to an accuracy of ± 7.5%), and the carbon content.

QC.9.4.6. Above-ground storage tanks

For above-ground storage tanks, the emitter must measure the annual throughput of all types of products in each tank using flowmeters.

QC.9.4.7. Wastewater treatment

For wastewater treatment, the emitter must measure the following parameters:

(1) the daily volume of wastewater treated;

(2) the quarterly chemical oxygen demand of the wastewater;

(3) the quantity of sludge removed annually and the organic content of the sludge;

(4) the quarterly nitrogen content of the wastewater.

QC.9.4.8. Oil-water separators

For oil-water separators, the emitter must measure the daily volume of wastewater treated by the oil-water separators.

QC.9.4.9. Leaks from system components

For leaks from system components, the emitter must:

(1) classify components by type: valve, pump seal, connector, flange, open-ended line, other;

(2) screen for leaks using the methods to identify and count components and the screening methods in CCME-EPC-73F “Environmental Code of Practice for the Measurement and Control of Fugitive Volatile Organic Compounds (VOC) Emissions from Equipment Leaks” published in October 1993 by the Canadian Council of Ministers of the Environment;

(3) screen for leaks at least once per year and measure emissions using instruments able to detect CH_4.

QC.9.5. Tables

Table 9-1. Coke burn rate material balance and conversion factors

(QC.9.3.1(1))

Conversion factor	(kg min)/(h m^3 (dry base) %)
K_1	0.2982
K_2	2.0880
K_3	0.0994

Table 9-2. Data for calculating emissions from above-ground storage tanks containing asphalt using the TANKS model

(QC.9.3.6(2))

Parameter	Data to be entered
Liquid Molecular Weight	1000
Vapor Molecular Weight	105
Liquid Density (lb/gal. at 60 oF)	8.0925
Antoine's Equation Constants (using K)	A = 75350.06
	B = 9.00346

Table 9-3. CH_4 conversion factors by type of industrial wastewater treatment process

(QC.9.3.7(1))

Type of treatment and discharge pathway or system	Comments	Conversion factor (MCF)	Range
Untreated			
Sea, river and lake discharge[1]	Rivers with high organic loading may turn anaerobic, however this is not considered here	0.1	0 - 0.2
Treated			
Aerobic treatment plant	Well maintained, some CH_4 may be emitted from settling basins	0	0 – 0.1
Aerobic treatment plant	Not well maintained, overloaded	0.3	0.2 – 0.4
Anaerobic digester for sludge[2]	CH_4 recovery not considered here	0.8	0.8 – 1.0
Anaerobic reactor[2]	CH_4 recovery not considered here	0.8	0.8 – 1.0
Anaerobic shallow lagoon	Depth less than 2 meters	0.2	0 – 0.3
Anaerobic deep lagoon	Depth more than 2 meters	0.8	0.8 – 1.0

For CH_4 generation capacity (B) in kilograms of CH_4 per kilogram of chemical oxygen demand (COD), the emitter must use the default emission factor of 0.25 kg CH_4 per kilogram COD.

The emission factor for N_2O from discharged wastewater (EF_{N2O}) is 0.005 kg N_2O-N per kg-N.

MCF = CH_4 conversion factor (the fraction of waste treated anaerobically).

(1) The fact that rivers with high organic loading may turn anaerobic is not taken into account.
(2) CH_4 recovery is not taken into account.

Table 9-4. Emission factors for oil-water separators

(QC.9.3.8)

Type of separator	Emission factor (EF_{sep})[a] kg NMHC/m^3 wastewater treated
Gravity type - uncovered	1.11e-01
Gravity type - covered	3.30e-03
Gravity type – covered and connected to destruction device	0
DAF[b] of IAF[c] - uncovered	4.00e-03[d]
DAF or IAF - covered	1.20e-04[d]
DAF or IAF – covered and connected to a destruction device	0

[a] EFs do not include ethane

[b] DAF = dissolved air flotation type

[c] IAF = induced air flotation device

[d] EFs for these types of separators apply where they are installed as secondary treatment systems.

Table 9-5. Gas service components fugitive emissions

(QC.9.3.9 (2), (3) and (4))

Component type / Service type	Default zero factor (kg/h)	Correlation equation (kg/h)	Correlation equation (kg/h)	Factor (kg/h) 10 000 ppmv
	ZF_{zi}	σ_i	β_i	(SV > 9 999) PF_i
Valves (1)	7.8×10^{-6}	2.27×10^{-6}	0.747	0.064
Pump seals (2)	1.9×10^{-5}	5.07×10^{-5}	0.622	0.089
Other (3)	4.0×10^{-6}	8.69×10^{-6}	0.642	0.082
Connectors (4)	7.5×10^{-6}	1.53×10^{-6}	0.736	0.030
Flanges (5)	3.1×10^{-7}	4.53×10^{-6}	0.706	0.095
Open-ended lines (6)	2.0×10^{-6}	1.90×10^{-6}	0.724	0.033

QC.10. PULP AND PAPER MANUFACTURING

QC.10.1. Covered sources

The covered sources are all the processes used to manufacture pulp and paper products.

QC.10.2. Greenhouse gas reporting requirements

The greenhouse gas emissions report referred to in section 6.2 must include the following information:

(1) the annual CO_2 emissions attributable to the combustion of biomass in recovery furnaces and kilns, calculated in accordance with QC.10.3.1, in metric tons;

(2) the annual CO_2 emissions attributable to the combustion of fossil fuels in recovery furnaces and kilns, calculated in accordance with QC.1, in metric tons;

(3) the annual CO_2 emissions attributable to the combustion of carbonate materials in recovery furnaces and kilns, calculated in accordance with QC.10.3.2, in metric tons;

(4) the annual CO_2, CH_4 and N_2O emissions attributable to the use of stationary combustion units, calculated in accordance with QC.1, in metric tons;

(5) the annual consumption of carbonate materials, in metric tons;

(6) the annual production of black liquor, in metric tons;

(7) the annual N_2O and CH_4 emissions from onsite wastewater treatment plants, calculated in accordance with QC.9.3.7, in metric tons.

QC.10.3. Calculation methods for CO_2 emissions

The annual CO_2 emissions attributable to the manufacture of pulp and paper products must be calculated using the calculation methods in QC.10.3.1 and QC.10.3.2.

QC.10.3.1. Calculation of CO_2 emissions from the combustion of biomass

The annual CO_2 emissions attributable to the combustion of biomass in recovery furnaces and kilns must be calculated using equation 10-1:

Equation 10-1

$$CO_{2,biomass} = \sum_{i=1}^{12} (BL_i \times CC_i \times 3.664)$$

Where:

$CO_{2,\text{ biomass}}$ = Annual CO_2 emissions attributable to the combustion of biomass in recovery furnaces and kilns, in metric tons;

i = Month;

BL_i = Black liquor produced during month *i*, in metric tons;

CC_i = Carbon content of the black liquor produced during month *i*, in kilograms of carbon per kilogram of black liquor;

3.664 = Ratio of molecular weights, CO_2 to carbon.

QC.10.3.2. Calculation of CO_2 emissions attributable to the combustion of carbonate materials

The annual CO_2 emissions attributable to the combustion of carbonate materials in recovery furnaces and kilns must be calculated using equation 10-2:

Equation 10-2

$$CO_{2,carb} = \sum_{i=1}^{12} (\sum_{j=1}^{n} RM_j \times EF_j)_i$$

Where:

$CO_{2,\text{ carb}}$ = Annual CO_2 emissions from the combustion of carbonate materials in recovery furnaces and kilns, in metric tons;

i = Month;

n = Number of carbonate materials;

j = Carbonate material;

RM_j = Quantity of carbonate material *j* consumed during month *i*, in metric tons;

EF_j = CO_2 emission factor for carbonate material *j* specified in Table 10-1 in QC.10.5 for month *i*, in metric tons of CO_2 per metric tons of carbonate material.

QC.10.4. Sampling, analysis and measurement requirements

An emitter who manufactures pulp and paper must:

(1) measure the quantity of black liquor produced each year;

(2) measure the monthly carbon content of the black liquor in accordance with ASTM D5373-08 "Standard Test Methods for Instrumental Determination of Carbon, Hydrogen, and Nitrogen in Laboratory Samples of Coal";

(3) to determine carbonate material consumption, either use records provided by the material supplier or monitor carbonate material consumption using the same plant instruments used for inventory purposes, such as weigh hoppers or belt weigh feeders;

(4) measure the carbonate content of each carbonate material by

(a) using the carbonate content data provided by the material supplier;

(b) using the emission factor specified in Table 10-1 in QC.10.5; or

(c) collecting monthly samples of each carbonate material consumed in accordance with ASTM C25-06 "Standard Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime", ASTM C1301-95 (2009) e1 "Standard Test Method for Major and Trace Elements in Limestone and Lime by Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP) and Atomic Absorption (AA)" or ASTM C1271-99 (2006) "Standard Test Method for X-ray Spectrometric Analysis of Lime and Limestone".

QC.10.5. Table

Table 10-1. CO_2 emission factors for common carbonate species

(QC.10.3.2, QC.10.4(4)*(b)*)

Carbonate	**Mineral name**	**Emission factor (t eq. CO_2/t carbonate)**
$CaCO_3$	Calcite	0.4397
$CaMg(CO_3)_2$	Dolomite	0.4773
Na_2CO_3	Soda ash (sodium carbonate)	0.4149

QC.11. SODIUM CARBONATE PRODUCTION

QC.11.1. Covered sources

The covered sources are all the processes used in the production of sodium carbonate by calcining sodium carbonate bearing ore or brine.

QC.11.2. Greenhouse gas reporting requirements

The greenhouse gas emissions report referred to in section 6.2 must include the following information:

(1) the annual CO_2 emissions from all soda ash calcining kilns, calculated in accordance with QC.11.3, in metric tons;

(2) the annual CO_2, CH_4 and N_2O emissions attributable to fuel combustion in calcining kilns, calculated in accordance with QC.1, in metric tons;

(3) the monthly consumption of trona ore or sodium carbonate-rich brine, in metric tons;

(4) the monthly production of sodium carbonate, in metric tons;

(5) the monthly quantity of kiln dust discarded and not recycled to the calcining kilns, in metric tons;

(6) the monthly carbon content of the trona ore or brine at the kiln input, in kilograms of carbon per kilogram of trona ore or brine;

(7) the monthly carbon content of sodium carbonate produced, in kilograms of carbon per kilogram of sodium carbonate;

(8) the monthly carbon content of the kiln dust not recycled by regulating devices and not combined with the soda ash product, in kilograms of carbon per kilogram of kiln dust recovered;

(9) in a facility that recycles the CO_2 generated from calcination for use in carbonation towers:

(a) the annual CO_2 emissions recycled, in metric tons;

(b) the monthly quantity of pre-treated brine consumed, in metric tons;

(c) the monthly carbon content of the pre-treated brine at the kiln input, in kilograms of carbon per kilogram of pre-treated brine;

(d) the monthly quantity of untreated brine consumed in pre-treatment, in metric tons;

(e) the monthly carbon content of the brine before pre-treatment, in kilograms of carbon per kilogram of untreated brine.

QC.11.3. Calculation methods for CO_2 emissions

QC.11.3.1. Calculation of CO_2 emissions from calcining kilns

The annual CO_2 emissions from calcining kilns must be calculated using one of the two following calculation methods:

(1) using data from a continuous emission monitoring and recording system in accordance with QC.1.3.4;

(2) using equation 11-1:

Equation 11-1

$$CO_2 = \sum_{j=1}^{12}[(C_{ij} \times T_{ij}) - (C_{Sj} \times T_{Sj}) - (C_{Wj} \times T_{wj})] \times 3.664$$

Where:

CO_2 = Annual CO_2 emissions attributable to sodium carbonate production processes, in metric tons;

j = Month;

C_{ij} = Carbon content of trona ore or brine input at the kiln for month *j*, in kilograms of carbon per kilogram of trona ore or brine;

T_{ij} = Quantity of trona ore or brine input during month *j*, in metric tons;

C_{Sj} = Carbon content of sodium carbonate produced during month *j*, in kilograms of carbon per kilogram of sodium carbonate;

Ts_j = Quantity of sodium carbonate produced during month *j*, in metric tons;

C_{Wj} = Carbon content of kiln dust discarded and not recycled by regulating devices and not combined with the soda ash product during month *j*, in kilograms of carbon per kilogram of kiln dust recovered;

T_{Wj} = Quantity of kiln dust discarded and not recycled by regulating devices and not combined with the soda ash product during month *j*, in metric tons;

3.664 = Ratio of molecular weights, CO_2 to carbon.

QC.11.3.2. Calculation of annual emissions of CO_2 from calcining kilns used in carbonation towers for brine pre-treatment

For a facility where CO_2 emissions from the calcining kilns are used in carbonation towers for brine pre-treatment, the annual emissions of recycled CO_2 must be calculated using equation 11-2:

Equation 11-2

$$CO_2 = \sum_{j=1}^{12} [(C_{Ij} \times T_{Ij}) - (Cb_j \times Tb_j)] \times 3.664$$

Where:

CO_2 = Annual recycled CO_2 emissions from calcining kilns for pre-treatment, in metric tons;

j = Month;

C_{Ij} = Carbon content of pre-treated brine kiln input for month *j*, in kilograms of carbon per kilogram of pre-treated brine;

T_{Ij} = Monthly quantity of pre-treated brine consumed during month *j*, in metric tons;

Cb_j = Carbon content of the brine prior to pre-treatment for month *j*, in kilograms of carbon per kilogram of untreated brine;

Tb_j = Monthly quantity of untreated brine consumed in pre-treatment during month *j*, in metric tons;

3.664 = Ratio of molecular weights, CO_2 to carbon.

QC.11.4. Sampling, analysis and measurement requirements

An emitter who uses one of the calculation methods in QC.11.3.1(2) and QC.11.3.2 must

(1) measure the quantity of trona ore, sodium carbonate, dust and brine using the same plant instruments used for inventory purposes, such as weigh hoppers or belt weigh feeders;

(2) collect monthly samples of trona ore, sodium carbonate, kiln dust and brine and measure the carbon content of each sample as follows:

(a) for brine, using total organic carbon analyzer in accordance with ASTM D4839-03 “Standard Test Methods for Instrumental Determination of Carbon in Water by Ultraviolet, or Persulfate Oxidation, or Both, and Infrared Detection”;

(b) for trona ore, sodium carbonate and kiln dust, in accordance with ASTM E359-00 (2005) e1 “Standard Test Methods for Analysis of Soda Ash (Sodium Carbonate)”.

QC.12. MANUFACTURING OF PETROCHEMICAL PRODUCTS

QC.12.1. Covered sources

The covered sources are all the processes used in the production of petrochemical products from feedstocks derived from petroleum, or petroleum and natural gas liquids.

QC.12.2. Greenhouse gas reporting requirements

The greenhouse gas emissions report referred to in section 6.2 must include

(1) the annual CO_2, CH_4 and N_2O emissions attributable to the use of stationary combustion units, calculated in accordance with QC.1, in metric tons;

(2) the annual CO_2, CH_4 and N_2O emissions attributable to the combustion of refinery fuel gas, flexigas or associated gas, calculated in accordance with QC.2, in metric tons;

(3) the annual CO_2, CH_4 and N_2O emissions attributable to each chemical process, calculated in accordance with QC.12.3.1, in metric tons;

(4) the annual CO_2 emissions attributable to catalyst regeneration, calculated in accordance with QC.12.3.2, in metric tons;

(5) the annual CO_2, CH_4 and N_2O emissions attributable to flares and antipollution devices, calculated in accordance with QC.12.3.3, in metric tons;

(6) the annual CO_2, CH_4 and N_2O emissions from process vents, calculated in accordance with QC.12.3.4, in metric tons;

(7) the annual CH_4 emissions from leaks from equipment components, calculated in accordance with QC.12.3.5, in metric tons;

(8) the annual CH_4 emissions from above-ground storage tanks, calculated in accordance with QC.12.3.6, in metric tons;

(9) the annual CH_4 and N_2O emissions from wastewater treatment, calculated in accordance with QC.12.3.7, in metric tons;

(10) the annual CH_4 emissions attributable to oil-water separators, calculated in accordance with QC.12.3.8, in metric tons;

(11) the annual consumption of each type of feedstock that emits CO_2, CH_4 or N_2O, expressed

(a) in millions of cubic metres at standard conditions, for gases;

(b) in kilolitres, for liquids;

(c) in metric tons for non-biomass solids;

(d) in bone dry metric tons, for biomass-derived solid fuels;

(12) the average monthly carbon content of the feedstock materials consumed or materials produced, in kilograms of carbon per kilogram of feedstock gas or kilograms of carbon per kilogram of materials produced;

(13) the average monthly molecular mass of the feedstock consumed or materials produced, in kilograms per kilomole.

QC.12.3. Calculation methods for CO_2, CH_4 and N_2O emissions

The annual CO_2, CH_4 and N_2O emissions attributable to the production of petrochemical products must be calculated in accordance with one of the calculation methods in QC.12.3.1 to QC.12.3.8.

QC.12.3.1. Calculation of emissions attributable to each petrochemical process

The annual CO_2 emissions attributable to each petrochemical process must be calculated in accordance with the following methods:

(1) where the feedstock and product are gases, using equation 12-1:

Equation 12-1

$$CO_2 = \sum_{n=1}^{12} \left[\sum_{i=1}^{j\ or\ k} \left\{ \left[(V_{GI})_{i,n} \times (C_{GI})_{i,n} \times \frac{(MM_{GI})_i}{MVC} \right] - \left[(V_{GP})_{i,n} \times (C_{GP})_{i,n} \times \frac{(MM_{GP})_i}{MVC} \right] \right\} \right] \times 3.664 \times 0.001$$

Where:

CO_2 = Annual CO_2 emissions attributable to each petrochemical process, in metric tons;

n = Month;

j = Number of feedstock materials;

k = Number of products;

i = Type of gas;

$(V_{GI})_{i,n}$ = Volume of gas *i* input for month *n*, in cubic metres at standard conditions;

$(C_{GI})_{i,n}$ = Average carbon content of gas *i* input for month *n*, in kilograms of carbon per kilogram of gas input;

$(MM_{GI})_i$ = Monthly average molecular mass of gas *i*, in kilograms per kilomole;

MVC = Molar volume conversion factor (24.06 m^3 per kilomole at standard conditions);

$(V_{GP})_{i,n}$ = Volume of gas *i* produced in month *n*, in cubic metres at standard conditions;

$(C_{GP})_{i,n}$ = Average carbon content of gas *i* produced in month *n*, in kilograms of carbon per kilogram of gas produced;

$(MM_{GP})_i$ = Monthly average molecular mass of gas *i*, in kilograms per kilomole;

3.664 = Ratio of molecular weights, CO_2 to carbon;

0.001 = Conversion factor, kilograms to metric tons.

(2) where the feedstock and the product are liquids or solids, using equation 12-2:

Equation 12-2

$$CO_2 = \sum_{n=1}^{12} \left[\sum_{i=1}^{j or k} \left\{ \left[(Q_F)_{i,n} \times (C_F)_{i,n} \right] - \left[(Q_P)_{i,n} \times (C_P)_{i,n} \right] \right\} \right] \times 3.664 \times 0.001$$

Where:

CO_2 = Annual CO_2 emissions attributable to each petrochemical process, in metric tons;

n = Month;

j = Number of feedstock materials;

k = Number of products;

i = Type of feedstock material;

$(Q_F)_{i,n}$ = Quantity of feedstock *i* consumed in month *n*, in kilograms;

$(C_F)_{i,n}$= Average carbon content of feedstock *i* for month *n*, in kilograms of carbon per kilogram of feedstock;

$(Q_P)_{i,n}$ = Quantity of product *i* for month *n*, in kilograms;

$(C_P)_{i,n}$= Average carbon content of product *i* for month *n*, in kilograms of carbon per kilogram of product;

3.664 = Ratio of molecular weights, CO_2 to carbon;

0.001 = Conversion factor, kilograms to metric tons.

QC.12.3.2. Calculation of CO_2 emissions attributable to catalyst regeneration

The annual CO_2 emissions attributable to catalyst regeneration at a facility equipped with a continuous emission monitoring and recording system must be calculated in accordance with QC.1.3.4 or, in the absence of such a system, in accordance with QC.9.3.1 according to the type of process.

QC.12.3.3. Calculation of CO_2, CH_4 and N_2O emissions attributable to combustion in flares and antipollution devices

The annual CO_2, CH_4 and N_2O emissions attributable to combustion in flares and antipollution devices must be calculated in accordance with the calculation methods in QC.1.

The annual CO_2 emissions attributable to the combustion of hydrocarbons in flares must be calculated in accordance with QC.9.3.5 according to the type of equipment used.

QC.12.3.4. Calculation of CO_2, CH_4 and N_2O emissions from process vents

The annual CO_2, CH_4 and N_2O emissions from process vents, other than emissions required for the process, must be calculated in accordance with QC.9.3.2.

QC.12.3.5. Calculation of fugitive CH_4 emissions from system components

The annual fugitive emissions of CH_4 from all components in the natural gas or refinery gas supply system and from pressure swing adsorption (PSA) systems must be calculated in accordance with QC.9.3.9.

QC.12.3.6. Calculation of CH_4 emissions from above-ground storage tanks

The annual CH_4 emissions from above-ground storage tanks containing petroleum-derived products that are not equipped with pressure swing adsorption (PSA) systems must be calculated in accordance with QC.9.3.6.

QC.12.3.7. Calculation of CH_4 and N_2O emissions attributable to wastewater treatment

The annual CH_4 and N_2O emissions attributable to wastewater treatment must be calculated in accordance with QC.9.3.7.

QC.12.3.8. Calculation of CH_4 emissions attributable to oil-water separators

The annual CH_4 emissions attributable to oil-water separators must be calculated in accordance with QC.9.3.8.

QC.12.4. Sampling, analysis and measurement requirements

QC.12.4.1. Catalyst regeneration

For catalyst regeneration, the emitter must measure the parameters in accordance with QC.9.4.1.

QC.12.4.2. Flares and other antipollution devices

For flares and antipollution devices, the emitter must measure the parameters in accordance with QC.9.4.5.

QC.12.4.3 Process vents

For process vents, the emitter must, for each process vent event, measure the parameters in accordance with QC.9.4.2.

QC.12.4.4. Fugitive emissions from system components

For fugitive emissions from system components, the emitter must measure the parameters in accordance with QC.9.4.9.

QC.12.4.5. Above-ground storage tanks

For above-ground storage tanks, the emitter must measure the annual throughput of crude oil, naphtha, distillate oils and gasoil using flowmeters.

QC.12.4.6. Wastewater treatment

For wastewater treatment, the emitter must measure the parameters in accordance with QC.9.4.7.

QC.12.4.7. Oil-water separators

For oil-water separators, the emitter must measure the daily volume of wastewater treated in the oil-water separators.

QC.12.4.8. Consumption of feedstock

The emitter must determine the quantity of feedstock consumed using the same instruments used for inventory purposes, such as weigh hoppers or belt weigh feeders.

QC.13. ADIPIC ACID PRODUCTION

QC.13.1. Covered sources

The covered sources are all the processes used for the production of adipic acid ($HOOC(CH_2)_4COOH$) by the oxidation of mixture of cyclohexanone ($(CH_2)_5CO$) and cyclohexanol ($(CH_2)_5CHOH$) with nitric acid in the presence of a catalyst.

QC.13.2. Greenhouse gas reporting requirements

The greenhouse gas emissions report referred to in section 6.2 must include the following information:

(1) the annual N_2O emissions in metric tons;

(2) the annual production of adipic acid, in metric tons;

(3) the N_2O emission factor in metric tons of N_2O per metric ton of adipic acid;

(4) the destruction factor for the facility's antipollution equipment;

(5) the utilization factor for the facility's antipollution equipment.

Subparagraphs 3, 4 and 5 of the first paragraph do not apply to the N_2O emissions of an emitter who calculates emissions using data from a continuous emission monitoring and recording system.

QC.13.3. Calculation methods for N_2O emissions attributable to the oxidation process

The annual N_2O emissions attributable to the oxidation process must be calculated in accordance with one of the two calculation methods in QC.13.3.1 and QC.13.3.2.

QC.13.3.1. Use of a continuous emission monitoring and recording system

The annual N_2O emissions may be calculated using data from a continuous emission monitoring and recording system in accordance with QC.1.3.4.

QC.13.3.2. Calculation method using the N_2O emission factor and the destruction and use factors for antipollution equipment

The annual N_2O emissions must be calculated using equation 13-1:

Equation 13-1

$$N_2O = EF_{N2O} \times AAP \times (1 - F_D \times F_U)$$

Where:

N_2O = Emissions of N_2O attributable to the oxidation process, in metric tons;

EF_{N2O} = N_2O emission factor, in metric tons of N_2O per metric ton of adipic acid produced;

AAP = Adipic acid production, in metric tons;

F_D = Destruction factor for the facility's antipollution equipment;

F_U = Utilization factor for the facility's antipollution equipment.

QC.13.4. Sampling, analysis and measurement requirements

An emitter who operates an enterprise, facility or establishment that produces adipic acid must:

(1) determine the N_2O emission factor for the facility annually using:

(a) method 320 in Appendix A of Part 63 of Title 40 of the Code of Federal Regulations, "Measurement of Vapor Phase Organic and Inorganic Emissions by Extractive Fourier Transform Infrared (FTIR) Spectroscopy", published by the United States Environmental Protection Agency (USEPA);

(b) standard ASTM D6348-03 "Standard Test Method for Determination of Gaseous Compounds by Extractive Direct Interface Fourier Transform Infrared (FTIR) Spectroscopy";

(c) a continuous emission monitoring and recording system to determine either the N_2O emissions when the antipollution equipment is not operational (creating an emission factor for use with the destruction factor for the equipment), or the quantity of N_2O emissions destroyed by the equipment;

(2) determine the quantity of adipic acid produced annually by

(a) using annual sales data; or

(b) using measurements from flowmeters or weigh scales.

QC.14. LEAD PRODUCTION

QC.14.1. Covered sources

The covered sources are all processes used in primary and secondary lead production.

QC.14.2. Greenhouse gas reporting requirements

The greenhouse gas emissions report referred to in section 6.2 must include the following information:

(1) the annual CO_2 emissions, in metric tons;

(2) the annual CO_2 emissions attributable to the use in the furnace of each material containing carbon, in metric tons;

(3) the annual quantity of each material containing carbon used in the furnace, in metric tons;

(4) the carbon content of each material containing carbon used in the furnace.

QC.14.3. Calculation methods for CO_2 emissions attributable to primary and secondary lead production processes

The annual CO_2 emissions attributable to use in the furnace of each material containing carbon must be calculated in accordance with one of the two calculation methods in QC.14.3.1 and QC.14.3.2.

QC.14.3.1. Use of a continuous emission monitoring and recording system

The annual CO_2 emissions may be calculated using data from a continuous emission monitoring and recording system in accordance with QC.1.3.4.

QC.14.3.2. Calculation by mass balance

The annual CO_2 emissions must be calculated using equation 14-1:

Equation 14-1

$$CO_2 = \sum_{i}^{n} (M_i \times CC_i) \times 3.664$$

Where:

CO_2 = Emissions of CO_2 attributable to the use in the furnace of materials containing carbon, in metric tons;

n = Number of types of material;

i = Type of material;

M_i = Annual quantity of material *i* used, in metric tons;

CC_i = Carbon content of material *i* used, in kilograms of carbon per kilogram of material;

3.664 = Ratio of molecular weights, CO_2 to carbon.

QC.14.4. Sampling, analysis and measurement requirements

An emitter who operates an enterprise, facility or establishment that produces lead must:

(1) obtain annually the carbon content of each material containing carbon used in the furnace, either by using the data provided by the material supplier, or by using the following methods:

(a) for metal ores and alloys, ASTM E1941-04 “Standard Test Method for Determination of Carbon in Refractory and Reactive Metals and Their Alloys”;

(b) for carbonaceous reducing agents and carbon electrodes, ASTM D5373-08 “Standard Test Methods for Instrumental Determination of Carbon, Hydrogen, and Nitrogen in Laboratory Samples of Coal”;

(c) for flux materials, ASTM C25-06 “Standard Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime”;

(2) calculate the annual quantity of each material containing carbon used in the furnace by direct weight measurement using the same plant instruments used for inventory purposes, such as weigh hoppers or belt weigh feeders.

QC.15. ZINC PRODUCTION

QC.15.1. Covered sources

The covered sources are all the processes used for primary and secondary zinc production.

QC.15.2. Greenhouse gas reporting requirements

The greenhouse gas emissions report referred to in section 6.2 must include the following information:

(1) the annual CO_2 emissions, in metric tons;

(2) the annual CO_2 emissions attributable to use in the furnace of each material containing carbon, in metric tons;

(3) the annual quantity of each material containing carbon used in the furnace, in metric tons;

(4) the carbon content of each material containing carbon used in the furnace.

QC.15.3. Calculation methods for CO_2 emissions attributable to primary and secondary zinc production processes

The annual CO_2 emissions attributable to use in the furnace of each material containing carbon must be calculated in accordance with one of the two calculation methods in QC.15.3.1 and QC.15.3.2.

QC.15.3.1. Use of a continuous emission monitoring and recording system

The annual CO_2 emissions may be calculated using data from a continuous emission monitoring and recording system in accordance with QC.1.3.4.

QC.15.3.2. Calculation by mass balance

The annual CO_2 emissions must be calculated using equation 15-1:

Equation 15-1

$$CO_2 = \sum_{i}^{n} \left(M_i \times CC_i \right) \times 3.664$$

Where:

CO_2 = Annual CO_2 emissions attributable to the use in the furnace of materials containing carbon, in metric tons;

n = Number of types of material;

i = Type of material;

M_i = Annual quantity of material *i* used, in metric tons;

CC_i = Carbon content of material *i* used, in kilograms of carbon per kilogram of material;

3.664 = Ratio of molecular weights, CO_2 to carbon.

QC.15.4. Sampling, analysis and measurement requirements

An emitter who operates an enterprise, facility or establishment that produces zinc must:

(1) obtain annually the carbon content of each material containing carbon used in the furnace, either by using the data provided by the supplier, or by using the following methods:

(a) for ores containing zinc, ASTM E1941-04 "Standard Test Method for Determination of Carbon in Refractory and Reactive Metals and Their Alloys";

(b) for carbonaceous reducing agents and carbon electrodes, ASTM D5373-08 "Standard Test Methods for Instrumental Determination of Carbon, Hydrogen, and Nitrogen in Laboratory Samples of Coal";

(c) for flux materials, ASTM C25-06 "Standard Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime";

(2) calculate the annual quantity of each material containing carbon entering the furnace by direct weight measurement using the same plant instruments used for inventory purposes, such as weigh hoppers or belt weigh feeders.

QC.16. ELECTRICITY GENERATION

QC.16.1. Covered sources

The covered sources are stationary combustion units that combust solid, liquid or gaseous fuel for the purpose of producing electricity either for sale or for use at the facility or establishment, as well as cogeneration facilities where steam and electricity are produced.

QC.16.2. Greenhouse gas reporting requirements

The greenhouse gas emissions report referred to in section 6.2 must include the following information:

(1) the annual greenhouse gas emissions attributable to the combustion of fossil fuels, biomass fuels, biomass and municipal solid waste, in metric tons, indicating for each type of fuel:

(a) the CO_2 emissions;

(b) the CH_4 emissions;

(c) the N_2O emissions;

(2) the annual consumption of fuel, expressed

(a) in cubic metres at standard conditions, for gases;

(b) in kilolitres, for liquids;

(c) in metric tons, for solids other than biomass solid fuels;

(d) in bone dry metric tons, for biomass solid fuels;

(3) where carbon content is used to calculate CO_2 emissions, the average carbon content of each type of fuel, in kilograms of carbon per kilogram of fuel;

(4) where high heat value is used to calculate CO_2 emissions, the average high heat value of each type of fuel, expressed:

(a) in gigajoules per metric ton, for solid fuels;

(b) in gigajoules per kilolitre, for liquid fuels;

(c) in gigajoules per cubic metre, for gaseous fuels;

(5) the nameplate generating capacity of each electricity generating unit, in megawatts;

(6) the annual electricity production, in megawatt-hours;

(7) for each cogeneration unit, the type of cycle, whether a topping or bottoming cycle, and the useful thermal output, as applicable, in megajoules;

(8) the annual CO_2 emissions attributable to acid gas scrubbers and acid gas reagent;

(9) the annual fugitive emissions of HFC from cooling units;

(10) the annual fugitive emissions of CO_2 from geothermal facilities;

(11) the annual fugitive emissions of CO_2 from coal storage in accordance with QC.5;

(12) the annual quantity of absorbent used in acid gas scrubbing equipment, in metric tons;

(13) the annual energy transferred from the steam or geothermal fluid in geothermal facilities, in gigajoules;

(14) where steam or heat is acquired from another facility or establishment for electricity generation, the name of the steam or heat supplier and the quantity supplied, in megajoules;

(15) where additional fuels are used to support electricity generation or industrial production, the annual consumption of fuel by fuel type.

Subparagraphs 3 and 4 of the first paragraph do not apply to the CO_2 emissions of an emitter who calculates emissions using data from a continuous emission monitoring and recording system.

QC.16.3. Calculation methods for CO_2 emissions

The annual CO_2 emissions attributable to stationary combustion units that produce electricity, acid gas scrubbers and geothermal facilities must be calculated in accordance with one of the calculation methods in QC.16.3.1 to QC.16.3.4.

QC.16.3.1. Use of a continuous emission monitoring and recording system

The annual CO_2 emissions attributable to stationary combustion units producing electricity may be calculated using data from a continuous emission monitoring and recording system in accordance with QC.1.3.4.

QC.16.3.2. Calculation of CO_2 emissions attributable to stationary combustion units producing electricity

The annual CO_2 emissions attributable to stationary combustion units producing electricity may be calculated using the following calculation methods:

(1) for units that use natural gas as a fuel:

(a) when the high heat value of the gas is greater than or equal to 36.3 MJ/m^3 and less than or equal to 40.98 MJ/m^3 at standard conditions, in accordance with QC.1.3.3 or, for an emitter to whom section 6.6 of this Regulation does not apply, in accordance with QC.1.3.2;

(b) when the high heat value of the gas is less than 36.3 MJ/m^3 or greater than 40.98 MJ/m^3 at standard conditions, in accordance with QC.1.3.3;

(2) for units that use coal or petroleum coke as a fuel, in accordance with QC.1.3.3(1);

(3) for units that use middle distillates as a fuel, such as diesel, fuel oil or kerosene, gasoline, residual oil or liquefied petroleum such as ethane, propane, isobutene or n-butane, in accordance with QC.1.3.3 or, for an emitter to whom section 6.6 of this Regulation does not apply, in accordance with QC.1.3.2;

(4) for units that use refinery fuel gas, flexigas or associated gas as a fuel, in accordance with QC.2;

(5) for units that use biogas or biomass as a fuel, the calculations must be completed in accordance with QC.1.3.3 or, for an emitter to whom section 6.6 of this Regulation does not apply, in accordance with QC.1.3.2;

(6) for units that use municipal solid waste as a fuel, in accordance with QC.1.3.3 or, for an emitter to whom section 6.6 of this Regulation does not apply, in accordance with QC.1.3.2;

(7) for units that use biogas or biomass as a fuel but that, during start-up, shut-down, or malfunction operating periods only use fossil fuels or fuel gas, the CO_2 emissions attributable to those fuels must be calculated:

(a) for fossil fuels, in accordance with QC.1.3.1, QC.1.3.2 and QC.1.3.3;

(b) for fuel gas, in accordance with QC.2.

(8) for units that use only fossil fuels, in accordance with QC.16.3.2(1) to (4), for each type of fuel;

(9) for units that use fossil fuels and biogas or biomass:

(a) when the emissions are calculated using data from a continuous emission monitoring and recording system, the portion of CO_2 emissions attributable to the biomass or biogas must be calculated in accordance with QC.1.3.4(3);

(b) when the emissions are not calculated using data from a continuous emission monitoring and recording system, in accordance with QC.16.3.2(1) to (7), for each type of fuel.

QC.16.3.3. Calculation of CO_2 emissions from acid gas scrubbing

The annual CO_2 emissions from acid gas scrubbing must be calculated using equation 16-1:

Equation 16-1

$$CO_2 = Q_S \times R \times \left(\frac{44}{MW_S} \right)$$

Where:

CO_2 = Annual CO_2 emissions from acid gas scrubbing, in metric tons;

Q_S = Annual quantity of sorbent used, in metric tons;

R = Ratio of moles of CO_2 released upon capture of one mole of acid gas;

44 = Molecular weight of CO_2, in kilograms per kilomole;

MW_S = Molecular weight of sorbent, in kilograms per kilomole, or, if calcium carbonate, 100.

QC.16.3.4. Calculation of fugitive CO_2 emissions form geothermal facilities

The annual fugitive CO_2 emissions from geothermal facilities must be calculated using equation 16-2:

Equation 16-2

$$CO_2 = 7.14 \times Q_E \times 0.001$$

Where:

CO_2 = Annual fugitive emissions of CO_2 from geothermal facilities, in metric tons per year;

7.14 = Default fugitive CO_2 emission factor for geothermal facilities, in kilograms per gigajoule;

Q_E = Quantity of energy transferred from geothermal steam or fluid, in gigajoules per year;

0.001 = Conversion factor, kilograms to metric tons.

QC.16.4. Calculation methods for CH_4 and N_2O emissions

The annual CH_4 and N_2O emissions attributable to stationary combustion units producing electricity must be calculated in accordance with QC.1.4.

QC.16.5. Calculation methods for fugitive HFC emissions

The annual fugitive HFC emissions attributable to cooling units used in electricity production must be calculated in accordance with one of the calculation methods in QC.16.5.1 and QC.16.5.2.

QC.16.5.1. Calculation of fugitive HFC emissions based on change in inventory

The annual fugitive HFC emissions attributable to cooling units used in electricity production may be calculated based on the change in inventory using equation 16-3:

Equation 16-3

$$HFC = INV_{begin} - INV_{end} + PURCHASES - SALES + \Delta CAP$$

Where:

HFC = Annual fugitive emissions of HFC attributable to cooling units used in electricity production, in metric tons;

INV_{begin} = Quantity of HFC in storage at the beginning of the year, in metric tons;

INV_{end} = Quantity of HFC in storage at the end of the year, in metric tons;

PURCHASES = Quantity of HFC purchased from other facilities or establishments during the year, in metric tons;

SALES = Quantity of HFC sold or otherwise transferred offsite to other facilities or establishments during the year, in metric tons;

ΔCAP = The net change in the total nameplate capacity (i.e. the full and proper charge) of the cooling equipment, in metric tons. The net change in capacity will be negative if the total nameplate capacity at the end of the year is less than the total nameplate capacity at the beginning of the year.

QC.16.5.2. Calculation of fugitives HFC emissions based on service logs

The annual fugitive HFC emissions attributable to cooling units used in electricity production may be calculated on the basis of entries in equipment service logs using equation 16-4:

Equation 16-4

$$HFC = \left[\sum_{i-1}^{n} \left(Q\ NEW_i - NC\ NEW_i \right) + \sum_{j=1}^{m} \left(Q\ RECH_j - Q\ RECO_j \right) + \sum_{k=1}^{p} \left(NC\ RET_k - Q\ RET_k \right) \right] \times 0.001$$

Where:

HFC = Annual fugitive emissions of HFC attributable to cooling units used in electricity production in metric tons;

n = Number of new cooling units brought into operation during the year;

i = Unit brought into operation;

$Q\ NEW_i$ = Quantity of HFC used to fill unit *i*, in kilograms;

$NC\ NEW_i$ = Nameplate capacity of unit *i*, in kilograms;

m = Number of maintenance operations, either to recharge or recover, completed during the year;

j = Unit maintained;

$Q\ RECH_j$ = Quantity of HFC used to recharge the unit *j* during maintenance, in kilograms;

$Q\ RECO_j$ = Quantity of HFC recovered from unit *j*, in kilograms;

p = Number of cooling units retired during the year;

k = Unit retired;

$NC\ RET_k$ = Nameplate generating capacity of unit *k*, in kilograms;

$Q\ RET_k$ = Quantity of HFC recovered from unit *k*, in kilograms;

0.001 = Conversion factor, kilograms to metric tons.

QC.16.6. Sampling, analysis and measurement requirements

QC.16.6.1. Solid, liquid and gaseous fuels

For all fuels except refinery fuel gas, flexigas and associated gas, sampling, consumption measurements, carbon content measurements, and measurements to calculate high heat value and emission factors must be completed in accordance with QC.1.5.

QC.16.6.2. Refinery fuel gas, flexigas and associated gas

For refinery fuel gas, flexigas and associated gas, sampling, consumption measurements, carbon content measurements, and measurements to calculate high heat value and emission factors must be completed in accordance with QC.2.4.

QC.16.6.3. Acid gas scrubbing

The emitter must measure the quantity of sorbent used annually.

QC.16.6.4. Geothermal facility

The emitter must measure the quantity of energy transferred annually from geothermal steam or fluid.

QC.17. CONSUMPTION AND SALE OF ELECTRICITY PRODUCED OUTSIDE QUÉBEC, AND EXPORTATION OF ELECTRICITY

QC.17.1. Covered sources

The covered sources are the activities of persons and municipalities that operate an enterprise, a facility or en establishment that purchases electricity produced outside Québec for their own consumption or for sale in Québec, or that exports electricity.

QC.17.2. Specific information to be reported concerning greenhouse gas emissions

The greenhouse gas emissions report referred to in section 6.2 must include the following information:

(1) for the acquisition of electricity produced outside Québec for the consumption of the enterprise, facility or establishment or for sale within Québec:

(a) the total quantity of electricity produced outside Québec that was acquired during the year for consumption or sale in Québec, in megawatt-hours;

(b) the total annual CO_2 emissions attributable to the production of electricity referred to in subparagraph *a*, calculated in accordance with QC.17.3.1, in metric tons;

(c) for each identifiable facility covered by a CO_2 emissions report made to Environment Canada under section 71 of the Canadian Environmental Protection Act (1999) (1999, c.33), to the U.S. Environmental Protection Agency (USEPA) under Part 75 of Title 40 of the Code of Federal Regulations, or to the organization The Climate Registry:

i. the name and address of the facility, the identification number assigned to it by the National Pollutant Release Inventory of Environment Canada, the U.S. Environmental Protection Agency (USEPA) or the organization The Climate Registry;

ii. the total quantity of electricity acquired, in megawatt-hours;

iii. the transmission losses, in megawatt-hours;

iv. the facility's net annual electricity production, in megawatt-hours;

v. the annual CO_2 emissions attributable to the production of electricity acquired from the facility, in metric tons;

vi. the annual CO_2 emissions of the facility, in metric tons;

(d) for each identifiable facility not covered by a CO_2 emissions report made to one of the organizations referred to in subparagraph *c*:

i. the information specified in subparagraphs *i* to *v* of subparagraph *c*, the identification number being required only if assigned;

ii. each type of fuel used to produce electricity and its high heat value, expressed

— in gigajoules per metric ton, for solid fuels;

— in gigajoules per kilolitre, for liquid fuels;

— in gigajoules per cubic metre, for gaseous fuels;

(e) for each identifiable facility for which the information needed to calculate CO_2 emissions using equation 17-1 or 17-2 is not available, and for each unspecified facility:

i. the province or state from which the electricity is acquired;

ii. the total quantity of electricity acquired, in megawatt-hours, for each province or state,;

iii. the annual CO_2 emissions attributable to the electricity acquired, in metric tons, from each province or state;

(2) for the exportation of electricity:

(a) the total quantity of electricity exported annually by the enterprise, facility or establishment, in megawatt-hours;

(b) the total annual CO_2 emissions caused or avoided by the exportation of the electricity, calculated in accordance with QC.17.3.2, in metric tons;

(c) for each identifiable facility covered by a CO_2 emissions report in accordance with this Regulation, for each destination province or state:

i. the annual CO_2 emissions caused or avoided by the exportation of the electricity produced by the facility, in metric tons;

ii. the total quantity of electricity produced by the facility and exported annually, in megawatt-hours;

(d) for each identifiable facility not covered by a CO_2 emissions report in accordance with this Regulation, and for each unidentifiable facility, by destination province or state:

i. the annual CO_2 emissions caused or avoided by the exportation of the electricity produced by the specified or unspecified facility, in metric tons;

ii. the quantity of electricity produced by the facility that is exported annually, in megawatt-hours.

Where, with regard to an identifiable facility, the information referred to in subparagraphs *iii* to *vi* of subparagraph *c* of paragraph 1 of QC.17.3.2. is not available for a report year, the emitter may provide and use for calculating the emissions of the facility, in accordance with QC.17.3.1., the information of the most recent year that does not precede the report year by more than 3 years.

QC.17.3. Calculation methods for CO_2 emissions

The annual CO_2 emissions attributable to the production of electricity acquired outside Québec and acquired by an enterprise, a facility or an establishment for its own consumption or for sale within Québec must be calculated in accordance with one of the calculation methods in QC.17.3.1. The annual CO_2 emissions caused or avoided by the exportation of the electricity must be calculated in accordance with one of the calculation methods in QC.17.3.2.

QC.17.3.1. Calculation of CO_2 emissions attributable to the production of electricity acquired outside Québec and sold or consumed within Québec

The annual CO_2 emissions attributable to electricity produced outside Québec and sold or consumed within Québec must be calculated by adding the CO_2 emissions attributable to electricity acquired outside Québec and produced by identifiable and unidentifiable facilities which emissions are calculated in accordance with the following methods:

(1) for an identifable facility covered by a CO_2 emissions report made to Environment Canada under section 71 of the Canadian Environmental Protection Act (1999) (1999, c. 33), the U.S. Environmental Protection Agency (USEPA) under Part 75 of Title 40 of the Code of Federal Regulations, or the organization The Climate Registry, using equation 17-1:

Equation 17-1

$$CO_2 = CO_{2,i} \times \frac{MWh_{imp}}{MWh_n}$$

Where:

CO_2 = Annual CO_2 emissions attributable to the production of electricity acquired outside Québec and produced by the identifiable facility, in metric tons;

$CO_{2,i}$ = Annual CO_2 emissions attributable to the identifiable facility, in metric tons;

MWh_{imp} = Total quantity of electricity acquired from the identifiable facility and consumed or sold annually in Québec, including an estimate of transmission losses, from the facility's busbar, in megawatt-hours;

MWh_n = Net annual production of electricity at the identifiable facility, in megawatt-hours;

(2) for a specified facility not covered by a CO_2 emissions report made to one of the organizations referred to in paragraph (1), using equation 17-2:

Equation 17-2

$$CO_2 = \sum_{j=1}^{n} \left(Q_j \times HHV_j \times EF_j\right) \times \frac{MWh_{imp}}{MWh_n} \times 0.001$$

Where:

CO_2 = Annual CO_2 emissions attributable to the production of electricity acquired outside Québec and produced by the identifiable facility, in metric tons;

n = Number of fuels used annually by the facility;

j = Type of fuel;

Q_j = Quantity of fuel *j*, expressed

— in metric tons, for solid fuels;

— in kilolitres, for liquid fuels;

— in cubic metres, for gaseous fuels;

HHV_j = High heat value of fuel *j* consumed for electricity production, as indicated in Table 1-1 for QC.1.6, expressed

— in gigajoules per metric ton, for solid fuels;

— in gigajoules per kilolitre, for liquid fuels;

— in gigajoules per cubic metre, for gaseous fuels;

EF_j = CO_2 emission factor for fuel *j* as indicated in Table 1-2, 1-3, 1-4 or 1-5 for QC.1.6, in kilograms of CO_2 per gigajoule;

MWh_{imp} = Quantity of electricity acquired from the identifiable facility and consumed or sold annually in Québec, including an estimate of transmission losses, from the facility's busbar, in megawatt-hours;

MWh_n = Net annual production of electricity at the identifiable facility, in megawatt-hours;

0.001 = Conversion factor, kilograms to metric tons

(3) for an identifiable facility for which the information needed to calculate CO_2 emissions using equation 17-1 or 17-2 is not available, and for an unidentifiable facility, using equation 17-3:

Equation 17-3

$$CO_2 = MWh_{imp} \times EF_D$$

Where:

CO_2 = Annual CO_2 emissions attributable to the production of electricity acquired outside Québec and produced by the identifiable or unidentifiable facility, in metric tons;

MWh_{imp} = Quantity of electricity acquired from the identifiable or unidentifiable facility and consumed or sold annually in Québec, in megawatt-hours;

EF_D = CO_2 emission factor for the province or North American market from which the electricity comes, as indicated in Table 17-1 for QC.17.4, in metric tons of CO_2 per megawatt-hour, or, where the electricity comes from an identifiable nuclear, hydroelectric, sea current, wind, solar or tidal power facility, a factor of 0.

QC.17.3.2. Calculation of CO_2 emissions caused or avoided by the exportation of the electricity

The annual CO_2 emissions caused or avoided by the exportation of the electricity must be calculated by adding the CO_2 emissions attributable to the exportation of electricity produced by identifiable facilities to the CO_2 emissions attributable to the exportation of electricity produced by unidentifiable facilities, using one of the following methods:

(1) for an identifiable facility covered by a CO_2 emissions report in accordance with QC.16, using equation 17-4:

Equation 17-4

$$CO_2 = \left(CO_{2,t} \times \frac{MWh_{\exp}}{MWh_n}\right) - \left(MWh_{\exp} \times EF_D\right)$$

Where:

CO_2 = Annual CO_2 emissions caused or avoided by the exportation of the electricity produced by the specified facility, in metric tons;

CO_{2t} = Total annual CO_2 emissions attributable to the identifiable facility, in metric tons;

MWh_{exp} = Total quantity of electricity produced by the identifiable facility and exported annually, including an estimate of transmission losses, from the facility's busbar, in megawatt-hours;

MWh_n = Net annual production of electricity at the identifiable facility, in megawatt-hours;

EF_D = CO_2 emission factor for the province or North American market where the electricity is delivered, as indicated in Table 17-1 for QC.17.4, in metric tons of CO_2 per megawatt-hour;

(2) for an identifiable facility not covered by a CO_2 emissions report made in accordance with QC.16 and for an unspecified facility, using equation 17-5:

Equation 17-5

$$CO_2 = MWh_{\exp} \times \left(EF_{QC} - EF_D\right)$$

Where:

CO_2 = Annual CO_2 emissions caused or avoided by the exportation of the electricity produced by the identifiable or unidentifiable facility, in metric tons;

$MWh_{\exp}$ = Quantity of electricity produced by the identifiable or unidentifiable facility and exported annually, in megawatt-hours;

EF_{QC} = CO_2 emission factor for Québec, as indicated in Table 17-1 for QC.17.4, in metric tons of CO_2 per megawatt-hour;

EF_D = CO_2 emission factor for the province or North American market where the electricity is delivered, as indicated in Table 17-1 for QC.17.4, in metric tons of CO_2 per megawatt-hour, or, where the electricity comes from an identifiable nuclear, hydroelectric, sea current, wind, solar or tidal power facility, a factor of 0.

QC.17.4. Table

Table 17-1. Default CO_2 emission factors for Canadian provinces and certain North American markets, in metric tons of CO_2 per megawatt-hour

(QC.17.3.1, (3), QC.17.3.2, (1) and (2))

Canadian province and north American market	**Default emission factor (t/MWh)**
Newfoundland and Labrador	0.025
Nova Scotia	0.803
New Brunswick	0.424
Québec	0.011
Ontario	0.220
New England Independent System Operator (NE-ISO), including all or part of the following states: - Connecticut - Massachusetts - Maine - Rhode Island - Vermont - New Hampshire	0.462
New York Independent System Operator (NY-ISO)	0.650
Pennsylvania Jersey Maryland Interconnection Regional Transmission Organization (PJM-RTO), including all or part of the following states: - Delaware - Illinois - Kentucky - Maryland - Michigan - North Carolina - New Jersey - Ohio - Pennsylvania - Tennessee - Virginia - West Virginia - District of Columbia	0.924
Midwest Independent Transmission System Operator (MISO-RTO), including all or part of the following province and states: - Manitoba - Wyoming - North Dakota - South Dakota - Minnesota - Iowa - Missouri - Wisconsin - Illinois - Michigan - Indiana - Ohio - Pennsylvania	0.946

.”.

13. Schedule B is amended by replacing Tables C and D of Part III by the following:

“**Table C**

Identification of raw material	% Sulphur	Quantity	Unit of measure

Table D

Contaminant	% Sulphur	Emission factor	Unit of measure	Product, raw material or fuel related to the emission factor	Origin or emission factor reference used(3)

(3) For each contaminant emitted for which the operator takes into account an emission factor to quantify its emissions, the operator must indicate the origin of the emission factor and, if it comes from a published documentary source, indicate its reference.”.

14. For report year 2010, an emitter that on *(insert the date preceding the day of coming into force of this Regulation)* was required to report greenhouse gas emissions under section 5 of the Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere and that did not have the data needed to use one of the calculation methods prescribed in Schedule A.2 may use, for that report year, one of the methods prescribed in the second paragraph of section 6 of the Regulation.

Section 6.6 of the Regulation, introduced by section 8 of this Regulation, does not apply to report year 2010.

15. From report year 2011, an emitter that on *(insert the date preceding the day of coming into force of this Regulation)* was not required to report greenhouse gas emissions under the Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere, and an emitter referred to in section 14, must report their emissions in accordance with the new Division II.1 of the Regulation.

16. This Regulation comes into force on the fifteenth day following the date of its publication in the *Gazette officielle du Québec*.

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Draft Regulation

Professional Code
(R.S.Q., c. C-26)

Certified management accountants — Indemnity fund

Notice is hereby given, in accordance with sections 10 and 11 of the Regulations Act (R.S.Q., c. R-18.1), that the Regulation respecting the indemnity fund of the Ordre des comptables en management accrédités du Québec, made by the board of directors of the Ordre des comptables en management accrédités du Québec, may be submitted to the Government which may approve it, with or without amendment, on the expiry of 45 days following this publication.

The object of the Regulation is to determine the process for reimbursing to a claimant any funds or property used by a certified management accountant for purposes other than those for which they were entrusted to the accountant acting in a professional capacity by the claimant, as well as the procedure for establishing the indemnity fund and the rules governing its administration and the investing of the amounts paid into the fund. The Regulation also sets the maximum indemnity payable from the fund for all claims against a member.

The Order advises that the Regulation will have no impact on enterprises, including small and medium-sized businesses.