Greenhouse Gas (GHG) Emissions Measurement and Reporting Guidelines

PART III: INTRODUCTION TO THE EMISSIONS REPORT

VERSION 2 29 MARCH 2021

National Environment Agency
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Contents

1. Introduction to the Guidelines....4
   1.1 Purpose....4
   1.2 Scope....4
2. Overview of the Emissions Report Form....5
   2.1 Layout and general rules....5
   2.2 Accounting of non-reckonable emissions....8
   Table 1: List of non-reckonable emissions....8
   2.3 Pre-Population of ER using Previous ER....10
   2.4 Auto-population of fuel combustion data from/to fuel use table of the Energy Use Report under the Energy Conservation Act....11
   2.5 Submission of the ECA Energy Use Report and CPA Emissions Report....13
   2.6 Units, decimal places and truncation....14
   2.7 First emissions reporting for taxable facilities registered after June 2018....15
   2.8 List of Supporting Documents....15
3. Emissions Report Sub-Forms....16
   3.1 Fuel Combustion....16
   3.2 Ethylene production....22
   3.3 Ethylene oxide production....24
   3.4 Flares....26
   3.5 Vents....29
   3.6 Fugitive emissions....31
   3.7 Coal gasification....33
   3.8 Integrated circuit or semiconductor production....35
   3.9 Thin-film transistor flat panel display (TFT FPD) or liquid crystal display (LCD) production....39
   3.10 Iron and steel production....42
   3.11 Use of GHGs in fire protection equipment....44
   3.12 Use of HFCs or PFCs in refrigeration and air-conditioning equipment....46
   3.13 Use of HFCs and PFCs in solvents....48
   3.14 Use of lubricants or paraffin waxes....50
   3.15 Use of SF_6 in electrical equipment....53
   3.16 Any other process or activity resulting in GHG emissions....57

Revision History

Version no.	Revision date	Summary of changes
1	25 Feb 2020	Initial release
2	29 Mar 2021	Amendments to align with Carbon Pricing Act 2018 (Amendment of Second Schedule) Order 2021 and incorporate the enhancements to the Emissions Report Form in EDMA system

1. Introduction to the Guidelines

1.1 Purpose

This document is aligned with and supports the Carbon Pricing (Measurement, Reporting and Verification) Regulations 2018 under the Carbon Pricing Act (CPA).

This document is part of a series of Measurement and Reporting (M&R) guidelines and templates developed by the National Environment Agency (NEA):

i) Part I: Introduction to the GHG Measurement and Reporting Requirements

ii) Part II: Monitoring Plan

iii) Part III: Emissions Report

This series of guidelines aim to provide guidance on:

i) the implementation of the Measurement and Reporting (M&R) requirements;

ii) compliance requirements relating to the measurement and reporting of greenhouse gas (GHG) emissions; and

iii) the preparation of the Monitoring Plan and the Emissions Report.

This series of guidelines should be read in conjunction with the Greenhouse Gas (GHG) Verification and Accreditation (V&A) guidelines and templates.

1.2 Scope

The Emissions Report (ER) Form is an electronic form available at https://www.edma.gov.sg/. A step-by-step guide to navigating the online ER Form can be downloaded from the Emissions Data Monitoring and Analysis (EDMA) System. This guideline highlights the computation formulae and special instructions for filling up the ER Form.

2. Overview of the Emissions Report Form

2.1 Layout and general rules

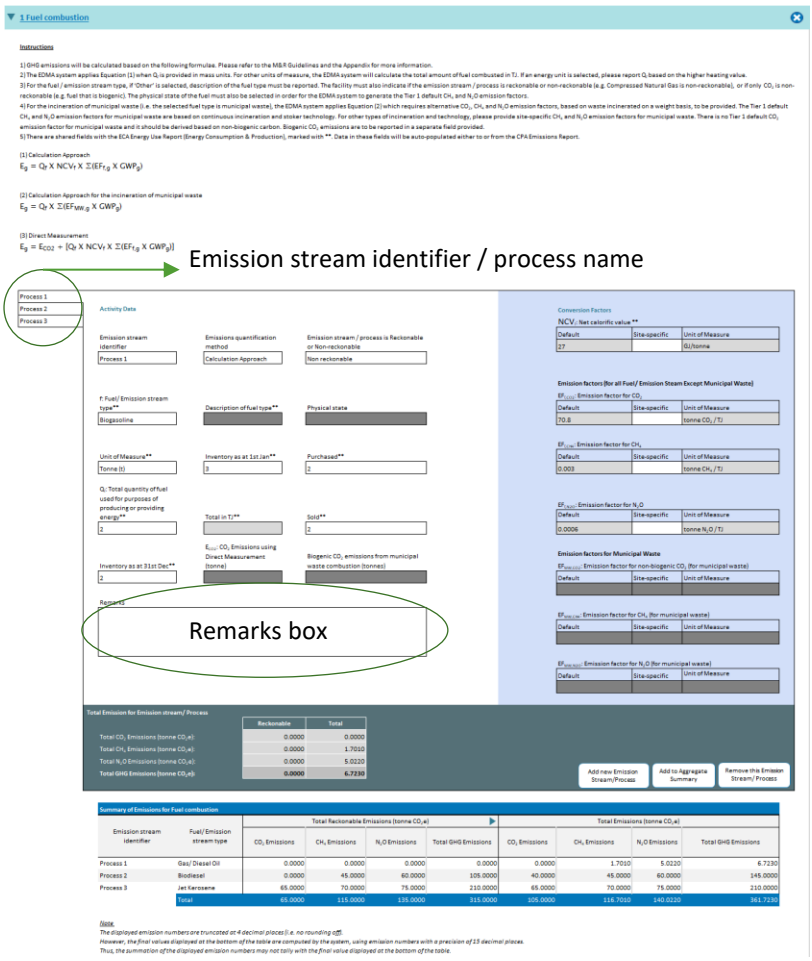
Firstly, GHG emissions are reported at the emission stream or process-level. The ER Form consists of 16 sub-forms and each sub-form has the following layout.

For the first reporting using the ER form, reportable facilities are to identify all emission streams and create the relevant sub-forms. For subsequent reporting, these sub-forms would then be automatically created in the ER, building from the previous reporting. Facilities are also able to add on additional sub-forms, if new emission streams become applicable.

For taxable facilities, the sub-forms for all emission streams should be created as per listed in the Monitoring Plan. For subsequent reporting, these sub-forms would also be automatically created in the ER.

Facilities are required to report/declare '0' if there is nil activity data/GHG emissions.

<u>Layout</u>



The general formulae displayed is the same formulae in the M&R Appendix.

Information is entered into the Activity Data and Conversion Factor panels (at the left and right hand sides respectively.)

The emission stream summary displays the calculated emissions in terms of CO_2e by type of GHG.

The emission source summary displays the calculated emissions in terms of CO_2e for each emission stream by type of GHG.

General Rules

In the Activity Data and Conversion Factor panels, a field either consists of a dropdown list of pre-populated entries for selection, or is a blank box for entering text or numeric values. Fields in dark grey are not applicable to the emission stream, while fields in light grey are not editable. The main types of information entered into the Emissions Report are as follow:

Activity Data panel	Conversion Factor panel
• Emission stream identifier (only for taxable facilities) • Emissions quantification method • Emission stream type / process, fuel, feedstock type • Activity data	• Site-specific conversion factor (where applicable)

The steps to enter information into the Activity Data and Conversion Factor panels in each ER sub-form are as follow:

1) Fill up the fields in the Activity Data panel, from left to right and row-by-row. The Conversion Factor panel, if applicable, will appear after the emissions quantification method and the emission stream type / fuel, feedstock or process type have been filled up. The default conversion factors are based on, and have been aligned with, the M&R Appendix.

2) Complete the Conversion Factor panel by entering a site-specific conversion factor, where applicable. Fields in light grey are non-editable and typically consists of default emission factors.

3) Provide additional information in the Remarks Box**,** where applicable (refer to Sections 2.6 and 3 for more information).

4) Proceed to next emission stream/process or summary by clicking on the relevant button within the Emission Stream Summary to i) add new emission stream / process, ii) remove emission stream / process, or iii) add to aggregate summary.

5) To add a new emission source, navigate to the top of the ER Form where the dropdown box to add emission source is located.

6) To submit the ER Form, navigate to the bottom of the webpage to i) upload the relevant supporting documents such as the verification report (for taxable facilities), and ii) click on the 'set to ready' button. Thereafter, upload the signed endorsement form under the "Endorsement" section and click on the "Submit" button.

Secondly, the ER Form is designed to be aligned with the M&R requirements under the Carbon Pricing Act and the M&R Appendix.

a) The emissions quantification methods and emission stream types applicable to each emission source shall be selected from the dropdown lists. There are three methods available for the quantification of GHG emissions. Please refer to M&R Guidelines Part II: Monitoring Plan; Section 3 for detailed information.

Method 1: Calculation Approach

- Calculation of emissions from activity data (e.g. amount of fuel or process input) and appropriate conversion factors (e.g. emission factors and net calorific values).

Method 2: Material Balance

- Determination of CO_2 emissions based on the carbon content entering the process through feedstock and the amount exiting the process through products

Method 3: Direct Measurement

- Measurement of GHG emissions directly at the point of release, e.g. a Continuous Emissions Monitoring System (CEMS) that measure the exhaust gas flow rate and the concentration of the GHG emissions at an exhaust stack.

b) Default conversion factors (emission factors and net calorific values), and Global Warming Potential (GWP) values have been programmed into the ER sub-forms. Please refer to the M&R Appendix for details.

c) The ER form has taken the treatment of non-reckonable emissions into account (see Section 2.2).

Thirdly, the formulae for computing GHG emissions (as a function of activity data and conversion factors) have been fixed for each sub-form. When the activity data and site-specific conversion factor (where relevant) have been entered, the GHG emissions will be calculated and reflected in the emission stream summary.

2.2 Accounting of non-reckonable emissions

On reporting non-reckonable emission sources or GHG, the ER Form has been designed to pre-set certain emissions sources or GHG as non-reckonable. For a few other emissions streams or GHG, facilities have the flexibility to designate them as non-reckonable. Detailed instructions are provided in each ER sub-form. The list of non-reckonable emissions sources or GHG is summarised in Table 1.

Table 1: List of non-reckonable emissions

S/N	GHG and circumstance of emission	Relevant emission source
NON-RECKONABLE BY DEFAULT		
1	NF_3 emitted in any circumstance	When NF_3 emissions are reported in: • Integrated circuit or semiconductor production • Thin-film transistor flat panel display (TFT FPD) or liquid crystal display (LCD) production • Any other process or activity resulting in GHG emissions
2	CO_2 emitted in the combustion of any of the following: (i) biodiesels; (ii) biogasoline; (iii) charcoal; (iv) landfill gas; (v) sludge gas; (vi) sulphite lyes (Black Liquor); (vii) wood or wood waste; (viii) other biogas; (ix) other liquid biofuel; (x) other primary solid biomass.	When CO_2 emissions are reported in: • Fuel Combustion and the fuels at the right-hand side are chosen as the emission stream type.
2	SF_6 emitted in the course of manufacturing, installing, using or disposing of any electrical equipment.	When SF_6 emissions are reported in: • Use of SF6 in electrical equipment
3	CO_2 Emitted in the course of using any lubricant or paraffin wax.	When CO_2 emissions are reported in: • Use of lubricants or paraffin waxes
4	Any GHG emitted in the course of using any fire protection equipment.	When GHG emissions are reported in: • Use of GHGs in fire protection equipment
5	Any GHG (i.e. CO_2, CH_4 and N_2O) emitted as a fugitive emission (excluding flaring and venting).	When GHG emissions are reported in: • Fugitive emissions
6	Any GHG (i.e. CO_2, CH_4 and N_2O) emitted in the course of using any fuel on which excise duty is payable, or which is exempt from the payment of excise duty, under the Customs Act (Cap. 70).	When GHG emissions are reported in: • Fuel Combustion and "gas/diesel oil" or "motor gasoline" is chosen as the emission stream type. If diesel oil with sulphur content of more than 10ppm was used, facilities shall select "Others (please specify)" and input "high sulphur diesel oil" under the description of fuel type, and indicate the emission stream as" Reckonable" from reporting period 2021 onwards.

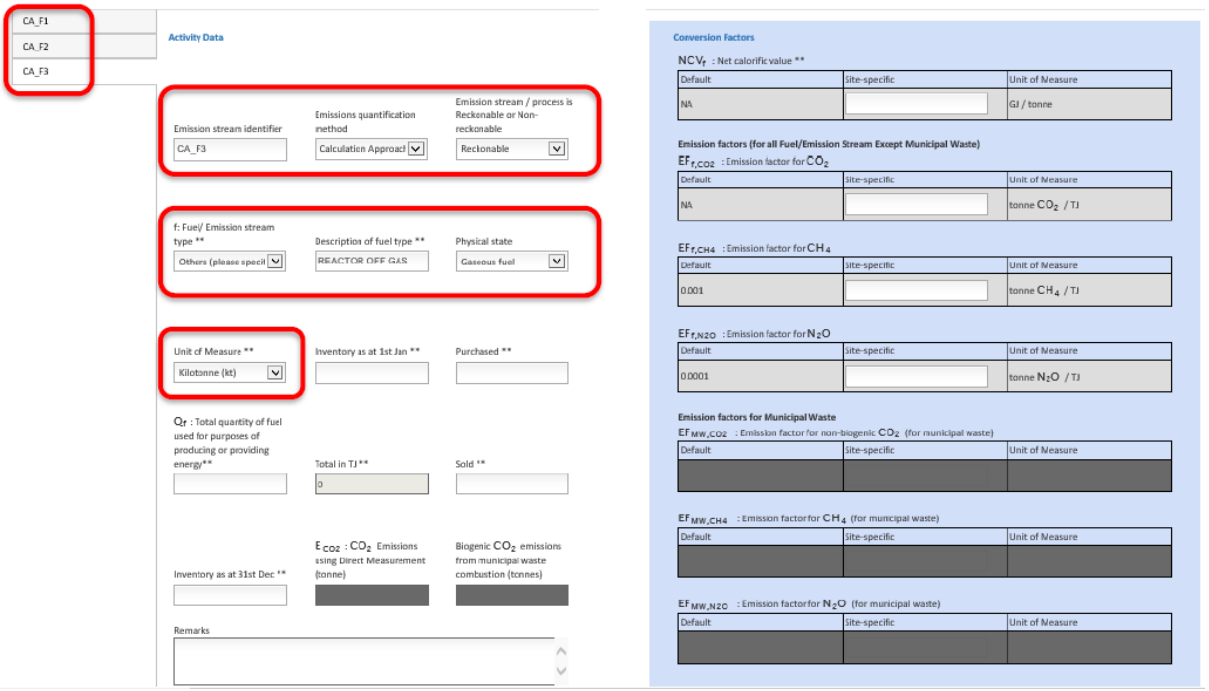
S/N	GHG and circumstance of emission	Relevant emission source
CORPORATIONS TO SELECT 'NON-RECKONABLE' OR 'NON-RECKONABLE CO_2' UNDER THE FIELD: • 'EMISSION STREAM / PROCESS IS RECKONABLE OR NON-RECKONABLE'; OR • 'CO_2 EMISSION IS RECKONABLE OR NON-RECKONABLE'		
1	CO_2 emitted in the combustion of any of the following: (i) biodiesels; (ii) biogasoline; (iii) charcoal; (iv) landfill gas; (v) sludge gas; (vi) sulphite lyes (Black Liquor); (vii) wood or wood waste; (viii) other biogas; (ix) other liquid biofuel; (x) other primary solid biomass.	1. When CO_2 emissions are reported in – • Vents • Flares and "non-reckonable" is selected under the field: "CO_2 Emission is Reckonable or Non-reckonable" 2. When CO_2 emissions are reported in – • Any other process or activity resulting in GHG emissions and (i) "Other (please specify)" is chosen as the emission stream type, and (ii) "Non-reckonable CO_2" is selected under the field: "Emission stream / process is Reckonable or Non-reckonable"
2	CO_2 used and emitted in the course of blasting or purging	When CO_2 emissions are reported in – • Any other process or activity resulting in GHG emissions and (i) "CO_2" is selected under the field "g: Type of GHG emitted", and (ii) "non-reckonable" is selected under the field: "Emission stream / process is Reckonable or Non-reckonable"
3	Any HFC or PFC emitted in the course of using any refrigeration and air-conditioning equipment for non-manufacturing purposes.	When HFC or PFC emissions are reported in – • Use of HFCs or PFCs in refrigeration and air-conditioning equipment and "non-reckonable" is selected under the field: "Emission stream / process is Reckonable or Non-reckonable"
4	Any GHG (i.e. CO_2, CH_4 and N_2O) emitted in the course of using any fuel on which excise duty is payable, or which is exempt from the payment of excise duty, under the Customs Act (Cap. 70).	When GHG emissions are reported in – • Fuel Combustion and (i) "Other (please specify)" is chosen as the emission stream type, and (ii) "Non-reckonable" is selected under the field: "Emission stream / process is Reckonable or Non-reckonable".

2.3 Pre-Population of ER using Previous ER

This section applies to taxable and reportable facilities from second reporting period onwards.

To simplify the annual emissions reporting by facilities, the EDMA system will pre-populate the new ER (e.g. 2020 ER) based on the emissions streams submitted in the previous ER (e.g. 2019 ER) for the same business facility. In particular, all non-numerical fields will be pre-filled as per previous year's ER (refer to screenshot below). GHG Manager can make changes as required in the new ER (e.g. input numerical fields, add/delete emissions streams) and save/submit.

Emissions Report - Screen capture:



2.4 Auto-population of fuel combustion data from/to fuel use table of the Energy Use Report under the Energy Conservation Act

This section applies to facilities registered under both the Carbon Pricing Act (CPA) and the Energy Conservation Act (ECA).

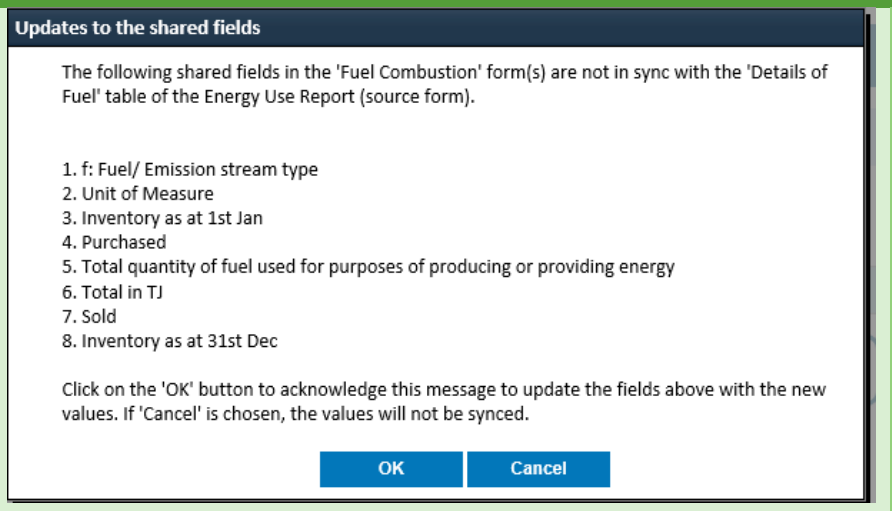
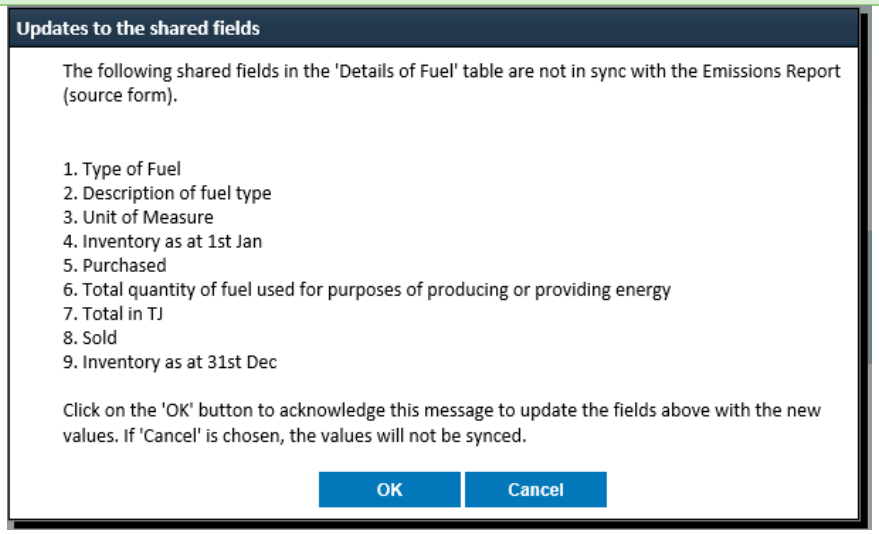
To avoid duplication of reporting effort and provide consistency in the data reported to NEA, fuel combustion data reported in the ER will be auto-populated into the "Details of Fuel and Energy Commodities – Type of Fuel" Table of the Energy Use Report (EUR) under the Energy Conservation Act (for taxable facilities), and vice versa (for reportable facilities).

Data flow: Source → Target	For taxable facilities	For reportable facilities
"Source" report	CPA ER	ECA EUR
"Target" report	ECA EUR	CPA ER

To ensure consistency in the data reported, the EDMA system will highlights discrepancies in the auto-populated shared fields within the "target" report. The list of shared fields is as follow:

CPA Emissions Report	ECA Energy Use Report
f: Fuel/ Emission stream type	Type of Fuel
Description of fuel type (If Others is selected)	Others textbox under "Type of Fuel"
Unit of Measure *(in Activity Data panel)*	Unit of Measure *(under "Quantity")*
Q_f: Total quantity of fuel used for purposes of producing or providing energy	Total quantity of fuel used for purposes of producing or providing energy
Total in TJ	Total in TJ
Site-specific (under "Net Calorific Value")	Local Factor (under "Net Calorific Value")
Inventory as at 1st Jan	Inventory as at 1st Jan
Purchased	Purchased
Sold	Sold
Inventory as at 31st Dec	Inventory as at 31st Dec

After the facility has filled up the "source" report and set its status to 'ready', when opening the "target" report (in 'ready' status or earlier), the system will display an acknowledgement prompt, requesting the facility to accept or cancel the acknowledgement prompt. Accepting the acknowledgement prompt will retrieve the values from the "source" report and update the fields accordingly, while cancelling the prompt will disable the auto-population.

	"Source" report	"Target" report	Acknowledgement prompt shown in the "Target" report
Reportable facilities	ECA EUR	CPA ER	
Taxable facilities	CPA ER	ECA EUR	

Please also note the following rules adopted by the EDMA system:

- For **taxable** facilities, if more than one stream has the same fuel type, unit of measure and net calorific value, the activity data will be summed up and be reflected as a line item in the ECA EUR.

- For **taxable** facilities: if (i) town gas, (ii) natural gas and (iii) natural gas liquids which are reported in energy units, any site-specific NCV will not be auto-populated from the ER to the ECA EUR.

- For municipal waste, there is no default NCV. The site-specific value will be auto-populated to the ECA EUR (for **taxable** facilities) under 'local factor'. For **reportable** facilities, the default NCV of 8.5 $TJ/10^3$ tonne will be auto-populated to the ER under 'site-specific'.

- For **reportable** facilities, fuels (i) not used for combustion (i.e. only reported under 'produced for purposes of producing or providing energy') e.g. Naphtha, or (ii) do not have a GHG emission factor (i.e. hydrogen), will not be auto-populated into the ER.

- For **taxable** facilities, fuels not used for combustion (i.e. only reported under 'produced for purposes of producing or providing energy') e.g. Naphtha, or fuels that do not have a CO2 emission factor (i.e. hydrogen), still need to be reported in the EUR but are not required for Emissions Report. The EUR allows for reporting of such fuel streams.

- For **taxable** facilities: when filling up the breakdown of Q_f in the ECA EUR under (i) used directly or for purposes other than electricity or stream generation and (ii) used for purposes of electricity or stream generation, the sum should add up to the auto-populated value of Q_f in the ECA EUR. This Q_f value that has been auto-populated to the EUR, has been truncated at 4 decimal places. Hence, the sum of (i) and (ii) should be the truncated Q_f value.

2.5 Submission of the ECA Energy Use Report and CPA Emissions Report

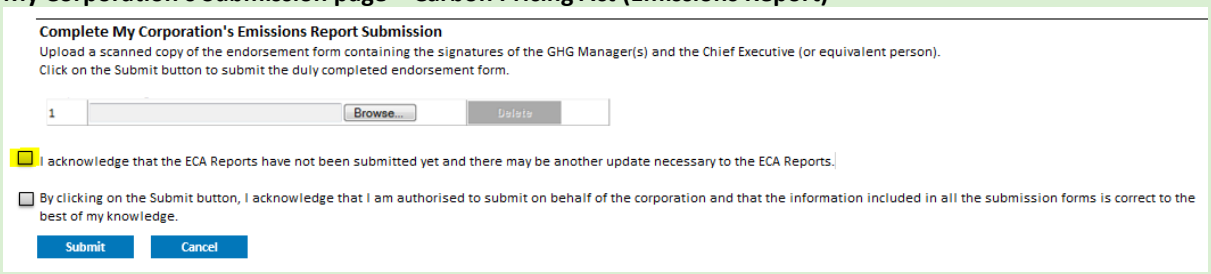
There is no fixed submission sequence for the "source" and "target" reports, although the ideal scenario is for the facility to complete the "source" report before the "target" report. Should the facility tries to submit the "target" form when "source" form has not been submitted, there will be an acknowledgement checkbox requesting the facility to acknowledge that the "source" has not be submitted yet.

	For reportable facilities	For taxable facilities
"Source" report	ECA EUR	CPA ER
"Target" report	CPA ER	ECA EUR

Acknowledgement checkbox shown in the "Target" report

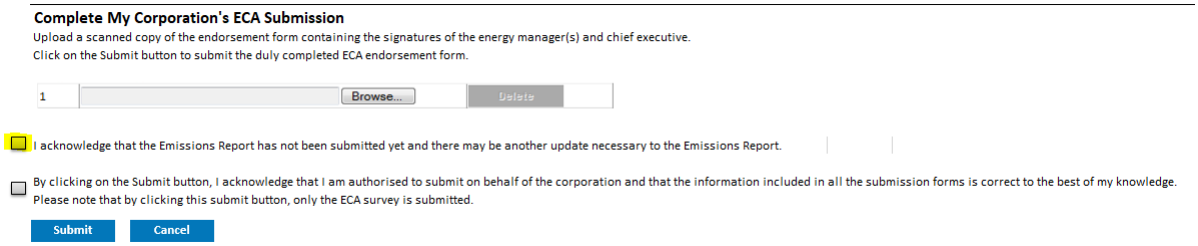
For reportable facilities

My Corporation's Submission page – Carbon Pricing Act (Emissions Report)



For taxable facilities

My Corporation's Submission page – Energy Conservation Act (ECA)



Regardless of the submission sequence and should there be a difference (e.g. error in data entry) in the shared fields, the facility should re-open the relevant form and make the changes.

In addition, should there be an update to any shared field, the facility should re-open the “source” form to make the edits, and re-open the “target” form to allow the system to perform the auto-population of the updated data.

2.6 Units, decimal places and truncation

The EDMA system allows the input and display of activity data and conversion factors with up to 15 decimal places in the ER form to provide the level of precision necessary for the final computation of GHG emissions. Taxable facilities shall enter the exact numeric values (e.g. as per values in the primary data sources such as the invoices or meter readings) in the ER Form to ensure accurate computation of GHG emissions.

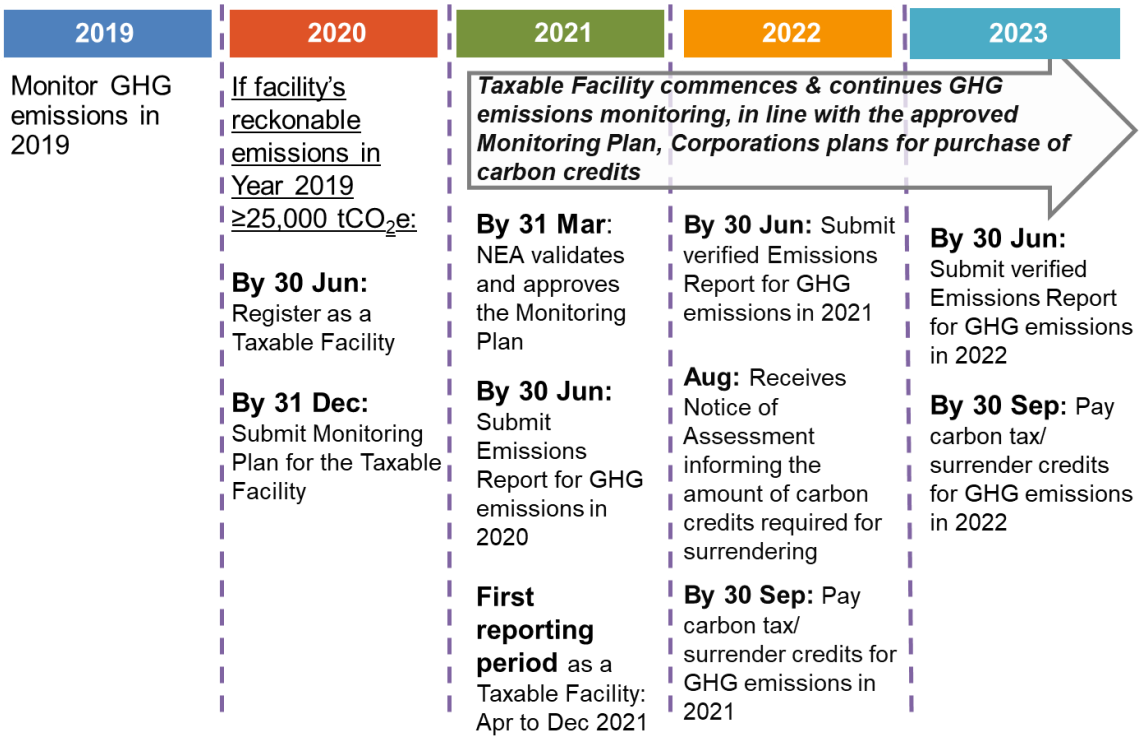
It is important to note that the summation of the displayed emission numbers may not always tally with the final value displayed at the bottom of the summary or aggregate table due to truncation of the numbers.

Calculated non-zero values which are less than 0.0001 (e.g. 0.00003) will be displayed with the less than sign "<" (i.e. <0.0000) in the ER Form.

2.7 First emissions reporting for taxable facilities registered after June 2018

For **taxable** facilities whose first reporting period (that informs amount of the carbon tax) commences on 1 April of the year (instead of the start of the year), the taxable facilities are to:

a. complete the Emissions Report forms based on data for the reporting period of 1 April to 31 December; and
b. record the GHG emissions (in tonne GHG) for the period of January to March in the Remarks box provided under the respective ER sub-forms.



2.8 List of Supporting Documents

The list of supporting documents for reportable and taxable facilities are as follow:

Reportable facilities	Taxable facilities
Underlying calculations for both reckonable and non-reckonable emissions such as spreadsheets, and evidence for activity data or conversion factors e.g. invoices, test reports.	Underlying calculations for non-reckonable emission such as spreadsheets for the full reporting period, and evidence for activity data or conversion factors e.g. screenshots of invoices indicating the activity data quantities, test reports. Underlying calculations for reckonable emissions such as spreadsheets.
Process flow diagram(s) that show the various GHG-emitting processes and activities.	Verification Report, Letter on change of verifiers (if applicable)

3. Emissions Report Sub-Forms

3.1 Fuel Combustion

☒ Method 1: Calculation Approach

☐ Method 2: Material Balance

☒ Method 3: Direct Measurement

Instructions (as displayed on the EDMA system)

1) GHG emissions will be calculated based on the following formulae. Please refer to the M&R Guidelines and the Appendix for more information.

2) The EDMA system applies Equation (1a) when Q_f is provided in mass units. For fuels reported in energy units, the EDMA system will convert the total amount of fuel combusted into TJ for emissions calculation. If unit of measure, btu (mmBTU/bbBTU) or Wh (KWh/MWh/GWh), is selected for natural gas, natural gas liquids or town gas, please report Q_f based on the higher heating value as a HHV-LHV conversion will be applied by the EDMA system as per Equation (1b). For site-specific fuels reported in TJ, please input "0" for the NCV as there are no default NCVs provided.

3) For the fuel / emission stream type, if 'Other' is selected, description of the fuel type must be reported. The facility must also indicate if the emission stream / process is reckonable or non-reckonable (e.g. Compressed Natural Gas is non-reckonable), or if only CO_2 is non-reckonable (e.g. fuel that is biogenic). The physical state of the fuel must also be selected in order for the EDMA system to generate the Tier 1 default CH_4 and N_2O emission factors.

4) For the incineration of municipal waste (i.e. the selected fuel type is municipal waste), the EDMA system applies Equation (2) which requires alternative CO_2, CH_4 and N_2O emission factors, based on waste incinerated on a weight basis, to be provided. The Tier 1 default CH_4 and N_2O emission factors for municipal waste are based on continuous incineration and stoker technology. For other types of incineration and technology, please provide site-specific CH_4 and N_2O emission factors for municipal waste. There is no Tier 1 default CO_2 emission factor for municipal waste and it should be derived based on non-biogenic carbon. Biogenic CO_2 emissions are to be reported in a separate field provided.

5) There are shared fields with the ECA Energy Use Report (Energy Consumption & Production), marked with **. Data in these fields will be auto-populated either to or from the CPA Emissions Report.

(1a) Calculation Approach (for all fuel types except municipal waste) reported in mass unit

$$E_g = Q_f \times NCV_f \times \sum (EF_{f,g} \times GWP_g)$$

(1b) Calculation Approach for fuel (natural gas, natural gas liquids and town gas) reported in btu (mmBTU/bbBTU) or Wh (KWh/MWh/GWh)

$$E_g = Q_f\ (in\ HHV) \times\ conversion\ to\ TJ \times HHV - LHV\ conversion\ \times \sum (EF_{f,g} \times GWP_g)$$

(2) Calculation Approach for the incineration of municipal waste

$$E_g = Q_{MW}\ \times \sum (EF_{MW,g} \times GWP_g)$$

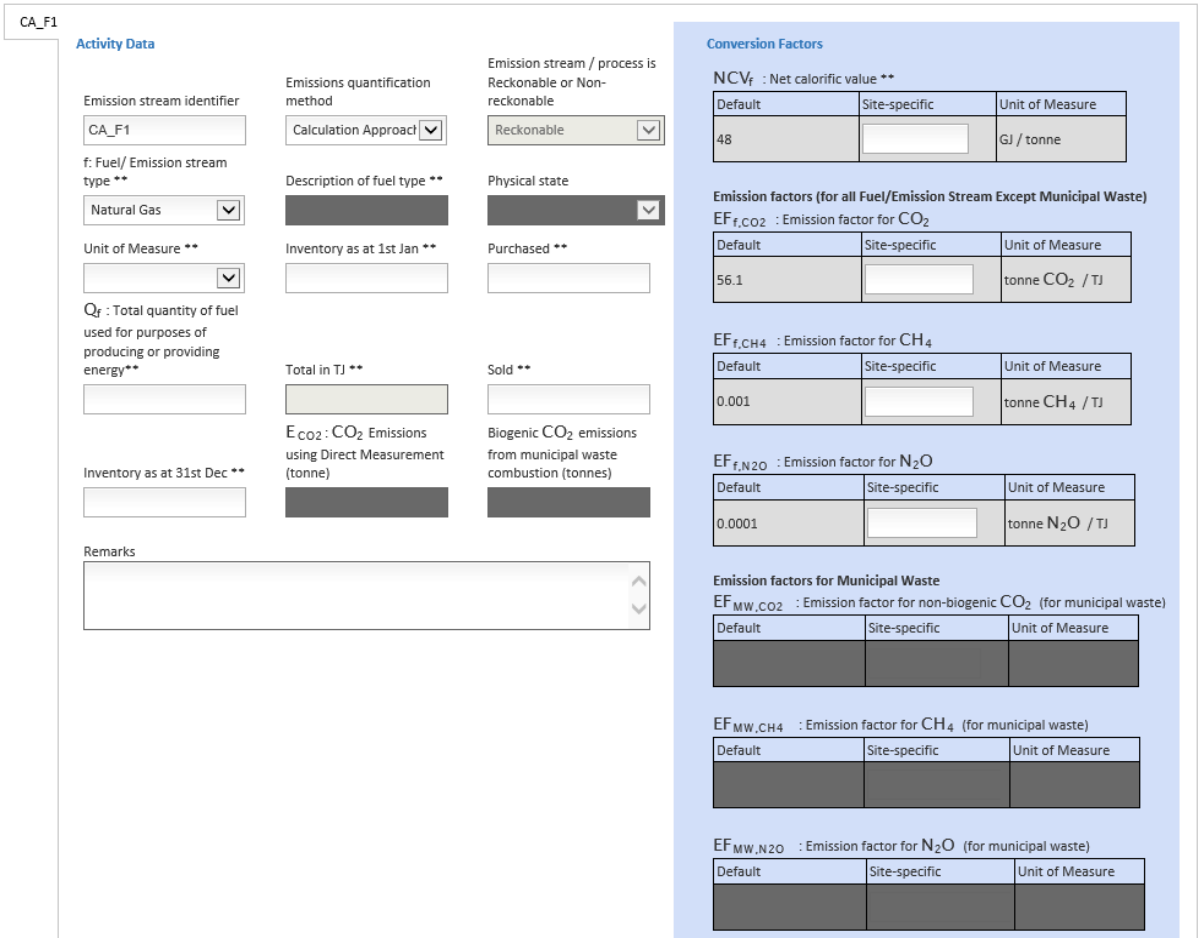
(3) Direct Measurement

$$E_g = E_{CO2} + E_{CH4} + E_{N2O}$$

$$= E_{CO2} + [Q_f \times NCV_f \times \sum_{g=CH4,N2O} (EF_{f,g} \times GWP_g)]$$

Parameter ID	Parameter description	Unit
E_g	Emissions for GHG (g) i.e. CO_2, CH_4 and N_2O	tonne CO_2e
Q_f	Quantity of fuel (f) combusted i.e. total quantity of fuel used for purposes of producing or providing energy	tonne
NCV_f	Net calorific value of fuel (f)	GJ/tonne (equivalent to TJ/kt)
$EF_{f,g}$	Emission factor for CO_2, CH_4 and N_2O for fuel (f) on a net calorific basis	tonne GHG/TJ (equivalent to kg GHG/GJ)
$EF_{MW,g}$	Emission factor for CO_2, CH_4 and N_2O for municipal waste on a weight basis	Tonne GHG /tonne of municipal waste
GWP_g	Global warming potential for GHG (g)	-

Emissions Report – Screen capture



Computation logic and business rules for the Emissions Report

Method 1a: Calculation Approach for all fuel types **except** (i) municipal waste; and (ii) town gas, natural gas and natural gas liquids which are reported in energy units (btu or Wh)

$$E_g = Total\ in\ TJ\ \times \sum (EF_{f,g} \times GWP_g)$$

Method 1b: Calculation Approach for town gas and natural gas which are reported in btu or Wh

$$E_g = Total\ in\ TJ\ \times\ 0.9\ \times \sum (EF_{f,g} \times GWP_g)$$

Method 1b: Calculation Approach for natural gas liquids which are reported in btu or Wh

$$E_g = Total\ in\ TJ\ \times\ 0.95\ \times \sum (EF_{f,g} \times GWP_g)$$

Method 2: Calculation Approach for the incineration of municipal waste

$$E_g = Q_f\ \times\ \sum (EF_{MW,g} \times GWP_g)$$

Method 3: Direct Measurement

$$E_g = E_{CO2} + E_{CH4} + E_{N2O}$$

$$= E_{CO2} + [Q_f \times NCV_f \times \sum_{g=CH4,N2O} (EF_{f,g} \times GWP_g)]$$

Field name	Field type	Business rules
ACTIVITY DATA PANEL		
Emission stream identifier (only for taxable facilities)	Text	Enter emission stream identifier (e.g. F1, P1) based on the Monitoring Plan
Emissions quantification method	Dropdown	Taxable facilities Select the method based on the Monitoring Plan (for CO_2 emissions): • Method 1: Calculation Approach • Method 3: Direct Measurement If Method 3: Direct Measurement is chosen e.g. DM_F1, CH_4 and N_2O emissions are reported within the same form i.e. no need to create a new form for CA_P1 to report CH_4 and N_2O emissions Reportable facilities Select the relevant method.
Emission stream / process is Reckonable or Non-Reckonable	Dropdown	For reporting a user-specified fuel, select an option as follows: • Reckonable: CO_2, CH_4 and N_2O emissions are all reckonable • Non-reckonable: CO_2, CH_4 and N_2O emissions are all non-reckonable (e.g. CNG) • Non-reckonable CO_2: CH_4 and N_2O emissions are reckonable while CO2 is non-reckonable (e.g. biofuel, biomass)
f: Fuel/ Emission stream type**	Dropdown	Refer to the M&R Appendix on the range of options. This list of fuels is the same as the list under the ECA Energy Use Report (Energy Consumption & Production), with the exclusion of 'hydrogen'. To report a user-specified fuel, select 'Other (please specify)' and report the fuel under 'Description of fuel type**'. If diesel oil with sulphur content of more than 10ppm was used, facilities shall select "Others (please specify)" and input "high sulphur diesel oil" under the description of fuel type, and indicate the emission stream as "Reckonable" from reporting period 2021 onwards.
Description of fuel type**	Text	Only applicable for input when 'Other (please specify)' is selected under 'f: Fuel/ Emission stream type**'. Taxable Facilities Enter emission stream type based on the Monitoring Plan (e.g. waste solvent) Reportable facilities

Field name	Field type	Business rules
		Enter the relevant fuel name.
Physical state	Dropdown	Only applicable for selection when 'Other (please specify)' is selected under 'f: Fuel/ Emission stream type**'. For reporting a user-specified fuel, select an option below: • Solid • Liquid • Gas Based on the selected physical state, the default CH_4 and N_2O emission factors will be displayed in the conversion factor panel.
Unit of Measure**	Dropdown	Unit of the following activity data fields: • Q_f: Total quantity of fuel used for purposes of producing or providing energy** • Inventory as at 1st Jan** • Purchased** • Sold** • Inventory as at 31st Dec** Relevant units of measure will be displayed depending on the selected fuel type under 'f: Fuel/ Emission stream type**' • Gramme (g), Kilogramme (kg), Tonne (t), Kilotonne (kt), • Short ton (st), Long ton (lt), Pound (lb), • Million Btu (mmBTU), Billion Btu (bbBTU), • Joule (J), Megajoule (MJ), Gigajoule (GJ), Terajoule (TJ), • Kilowatt-hour (KWh), Megawatt-hour (MWh), Gigawatt-hour (GWh), • Tonne of Oil Equivalent (toe), Kilotoe (Ktoe), Milliontoe (Mtoe)
Inventory as at 1st Jan **Purchased** **Sold** **Inventory as at 31st Dec****	Numeric	Common fields with the ECA Energy Use Report (Energy Consumption & Production) are marked with **. Data in these fields will be auto-populated either to or from the Emissions Report. If there is more than one emission stream of the same fuel type and unit of measure (i.e. NCVs are same/different), where there is a common inventory, facility can choose to enter these information under one emission stream and enter '0' for these fields under the remaining emission streams.
Q_f: Total quantity of fuel used for purposes of producing or providing energy**	Numeric	Quantity of fuel combusted in the selected unit of measure. Enter '0', if there was no fuel combusted in the reporting year.
Total in TJ**	Calculated	Quantity of fuel combusted in terms of TJ. Q_f entered will be converted into TJ (refer to Annex A for calculations performed by the EDMA system).
E_{CO2}: CO_2 Emissions using Direct Measurement (tonne)	Numeric	Enabled only if Method 3: Direct Measurement is selected. To enter the quantity of reckonable CO_2 emissions. If there is nil activity data, enter '0'. Non-reckonable CO_2 emissions (e.g. from diesel combusted in the same boiler or incinerator) should be reported under a separate ER sub-form using Calculation Approach

Field name	Field type	Business rules
Biogenic CO_2 emissions from municipal waste combustion (tonnes)	Numeric	Enabled only if 'Municipal waste' is selected under 'f: Fuel/ Emission stream type**'. As CO_2 emissions are from biogenic sources, it is accounted as non-reckonable in the emissions summaries.
Remarks	Text	Taxable facilities To inform on the: • use of alternative approach and the period which the alternative approach was used • quantity of GHG emissions (in tonne GHG) from 1 Jan to 31 Mar with a reporting period from 1 Apr to 31 Dec
CONVERSION FACTOR PANEL		
NCV_f: Net calorific value**		
- **Unit of measure**	Fixed	GJ/tonne
- **Default**	Fixed	Pre-populated based on selected fuel type under 'f: Fuel/ Emission stream type**'. Displays "N/A" for municipal waste and user-specified fuels.
- **Site-specific**	Numeric	Enter the site-specific NCV, if any. If not, the EDMA system will use the default value for emissions calculation. For municipal waste, there is no default NCV. The site-specific NCV will be auto-populated to the ECA EUR (for taxable facilities) under 'local factor'. For reportable facilities, the default NCV of 8.5 TJ/10^3 tonne will be auto-populated to the ER under 'site-specific'. For town gas, natural gas and natural gas liquids, which are reported in energy units, the site-specific NCV will not be auto-populated to the ECA EUR (for taxable facilities) as they are not used to compute the energy consumption.
CO_2, CH_4 and N_2O emission factors for all fuel/emission stream types except municipal waste: $EF_{f,CO2}$, $EF_{f,CH4}$, $EF_{f,N2O}$		
- **Unit of measure**	Fixed	tonne CO_2/TJ tonne CH_4/TJ tonne N_2O/TJ
- **Default**	Fixed	Pre-populated based on selected fuel type under 'f: Fuel/ Emission stream type**'. For CO_2, displays "N/A" for user-specified fuels. For CH_4 and N_2O emission factors of user-specified fuels, refer to M&R Appendix.
- **Site-specific**	Numeric	Enter the site-specific emission factor, if any. If not, the EDMA system will use the default value for emissions calculation.
Non-biogenic CO_2; CH_4 and N_2O emission factors for municipal waste: $EF_{MW,CO2}$, $EF_{MW,CH4}$, $EF_{MW,N2O}$		
- **Unit of measure**	Fixed	tonne CO_2/tonne municipal waste g CH_4/tonne municipal waste g N_2O/tonne municipal waste
- **Default**	Numeric	N/A for non-biogenic CO_2 emission factor. Refer to M&R Appendix.
- **Site-specific**	Numeric	Compulsory field for CO_2 emission factor For CH_4 and N_2O, enter the site-specific emission factor, if any. If not, the EDMA system will use the default value for emissions calculation.

3.2 Ethylene production

☒ Method 1: Calculation Approach

☒ Method 2: Material Balance

☒ Method 3: Direct Measurement

Instructions (as displayed on the EDMA system)

1) GHG emissions will be calculated based on the following formulae. Please refer to the M&R Guidelines and the Appendix for more information.

2) For the feedstock / emission stream type, if 'Other feedstock' is selected, the description of the feedstock type must be reported. The site-specific emission factors for CO_2 and CH_4 must also be reported.

(1) Calculation Approach

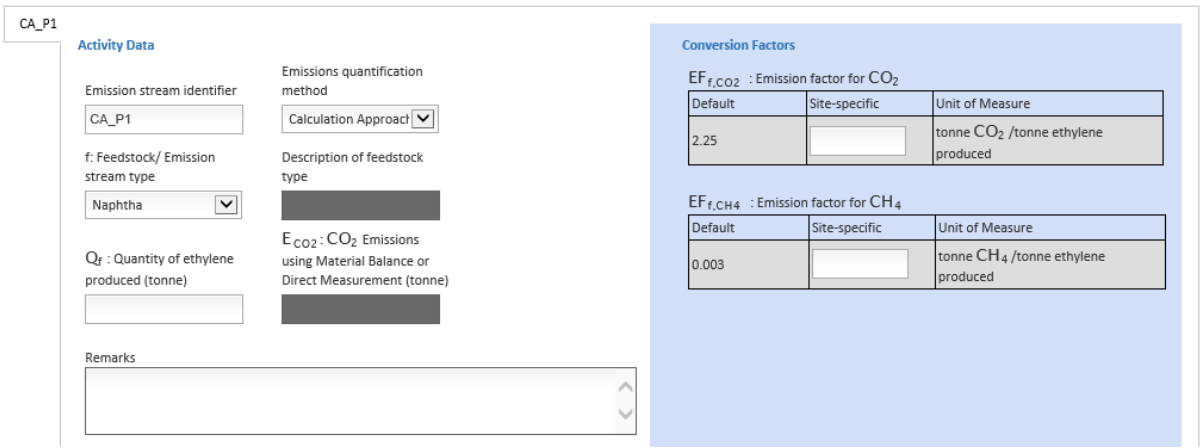
$$E_g = Q_f \times \sum EF_{f,g} \times GWP_g$$

(2) Material Balance / Direct Measurement

$$E_g = E_{CO2} + [Q_f \times EF_{f,CH4} \times GWP_{CH4}]$$

Parameter ID	Parameter description	Unit
E_g	Emissions for GHG (g) i.e. CO_2 and CH_4	tonne CO_2e
Q_f	Quantity of ethylene produced using feedstock (f)	Tonne
$EF_{f,GHG}$	Emission factor for GHG (g) based on feedstock (f)	tonne GHG/tonne ethylene produced
GWP_g	Global warming potential for GHG (g)	-

Emissions Report – Screen capture



Business rules for the Emissions Report

Field name	Field type	Business Rules
ACTIVITY DATA PANEL		
Emission stream identifier (only for taxable facilities)	Text	Enter emission stream identifier (e.g. F1, P1) based on the Monitoring Plan.
Emissions quantification method	Dropdown	Select the method * (for CO_2 emissions): • Method 1: Calculation Approach • Method 2: Material Balance • Method 3: Direct Measurement If Method 2: Material Balance or Method 3: Direct Measurement is chosen e.g. DM_P1, CH_4 emissions are reported within the same form i.e. no need to create a new stream CA_P1 for CH_4 emissions.
f: Feedstock/ Emission stream type	Dropdown	Refer to the M&R Appendix on the range of options. To report a user-specified feedstock, select 'Other feedstock (please specify)'.
Description of feedstock type	Text	Enter feedstock type *
Q_f: Quantity of ethylene produced (tonne)	Numeric	If there is nil activity data, enter '0'.
E_{CO2}: CO_2 Emissions using Material Balance or Direct Measurement (tonne)	Numeric	Enabled only if Method 2: Material Balance or Method 3: Direct Measurement is selected If there is nil activity data, enter '0'.
Remarks	Text	Taxable facilities To inform on the: • use of alternative approach and the period which the alternative approach was used • quantity of GHG emissions (in tonne GHG) from 1 Jan to 31 Mar with a reporting period from 1 Apr to 31 Dec
CONVERSION FACTOR PANEL		
CO_2 and CH_4 emission factors: $EF_{f,CO2}$, $EF_{f,CH4}$,		
- **Unit of measure**	Fixed	tonne CO_2/tonne ethylene produced tonne CH_4/tonne ethylene produced
- **Default**	Fixed	Pre-populated based on selected feedstock type under 'f: Feedstock/ Emission stream type'. Displays "N/A" for other feedstock type.
- **Site-specific**	Numeric	Enter the site-specific emission factor, if any. If not, the EDMA system will use the default value for emissions calculation. Auto-calculated if Method 2: Material Balance or Method 3: Direct Measurement is selected.

*Taxable facilities shall enter/select the information based on the approved Monitoring Plan

3.3 Ethylene oxide production

☒ Method 1: Calculation Approach

☒ Method 2: Material Balance

☐ Method 3: Direct Measurement

Instructions (as displayed on the EDMA system)

1) GHG emissions will be calculated based on the following formulae. Please refer to the M&R Guidelines and the Appendix for more information.

2) For the process / emission stream type, if 'Other' is selected, the (i) description of the process type and (ii) site-specific CO_2 emission factor must be reported.

3) For the type of abatement technology used, if 'Other abatement' is selected, the (i) description of the abatement type and (ii) site-specific CH_4 emission factor must be reported.

(1) Calculation Approach

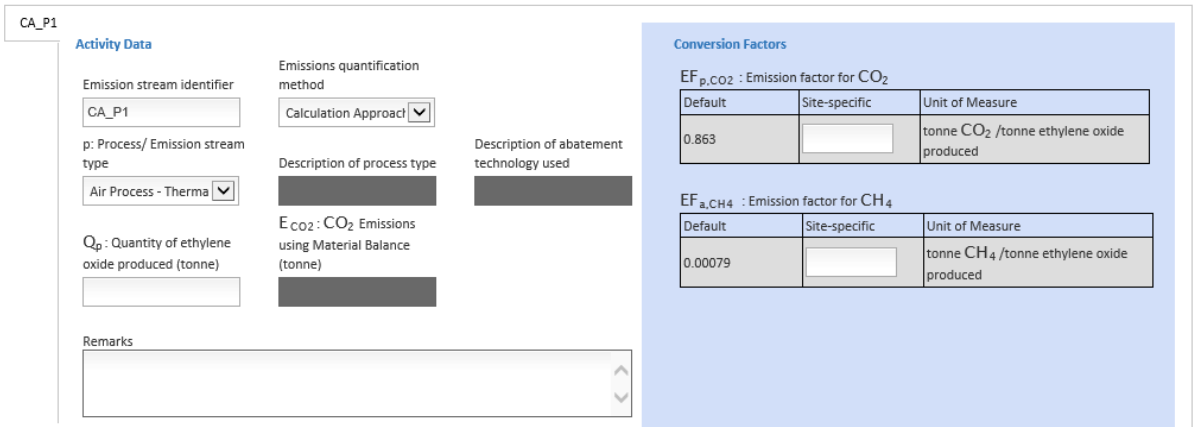
$$E_g = Q_p \times \left[EF_{p,CO2} + \left(EF_{a,CH4} \times GWP_{CH4}\right)\right]$$

(2) Material Balance

$$E_g = E_{CO2} + \left(Q_p \times EF_{a,CH4} \times GWP_{CH4}\right)$$

Parameter ID	Parameter description	Unit
E_g	Emissions for GHG (g) i.e. CO_2, CH_4 and N_2O	tonne CO_2e
Q_p	Quantity of ethylene oxide produced in process (p)	tonne
$EF_{p,CO2}$	Emission factor for CO_2 based on process (p)	tonne CO_2/tonne ethylene oxide produced
$EF_{a,CH4}$	Emission factor for CH_4 based on abatement type (a)	tonne CH_4/tonne ethylene oxide produced
GWP_g	Global warming potential for GHG (g)	-

Emissions Report – Screen capture



Business rules for the Emissions Report

Field name	Field type	Business Rules
ACTIVITY DATA PANEL		
Emission stream identifier (only for taxable facilities)	Text	Enter emission stream identifier (e.g. F1, P1) based on the Monitoring Plan.
Emissions quantification method	Dropdown	Select the method *: • Method 1: Calculation Approach • Method 2: Material Balance If Method 2: Material Balance is chosen e.g. MB_P1, CH_4 emissions are reported within the same form i.e. no need to create a new stream CA_P1 for CH_4 emissions.
p: Process/ Emission stream type	Dropdown	Refer to the M&R Appendix on the range of options. To report a user-specified process, select "Others".
Description of process type	Text	Enter process type *
Description of abatement technology used	Text	Enter the type of abatement technology *
Q_p: Quantity of ethylene oxide produced (tonne)	Numeric	If there is nil activity data, enter '0'.
E_{CO2}: CO_2 Emissions using Material Balance (tonne)	Numeric	Enabled only if Method 2: Material Balance is selected. If there is nil activity data, enter '0'.
Remarks	Text	Taxable facilities To inform on the: • use of alternative approach and the period which the alternative approach was used • quantity of GHG emissions (in tonne GHG) from 1 Jan to 31 Mar with a reporting period from 1 Apr to 31 Dec
CONVERSION FACTOR PANEL		
CO_2 and CH_4 emission factors: $EF_{p,CO2}$, $EF_{a,CH4}$		
- **Unit of measure**	Fixed	tonne CO_2/tonne ethylene oxide produced tonne CH_4/tonne ethylene oxide produced
- **Default**	Fixed	Pre-populated based on selected fuel type under 'p: Process/ Emission stream type'. For CO_2 emission factor, displays "N/A" for other process type. For CH_4 emission factor, displays "N/A" for other abatement type.
- **Site-specific**	Numeric	Enter the site-specific emission factor, if any. If not, the EDMA system will use the default value for emissions calculation. Auto-calculated if Method 2: Material Balance is selected.

*Taxable facilities shall enter/select the information based on the approved Monitoring Plan

3.4 Flares

☒ Method 1: Calculation Approach

☐ Method 2: Material Balance

☐ Method 3: Direct Measurement

Instructions (as displayed on the EDMA system)

1) GHG emissions will be calculated based on the following formulae. Please refer to the M&R Guidelines and the Appendix for more information.

2) If applicable, please report the site-specific flare combustion efficiency as well as the site-specific CO_2 and CH_4 emission factors. If a site-specific flare combustion efficiency is reported, the default CO_2 and CH_4 emission factors would not be applicable.

3) Based on the formula, the site-specific CO_2 and CH_4 emission factors should have accounted for the site-specific flare combustion efficiency i.e. CO_2 emission factor, $EF_{p,CO2,fe}$ should be $EF_{p,CO2}$ X fe while the CH_4 emission factor, $EF_{p,CH4,fe}$ should be $EF_{p,CH4}$ X (1-fe).

4) For the process / emission stream type, if 'Others' is selected, the description of process type must be reported.

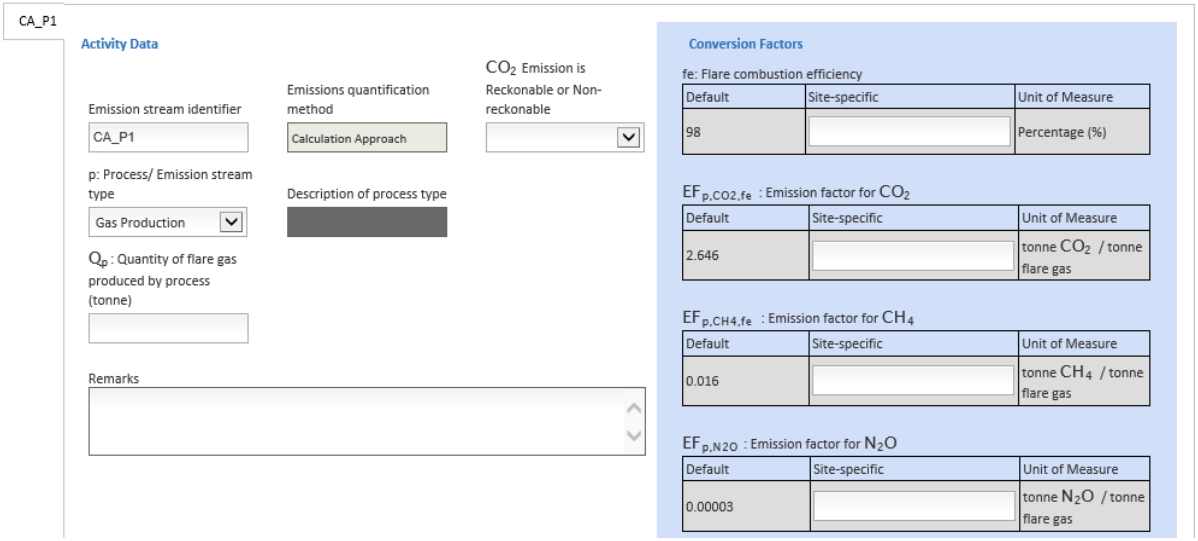
(1) Calculation Approach

$$E_g = Q_p \times \sum EF_{p,g,fe} \times GWP_g$$

Parameter ID	Parameter description	Unit
E_g	Emissions for GHG (g) i.e. CO_2, CH_4 and N_2O	tonne CO_2e
Q_p	Quantity of flare gas produced by process (p)	tonne
$EF_{p,CO2,fe}$	Emission factor for CO_2 based on process (p) and flare efficiency (fe)	tonne CO_2/tonne flare gas
$EF_{p,CH4,fe}$	Emission factor for CH_4 based on process (p) and flare efficiency (fe)	tonne CH_4/tonne flare gas
$EF_{p,N2O}$[1]	Emission factor for N_2O based on process (p)	tonne N_2O/tonne flare gas
GWP_g	Global warming potential for GHG (g)	-

[1] Even though the overall formula uses $EF_{p,g,fe}$, note that $EF_{p,N2O}$ is independent of the flare efficiency.

Emissions Report – Screen capture



Computation logic and business rules for the Emissions Report

Field name	Field type	Business Rules
ACTIVITY DATA PANEL		
Emission stream identifier (only for taxable facilities)	Text	Enter emission stream identifier (e.g. F1, P1) based on the Monitoring Plan.
Emissions quantification method	Fixed	Method 1: Calculation Approach is selected by default.
CO_2 Emission is Reckonable or Non-reckonable	Dropdown	Select an option below: • Reckonable: CO_2 is reckonable • Non-reckonable: CO_2 is non-reckonable (e.g. biogas flaring)
p: Process/ Emission stream type	Dropdown	Refer to the M&R Appendix on the range of options. To report a user-specified process, select "Other (please specify)".
Description of process type	Text	Enter process type *
Q_p: Quantity of flare gas produced by process (tonne)	Numeric	If there is nil activity data, enter '0'.
Remarks	Text	Taxable facilities To inform on the: • use of alternative approach and the period which the alternative approach was used • quantity of GHG emissions (in tonne GHG) from 1 Jan to 31 Mar with a reporting period from 1 Apr to 31 Dec
CONVERSION FACTOR PANEL		
fe: Flare combustion efficiency		
- **Unit of measure**	Fixed	Percentage (%)
- **Default**	Fixed	Pre-populated based on selected process type under 'p: Process/ Emission stream type'.
- **Site-specific**		Enter the site-specific value, if any.

Field name	Field type	Business Rules
CO_2, CH_4 and N_2O emission factors: $EF_{p,CO2,fe}$, $EF_{p,CH4,fe}$, $EF_{f,N2O}$		
- **Unit of measure**	Fixed	tonne GHG/tonne flare gas
- **Default**	Fixed	Pre-populated based on selected feedstock type under 'p: Process/ Emission stream type'. Displays "N/A" for other process type.
- **Site-specific**	Numeric	Enter the site-specific emission factor, if any. Site-specific CO_2 and CH_4 emission factors should have accounted for the site-specific flare combustion efficiency whereas N_2O emission factor is independent of the flare efficiency. Please refer to the M&R Appendix for more information.

*Taxable facilities shall enter/select the information based on the approved Monitoring Plan

3.5 Vents

☒ Method 1: Calculation Approach

☒ Method 2: Material Balance

☒ Method 3: Direct Measurement

Instructions (as displayed on the EDMA system)

1) GHG emissions will be calculated based on the following formulae. Please refer to the M&R Guidelines and the Appendix for more information.

2) The different emission stream types for vents are defined taking reference from the API Compendium.

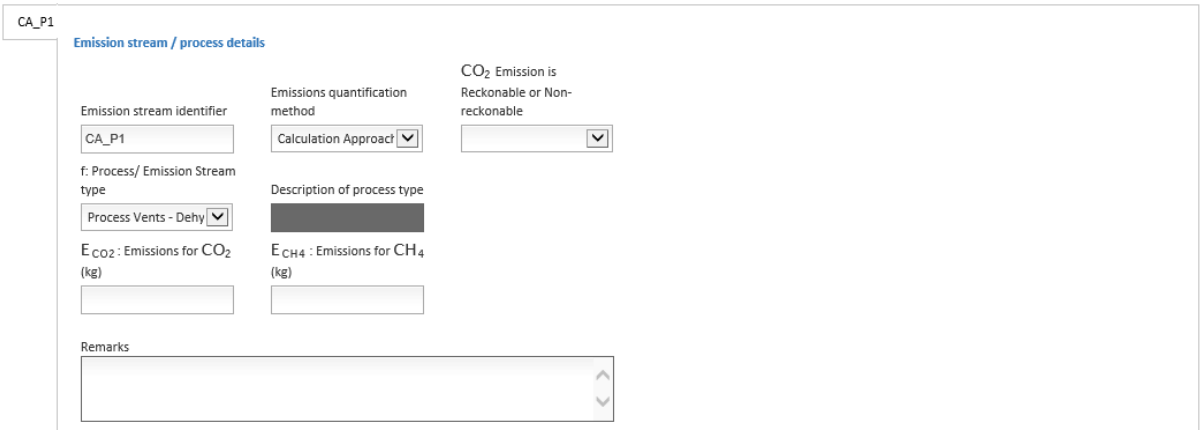
3) For the process / emission stream type, if 'Other' is selected, the description of process type must be reported.

(1) Calculation Approach / Direct Measurement / Material Balance

$$E_{g,f} = E_{CO2} + E_{CH4} \times GWP_{CH4}$$

Parameter ID	Parameter description	Unit
$E_{g,f}$	Emissions for GHG (g) i.e. CO_2 and CH_4	tonne CO_2e
E_{CO2}	Emissions for CO_2	tonne
E_{CH4}	Emissions for CH_4	tonne
GWP_{CH4}	Global warming potential for GHG (g)	-

Emissions Report – Screen capture



Computation logic and business rules for the Emissions Report

Method 1: Calculation Approach, Method 2: Material Balance and Method 3: Direct Measurement

$$E_{g,f} = (E_{CO2} + E_{CH4} \times GWP_{CH4}) \times 0.001$$

Field name	Field type	Business Rules
ACTIVITY DATA PANEL		
Emission stream identifier (only for taxable facilities)	Text	Enter emission stream identifier (e.g. F1, P1) based on the Monitoring Plan.
Emissions quantification method	Dropdown	Select the method *: • Method 1: Calculation Approach • Method 2: Material Balance • Method 3: Direct Measurement **Taxable facilities to select the method based on Monitoring Plan*
CO_2 Emission is Reckonable or Non-reckonable	Dropdown	Select an option below: • Reckonable: CO_2 is reckonable • Non-reckonable: CO_2 is non-reckonable (e.g. biogas venting)
p: Process/ Emission stream type	Dropdown	Refer to the M&R Appendix on the range of options. To report a user-specified process, select "Other (please specify)".
Description of process type	Text	Enter process type based on the Monitoring Plan.
E_{CO2}: Emissions for CO_2 (kg) **E_{CH4}: Emissions for CH_4 (kg)**	Numeric	If there is nil emissions for a particular GHG, enter '0'.
Remarks	Text	<u>Taxable facilities</u> To inform on the: • use of alternative approach and the period which the alternative approach was used • quantity of GHG emissions (in tonne GHG) from 1 Jan to 31 Mar with a reporting period from 1 Apr to 31 Dec

3.6 Fugitive emissions

☒ Method 1: Calculation Approach

☐ Method 2: Material Balance

☐ Method 3: Direct Measurement

Instructions (as displayed on the EDMA system)

1) GHG emissions will be calculated based on the following formulae. Please refer to the M&R Guidelines and the Appendix for more information.

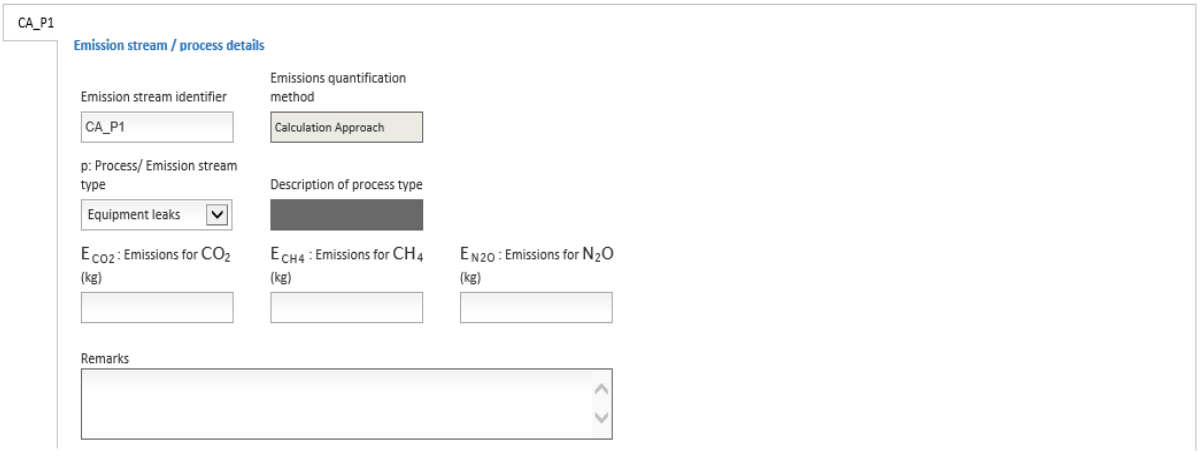
2) For the process / emission stream type, if 'Other' is selected, the description of type of fugitive emissions must be reported.

(1) Calculation Approach

$$E_{g,p} = E_{CO2} + (E_{CH4} \times GWP_{CH4}) + (E_{N2O} \times GWP_{N2O})$$

Parameter ID	Parameter description	Unit
$E_{g,p}$	Emissions for GHG (g) i.e. CO_2 , CH_4 and N_2O, from process (p)	tonne CO_2e
E_{GHG}	Emissions for CO_2, CH_4 or N_2O	tonne GHG
GWP_{GHG}	Global warming potential for GHG (g)	-

Emissions Report – Screen capture



Computation logic and business rules for the Emissions Report

$$E_{g,p} = (E_{CO2} + E_{CH4} \times GWP_{CH4} + E_{N2O} \times GWP_{N2O}) \times 0.001$$

Field name	Field type	Business Rules
ACTIVITY DATA PANEL		
Emission stream identifier (only for taxable facilities)	Text	Enter emission stream identifier (e.g. F1, P1) based on the Monitoring Plan.
Emissions quantification method	Fixed	Method 1: Calculation Approach is selected by default.
p: Process/ Emission stream type	Dropdown	Refer to the M&R Appendix on the range of options. To report a user-specified process, select "Others".
Description of process type	Text	Enter process type* **Taxable facilities to enter process type based on the Monitoring Plan*
E_{CO2}: Emissions for CO_2 (kg) **E_{CH4}: Emissions for CH_4 (kg)** **E_{N2O}: Emissions for N_2O (kg)**	Numeric	If there is nil emissions for a particular GHG, enter '0'.
Remarks	Text	<u>Taxable facilities</u> To inform on the: • use of alternative approach and the period which the alternative approach was used • quantity of GHG emissions (in tonne GHG) from 1 Jan to 31 Mar with a reporting period from 1 Apr to 31 Dec

3.7 Coal gasification

☒ Method 1: Calculation Approach

☒ Method 2: Material Balance

☐ Method 3: Direct Measurement

Instructions (as displayed on the EDMA system)

1) GHG emissions will be calculated based on the following formulae. Please refer to the M&R Guidelines and the Appendix for more information.

2) For Method 1: Calculation Approach, the site-specific CO_2 emission factor must be reported. For Method 2: Material Balance, the CO_2 emissions is reported and the site-specific CO_2 emission factor will be calculated by the EDMA system.

3) For the feedstock type, if 'Other' is selected, the description of feedstock type must be reported.

(1) Calculation Approach

$$E_{CO2} = Q_f \times EF_{f,CO2}$$

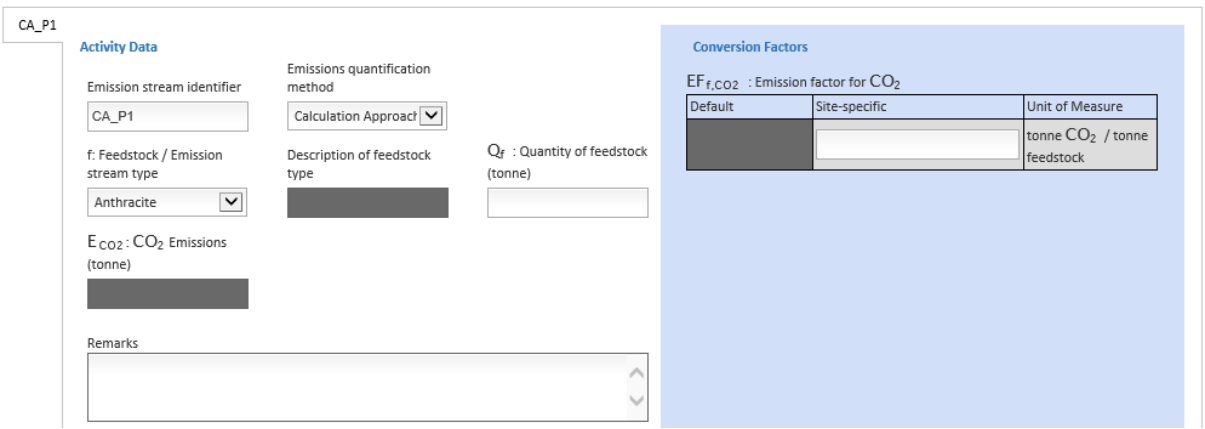
(2) Material Balance

$$E_g = E_{CO2}$$

where $EF_{f,CO2} = \frac{E_{CO2}}{Q_f}$

Parameter ID	Parameter description	Unit
$E_{g,p}$	Emissions of CO_2	tonne CO_2e
Q_f	Quantity of feedstock (f)	tonne
$EF_{f,CO2}$	Emissions factor for CO_2 based on feedstock (f)	tonne CO_2/tonne feedstock

Emissions Report – Screen capture



Computation logic and business rules for the Emissions Report

Field name	Field type	Business Rules
ACTIVITY DATA PANEL		
Emission stream identifier (only for taxable facilities)	Text	Enter emission stream identifier (e.g. F1, P1) based on the Monitoring Plan.
Emissions quantification method	Dropdown	Select the method *: • Method 1: Calculation Approach • Method 2: Material Balance
f: Feedstock/ Emission stream type	Dropdown	Refer to the M&R Appendix on the range of options. To report a user-specified feedstock, select "Others (please specify)".
Description of feedstock type	Text	Enter feedstock type *
Q_f: Quantity of feedstock (tonne)	Numeric	If there is nil activity data, enter '0'.
E_{CO2}: CO_2 Emissions (tonne)	Numeric	Enabled only if Method 2: Material Balance is selected. If there is nil activity data, enter '0'.
Remarks	Text	Taxable facilities To inform on the: • use of alternative approach and the period which the alternative approach was used • quantity of GHG emissions (in tonne GHG) from 1 Jan to 31 Mar with a reporting period from 1 Apr to 31 Dec
CONVERSION FACTOR PANEL		
Emission factor for CO_2: $EF_{f,CO2}$		
- **Unit of measure**	Fixed	tonne CO_2/tonne feedstock
- **Default**	N/A	No default emission factor available
- **Site-specific**	Numeric / Calculated	Enabled only if Method 1: Calculation Approach is selected. Auto-calculated if Method 2: Material Balance is selected.

*Taxable facilities shall enter/select the information based on the approved Monitoring Plan

3.8 Integrated circuit or semiconductor production

☒ Method 1: Calculation Approach

☐ Method 2: Material Balance

☒ Method 3: Direct Measurement

Instructions (as displayed on the EDMA system)

1) GHG emissions will be calculated based on the following formulae. Please refer to the M&R Guidelines and the Appendix for more information.

2) The dropdown for 'type of fluorinated compound fed into the process' includes non-fluorinated compounds such as CO_2, CH_4 and N_2O based on industry feedback.

3) Where the default rate of creation of by-products is "NA", the site-specific field may be left blank if the associated by-product is not relevant.

4) For non-metered consumption, the default value for the fraction of gas remaining in the shipping container (heel), h = 0.10. i.e. (1−h) = 0.9. If there is a site-specific value for heel, please select "Metered" consumption.

5) In the following formulae, $B_{b,g}$ refers to B_{CF4}, B_{C2F6} and/or B_{C3F8}:

- By-product gases field only available based on IPCC factors. To remind taxable facilities, and inform reportable facilities, that for reporting gases that have no default factors and where facility is adopting other standards, have to create another 'any other' form to input by-product gases.

(1) Calculation Approach – Metered

$$E_g = FC_{g,used} \times \{(1 - C_g) \times [1 - (A_g \times D_g)] \times GWP_g + (B_{b,g} \times GWP_{b,g})\}$$

(2) Calculation Approach – Non-metered

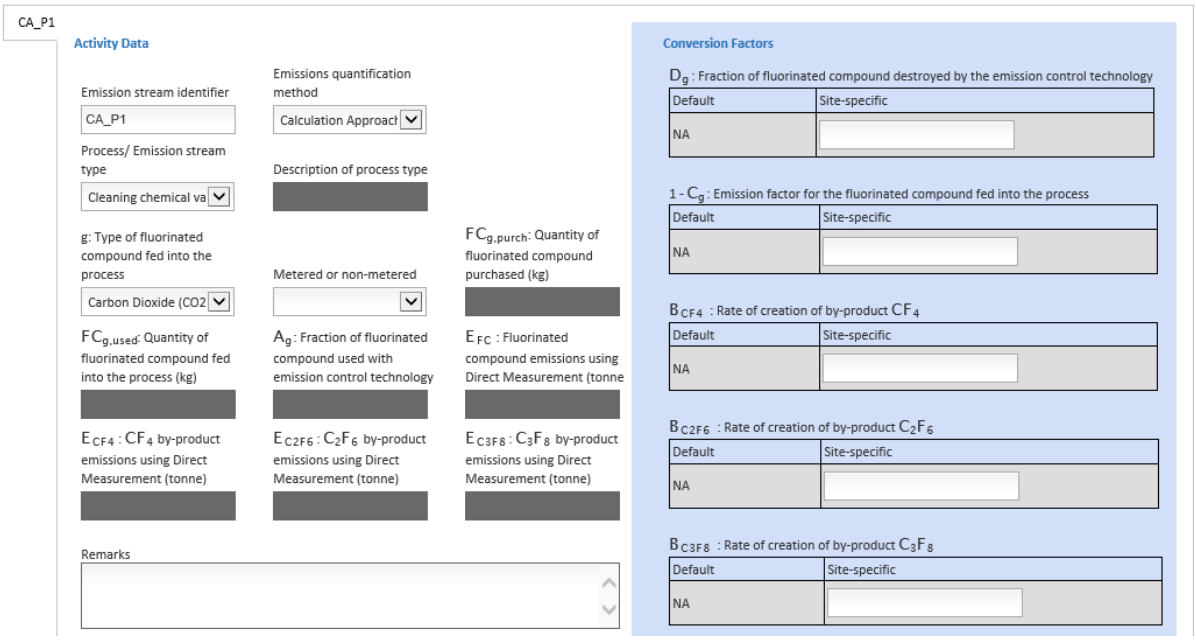
$$E_g = FC_{g,purchased} \times (1 - h) \times \{(1 - C_g) \times [1 - (A_g \times D_g)] \times GWP_g + (B_{b,g} \times GWP_{b,g})\}$$

(3) Direct Measurement

$$E_g = E_{FC} + E_{CF4} + E_{C2F6} + E_{C3F8}$$

Parameter ID	Parameter description	Unit
E_g	Emissions from use of fluorinated compound (g)	tonne CO_2e
$FC_{g,used}$	Quantity of fluorinated compound (g) fed into the process	tonne
$FC_{g,ourchased}$	Quantity of fluorinated compound (g) purchased	tonne
h	Fraction of gas remaining in gas cylinder (heel) after use	-
1 - C_g	Emission factor for fluorinated compound (g); with C_g being the use rate of fluorinated compound (g) i.e. fraction destroyed or transformed in the process	-
A_g	Fraction of fluorinated compound (g) volume used with emission control technology	-
D_g	Fraction of fluorinated compound (g) destroyed by the emission control technology	-
$B_{b,g}$	Rate of creation of by-product fluorinated compound (b) from fluorinated compound (g) in the process	-
GWP_g, $GWP_{b,g}$	Global warming potential for GHG (g) or by-product (b)	-

Emissions Report – Screen capture



Computation logic and business rules for the Emissions Report

(1) Calculation Approach – Metered

$$E_g = FC_{g,used} \times 0.001 \times \{(1 - C_g) \times [1 - (A_g \times D_g)] \times GWP_g + (B_{b,g} \times GWP_{b,g})\}$$

(2) Calculation Approach – Non-metered

$$E_g = FC_{g,purchased} \times 0.001 \times 0.9 \times \{(1 - C_g) \times [1 - (A_g \times D_g)] \times GWP_g + (B_{b,g} \times GWP_{b,g})\}$$

(3) Direct Measurement

$$E_g = E_{FC} + E_{CF4} + E_{C2F6} + E_{C3F8}$$

Field name	Field type	Business Rules
ACTIVITY DATA PANEL		
Emission stream identifier (only for taxable facilities)	Text	Enter emission stream identifier (e.g. F1, P1) based on the Monitoring Plan.
Emissions quantification method	Dropdown	Select the method *: • Method 1: Calculation Approach • Method 3: Direct Measurement
Process/ Emission stream type	Dropdown	Refer to the M&R Appendix on the range of options. To report a user-specified feedstock, select 'Other (please specify)'.
Description of process type	Text	Enter process type *
g: Type of fluorinated compound fed into the process	Dropdown	Refer to the M&R Appendix on the range of options. NF_3 (remote) simply refers to a particular cleaning method and is no different than NF_3 in terms of GWP. F_2 and COF_2 are non-GHGs (GWP = 0) but produce GHGs as by-products
Metered or non-metered	Dropdown	Select the method *: • Metered (when site-specific heel fraction is used) • Non-metered (when default heel fraction of 0.1 is used)
$FC_{g,purch}$: Quantity of fluorinated compound purchased (kg)	Numeric	Enabled only if Method 1: Calculation Approach and Non-metered is selected. If there is nil activity data, enter '0'.
$FC_{g,used}$: Quantity of fluorinated compound fed into the process (kg)	Numeric	Enabled only if Method 1: Calculation Approach and Metered is selected. Enter the calculated quantity based on: $FC_{g,purchased}$ x (1 – h), where h is the site-specific heel fraction. If there is nil activity data, enter '0'.
A_g: Fraction of fluorinated compound used with emission control technology	Numeric	Range is between 0 and 1
E_{FC}: Fluorinated compound emissions using Direct Measurement (tonne) **E_{CF4}: CF_4 by-product emissions using Direct Measurement (tonne)** **E_{C2F6}: C_2F_6 by-product emissions using Direct Measurement (tonne)** **E_{C3F8}: C_3F_8 by-product emissions using Direct Measurement (tonne)**	Numeric	Enabled only if Method 3: Direct Measurement is selected. By-product gases field only available for CF_4, C_2F_6 and C_3F_8, based on the 2006 IPCC Guidelines. To report other by-product GHGs, please create a separate emission stream under "Any other process or activity resulting in GHG emissions".

Field name	Field type	Business Rules
Remarks	Text	<u>Taxable facilities</u> To inform on the: • use of alternative approach and the period which the alternative approach was used • quantity of GHG emissions (in tonne GHG) from 1 Jan to 31 Mar with a reporting period from 1 Apr to 31 Dec
CONVERSION FACTOR PANEL		
<u>D_g: Fraction of fluorinated compound destroyed by the emission control technology</u>		
- **Default**	Fixed	Pre-populated based on selected fuel type under 'g: Type of fluorinated compound fed into the process'. Displays "N/A" for certain GHGs. Refer to the M&R Appendix for more details.
- **Site-specific**	Numeric	Enter the site-specific fraction, if any. Range is between 0 and 1. If not, the EDMA system will use the default value for emissions calculation.
<u>1 - Cg: Emission factor for the fluorinated compound fed into the process</u>		
- **Default**	Fixed	Pre-populated based on selected fuel type under 'g: Type of fluorinated compound fed into the process'. Displays "N/A" for certain GHGs. Refer to the M&R Appendix for more details.
- **Site-specific**	Numeric	Enter the site-specific emission factor, if any. Range for $(1 - C_g)$ is between 0 and 1, where: • "0" represents the gas has been fully consumed/ transformed during the process and none was emitted; • "1" represents the gas has not been consumed/ transformed during the process, and was fully emitted. If not, the EDMA system will use the default value for emissions calculation.
Rate of by-product creation, B_{CF4}, B_{C2F6}, B_{C3F8}		
- **Default**	Fixed	Pre-populated based on selected fuel type under 'g: Type of fluorinated compound fed into the process'. Displays "N/A" for certain GHGs. Refer to the M&R Appendix for more details. By-product gases field only available for CF_4, C_2F_6 and C_3F_8, based on the 2006 IPCC Guidelines. To report other by-product GHGs, please create a separate emission stream under "Any other process or activity resulting in GHG emissions".
- **Site-specific**	Numeric	Enter the site-specific emission factor, if any. If not, the EDMA system will use the default value for emissions calculation. If a by-product GHG is non-applicable, enter '0'.

*Taxable facilities shall enter/select the information based on the approved Monitoring Plan

3.9 Thin-film transistor flat panel display (TFT FPD) or liquid crystal display (LCD) production

☒ Method 1: Calculation Approach

☐ Method 2: Material Balance

☒ Method 3: Direct Measurement

Instructions (as displayed on the EDMA system)

1) GHG emissions will be calculated based on the following formulae. Please refer to the M&R Guidelines and the Appendix for more information.

2) For Method 1: Calculation Approach, the 2006 IPCC Guidelines only provide default emission factors (EF_g) for PFC-14, NF_3 and SF_6. For other GHGs, i.e. HFCs and other PFCs, a site-specific emission factor (EF_g) must be provided.

3) For Method 1: Calculation Approach, the product of C_u and C_d is an estimate of the quantity of substrate consumed during the TFT-FPD or LCD manufacture.

4) If Method 3: Direct Measurement is used, C_u, C_d and EF_g are irrelevant and need not be reported.

(1) Calculation Approach

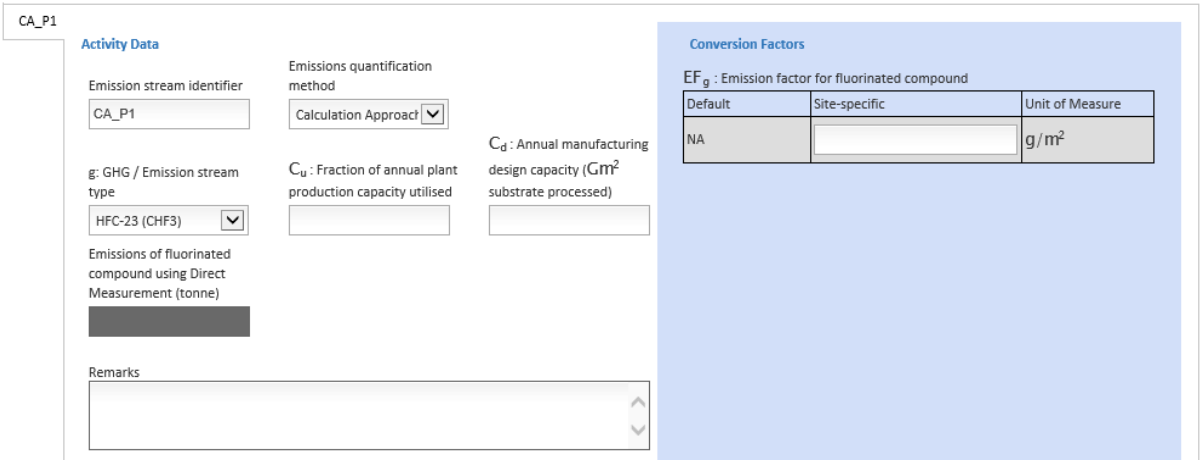
$$E_g = C_u \times C_d \times EF_g \times GWP_g$$

(2) Direct Measurement

$$E_g = \text{Emissions of fluorinated compound using Direct Measurement (tonne)} \times GWP_g$$

Parameter ID	Parameter description	Unit
E_g	Emissions of fluorinated compound (g)	tonne CO_2e
C_u	Fraction of annual plant production capacity utilised i.e. annual capacity utilisation	-
C_d	Annual manufacturing design capacity, expressed in terms of m^2 substrate processed	Giga or 10^9 square metres of substrate processed, Gm^2
EF_g	Emission factor for fluorinated compound (g) expressed as annual mass emissions per square metre of substrate area processed	g/m^2 substrate processed
GWP_g	Global warming potential for fluorinated compound (g)	-

Emissions Report – Screen capture



Computation logic and business rules for the Emissions Report

(1) Method 1: Calculation Approach

$$E_g = C_u \times C_d \times EF_g \times GWP_g \times 1000$$

(1) Method 2: Direct Measurement

$$E_g = \text{Emissions of fluorinated compound using Direct Measurement (tonne)} \times GWP_g$$

Field name	Field type	Business Rules
ACTIVITY DATA PANEL		
Emission stream identifier (only for taxable facilities)	Text	Enter emission stream identifier (e.g. F1, P1) based on the Monitoring Plan.
Emissions quantification method	Fixed	Select the method*: • Method 1: Calculation Approach • Method 3: Direct Measurement
GHG/ Emission stream type	Dropdown	Refer to the M&R Appendix on the range of options.
C_u: Fraction of annual plant production capacity utilised	Numeric	Enabled only if Method 1: Calculation Approach is selected. Range is between 0 and 1.
C_d: Annual manufacturing design capacity (Gm^2 substrate processed)	Numeric	Enabled only if Method 1: Calculation Approach is selected. If there is nil activity data, enter '0'.
Emissions of fluorinated compound using Direct Measurement (tonne)	Numeric	Enabled only if Method 3: Direct Measurement is selected.
Remarks	Text	Taxable facilities To inform on the: • use of alternative approach and the period which the alternative approach was used • quantity of GHG emissions (in tonne GHG) from 1 Jan to 31 Mar with a reporting period from 1 Apr to 31 Dec

Field name	Field type	Business Rules
CONVERSION FACTOR PANEL		
EF_g: Emission factor for fluorinated compound		
- **Unit of measure**	Fixed	g/m^2
- **Default**	Fixed	Pre-populated based on selected emission stream type under 'GHG/ Emission stream type'. Displays "N/A" for certain GHGs. Refer to the M&R Appendix for more details.
- **Site-specific**	Numeric	Enter the site-specific emission factor, if any. If not, the EDMA system will use the default value for emissions calculation.

*Taxable facilities shall enter/select the information based on the approved Monitoring Plan

3.10 Iron and steel production

☒ Method 1: Calculation Approach

☒ Method 2: Material Balance

☐ Method 3: Direct Measurement

Instructions (as displayed on the EDMA system)

1) GHG emissions will be calculated based on the following formulae. Please refer to the M&R Guidelines and the Appendix for more information.

2) If 'Others' is selected for the process or steelmaking method, a description of the process or steelmaking method would need to be provided. A site-specific CO_2 emission factor and CH4 emission factor must be provided.

3) The 2006 IPCC Guidelines provides CH_4 emission factors only for (i) Sinter Production, (ii) Coke Oven and (iii) Direct Reduced Iron Production. CH_4 emissions are likely from any process involving heating of carbon containing products. For other process or steelmaking method, please provide a site-specific CH_4 emission factor.

4) If Method 2: Material Balance is used, the system will compute a site-specific CO_2 emission factor based on the E_{CO2} and Q_p reported.

(1) Calculation Approach

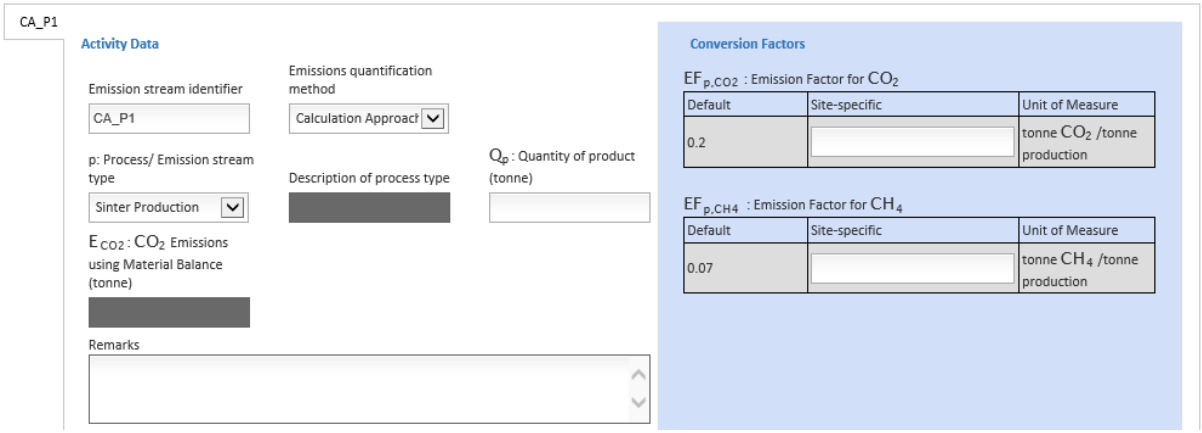
$$E_g = Q_p \times \sum \left(EF_{p,g} \times GWP_g \right)$$

(2) Material Balance

$$E_g = E_{CO2} + \left(Q_p \times EF_{p,CH4} \times GWP_{CH4} \right)$$

Parameter ID	Parameter description	Unit
E_g	Emissions for GHG (g) i.e. CO_2, and CH_4	tonne CO_2e
Q_p	Quantity of Tonne coke, crude steel, pig iron, DRI, sinter or pellet produced using process or steelmaking method (p)	tonne
$EF_{p,g}$	Emission factor for GHG (g) and process or steelmaking method (p)	tonne or kg GHG/tonne production
GWP_g	Global warming potential for fluorinated compound (g)	-

Emissions Report – Screen capture



Business rules for the Emissions Report

Field name	Field type	Business Rules
ACTIVITY DATA PANEL		
Emission stream identifier (only for taxable facilities)	Text	Enter emission stream identifier (e.g. F1, P1) based on the Monitoring Plan.
Emissions quantification method	Fixed	Select the method *: • Method 1: Calculation Approach • Method 2: Material Balance
p: Process/ Emission stream type	Dropdown	Refer to the M&R Appendix on the range of options.
Description of process type	Text	Enter process type *
Q_p: Quantity of product (tonne)	Numeric	If there is nil activity data, enter '0'.
E_{CO2}: CO_2 Emissions using Material Balance (tonne)	Numeric	Enabled only if Method 2: Material Balance is selected.
Remarks	Text	Taxable facilities To inform on the: • use of alternative approach and the period which the alternative approach was used • quantity of GHG emissions (in tonne GHG) from 1 Jan to 31 Mar with a reporting period from 1 Apr to 31 Dec
CONVERSION FACTOR PANEL		
CO_2 and CH_4 emission factors: $EF_{p,CO2}$, $EF_{p,CH4}$		
- **Unit of measure**	Fixed	tonne CO_2/tonne production tonne CH_4/tonne production
- **Default**	Fixed	Pre-populated based on selected process type under 'p: Process/ Emission stream type'. Displays "N/A" for certain process types. Refer to the M&R Appendix for more details.
- **Site-specific**	Numeric	Enter the site-specific emission factor, if any. If not, the EDMA system will use the default value for emissions calculation. Auto-calculated if Method 2: Material Balance is selected.

*Taxable facilities shall enter/select the information based on the approved Monitoring Plan.

3.11 Use of GHGs in fire protection equipment

☒ Method 1: Calculation Approach

☐ Method 2: Material Balance

☐ Method 3: Direct Measurement

Instructions (as displayed on the EDMA system)

1) GHG emissions will be calculated based on the following formula. Please refer to the M&R Guidelines and the Appendix for more information.

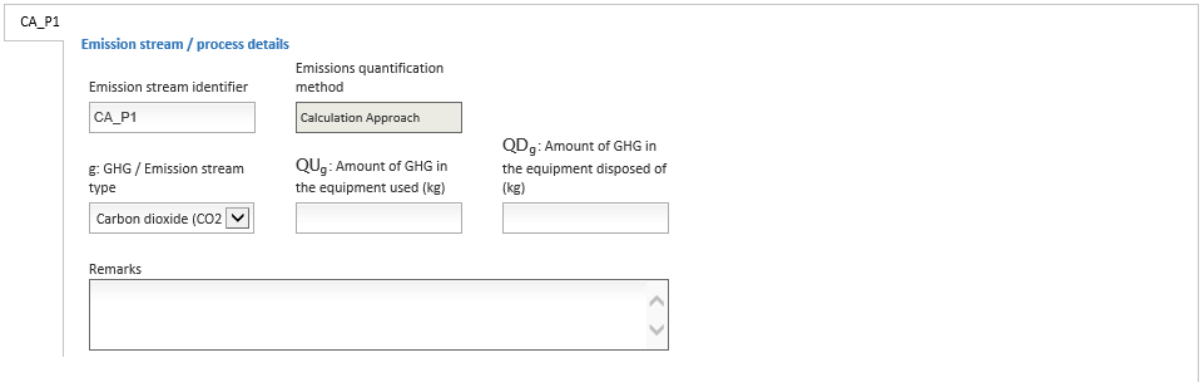
2) The dropdown selection for 'Type of GHG' used in the fire protection equipment includes CO_2, HFCs and PFCs.

(1) Calculation Approach

$$E_g = (QU_g + QD_g) \times GWP_g$$

Parameter ID	Parameter description	Unit
E_g	Emissions of GHG (g) i.e. HFCs, PFCs or CO_2	tonne CO_2e
QU_g	Amount of the GHG (g) in the equipment used	tonne
QD_g	Amount of the GHG (g) in the equipment disposed of	tonne
GWP_g	Global warming potential for GHG (g)	-

Emissions Report – Screen capture



Computation logic and business rules for the Emissions Report

Method 1: Calculation Approach

$$E_g = (QU_g + QD_g) \times GWP_g \times 0.001$$

Field name	Field type	Business Rules
ACTIVITY DATA PANEL		
Emission stream identifier (only for taxable facilities)	Text	Enter emission stream identifier (e.g. F1, P1) based on the Monitoring Plan.
Emissions quantification method	Fixed	Method 1: Calculation Approach is selected by default.
g: GHG/ Emission stream type	Dropdown	Refer to the M&R Appendix on the range of options.
QU_g: Amount of GHG in the equipment used (kg) **QD_g: Amount of GHG in the equipment disposed of (kg)**	Numeric	If there is nil activity data, enter '0'.
Remarks	Text	<u>Taxable facilities</u> To inform on the: • use of alternative approach and the period which the alternative approach was used • quantity of GHG emissions (in tonne GHG) from 1 Jan to 31 Mar with a reporting period from 1 Apr to 31 Dec

3.12 Use of HFCs or PFCs in refrigeration and air-conditioning equipment

☒ Method 1: Calculation Approach

☐ Method 2: Material Balance

☐ Method 3: Direct Measurement

Instructions (as displayed on the EDMA system)

1) GHG emissions will be calculated based on the following formula. Please refer to the M&R Guidelines and the Appendix for more information.

2) The dropdown selection for GHG / emission stream type include refrigerant blends. The composition of the refrigerant blends are provided in the Appendix.

3) Where possible, the facility should create separate emission streams for manufacturing and non-manufacturing purposes.

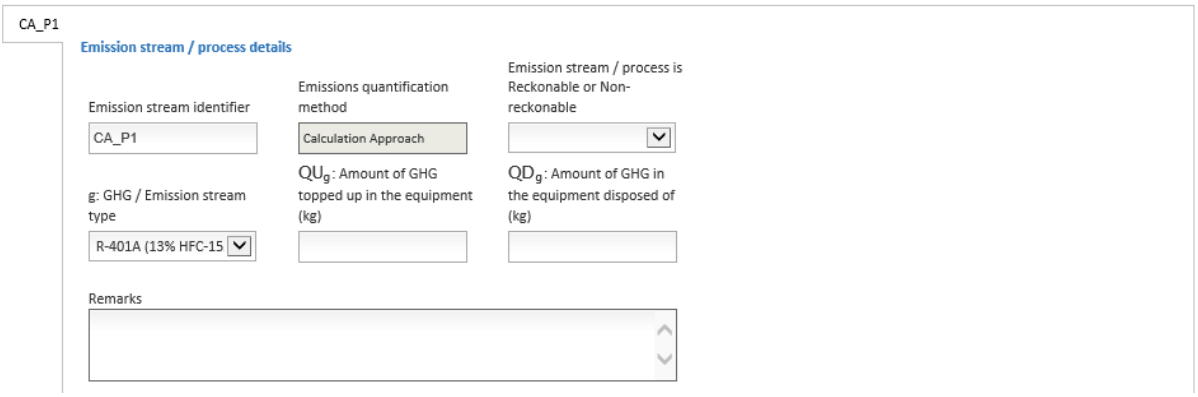
4) QD_g refers to on-site disposal of refrigerant. Refrigerant disposal conducted by external parties does not need to be reported.

(1) Calculation Approach

$$E_g = (QU_g + QD_g) \times GWP_g$$

Parameter ID	Parameter description	Unit
E_g	Emissions of GHG (g) i.e. HFCs or PFCs	tonne CO_2e
QU_g	Amount of the GHG (g) topped up in the equipment	tonne
QD_g	Amount of the GHG (g) in the equipment disposed onsite	tonne
GWP_g	Global warming potential for GHG (g)	-

Emissions Report – Screen capture



Computation logic and business rules for the Emissions Report

Method 1: Calculation Approach

$$E_g = \left(QU_g + QD_g\right) \times \sum \%\ HFC\ or\ PFC\ in\ refrigerant\ blend\ \times GWP_g \times 0.001$$

Field name	Field type	Business Rules
ACTIVITY DATA PANEL		
Emission stream identifier (only for taxable facilities)	Text	Enter emission stream identifier (e.g. F1, P1) based on the Monitoring Plan.
Emissions quantification method	Fixed	Method 1: Calculation Approach is selected by default.
Emission stream / process is Reckonable or Non-reckonable	Dropdown	Select an option below: • Reckonable: manufacturing purpose • Non-reckonable: non-manufacturing purpose
g: GHG/ Emission stream type	Dropdown	Displays various refrigerant blends. Refer to the M&R Appendix for the refrigerant blend composition
QU_g: Amount of GHG topped up in the equipment (kg) **QD_g: Amount of GHG in the equipment disposed of (kg)**	Numeric	If there is nil activity data, enter '0'.
Remarks	Text	Taxable facilities To inform on the: • use of alternative approach and the period which the alternative approach was used • quantity of GHG emissions (in tonne GHG) from 1 Jan to 31 Mar with a reporting period from 1 Apr to 31 Dec

3.13 Use of HFCs and PFCs in solvents

☒ Method 1: Calculation Approach

☐ Method 2: Material Balance

☐ Method 3: Direct Measurement

Instructions (as displayed on the EDMA system)

1) GHG emissions will be calculated based on the following formula. Please refer to the M&R Guidelines and the Appendix for more information.

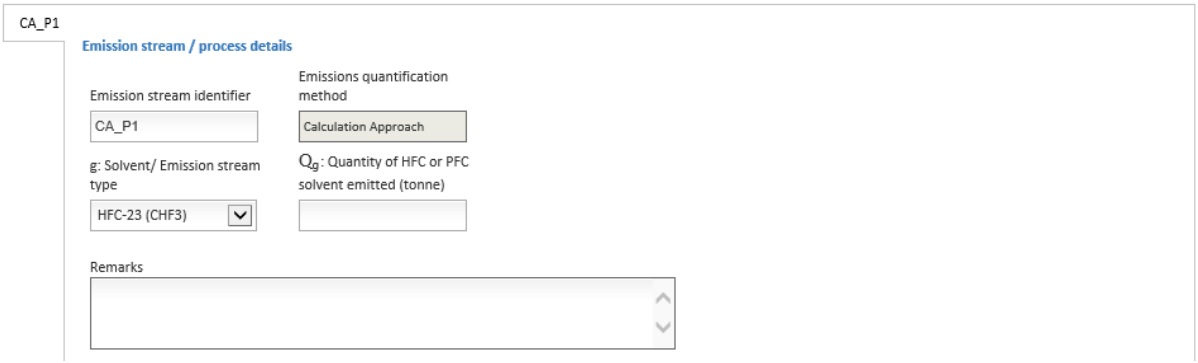
2) Solvents refer to non-aerosol solvents. The four main areas of use are: (i) precision cleaning, (ii) electronics cleaning, (iii) metal cleaning, and (iv) deposition applications.

(1) Calculation Approach

$$E_g = Q_g \times GWP_g$$

Parameter ID	Parameter description	Unit
E_g	Emissions of GHG (g) i.e. HFC or PFC	tonne CO_2e
Q_g	Quantity of HFC or PFC solvent (g) emitted	tonne
GWP_g	Global warming potential for fluorinated compound (g)	-

Emissions Report – Screen capture



Business rules for the Emissions Report

Field name	Field type	Business Rules
ACTIVITY DATA PANEL		
Emission stream identifier (only for taxable facilities)	Text	Enter emission stream identifier (e.g. F1, P1) based on the Monitoring Plan.
Emissions quantification method	Fixed	Method 1: Calculation Approach is selected by default
g: Solvent/ Emission stream type	Dropdown	Refer to the M&R Appendix on the range of options.

Field name	Field type	Business Rules
Q_g: Quantity of HFC or PFC solvent emitted (tonne)	Numeric	If there is nil activity data, enter '0'.
Remarks	Text	<u>Taxable facilities</u> To inform on the: • use of alternative approach and the period which the alternative approach was used • quantity of GHG emissions (in tonne GHG) from 1 Jan to 31 Mar with a reporting period from 1 Apr to 31 Dec

3.14 Use of lubricants or paraffin waxes

☒ Method 1: Calculation Approach

☐ Method 2: Material Balance

☐ Method 3: Direct Measurement

Instructions (as displayed on the EDMA system)

1) GHG emissions will be calculated based on the following formula. Please refer to the M&R Guidelines and the Appendix for more information.

2) Lubricants that were topped-up due to losses from combustion or evaporation at high temperatures need to be reported.

3) The quantity of lubricant or paraffin wax used is usually reported in terms of tonne or litres. The EDMA system will apply a default net calorific value (NCV) to convert the reported quantity of lubricant or paraffin wax from tonne or litres to TJ.

4) For 'Average lubricants (default)', the default oxidation fraction is the weighted average oxidation fraction for lubricants as a whole. This assumes 90% of the mass of lubricants is lubricating oil and 10% is grease, and these weights are applied to the oxidation fractions for oils and greases.

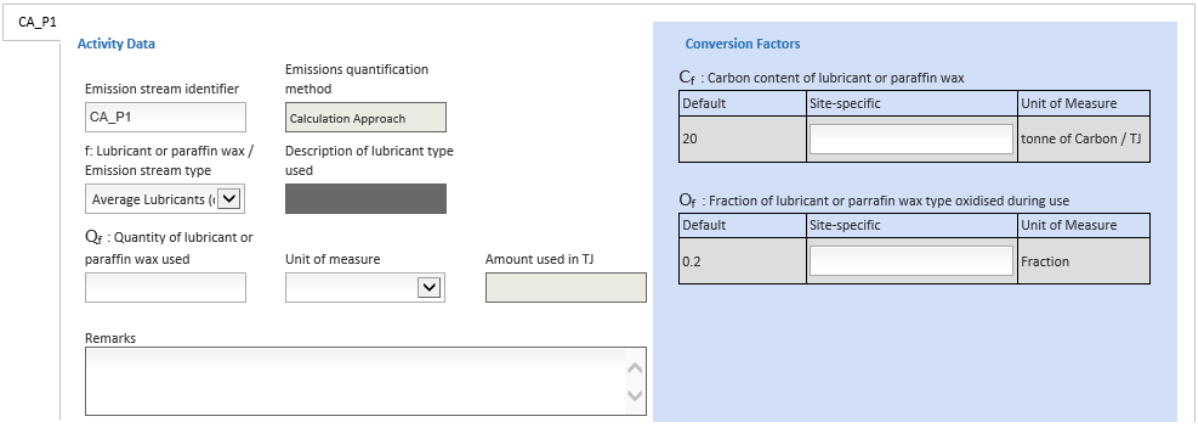
5) If 'Other lubricants' is selected, a site-specific carbon content factor (C_f) and site-specific fraction oxidised during use / oxidation factor (O_f) must be provided.

(1) Calculation Approach

$$E_{CO2} = Q_f \times NCV_f \times C_f \times O_f \times \frac{44}{12}$$

Parameter ID	Parameter description	Unit
E_{CO2}	Emissions of CO_2	tonne CO_2e
Q_f	Quantity of lubricant or paraffin wax (f) used	tonne or litre
NCV_f	Net calorific value of lubricant or paraffin wax (f) used	TJ/tonne or TJ/litre
C_f	Carbon content of lubricant or paraffin wax (f)	tonne of Carbon/TJ
O_f	Fraction of the lubricant or paraffin wax (f) oxidised during use	-

Emissions Report – Screen capture



Computation logic and business rules for the Emissions Report

$$E_{CO2} = \text{Amount used in TJ} \times C_f \times O_f \times \frac{44}{12}$$

Field name	Field type	Business Rules
ACTIVITY DATA PANEL		
Emission stream identifier (only for taxable facilities)	Text	Enter emission stream identifier (e.g. F1, P1) based on the Monitoring Plan
Emissions quantification method	Fixed	Method 1: Calculation Approach is selected by default
f: Lubricant or paraffin wax / Emission stream type	Dropdown	Refer to the M&R Appendix on the range of options. To report a user-specified lubricant, select "Other lubricants".
Description of lubricant type used	Text	Enter emission stream type*
Q_f: Quantity of lubricant or paraffin wax used	Numeric	Quantity of lubricant or paraffin wax used in the selected unit of measure. If there is nil activity data, enter '0'.
Unit of measure	Dropdown	Unit of the following activity data fields: • Q_f: Quantity of lubricant or paraffin wax used Units of measure: • Tonne • Litre
Amount used in TJ	Calculated	Amount used in TJ = Q_f X NCV_f, where:

Emission stream type / Lubricant or paraffin wax	**Net calorific value, NCV_f**	
	TJ/litre (l)	**TJ/tonne**
Lubricating oil (motor oil / industrial oil)	0.00003708961845608	0.0418
Grease		
Average lubricants (default)		
Other lubricants		
Paraffin wax	0.00003197115384615	0.0399

Field name	Field type	Business Rules
Remarks	Text	Taxable facilities To inform on the: • use of alternative approach and the period which the alternative approach was used • quantity of GHG emissions (in tonne GHG) from 1 Jan to 31 Mar with a reporting period from 1 Apr to 31 Dec
CONVERSION FACTOR PANEL		
C_f: Carbon content of lubricant or paraffin wax		
- **Unit of measure**	Fixed	tonne of Carbon / TJ
- **Default**	Fixed	Pre-populated based on selected fuel type under 'f: Lubricant or paraffin wax / Emission stream type'. Displays "N/A" if 'Other lubricants' is selected. Refer to the M&R Appendix for more details.
- **Site-specific**	Numeric	Enter the site-specific emission factor, if any. If not, the EDMA system will use the default value for emissions calculation.
O_f: Fraction of lubricant or paraffin wax oxidised during use		
- **Unit of measure**	Fixed	N/A. Fraction.
- **Default**	Fixed	Pre-populated based on selected fuel type under 'f: Lubricant or paraffin wax / Emission stream type'. Displays "N/A" if 'Other lubricants' is selected. Refer to the M&R Appendix for more details.
- **Site-specific**	Numeric	Enter the site-specific fraction, if any. Range is between 0 and 1. If the reported quantity for Q_f refers to the quantity topped up (i.e. lubricant or paraffin wax losses), site-specific fraction of 1 should be entered. If not, the EDMA system will use the default value for emissions calculation.

*Taxable facilities shall enter/select the information based on the approved Monitoring Plan

3.15 Use of SF_6 in electrical equipment

☒ Method 1: Calculation Approach

☐ Method 2: Material Balance

☐ Method 3: Direct Measurement

Instructions (as displayed on the EDMA system)

1) GHG emissions will be calculated based on the following formulae. Please refer to the M&R Guidelines and the Appendix for more information.

2) SF_6 is used in electrical equipment such as insulated switchgear and substations (GIS), gas circuit breakers (GCB), high voltage gas insulated lines (GIL), outdoor gas-insulated instrument transformer and other equipment.

3) The emission stream types (or types of activity) are grouped into (i) equipment use and installation, (ii) equipment manufacture, and (iii) equipment disposal. For emissions from the installation of electrical equipment, please select "Use" as the type of activity.

4) If "Others" is selected as the electrical equipment, a description of the type of electrical equipment would need to be provided. A site-specific manufacture emission rate, site-specific usage leakage rate and site-specific fraction remaining at disposal must be provided accordingly.

5) Emissions from equipment usage can be estimated based on the quantity of SF_6 used to top up the installed equipment. If the SF_6 top up is reported, the capacity of installed equipment need not be reported. If there is no new equipment installed, please enter 0 for both the capacity of new equipment and quantity of SF_6 used to fill new equipment.

6) For manufacturing emissions, it is optional to provide the capacity of equipment manufactured. If provided, the system will display 1 for the site-specific manufacture emission rate.

7) For disposal emissions, it is optional to provide the quantity of SF_6 remaining in the equipment disposed. If provided, the system will display 1 for the site-specific fraction of SF_6 remaining in the equipment disposed.

(1) Calculation Approach

For equipment use and installation emissions:

$$E_{SF6} = E_{SF6,install} + E_{SF6,usage}$$

$$E_{SF6,install} = \left(Q_{t,SF6} - Cap_{t,New}\right) \times GWP_{SF6}$$

$$E_{SF6,use} = \left(Cap_{t,Stock} \times EF_{t,Stock}\right) \times GWP_{SF6}$$

For manufacturing emissions:

$$E_{SF6} = Q_t \times EF_t \times GWP_{SF6}$$

$$EF_t = \frac{Q_t - Cap_t}{Q_t}$$

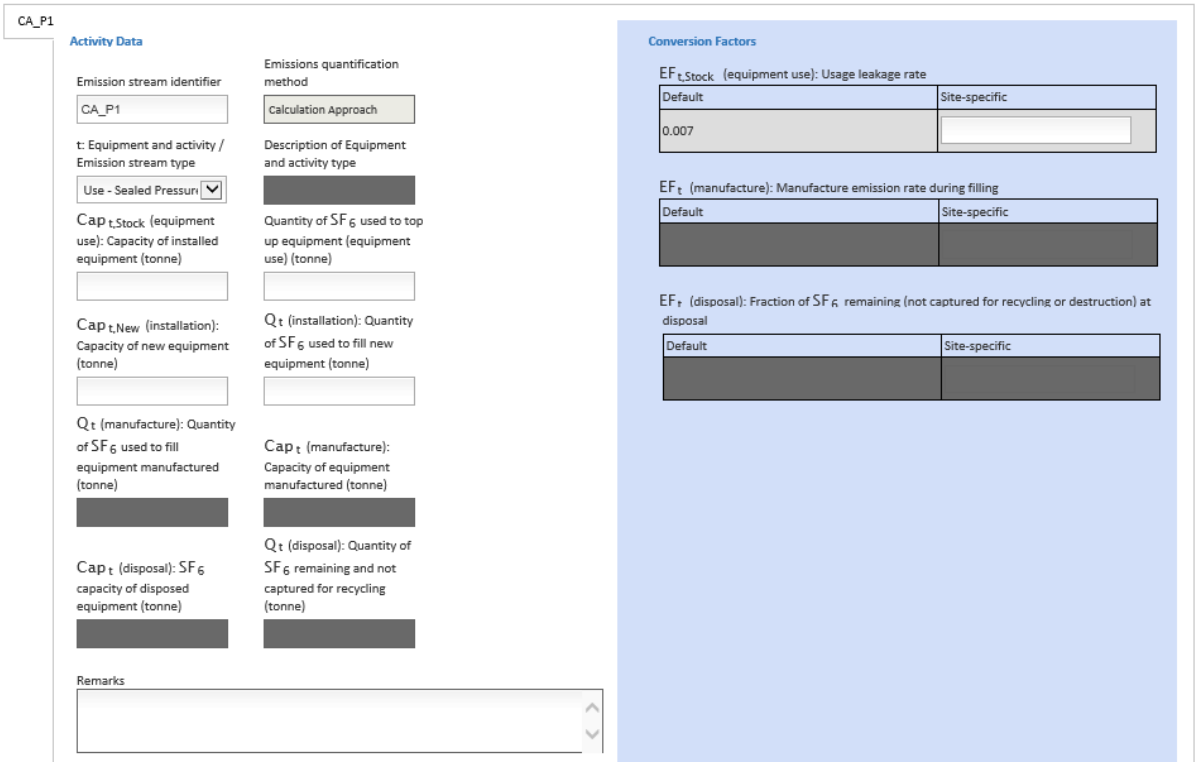
For equipment disposal emissions:

$$E_{SF6} = Cap_t \times EF_t \times GWP_{SF6}$$

$$EF_t = \frac{Cap_t - Q_t}{Cap_t}$$

Parameter ID	Parameter description	Unit
E_{SF6}	Emissions of SF_6	tonne CO_2e
t	Type of equipment (i.e. Sealed-pressure, closed-pressure, gas-insulated transformers, other)	Nil
Equipment use and installation emissions		
$E_{SF6,\ install}$	Emissions of SF_6 from filling of new equipment	tonne CO_2e
$E_{SF6,\ usage}$	Emissions of SF_6 from use of installed equipment	tonne CO_2e
$Q_{t,SF6}$	Quantity of SF_6 used to fill new equipment (t)	tonne SF_6
$Cap_{t,New}$	Capacity of the new equipment (t)	tonne SF_6
$Cap_{t,Stock}$	Capacity of the installed equipment (t)	tonne SF_6
$EF_{t,Stock}$	Usage leakage rate for equipment (t) during use	Factor
Manufacturing		
Q_t	Quantity of SF_6 used to fill equipment by (t)	tonne SF_6
EF_t	Manufacture emission rate for equipment (t) during filling	Factor
Equipment disposal		
Cap_t	SF_6 capacity of equipment disposed	tonne SF_6
EF_t	Fraction of SF_6 remaining at disposal	Factor
Q_t	Quantity of SF_6 remaining and not captured for recycling	tonne SF_6

Emissions Report – Screen capture



Business rules for the Emissions Report

Field name	Field type	Business Rules
ACTIVITY DATA PANEL		
Emission stream identifier (only for taxable facilities)	Text	Enter emission stream identifier (e.g. F1, P1) based on the Monitoring Plan
Emissions quantification method	Fixed	Method 1: Calculation Approach is selected by default
t: Equipment and activity / Emission stream type	Dropdown	Refer to the M&R Appendix on the range of options.
Description of Equipment and activity type	Text	Enabled only when 'Others (Please specify)' is selected. Enter equipment and activity type *
$Cap_{t,Stock}$ (equipment use): Capacity of installed equipment (tonne) **Quantity of SF_6 used to top up equipment (equipment use) (tonne)**	Numeric	Enabled only if 'Use' is selected under 't: Equipment and activity / Emission stream type'. Both fields are mutually exclusive, so fill up only either field. - If a value for '$Cap_{t,Stock}$ (equipment use)' is entered • SF_6 Emissions (usage) = $Cap_{t,Stock}$ * $EF_{t,Stock}$ - If a value for 'Quantity of SF_6 used to top up equipment (equipment use) (tonne)' is entered • SF6 (usage) emissions = reported value • Fill up this field, if activity data is determined through invoices. Enter '0' in either field, if there is nil activity data.

Field name	Field type	Business Rules
$Cap_{t,New}$ (installation): Capacity of new equipment (tonne) **$Q_{t,SF6}$ (installation): Quantity of SF6 used to fill new equipment (tonne)**	Numeric	Enabled only if 'Use' is selected under 't: Equipment and activity / Emission stream type'. If there is no new equipment installed i.e. only top-ups, enter '0' for both fields. If not, E_{SF6} (install) = $Q_{t,SF6}$ - $Cap_{t,New}$
Q_t (manufacture): Quantity of SF_6 used to fill equipment manufactured (tonne) **Cap_t (manufacture): Capacity of equipment manufactured (tonne)**	Numeric	Enabled only if 'Manufacture' is selected under 't: Equipment and activity / Emission stream type'. - If facility provides Q_t (manufacture) • SF_6 emissions = Q_t * EF (manufacture) - If facility provides Cap_t (manufacture) • SF_6 emissions = Q_t (manufacture) - Cap_t (manufacture) The system will display 1 as the site-specific EF (manufacture)
Cap_t (disposal): SF_6 capacity of disposed equipment (tonne) **Q_t (disposal): Quantity of SF_6 remaining and not captured for recycling (tonne)**	Numeric	Enabled only if 'Disposal' is selected under 't: Equipment and activity / Emission stream type'. - If facility provides Cap_t (disposal) • SF_6 emissions = Cap_t * EF (disposal) - If facility provides Q_t (disposal) • SF_6 emissions = Cap_t (disposal) – Q_t (disposal) The system will display 1 as the site-specific EF (disposal)
Remarks	Text	Taxable facilities To inform on the: • use of alternative approach and the period which the alternative approach was used • quantity of GHG emissions (in tonne GHG) from 1 Jan to 31 Mar with a reporting period from 1 Apr to 31 Dec
CONVERSION FACTOR PANEL		
$EF_{t,Stock}$ (equipment use): Usage leakage rate during use **EF_t (manufacture): Manufacture emission rate during filling** **EF_t (disposal): Fraction of SF_6 remaining (not captured for recycling or destruction) at disposal**		
- **Default**		Pre-populated based on selected equipment and activity type under 't: Equipment and activity / Emission stream type'.
- **Site-specific**		If facility provides Cap_t (manufacture) • SF_6 emissions = Q_t (manufacture) - Cap_t (manufacture). The system will display 1 as the site-specific EF (manufacture). If facility provides Q_t (disposal), • SF_6 emissions = Cap_t (disposal) – Q_t (disposal). The system will display 1 as the site-specific EF (disposal).

*Taxable facilities shall enter/select the information based on the approved Monitoring Plan

3.16 Any other process or activity resulting in GHG emissions

☒ Method 1: Calculation Approach

☒ Method 2: Material Balance

☒ Method 3: Direct Measurement

Instructions (as displayed on the EDMA system)

1) GHG emissions will be calculated based on the following formulae. Please refer to the M&R Guidelines and the Appendix for more information.

2) The facility should use the appropriate and specific IPPU emission source as defined in the MP Template when available.

(1) Calculation Approach

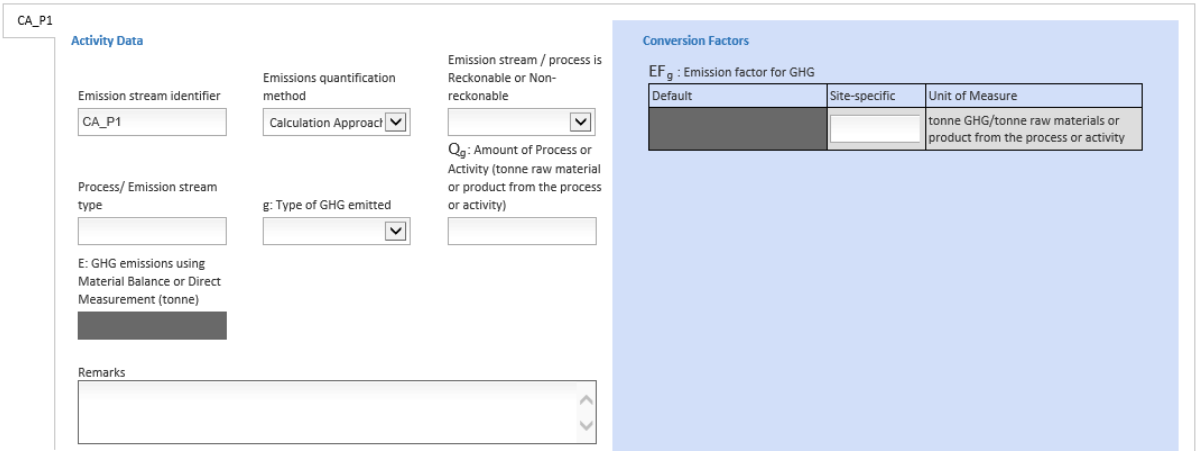
$$E_g = Q_g \times EF_g \times GWP_g$$

(2) Material Balance / Direct Measurement

$$E_g = E \times GWP_g$$

Parameter ID	Parameter description	Unit
E_g	Emissions of GHG (g)	tonne CO_2e
E	Emissions of GHG (g)	tonne GHG
Q_g	Amount of process or activity (p)	tonne raw materials or product from the process or activity
EF_g	Emission factor for GHG	tonne GHG/tonne raw materials or product from the process or activity

Emissions Report – Screen capture



Business rules for the Emissions Report

Field name	Field type	Business Rules
ACTIVITY DATA PANEL		
Emission stream identifier (only for taxable facilities)	Text	Enter emission stream identifier (e.g. F1, P1) based on the Monitoring Plan
Emissions quantification method	Fixed	Select relevant method *: • Method 1: Calculation Approach • Method 2: Material Balance • Method 3: Direct Measurement
Emission stream / process is Reckonable or Non-reckonable	Dropdown	Select an option below: • Reckonable • Non-reckonable
Process/ Emission stream type	Text	Enter process type*
g: Type of GHG emitted	Dropdown	Select type of GHG emitted*
Q_g: Amount of Process or Activity (tonne raw material / product from the process or activity)	Numeric	Enabled only if Method 1: Calculation Approach is selected. If there is nil activity data, enter '0'.
E: GHG Emissions using Material Balance or Direct Measurement (tonne)	Numeric	Enabled only if Method 2: Material Balance or Method 3: Direct Measurement is selected. If there is nil activity data, enter '0'.
Remarks	Text	Taxable facilities To inform on the: • use of alternative approach and the period which the alternative approach was used • quantity of GHG emissions (in tonne GHG) from 1 Jan to 31 Mar with a reporting period from 1 Apr to 31 Dec
CONVERSION FACTOR PANEL		
GHG emission factors: EF_g		
- **Unit of measure**	Fixed	tonne GHG/tonne raw materials or product from the process or activity
- **Default**	N/A	N/A
- **Site-specific**	Numeric	Enabled only if Method 1: Calculation Approach is selected. Enter the site-specific emission factor.

*Taxable facilities shall enter/select the information based on the approved Monitoring Plan

Annex A

This table displays the conversion factor from different Unit of Measure (UOM) to TJ for the reporting of fuels in the Energy Use Report and Emission Report submission forms on the EDMA Portal.

Source UOM	Conversion Factor	Sample Calculation in Emission Report
Mass Conversion		
gramme (g)	10^{-9}	Total in TJ = Q_f (g) x 10^{-9} x NCV (TJ / KT)
Kilogramme (kg)	10^{-6}	Total in TJ = Q_f (kg) x 10^{-6} x NCV (TJ / KT)
Tonne (t)	10^{-3}	Total in TJ = Q_f (t) x 10^{-3} x NCV (TJ / KT)
Kilotonne (kt)	1	Total in TJ = Q_f (kt) x 1 x NCV (TJ / KT)
Short ton (st)	10^{-4} x 9.071847	Total in TJ = Q_f (st) x (10^{-4} x 9.071847) x NCV (TJ / KT)
Long ton (lt)	10^{-3} x 1.016047	Total in TJ = Q_f (lt) x (10^{-3} x 1.016047) x NCV (TJ / KT)
Pound (lb)	10^{-7} x 4.5359702	Total in TJ = Q_f (lb) x (10^{-7} x 4.5359702) x NCV (TJ / KT)
Energy Conversion		
Million Btu (mmBTU)	10^{-3} x 1.05505585	Total in TJ = Q_f (mmBTU) x (10^{-3} x 1.05505585)
Billion Btu (bbBTU)	1.05505585	Total in TJ = Q_f (bbBTU) x 1.05505585
Megajoule (MJ)	10^{-6}	Total in TJ = Q_f (MJ) x 10^{-6}
Gigajoule (GJ)	10^{-3}	Total in TJ = Q_f (GJ) x 10^{-3}
Terajoule (TJ)	1	Total in TJ = Q_f (TJ) x 1
Kilowatt-hour (KWh)	10^{-6} x 3.6	Total in TJ = Q_f (KWh) x (10^{-6} x 3.6)
Megawatt-hour (MWh)	10^{-3} x 3.6	Total in TJ = Q_f (MWh) x (10^{-3} x 3.6)
Gigawatt-hour (GWh)	3.6	Total in TJ = Q_f (GWh) x 3.6
Tonne of Oil Equivalent (toe)	10^{-2} x 4.1868	Total in TJ = Q_f (toe) x (10^{-2} x 4.1868)
Kilotonne of Oil Equivalent (Ktoe)	41.868	Total in TJ = Q_f (Ktoe) x 41.868
Megatonne of Oil Equivalent (Mtoe)	41868	Total in TJ = Q_f (Mtoe) x 41868