National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

Methodology for the **calculation** of emissions to air from the sectors Energy, Industry and Waste

RIVM report 2025-0002
E. Honig et al.

Methodology for the calculation of emissions to air from the sectors Energy, Industry and Waste

RIVM report 2025-0002

Colophon

© RIVM 2025
Parts of this publication may be reproduced, provided acknowledgement is given to: National Institute for Public Health and the Environment, along with the title and year of publication.

DOI 10.21945/RIVM-2025-0002

E. Honig (author), RIVM
J.A. Montfoort (author), RIVM
R. Dröge (author), TNO[1]
S.E.H. van Mil (author), TNO[1]
B. Guis (author), CBS[2]
K. Baas (author), CBS [2]
B. van Huet (author), Rijkswaterstaat [3]
O.R. van Hunnik (author), Rijkswaterstaat [3]

1 Netherlands Organisation for Applied Scientific Research (TNO), P.O. Box 80015, NL-3508 TA Utrecht
2 Statistics Netherlands (in Dutch: 'Centraal Bureau voor de Statistiek', CBS), P.O. Box 24500, NL-2490 HA Den Haag
3 Rijkswaterstaat, P.O. Box 2232, NL-3500 GE Utrecht

Contact:
emissieregistratie@rivm.nl

This report has been compiled by order and for the account of the Directorate-General for the Environment and International Affairs, within the framework of the project Emission Registration M/240107, 'Netherlands Pollutant Release & Transfer Register'.

Published by:
National Institute for Public Health and the Environment, RIVM
P.O. Box 1 | 3720 BA Bilthoven
The Netherlands
www.rivm.nl/en

Synopsis

Methodology to calculate industrial emissions into the air from the energy, industry and waste sectors

Each year, the Netherlands reports both nationally and internationally on the amount of substances emitted into the air by the industry, energy generation and waste processing sectors. This includes all substances listed in the Netherlands' Emission Registration that require reporting for these sectors, such as greenhouse gases and substances contributing to significant air pollution.

RIVM updates and outlines the methods used to calculate emissions annually. These methods are refined each year based on the latest scientific insights. The emissions are calculated in compliance with international guidelines.

Emission data can be found at www.emissieregistratie.nl. The data is used for reports mandated by international agreements and EU legislation, such as the reporting obligations stemming from the United Nations Framework Convention on Climate Change (UNFCCC); the Paris Agreement (PA); the Convention on Long-Range Transboundary Air Pollution (CLRTAP), which includes the Gothenburg Protocol; the EU National Emission reduction Commitments Directive (NEC Directive); and Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action. Furthermore, these reports serve as the foundation for national and international reviewers tasked with approving Dutch reports.

Keywords: emissions, industry, greenhouse gases, air pollution

Publiekssamenvatting

Methodiek om Industriële emissies naar lucht te berekenen van de sectoren Energie, Industrie en Afval

Nederland rapporteert elk jaar nationaal en internationaal hoeveel stoffen de sectoren Industrie, Energieopwekking en Afvalverwerking (ENINA) uitstoten naar de lucht. Het gaat om alle stoffen die in de Emissieregistratie voorkomen en voor deze sectoren moeten worden gerapporteerd. Denk aan broeikasgassen en stoffen die grootschalige luchtverontreiniging veroorzaken.

Het RIVM actualiseert en beschrijft elk jaar de methoden waarmee de uitstoot wordt berekend. De methoden worden elk jaar bijgesteld volgens de meest actuele wetenschappelijke inzichten. De emissieberekeningen worden uitgevoerd op basis van internationale richtlijnen.

De emissiegegevens zijn te vinden op www.emissieregistratie.nl. De gegevens worden gebruikt voor de rapportages die vanwege internationale overeenkomsten en EU-wetgeving verplicht zijn. Zoals de rapportageverplichtingen in het kader van het Raamverdrag van de Verenigde Naties over klimaatverandering (UNFCCC), het Akkoord van Parijs (PA), het Verdrag over grensoverschrijdende luchtverontreiniging over lange afstand (CLRTAP), waaronder het Gothenburg-protocol, de EU-richtlijn over nationale emissiereductieverplichtingen (NEC-richtlijn) en de Governanceverordening van de Energie-unie (EU 2018/1999). De rapportage is ook de basis voor de (internationale) reviewers die de Nederlandse rapporten moeten goedkeuren.

Kernwoorden: emissie, industrie, broeikasgassen, luchtverontreiniging

Contents

1 Introduction and scope — 9
1.1 Methods: Air IPCC and Air Actual — 10
1.2 Preliminary and final emission figures — 10

2 Emission calculations according to the IPCC method — 13
2.1 Combustion emissions from stationary combustion (CRT 1A, excluding transport, and part of CRT 2) — 27
2.1.1 Emission sources — 28
2.1.2 Calculation method of preliminary emission figures — 29
2.1.3 Calculation method of final emission figures — 30
2.1.4 Reference Approach — 38
2.2 Process emissions (CRT 2 and part of CRT 1)) — 39
2.2.1 Emission sources — 39
2.2.2 Calculation method of preliminary emission figures — 42
2.2.3 Calculation method of final emission figures — 42
2.3 Emissions from waste (CRT 1A1a and CRT 5) — 74
2.3.1 Calculation method of preliminary emission figures — 76
2.3.2 Calculation method of final emission figures — 78
2.4 Emissions from oil and gas extraction, transport and distribution (CRT 1A1c, 1A3ei gaseous and 1B) — 128
2.4.1 Calculation method of preliminary emission figures — 130
2.4.2 Calculation method of final emission figures — 130

3 Emission calculations according to the Air Actual method — 137
3.1 Emissions of individually registered companies — 137
3.1.1 Calculation method of preliminary emission figures — 137
3.1.2 Calculation method of final emission figures — 138
3.2 Supplemental estimates of combustion emissions — 147
3.2.1 Emission sources — 147
3.2.2 Calculation method of preliminary emission figures — 149
3.2.3 Calculation method of final emission figures — 149
3.3 Supplemental estimation of process emissions — 157
3.3.1 Emission sources — 157
3.3.2 Calculation method of preliminary emission figures — 158
3.3.3 Calculation method of final emission figures — 159
3.4 Emissions from waste treatment — 172
3.4.1 Emission sources — 172
3.4.2 Calculation method of preliminary emission figures — 172
3.4.3 Calculation method of final emission figures — 172
3.5 Emissions from oil and gas extraction, transport and distribution — 178
3.5.1 Calculation method of preliminary emission figures — 178
3.5.2 Calculation method of final emission figures — 178

4 Quality — 181
4.1 General quality control — 181
4.2 Quality of the several emission sources — 182
4.3 Uncertainty — 185

5 Recalculations — 187

6 Emission characteristics — 189

7 Spatial allocation — 191

8 Terminology — 193

9 References — 197

Appendix 1 Emission Sources — 205

Appendix 2 List of company data — 220

Appendix 3 Ratio between $PM_{2.5}$ and PM_{10} for emissions from the energy and industry sector — 223

1 Introduction and scope

Industrial combustion and industrial processing cause atmospheric emissions. Combustion of fuels, with natural gas being the most used fuel in the Netherlands, cause emissions of GHG and acidifying substances like SO_2 and NO_x. Industrial processes, like iron and steel production and crude oil refining and many other processes cause emissions of substances like particulate matter (PM), metals, polycyclic aromatic hydrocarbons (PAH) and hydrocarbons.

The ENINA Taskforce is responsible for annually compiling and managing emission data on a national scale in the Netherlands of all stationary combustion sources and process emissions in the energy, industry and waste disposal sectors.
ENINA (acronym: ENergie (energy), INdustrie (industry), Afvalverwijdering (waste disposal)) is part of the Dutch Pollutant Release and Transfer Register (PRTR). The URL to access the data is www.emissieregistratie.nl. The emission data concern substances categorised as greenhouse gases, acidifying substances, toxic substances (including volatile organic compounds, metals, dioxins) and other substances that have been prioritised in environmental policy.

This report deals exclusively with atmospheric emissions; emissions to water are accounted for and entered into the PRTR by another PRTR taskforce (see www.emissieregistratie.nl).

The purpose of this report is to provide a clear description of the methods followed for assessment of air emissions originating in the energy and industry sectors in the Dutch PRTR.
The report is divided into two sections, each one dealing with two separate main methods:

- 'Air IPCC', the methods for calculating greenhouse gas (GHG) emissions prescribed by the Intergovernmental Panel on Climate Change (IPCC, 2006) is described in section 2. These calculations are used for international reporting obligations under UNFCCC, the Paris Agreement, EU Governance Regulation (GR) and EU Effort Sharing Regulation (ESR).
- 'Air actual' the method followed by the Dutch PRTR for other reporting obligations is described in section 3. These calculations are used for international reporting obligations under CLRTAP and the NEC Directive. These calculations are also used for Dutch emission maps.

Section 1.1 explains the difference between the two main methods. The subsequent sections contain general descriptions of the emission calculations, i.e. calculation quality (section 4), changes in comparison to the previous version of the Methodology Report (section 5), emission dispersal characteristics (section 6) and geographical distribution of emissions (section 7).

The PRTR uses a subdivision of combustion and process emissions based on emission sources related to the various economic activities

(NACE2008-harmonized SBI codes; see https://www.cbs.nl/nl-nl/onze-diensten/methoden/classificaties/activiteiten/sbi-2008-standaard-bedrijfsindeling-2008) to facilitate the reporting of Dutch emissions in accordance with several international agreements. The present report is based on this classification. Annex 1 contains a complete list of the emission sources including a reference to the section in this report where the method is described. Emission data from the emission sources listed are available on www.emissieregistratie.nl.

1.1 Methods: Air IPCC and Air Actual

The main difference between methods Air IPCC and Air Actual is the data used as input for the calculations. The calculation for the Air Actual method is based on emissions of individual companies and a supplemental estimate for remaining companies. The calculation according to Air IPCC uses data mainly derived from national energy consumption statistics and production output statistics, in some instances improved with individual company data (if this improves the emission estimate).

Greenhouse gases are calculated by both methods. The calculation methodology is the same for some sectors, but for other sectors it is different. The reason for this is the fact that the greenhouse gas emissions from both methodologies are used for different purposes. The greenhouse gas emissions calculated according to the IPCC methodology are used for international reporting obligations under the UNFCCC, the Paris Agreement, EU Governance Regulation (GR) and EU Effort Sharing Regulation (ESR). Emissions are calculated following the UNFCCC Reporting Guidelines.
The greenhouse gas emissions calculated according to the Air Actual methodology are amongst others used for emission maps of the Netherlands. It is expected that the emissions according to the Air Actual method are more accurate compared to the Air IPCC method for preparing the Dutch emission maps. For example, emissions from road transport in the Air Actual method are calculated based on the amount of fuel used in the country, while emissions from road transport in the Air IPCC method are calculated based on the amount of fuel sold. The first methodology will provide more accurate emission maps, while the second methodology is in line with the UNFCCC Reporting Guidelines. Also, the two methodologies can be compared as a quality check.

1.2 Preliminary and final emission figures

In annual cycles the emission data are established twice a year (for both the Air IPCC and the Air Actual methods):

1. In June, the preliminary emission figures of the previous year are established using preliminary statistics. The preliminary emission figures are used for preliminary GHG reports. In September each year preliminary figures are published on the public website (www.emissieregistratie.nl, national level).
2. In December the final emission figures of the previous year are established using the final energy and production statistics, as well as the emission data from the eAERs. The final emission figures are used to ensure compliance with international reporting requirements, such as those pursuant to the NEC

Directive, UNFCCC reporting Guidelines, etc.

The final figures are also geographically distributed and the resulting data are used as input for model calculations of air quality in so called large-scale concentration maps https://www.rivm.nl/gcn-gdn-kaarten. Around the summer of the next year the final figures are published on the public website (national level and geographically distributed emissions).

2 Emission calculations according to the IPCC method

This section describes how GHG emissions are calculated using the IPCC method for the CRT categories 1 (excluding 1A3), 2 and 5. The calculated emissions are divided into four categories:

- Combustion emissions (section 2.1)
- Process emissions (section 2.2)
- Emissions from waste processing (section 2.3)
- Emissions from the extraction, transportation and distribution of oil and gas (section 2.4)

The following table shows the link between the CRT categories and the emission sources used in the Netherlands (including the relevant section describing the method). Part of the emissions in the CRT categories 1, 2 and 5 is not described in this methodology report. These emission sources are also indicated in the table, including a link to the methodology report where these sources are described.

Table 1 Allocation of CRT codes to emission sources, including a reference to the corresponding section describing the method.

CRT	Section	ES CODE	EMISSION SOURCE	Comment
1.A.1.a Public electricity and heat production	2.1	8920400	NACE 35: production and distribution of electricity and gas	
		8921800	NACE 38.1/38.2 (partly): waste-incineration plants	
		8930401	NACE 35: decentral production of electricity, general	
		8930410	NACE 35: production of electricity, heat	
	2.3	8921804	NACE 38.2/84.1 treatment of waste, including communal waste-incineration plants	
		E401200	Solid waste disposal on land: managed disposal	Emissions from combustion of landfill gas for energy recovery are allocated to CRT category 1A1a. Combustion of landfill gas for flaring and other emissions from solid waste disposal on land are allocated to CRT category 5A1
1.A.1.b Petroleum refining	2.1	8924200	NACE 19.2 (excluding NACE 19.202): manufacture of refined petroleum products	Process emissions from petroleum refining are allocated to sector 1B2a4 and combustion emissions are allocated to sector 1A1b
1.A.1.c Manufacture of solid fuels and other	2.1	8912500	NACE 19.202: manufacture of refined petroleum products - not oil refineries	
		8924102	NACE 19.1: manufacture of coke oven products (ACZ)	Process emissions from coke production are allocated to sector

CRT	Section	ES CODE	EMISSION SOURCE	Comment
energy industries				1B1b and combustion emissions are allocated to sector 1A1c
		8924103	NACE 19.1: production of coke, coke factory Corus	Process emissions from coke production are allocated to sector 1B1b and combustion emissions are allocated to sector 1A1c
	2.4	0020400	NACE 06/09.1: extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, onshore	
		0020502	NACE 06/09.1: extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, drilling activities	
		8120001	NACE 06/09.1: extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, offshore	
1.A.2.a Iron and steel	2.1	8924407	NACE 24.1-24.3/24.51/24.52: base metal iron and steel	Process emissions from the iron and steel industry are allocated to sector 2C1, combustion emissions are allocated to sector 1A2a and the use of lubricants is allocated to sector 2D1
1.A.2.b Non-ferrous metals	2.1	8920100	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals	Process emissions from carbon electrodes are allocated to sector 2C3 and combustion emissions are allocated to sector 1A2b
1.A.2.c Chemicals	2.1	8900900	NACE 20.15: manufacture of fertilizers and nitrogen compounds	Process emissions from ammonia production are allocated to sector 2B1 and combustion emissions are allocated to sector 1A2c
		8901100	NACE 20.1: manufacture of basic chemicals	Process emissions from the chemical industry are allocated to sector 2B8 and sector 2B10, combustion emissions are allocated to sector 1A2c and the use of lubricants is allocated to sector 2D1
		8901702	NACE 22: manufacture of rubber and plastic products	
		8913700	NACE 20.2-20.5: chemical products industry	Process emissions from the chemical industry are allocated to sector 2B8 and sector 2B10, combustion emissions are allocated to sector 1A2c and the use of lubricants is allocated to sector 2D1

CRT	Section	ES CODE	EMISSION SOURCE	Comment
1.A.2.d Pulp, paper and print	2.1	8900600	NACE 17.1/17.2: manufacture of pulp, paper and paperboard	
		8900700	NACE 18/58: publishing, printing and reproduction of recorded media	
1.A.2.e Food processing, beverages and tobacco	2.1	8900200	NACE 10-12: manufacture of food products, beverages and tobacco	
1.A.2.f Non-metallic minerals	2.1	8914600	NACE 23: construction material and glass industry	
1.A.2.g.i Manufactu-ring of machinery	2.1	8902200	NACE 28: manufacture of machinery	
1.A.2.g.ii Manufactu-ring of transport equipment	2.1	8902400	NACE 29: motor-industry	
		8908100	NACE 30: manufacture of other transport equipment	
1.A.2.g.iii Mining and quarrying	2.1	8922701	NACE 08: other quarrying and mining	
1.A.2.g.iv Wood and wood products	2.1	8912101	NACE 16: manufacture of wooden products	
1.A.2.g.v Construction	2.1	0020401	NACE 41-43: construction and building industies	
1.A.2.g.vi Textile and leather	2.1	8900300	NACE 13/14: manufacture of textiles and textile apparel	
		8900400	NACE 15: leather industry and fur preparation	
1.A.2.g.vii Off-road vehicles and other machinery	--	0401102	Exhaust gas, mobile machinery - building & construction	Method is described in the transport methodology report (Witt et al., 2025)
		0401103	Exhaust gas, mobile machinery - industry	
1.A.2.g.viii Other	2.1	8900601	NACE unknown: other industry	
		8902100	NACE 25: manufacture of metal structures and parts of structures	
		8902301	NACE 26/28: manufacture of machinery and electronic apparatus	
		8902303	NACE 27: manufacture of electrical apparatus	

CRT	Section	ES CODE	EMISSION SOURCE	Comment
		8902304	NACE 26: manufacture of computers and electronic and optical apparatus	
		8908000	NACE 31/32: manufacture of furniture and other goods	
		8915300	NACE 26/31/32: manufacture of electronic apparatus and furniture	
		N339000	NACE 06-33: Industry not specified	
1.A.3.a Domestic aviation	--	E301201	Exhaust gas, aviation, national	Method is described in the transport methodology report (Witt et al., 2025)
1.A.3.b Road transpor-tation	--	0100100	Exhaust gas, passenger cars	Method is described in the transport methodology report (Witt et al., 2025)
		0100400	Exhaust gas, vans	
		0100700	Exhaust gas, heavy vehicles	
		0100800	Exhaust gas, busses	
		0100805	Exhaust gas, motorcycles and mopeds	
1.A.3.c Railways	--	0200400	Exhaust gas, rail traffic	Method is described in the transport methodology report (Witt et al., 2025)
1.A.3.d Domestic navigation	--	0230006	Exhaust gas, inland shipping national	Method is described in the transport methodology report (Witt et al., 2025)
		0230101	Exhaust gas, inland navigation	
		0230302	Exhaust gas, inland navigation	
		0500100	Exhaust gas, pleasure craft	
1.A.3.e.i Other transpor-tation - pipeline transport	2.4	6800100	Gas transport network	Combustion emissions of CO_2 and N_2O are allocated to sector 1A3ei gaseous, other emissions are allocated to sector 1B2b4
1.A.4.a.i Commercial/ institutional Stationary combustion	2.1	0020500	Commercial and governmental institutions	Emissions from all fuels except lubricants are allocated to sector 1A4a. Emissions from lubricants are allocated to sector 2D1
		8916000	NACE 38.3: preparation to recycling of metal and non-metal waste and scrap	
		8920500	NACE 36: collection, purification and distribution of water	
		8922000	NACE 38.1/38.2 (partly): landfill gas companies	

CRT	Section	ES CODE	EMISSION SOURCE	Comment
	2.3	E400109	NACE 37: collection and treatment of sewage	
1.A.4.a.ii Commercial/ institutional Off-road vehicles and other machinery	--	0401105	Exhaust gas, mobile machinery - trade, service sector, government	Method is described in the transport methodology report (Witt et al., 2025)
1.A.4.b.i Residential – Stationary combustion	2.1	0012100	Residential combustion	
		0012101	Residential combustion, appliances, gas leakage before ignition	
	--	0801801	Charcoal use for barbecuing	Method is described in the WESP methodology report (A. Visschedijk et al., 2025)
		T012200	Residential combustion, wood stoves and fire places	
1.A.4.b.ii Residential – Off-road vehicles and other machinery	--	0401104	Exhaust gas, mobile machinery - consumers	Method is described in the transport methodology report (Witt et al., 2025)
1.A.4.c.i Agriculture/ forestry/ fishing - Stationary	2.1	0401200	NACE 0: other agriculture, hunting and services to agriculture and hunting	
		0401201	Combustion in agricultural buildings	
1.A.4.c.ii Agriculture/ forestry/ fishing - Off-road vehicles and other machinery	--	0401100	Exhaust gas, mobile machinery - agriculture	Method is described in the transport methodology report (Witt et al., 2025)
1.A.4.c.iii Agriculture/ forestry/ fishing - Fishing	--	0240105	Exhaust gas, fisheries	Method is described in the transport methodology report (Witt et al., 2025)
1.A.5.b Other – Mobile – Military use	--	0240100	Exhaust gas, militairy fuel consumption in ships and airplanes	Method is described in the transport methodology report (Witt et al., 2025)
1.B.1.a Coal mining and handling	--			Not occuring
1.B.1.b Solid fuel transfor-mation	2.2	8912800	NACE 20.14: manufacture of inorganic basic chemicals, charcoal production	

CRT	Section	ES CODE	EMISSION SOURCE	Comment
		8924102	NACE 19.1: manufacture of coke oven products (ACZ)	Process emissions from coke production are allocated to sector 1B1b and combustion emissions are allocated to sector 1A1c
		8924103	NACE 19.1: production of coke, coke factory Corus	Process emissions from coke production are allocated to sector 1B1b and combustion emissions are allocated to sector 1A1c
1.B.1.c Other	--			Not occuring
1.B.2.a.1 Oil exploration	2.4	0020502	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, drilling activities	Included in 1A1C
1.B.2.a.2 Oil production	2.4	0020400	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, onshore	Combustion emissions included in 1A1C, other emissions included in 1.B.2.c.1.iii
		8120001	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, offshore	
1.B.2.a.3 Oil transport	2.4	8120503	NACE 495: Transport of oil via pipelines	
1.B.2.a.4 Oil refining/ storage	2.2	8924200	NACE 19.2 (excluding NACE 19.202): manufacture of refined petroleum products	Process emissions from petroleum refining are allocated to sector 1B2a4 and combustion emissions are allocated to sector 1A1b
		8924204	NACE 19.201: manufacture of refined petroleum products	
1.B.2.a.5 Distribution of oil products	--			Not applicable
1.B.2.a.6 Oil - Other	--			Not occuring
1.B.2.b.1 Natural gas exploration	2.4	0020502	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, drilling activities	Included in 1A1C
1.B.2.b.2 Natural gas production	2.4	0020400 8120001 8120002 8120502	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, onshore NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, offshore	Combustion emissions included in 1A1c, other emissions included in 1.B.2.c.1.iii

CRT	Section	ES CODE	EMISSION SOURCE	Comment
1.B.2.b.3 Natural gas processing	2.4	0020400 8120001 8120002 8120502	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, onshore NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, offshore	Combustion emissions included in 1A1c, other emissions included in 1.B.2.c.1.iii
1.B.2.b.4 Natural gas transmission and storage	2.4	6800100	Gas transport network	Combustion emissions of CO_2 and N_2O are allocated to sector 1A3ei gaseous, other emissions are allocated to sector 1B2b4
1.B.2.b.5 Natural gas distribution	2.4	0800200	Gas distribution network	
1.B.2.b.6 Natural gas - Other	--			Not occurring
1.B.2.c.1.i Venting - Oil	--			Included in 1.B.2.c.1.iii
1.B.2.c.1.ii Venting - Gas	--			Included in 1.B.2.c.1.iii
1.B.2.c.1.iii Venting - Combined	2.4	8120002	NACE 06: extraction of crude oil and natural gas, venting, offshore	
		8120502	NACE 06: extraction of crude oil and natural gas, venting, onshore	
1.B.2.c.2.i Flaring – Oil	--			Included in 1.B.2.c.2.iii
1.B.2.c.2.ii Flaring – Gas	--			Included in 1.B.2.c.2.iii
1.B.2.c.2.iii Flaring - Combined	2.4	8120000	NACE 06: extraction of crude oil and natural gas, flaring, offshore	
		8120500	NACE 06: extraction of crude oil and natural gas, flaring, onshore	
1.D.1.a Aviation bunkers	--	T000000	Bunkers: aviation	Method is described in the transport methodology report (Witt et al., 2025)
1.D.1.b Marine bunkers	--	T000001	Bunkers: marine	Method is described in the transport methodology report (Witt et al., 2025)
		T000002	Bunkers: marine, inland	
		T000003	Bunkers: marine, maritime	
2.A.1 Cement production	2.2	8914300	NACE 23.6: manufacture of articles of concrete, plaster and cement	
2.A.2 Lime production	--			Included in 1.A.2.e

CRT	Section	ES CODE	EMISSION SOURCE	Comment
2.A.3 Glass production	2.2	8914000	NACE 23.1: manufacture of glass and glassware	
2.A.4.a Ceramics	2.2	8914101	NACE 23.32: manufacture of ceramic products for the building industies	
2.A.4.b Other uses of soda ash	2.2	8912702	NACE 20.13: manufacture of inorganic basic chemicals, soda consumption (PBL)	
2.A.4.c Non-metal-lurgical magnesium production	--			Not occuring
2.A.4.d Other process uses of carbonates	2.2	0834000	NACE 35.11: production of electricity, flue gas desulphurization	
		8924400	NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel, consumption of lime (PBL)	
		N340000	Limestone application in NACE 45: road construction	
2.B.1 Ammonia production	2.1	8900900	NACE 20.15: manufacture of fertilizers and nitrogen compounds	Process emissions from ammonia production are allocated to sector 2B1, combustion emissions of waste gas are allocated to 2B1 and combustion emissions of other fuels are allocated to sector 1A2c
	2.2	8900900	NACE 20.15: manufacture of fertilizers and nitrogen compounds	Process emissions from ammonia production are allocated to sector 2B1, combustion emissions of waste gas are allocated to 2B1 and combustion emissions of other fuels are allocated to sector 1A2c
2.B.2 Nitric acid production	2.2	8919514	NACE 20.149: manufacture of organic basic chemicals (no petrochemicals), production of nitric acid (PBL)	
2.B.3 Adipic acid production	--			Not occuring
2.B.4.a Caprolactam production	2.2	8919512	NACE 20.149: manufacture of organic basic chemicals (no petrochemicals), production of caprolactam (PBL)	
2.B.4.b Glyoxal production	--			Not occuring

CRT	Section	ES CODE	EMISSION SOURCE	Comment
2.B.4.c Glyoxylic acid production	--			Not occuring
2.B.5.a Silicon carbide production	--			Included in 2.B.8.g
2.B.5.b Calcium carbide production	--			Not occuring
2.B.6 Titanium dioxide production	--			Included in 2.B.8.g
2.B.7 Soda ash production	2.2	8912704	NACE 20.13: manufacture of inorganic basic chemicals, production of soda ash (CBS)	
2.B.8.a Methanol production	--			Included in 2.B.8.g
2.B.8.b Ethylene production	--			Included in 2.B.8.g
2.B.8.c Ethylene dichloride and vinyl chloride monomer production	--			Not occuring
2.B.8.d Ethylene oxide production	--			Included in 2.B.8.g
2.B.8.e Acrylonitrile production	--			Included in 2.B.8.g
2.B.8.f Carbon black production	--			Included in 2.B.8.g
2.B.8.g Other petrochemical and carbon black production	2.1	8913000	NACE 20.13: manufacture of inorganic basic chemicals	Process emissions from the chemical industry are allocated to sector 2B8g, combustion emissions are allocated to sector 1A2c and the use of lubricants is allocated to sector 2D1

CRT	Section	ES CODE	EMISSION SOURCE	Comment
2.B.9.a.i	2.2	8913005	NACE 20.16: manufacture of plastics in primary forms (production of HCFK 22)	
2.B.9.a.ii	--			Not occuring
2.B.9.b.i	--			Not occuring
2.B.9.b.ii	--			Not occuring
2.B.9.b.iii	2.2	8913002	NACE 20.16: manufacture of plastics in primary forms, handling of F-gasses	
2.B.10 Other	2.1	8901100	NACE 20.1: manufacture of basic chemicals	Process emissions from the chemical industry are allocated to sector 2B10, combustion emissions from waste gases are allocated to sector 2B10, combustion emissions of other fuels are allocated to sector 1A2c and the use of lubricants is allocated to sector 2D1
		8913700	NACE 20.2-20.5: chemical products industry	Process emissions from the chemical industry are allocated to sector 2B10, combustion emissions are allocated to sector 1A2c and the use of lubricants is allocated to sector 2D1
	2.2	8901100	NACE 20.1: manufacture of basic chemicals	Process emissions from the chemical industry are allocated to sector 2B10, combustion emissions from waste gases are allocated to sector 2B10, combustion emissions of other fuels are allocated to sector 1A2c and the use of lubricants is allocated to sector 2D1
		8912700	NACE 20.13: manufacture of inorganic basic chemicals, production of active carbon	Process emissions from the chemical industry are allocated to sector 2B10, combustion emissions are allocated to sector 1A2c and the use of lubricants is allocated to sector 2D1
		8912900	NACE 20.149: manufacture of organic basic chemicals (no petrochemicals)	Process emissions from the chemical industry are allocated to sector 2B10, combustion emissions are allocated to sector 1A2c and the use of lubricants is allocated to sector 2D1
2.C.1.a Steel production	2.2	8924402	NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	

CRT	Section	ES CODE	EMISSION SOURCE	Comment
2.C.1.b Pig iron production	--			Included in 2.C.1.f
2.C.1.c Direct reduced iron production	2.2	8924401	NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel, anode use with production of electrosteel	
2.C.1.d Sinter production	--			Included in 2.C.1.f
2.C.1.e Pellet production	--			Included in 2.C.1.f
2.C.1.f Other iron and steel production	2.2	8924407	NACE 24.1-24.3/24.51/24.52: base metal iron and steel	Process emissions from the iron and steel industry are allocated to sector 2C1, combustion emissions are allocated to sector 1A2a and the use of lubricants is allocated to sector 2D1
2.C.3 Aluminium production	2.1	8920100	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals	Process emissions from carbon electrodes are allocated to sector 2C3 and combustion emissions are allocated to sector 1A2b
	2.2	8914700	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals	
2.C.4 Magnesium production				Not occuring
2.C.5 Lead production				Not occuring
2.C.6 Zinc production				Not occuring
2.C.7 Other metal industry				Not occuring
2.D.1 Lubricant use	2.1	N339000	NACE 06-33: Industry not specified	Combustion emissions are allocated to 1A2 and the use of lubricants is allocated to sector 2D1
	2.2	0020500	Commercial and governmental institutions	Emissions from all fuels except lubricants are allocated to sector 1A4a. Emissions from lubricants are allocated to sector 2D1
		8924407	NACE 24.1-24.3/24.51/24.52: base metal iron and steel	Process emissions from the iron and steel industry are allocated to sector 2C1, combustion emissions are allocated to sector 1A2a and

CRT	Section	ES CODE	EMISSION SOURCE	Comment
				the use of lubricants is allocated to sector 2D1
		N091100	Use of lubricants, railways	
		N091200	Use of lubricants, road traffic	
		N091300	Use of lubricants, inland navigation	
		N091400	Use of lubricants, air traffic	
2.D.2 Paraffin wax use	--	0801000	Burning of candles	Method is described in the WESP methodology report (A. Visschedijk et al., 2024)
2.D.3 Other use of non-energy products from fuels and solvents	--	0100204	Exhaust gas, passenger cars (diesel SCR)	Method is described in the transport methodology report (Witt et al., 2025)
		0100504	Exhaust gas, vans (diesel SCR)	
		0100704	Exhaust gas, heavy vehicles (diesel SCR)	
		0100804	Exhaust gas, busses (diesel SCR)	
	3.3.3.2	8914501	Road paving with asphalt	
2.E.1 Integrated circuit or semi-conductor	2.2	8924509	NACE 25-33/95 (excluding NACE 30.1/33.15): metal-electronic industry, production of semi-conductors	
2.E.2 TFT flat panel display	--			Not occuring
2.E.3 Photo-voltaïcs	--			Not occuring
2.E.4 Heat transfer fluid	--			Not occuring
2.E.5 Other electronics industry	--			Not occuring
2.F.1 Refrigeration and air conditioning	2.2	8924506	Solvent and other product use: refrigeration and air conditioning equipment, stationary	
2.F.1.a Commercial refrigeration	2.2	8924504	Solvent and other product use: Commercial refrigeration	
2.F.1.c Industrial refrigeration	2.2	8924505	Solvent and other product use: Industrial refrigeration	
2.F.1.d Transport refrigeration	2.2	8924507	Solvent and other product use: Transport refrigeration	
2.F.1.e	2.2	0120000	Solvent and other product use: air conditioning equipment, mobile	

CRT	Section	ES CODE	EMISSION SOURCE	Comment
Mobile air - conditioning				
2.F.1.f Stationary air - conditioning	2.2	8924508	Solvent and other product use: Stationary air-conditioning	
2.F.2 Foam blowing agents	--			Included in 2F6
2.F.3 Fire protection	--			Included in 2F6
2.F.4 Aerosols	--			Included in 2F6
2.F.5 Solvents	--			Included in 2F6
2.F.6 Other product uses as substitues for ODS	2.2	8924502	Solvent and other product use: other	
2.G.1 Electrical equipment	--			Included in 2.G.2
2.G.2 SF6 and PFCs from other product use	2.2	8924502	Solvent and other product use: other	
2.G.3.a N_2O from medical applications	--	9310100	Solvent and other product use: anaesthesia	Method is described in the WESP methodology report (A. Visschedijk et al., 2025)
2.G.3.b N_2O from aerosol cans	--	0811301	Solvent and other product use: sprays	Method is described in the WESP methodology report (A. Visschedijk et al., 2025)
2.G.4 Other product manufacture and use	--	0801700	Fireworks at new year	Method is described in the WESP methodology report (A. Visschedijk et al., 2025)
		0850000	Degassing of groundwater, production of drinking water	
2.H.1 Pulp and paper	--			Not occuring
2.H.2 Food and beverages industry	2.2	8910600	NACE 10.9: manufacture of prepared animal feeds	
5.A.1 Managed waste disposal sites	2.3	E402200	Solid waste disposal on land: managed disposal	Emissions from combustion of landfill gas for energy recovery are allocated to CRT category 1A1a. Emissions from flaring of landfill gas and other emissions from solid

CRT	Section	ES CODE	EMISSION SOURCE	Comment
				waste disposal on land are allocated to CRT category 5A1
5.A.2 Unmanaged waste disposal sites	--			Not occuring
5.A.3 Uncategorized waste disposal sites	--			Not occuring
5.B.1 Composting	2.3	E400313	Digesting of organic waste from households	This does not include installations that treat manure. Emissions from installations that treat manure are described in the methodology report for agriculture (Van der Zee et al., 2025).
		E400314	Composting of organic waste from households	
		E400315	Digesting of organic horticultural waste	This does not include installations that treat manure. Emissions from installations that treat manure are described in the methodology report for agriculture (Van der Zee et al., 2025).
		E400316	Composting of organic horticulture waste	
5.C.1 Waste incineration	--			Incineration in Waste-to-Energy plants included in 1A1a.
5.C.2 Open burning of waste	--			Method is described in the WESP methodology report (A. Visschedijk et al., 2025)
5.D.1 Domestic wastewater treatment and discharge	2.3	E400107	NACE 90.01: collection and treatment of sewage	
		E400108	NACE 90.01: collection and treatment of sewage	
		E400102	Anaerobic waste water treatement plants, other industries	
		E400103	Anaerobic waste water treatement plants, waste treatment plants	
5.D.2 Industrial wastewater treatment and discharge	2.3	E400104	Anaerobic waste water treatement plants, paper industries	
		E400105	Anaerobic waste water treatement plants, food industries	
		0444900	Indirect related to waste water	
		E400106	Discharges of domestic waste water: septic tanks, anaerobic processes	

CRT	Section	ES CODE	EMISSION SOURCE	Comment
5.D.3 Other: Septic tanks; Wastewater effluents	2.3	N000400	Indirect CO2 from NMVOC: energy	
		N000401	Indirect CO2 from NMVOC: traffic & transport	
Indirect emissions: 1. Energy	2.2	N000402	Indirect CO_2 from NMVOC: refineries	
		N000403	Indirect CO_2 from NMVOC: consumers	
		N000404	Indirect CO_2 from NMVOC: commercial and governmental institutions	
Indirect emissions: 2. Industrial processes and product use	2.2	N000405	Indirect CO_2 from NMVOC: industry	
		N000406	Indirect CO_2 from NMVOC: construction and building industries	
		N000407	Indirect CO_2 from NMVOC: agriculture	
				Not occuring
Indirect emissions: 3. Agriculture	2.2	N000408	Indirect CO_2 from NMVOC: waste	
Indirect emissions: 4. LULUCF	--			Not occuring
Indirect emissions: 5. Waste	2.2			
Indirect emissions: 6. Other	--			

2.1 Combustion emissions from stationary combustion (CRT 1A, excluding transport, and part of CRT 2)

This section describes the method for calculating the emissions of CO_2, CH_4 and N_2O from stationary combustion sources based on fuel consumption. These emissions are reported in CRT categories 1A1, 1A2 and 1A4. In line with the IPCC 2006 Guidelines (vol. 3, chapter 1, box 1.1), the emissions from the combustion of waste gases within the same sector where the waste gases are produced (i.e. chemical sector) are allocated in the IPPU sector (CRT 2B1 and 2B10). Table 2 lists all CRT categories and emission sources.
Calculation methods for emissions from mobile combustion are described in Witt et al. (2025) and emissions from residential activities are described in WESP (2025).

The emissions are calculated using fuel consumption data in the Dutch Energy Balance Sheet (Statistics Netherlands). The total emissions are calculated by multiplying fuel consumption by default IPCC emission factors or country specific emission factors (see Table 3). For several energy intensive industries, emission figures from annual environmental reports (AERs; Dutch accronym: e-MJV) of companies are used, as well as emission data reported under the ETS framework (in the Netherlands ETS data is collected by the Dutch Emissions Authority (NEa)). This extra refinement is also applied to companies using fuels with potentially non-standard emission factors, such as waste gases, and companies with significant emissions using fuels with a variable emission factor (e.g. coal). (see paragraph 2.1.3.3). The resulting calculation is a combination of Tier 2 and Tier 3 methods. The annual delivery of data by the NEa is laid down in the agreement '2022-11-09-NEa data aan CBS milieu en energiestatistieken.docx'

2.1.1 Emission sources

The following table lists the combustion emission sources described in this document.

Table 2 Allocation of CRT codes to combustion emission sources classified according to NACE 2008

CRT category	ES CODE	EMISSION SOURCE
1.A.1.a	8920400	NACE 35: production and distribution of electricity and gas
	8921800	NACE 38.1/38.2 (partly): waste-incineration plants
	8930401	NACE 35: decentral production of electricity, general
	8930410	NACE 35: production of electricity, heat
1.A.1.b	8924200	NACE 19.2 (excluding NACE 19.202): manufacture of refined petroleum products
1.A.1.c	8912500	NACE 19.202: manufacture of refined petroleum products - not oil refineries
	8924102	NACE 19.1: manufacture of coke oven products (ACZ)
	8924103	NACE 19.1: production of coke, coke factory Corus
1.A.2.a	8924407	NACE 24.1-24.3/24.51/24.52: base metal iron and steel
1.A.2.b	8920100	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals
1.A.2.c	8900900	NACE 20.15: manufacture of fertilizers and nitrogen compounds
	8901100	NACE 20.1: manufacture of basic chemicals
	8901702	NACE 22: manufacture of rubber and plastic products
	8913700	NACE 20.2-20.5: chemical products industry
1.A.2.d	8900600	NACE 17.1/17.2: manufacture of pulp, paper and paperboard
	8900700	NACE 18/58: publishing, printing and reproduction of recorded media
1.A.2.e	8900200	NACE 10-12: manufacture of food products, beverages and tobacco
1.A.2.f	8914600	NACE 23: construction material and glass industry
1.A.2.g.i	8902200	NACE 28: manufacture of machinery
1.A.2.g.ii	8902400	NACE 29: motor-industry

CRT category	ES CODE	EMISSION SOURCE
	8908100	NACE 30: manufacture of other transport equipment
1.A.2.g.iii	8922701	NACE 08: other quarrying and mining
1.A.2.g.iv	8912101	NACE 16: manufacture of wooden products
1.A.2.g.v	0020401	NACE 41-43: construction and building industies
1.A.2.g.vi	8900300	NACE 13/14: manufacture of textiles and textile apparel
	8900400	NACE 15: leather industry and fur preparation
1.A.2.g.vii i	8900601	NACE: unknown industry
	N339000	NACE 06-33: Industry not specified
	8902100	NACE 25: manufacture of metal structures and parts of structures
	8902301	NACE 26/28: manufacture of machinery and electronic apparatus
	8902303	NACE 27: manufacture of electrical apparatus
	8902304	NACE 26: manufacture of computers and electronic and optical apparatus
	8908000	NACE 31/32: manufacture of furniture and other goods
	8915300	NACE 26/31/32: manufacture of electronic apparatus and furniture
1.A.4.a.i	0020500	Commercial and governmental institutions
	8916000	NACE 38.3: preparation to recycling of metal and non-metal waste and scrap
	8920500	NACE 36: collection, purification and distribution of water
	8922000	NACE 38.1/38.2 (partly): landfill gas companies
	E400109	NACE 37: collection and treatment of sewage
1.A.4.b.i	0012100	Residential combustion
	0012101	Residential combustion, appliances, gas leakage before ignition
1.A.4.c.i	0401200	NACE 0: other agriculture, hunting and services to agriculture and hunting
	0401201	Combustion in agricultural buildings
2.B.1	8900900	NACE 20.15: manufacture of fertilizers and nitrogen compounds
2.B.10	8901100	NACE 20.1: manufacture of basic chemicals
	8913700	NACE 20.2-20.5: chemical products industry

Emissions from oil and gas extraction are calculated by RIVM and are described in chapter 2.4. Emissions from waste incineration are calculated by the Department of Public Works and Water Management (Rijkswaterstaat) and are described in chapter 2.3.

In line with the IPCC 2006 Guidelines (vol. 3, chapter 1, box 1.1), the emissions from the combustion of waste gases within the same sector where the waste gases are produced (i.e. chemical sector) are allocated in the IPPU sector (CRT 2B1 and 2B10).

2.1.2 Calculation method of preliminary emission figures

The preliminary emissions are calculated as follows, using the preliminary energy statistics data:

*Preliminary emission = preliminary energy consumption / energy consumption t-1 * emissions t-1*

Where:

Preliminary emissions	=	Emissions of latest year (kg)
Emissions t-1	=	Emissions of the year before latest year (kg)
Preliminary energy consumption	=	Energy consumption of latest year (GJ)
Energy consumption t-1	=	Energy consumption of the year before last year (GJ)

Additional adjustment may be required if literature shows an emission source has changed.

2.1.3 Calculation method of final emission figures

2.1.3.1 Introduction

The calculation is based on the fuel consumption figures from the energy statistics and the data reported by companies in the AERs or under the ETS framework.

The emissions of GHGs CO_2, CH_4 and N_2O are calculated using the following formula:

Emission = fuel consumption * emission factor

2.1.3.2 Activity data

Emissions are caused by fuel combustion. The Statistics Netherlands provides a comprehensive overview of energy consumption (expressed in PJ) in the Netherlands.
Two files are provided by Statistics Netherlands:

- The energy consumption of individual companies, obtained by Statistics Netherlands through a survey.
- Fuel consumption as published by Statistics Netherlands in the energy statistics (file data subdivided by company group and fuel type, including supplemental estimates of consumption, not covered by the survey of Statistics Netherlands).

These files are combined in one emission calculation database including energy statistics of individual companies and energy statistics of supplemental estimates. This results in a file containing the total energy consumption in the Netherlands including the data of individual companies covering all reporting years, allowing company-specific calculations to be made.
The Energy Statistics from Statistics Netherlands for the latest published year are in preliminary final.
Normally only minor changes will be implemented in the following Year, for example after processing subsequent information. Data for previous years is fixed. If exceptional changes have been made to energy quantities, these changes will be described in the statline tables with energy data and published as a revision.

The Energy Statistics from Statistics Netherlands reports the data of natural gas including biogas, which is added to the Dutch natural gas network. The total amount of added biogas in the Netherlands is also reported by Statistics Netherlands.

However, in the CRT, the natural gas and the biogas need to be reported separately. To do this, the amount of natural gas from the Energy Statistics is reduced by the amount of biogas. The biogas is distributed proportionately among the different CRT categories and the emission factors used are equal to the factors of natural gas.

The emissions of mobile equipment, as reported in CRT 1A2 and 1A4, are covered by the calculation of emissions from mobile sources as described in the methodology report for transport (Witt et al., 20252025).

2.1.3.3 Emission factors

The standard emission factors (EFs) based on the Dutch fuel list are included in Table 3).
The translation between the fuel names from the energy statistics and the Dutch fuel list are included in Table 9.

Table 3 List of standard emission factors, (kg/TJ)

Fuel typein the energy statistics	**EF_CO_2 (source: Zijlema, 2025)**	**EF_N_2O (source: IPCC, 2006)**	**EF_CH_4 (source: Scheffer *et al.,* 1997)**
Coal and coal briquettes (coke oven)	95400	1.5	0.44
Coal and coal briquettes (blast furnaces)	89800	1.5	0.44
Coal and coal briquettes	94700	1.5	0.44
Lignite	101000	1.5	4.4
Coal cokes	106800	1.5	44.4
Coke oven gas	42800	0.1	2.8
Blast furnace gas	247400	0.1	0.35
Coal aromatics	73300	0.6	1.6
Coal bitumen	80700	0.6	1.6
Crude oil	73300	0.6	1.4
Natural gas condensate	64200	0.6	1.9
Other crude oil raw materials	73300	0.6	1.4
Refinery gas	67000	0.1	3.6
Chemical waste gas	62400	0.1	3.6
LPG, propane, butane	66700	0.1	0.7
Naphthas	73300	0.6	3.4
Crude oil aromatics	73300	0.6	3.4
Aviation fuel	72000	0.6	3.4
Jet fuel (kerosene base)	71500	0.6	3.4
Petrol / gasoline	72000	0.6	3.4
Other light oils	73300	0.6	3.4
Petroleum	71900	0.6	3.4
Gas-oil, diesel oil, heating oil < 15cSt	74300	0.6	3.4

Fuel typein the energy statistics	EF_CO_2 (source: Zijlema, 2025)	EF_N_2O (source: IPCC, 2006)	EF_CH_4 (source: Scheffer *et al.,* 1997)
Heavy heating oil >= 15cSt	77400	0.6	1.6
Lubricating oils and fats	73300	0.6	1
Bitumen	80700	0.6	1.6
Mineral turpentine	73300	0.6	3.4
Mineral waxes	73300	0.6	1.5
Raw materials for carbon black	73300	0.6	1.6
Petroleum cokes	97500	1.5	3.8
Total anti-knock preparations	73300	0.6	7.5
Additives for lubricants	73300	0.6	7.5
Other crude oil products H27	73300	0.6	3.4
Other products (not H27)	73300	0.6	3.4
Natural gas 1)	56500	0.1	5.7
Fermentation gas	90800	0.1	5
Sewage gas	84200	0.1	5
Landfill gas	100700	0.1	5
Industrial fermentation gas	84200	0.1	5
Biomass, liquid	71200	4	30
Biomass, solid	109600	4	30
Wood 2)	109600	4	30 / 300

Notes:
1) CO_2 emission factors for natural gas vary yearly and are presented in Table 5. CH_4 emission factors for natural gas are only valid for natural gas not combusted in gas engines. For gas engines, the emission factors are presented in Table 6. Residential gas leakage before ignition in cooking, hot water and space heating are not included in the CH4 emission factor for natural gas; these are separately estimated to be 35 g / GJ.
2) CH_4 emission factors for wood are 30 kg/TJ for CRT categories 1A1 and 1A2 and 300 kg/TJ for CRT category 1A4.

For some fuels, the CO2 emission factor fluctuates every year and therefore the emission factor from Table 3 cannot be used for all fuels for every year. Table 4 and Table 5 contain different emission factors for different years.

Table 4 Different CO_2 emission factors, (kg/TJ), (source: Zijlema, 2025)

Fuel type	EF_CO2 1990-2012 (Vreuls, 2013)	EF_CO2 2013-2020 (Zijlema, 2025)	EF_CO2 2021-current (Zijlema, 2025)
Coal cokes	111900	106800	106800
Other bituminous coal	94700	94700	92700
Coke oven gas	41200	42800	42800
Refinery gas	66700	67000	64400

Fuel type	EF_CO2 1990-2012 (Vreuls, 2013)	EF_CO2 2013-2020 (Zijlema, 2025)	EF_CO2 2021-current (Zijlema, 2025)
Chemical waste gas	66700	62400	61800

Table 5 CO_2 emission factors for natural gas, (kg/TJ), (source: Zijlema, 2025)

Years	EF CO_2
1990-2006	56800
2007-2008	56700
2009-2010	56600
2011-2013	56500
2014	56400
2015	56500
2016	56500
2017	56600
2018	56600
2019	56600
2020	56400
2021	56400
2022	56500
2023	56300

Measurements indicate that CH_4 emissions from gas engines are higher than in small-scale plants due to incomplete combustion. Therefore, a higher emission factor for CH_4 applies when a gas engine is used (see Table 6). The consumption of natural gas in gas engines is based on data provided by CBS.

Table 6 CH_4 emission factors for natural gas used in gas engines, (kg/TJ)

Year	EF CH_4 gas engines in agriculture	EF CH_4 gas engines in other sectors
1990	305	305
1991	305	305
1992	305	305
1993	305	305
1994	305	305
1995	305	305
1996	305	305
1997	305	305
1998	294	294
1999	283	283
2000	272	272

Year	EF CH_4 gas engines in agriculture	EF CH_4 gas engines in other sectors
2001	261	261
2002	250	250
2003	250	250
2004	268.9	250
2005	301.5	250
2006	354.6	250
2007	382.3	250
2008	395.3	250
2009	403.9	250
2010	410.1	250
2011	416.0	250
2012	421.8	250
2013	427.0	250
2014	431.7	250
2015	436.5	250
2016	441.3	250
2017	446.1	250
2018	450	250
2019	460	250
2020	460	250
2021	460	250
2022	460	250
2023	460	250

Company specific emission factors
To refine the emission calculations, sometimes company specific emission factors are used. This refinement is mainly applied for companies using fuels with potentially non-standard emission factors (e.g. waste gases) and companies with significant emissions (e.g. coal combustion).

In practice, this concerns:
- Coal consumption in the base metal industry and power plants.
- Residual gases in refineries, the chemical industry and the base metal industry.

The company specific CO_2 emission factor for fuel types with non-standard emission factors is calculated as follows:
1. First, the CO_2 emission of the fuels with known EFs is calculated by multiplying the fuel consumption with the standard CO_2 emission factor (from Table 3).
2. Second, the CO_2 emission from the specific fuel is calculated by subtracting the CO_2 emissions of the other fuels (as calculated in

step 1) from the total CO_2 emission of the company (as reported in ETS or the AER). Also process emissions (which are reported in CRT 2) are subtracted from the total CO2 emission of the company.

3. Then the company specific emission factor is calculated by dividing the fuel specific CO_2 emission with the fuel consumption from the energy statistics.

This is described in the following formulas (for refinery gas as an example, see Table 7 and Table 8):
CO_2 emissions Refinery gas = total emission (AER/ETS) – CO_2 emissions natural gas - CO_2 emissions petroleum gas

EF CO_2 Refinery gas = CO_2 emissions Refinery gas / consumption Refinery gas

This approach provides the company-specific emission factor for the relevant fuel of that company.

Table 7 Example of basic data. Because this is not public energy data of a company, fictive values for fuel quantities are recorded. This is an example for the calculation of the IEF of refinery gas.

Source	**Plant**	**CO_2 emissions (kg)**	**Fuel type**	**Consumption (TJ)**
AER	Oil refinery X	2145614210		
energy statistics	Oil refinery X		Refinery gas	15000
energy statistics	Oil refinery X		Petroleum cokes	6000
energy statistics	Oil refinery X		Natural gas	10000

Table 8 Example of calculation

	Consumption (TJ)	**EF_CO_2 (kg/TJ)**	**CO_2 emissions (kg)**	**Explanation**
Total emission (AER)			2145614210	
Natural gas	10000	56500	565000000	CO2 emission is calculated based on the standard EF for natural gas (see Table 3)
Petroleum cokes	6000	97500	585000000	CO2 emission is calculated based on the standard EF for petroleum cokes (see Table 3)
Refinery gas	15000	66374	995614210	CO2 emission is calculated from the total CO2 emission minus the CO2 emission of natural gas and petroleum cokes. After that, the company specific EF is calculated by dividing the CO_2 emissions of refinery gas by the fuel consumption

For the calculation of the company-specific emission factors, the reported CO_2 emissions from a company are used (from either ETS or

AER). From 2014 onwards, the CO_2 emissions as reported in the ETS reporting is used. For earlier years, the company definition for ETS reporting sometimes deviated from the company definition in the energy statistics. In that case, the CO2 reporting from the AERs was used.

Applicability of company specific emission factors
To determine whether a company specific emission factor can be used or not, the natural gas consumption of the chemical company is examined. If the difference between the energy statistics from CBS and the amount of natural gas reported in AER is more than 2%, it is assumed that the company definition (i.e. scope of the company reporting in AER/ETS and in the energy statistics) is not the same in both datasets and the specific emission factor cannot be determined. In that case the emissions are calculated using the standard emission factor from Table 3.

In refineries and base metal industries this check is not applied because the consumption of natural gas is relatively small compared to the total energy consumption. For these companies the company boundaries are clear. Therefore it is sure that in both the energy statistics and the AER the same data is included.

Note: Both the energy data from individual companies in the energy statistics and energy data from ETS and AER reports are confidential.

Company specific emission factors have been derived for the following gases and years:

- Refinery gas: Until 2002, country-specific EFs from the Netherlands' list of fuels (Zijlema, 2025) are used. Since 2002, company-specific EFs have been derived for all companies and are used in the emission inventory.
- Chemical waste gas: Since 1995, company-specific EFs have been derived for a selection of companies. For the remaining companies, the default EF is used. In 2022, this selection of companies consisted of 18 companies (more than in previous years). If any of these companies was missing, then a company-specific EF for the missing company was used (derived in 1995). For the period 1990–1994, a country-specific EF based on an average EF for four companies has been used.
- Blast furnace gas: Until 2007, country-specific EFs from the Netherlands' list of fuels (Zijlema, 2025) are used. Since 2007, company-specific EFs have been derived for most companies. Since blast furnace gas is produced only at the single iron and steel company in the Netherlands, it is assumed that all blast furnace gas has the same content and the same company specific EF is used for all companies using blast furnace gas.
- Coke oven gas: Until 2007, country-specific EFs from the Netherlands' list of fuels (Zijlema, 2025) are used. Since 2007, company-specific EFs have been derived for most companies. Since coke oven gas is produced only at the single iron and steel company in the Netherlands, it is assumed that all coke oven gas has the same content and the same company specific EF is used for all companies that use coke oven gas.
- Phosphor gas: Until 2006, country-specific EFs from the Netherlands' list of fuels (Zijlema, 2025) are used. Since 2006,

company-specific EFs have been derived for the single company and are used in the emissions inventory.

- Coal: Until 2006, country-specific EFs from the Netherlands list of fuels (Zijlema, 2025) are used. Since 2006, company-specific EFs have been derived for most companies and for the remaining companies the default EFs is used. .
- Coke oven/gas coke: Until 2006, country-specific EFs from the Netherlands' list of fuels (Zijlema, 2025) are used for all companies. Since 2006, a company-specific EF has been derived for one company. For the other companies, a country-specific EF is used.

Additional remark for the company-specific emission factors in the iron and steel sector.
Tata steel is the single iron and steel company with the only coke plant and blast furnace gas production location in the Netherlands. The calculation method used by ETS for CO_2 emissions from Tata Steel is based on a carbon mass balance for the entire company. Fugitive CO_2 emissions are determined based on company information that about 1% of the input from coking coal is lost. The other 99% of the reported CO_2 emissions are assumed to be released by fuel combustion.
When calculating the company-specific emission factors of Tata-Steel, all energy flows from Statistics Netherlands energy statistics are considered energetic.
In the blast furnace and in the coke oven plant, the EF for solid fuels for N_2O is 0.27 kg / TJ (based on reported emissions from Tata Steel) and for CH_4 0.44 kg / TJ (standard EF for other bituminous coal).

2.1.3.4 Aggregation of fuels

The fuels, as included in the energy statistics, are aggregated to match the same level of detail as the Netherlands list of fuels (Zijlema, 2025). This level of detail is used in the Dutch Emission Registration.

Table 9 Aggregated fuels

Fuel code	**Fuel type in the energy statistics**	**Dutch fuel list**
10110	Coal and coal briquettes (coke oven)	Coking Coal (used in coke oven)
10110	Coal and coal briquettes (blast furnaces)	Coking Coal (used in blast furnaces
10110	Coal and coal briquettes	Other Bitumiuus Coal
10120	Lignite	Lignite
10200	Coal cokes	Coke Oven/ Gas Coke
10300	Coke oven gas	Coke Oven gas
10400	Blast furnace gas	Blast furnace gas
10910	Coal aromatics	Other oil
10920	Coal bitumen	Bitumen
20100	Crude oil	Crude oil
20200	Natural gas condensate	Natural Gas Liquids
20300	Other crude oil raw materials	Other Petroleum Products
30100	Refinery gas	Refinery Gas

Fuel code	Fuel type in the energy statistics	Dutch fuel list
30200	Chemical waste gas	Chemical Waste Gas
30300	LPG, propane, butane	Liquefied Petroleum Gas
30400	Naphthas	Naphta
30500	Crude oil aromatics	Other oil
30600	Aviation fuel	Aviation gasoline
30800	Jet fuel (kerosene base)	Jet kerosene
30900	Petrol / gasoline	Gasoline
31000	Other light oils	Other oil
31100	Petroleum	Other kerosene
31200	Gas-oil, diesel oil, heating oil < 15cSt	Gas/Diesel oil
31300	Heavy heating oil >= 15cSt	Residual Fuel oil
31400	Lubricating oils and fats	Lubricants
31500	Bitumen	Bitumen
31910	Mineral turpentine	Lubricants
31920	Mineral waxes	Lubricants
31930	Raw materials for carbon black	Other Petroleum Products
31950	Petroleum cokes	Petroleum Coke
31960	Total anti-knock preparations	Other Petroleum Products
31970	Additives for lubricants	Other Petroleum Products
31980	Other crude oil products H27	Other Petroleum Products
31990	Other products (not H27)	Other Petroleum Products
40100	Natural gas	Natural Gas (dry)
40400	Fermentation gas	Gas Biomass
40410	Sewage gas	Wastewater biogas
40420	Landfill gas	Landfill gas
40430	Industrial fermentation gas	Industrial organic waste gas
40510	biomass, liquid	Other liquid biofuels
50520	biomass, solid	Solid biomass
50530	wood	Solid Biomass

2.1.4 Reference Approach

The Reference Approach is used to verify the emission data from fuel combustion emissions in the Sectoral Approach for a quality check as part of the QA/QC. In addition to the emissions from fossil fuels, the Reference Approach also includes (for informational purposes) emissions from the use of biomass.

Fossil and biogenic fuels are used both as fuel and as raw material (feedstock) in the Netherlands. When used as a fuel, almost all carbon is converted into CO_2, while when fossil fuels are used as feedstock, part of the carbon can be stored in products. The Reference Approach (RA) determines the total emissions using the apparent domestic

consumption of fuels as its starting point. This means that the total available amount of carbon in the Netherlands is first determined per fuel type and then the amount stored in products is deducted from this total. The CO_2 emissions are calculated by multiplying the amount of C by the ratio of the molecular weight of CO_2 and C (44/12).

Determining apparent consumption
The apparent domestic consumption is calculated by the following formula:
Apparent domestic consumption = Production + import – export – bunkers + stock change

The Energy Statistics from Eurostat are used for the activity data.

Calculating emissions by the reference approach
The emissions are calculated using the following four steps:

Step 1: Calculating the carbon content
The carbon content is calculated per fuel, by multiplying the apparent energy consumption by the fuel specific carbon content. This fuel specific carbon content is taken from the national fuels list (Zijlema, 2025).
Step 2: Determining the amount of carbon for feedstock and non-energy use of fuels
The Energy Statistics from Eurostat provides the data on the non-energetic use of fuels. This is the same data as submitted to the IEA. The non-energetic use is multiplied by the carbon content of the fuel. Similar to Step 1, this factor is taken from the national fuels list (Zijlema, 2025). The result of this multiplication is the amount of carbon stored per fuel.

Step 3: calculating net carbon emissions
The net carbon emissions are calculated by deducting the carbon stored (step 2) from the carbon content (step 1).

Step 4: calculating the actual CO_2 emissions
The CO_2 emissions are calculated by multiplying the amount of C by the ratio of the molecular weight of CO_2 and C (44/12).

The CO_2 emissions from the Sectoral Approach are compared to the CO_2 emissions from the Reference Approach. Statistical differences are taken into account in the comparison. The results of the comparison are reported in the NIR every year.

2.2 Process emissions (CRT 2 and part of CRT 1))

2.2.1 Emission sources

Process emissions are released by many different emission sources. The calculation of these emissions is explained in the following sections. Table 10 shows the emission sources with a reference to the sections in which they are described.

Table 10 Allocation of CRT codes to process emission sources classified according to NACE 2008 with reference to paragraph of method description.

CRT	Paragraph	ES CODE	EMISSION SOURCE
1.A.1.b	2.2.3.1	8924200	NACE 19.2: Manufacture of refined petroleum products
1.B.1.b	2.2.3.1	8924102	NACE 19.1: manufacture of coke oven products (ACZ)
1.B.1.b	2.2.3.1	8924103	NACE 19.1: Production of coke, coke factory Corus
1.B.1.b	2.2.3.2	8912800	NACE 20.14: Manufacture of inorganic basic chemicals, charcoal production
1.B.2.a.4	2.2.3.1	8924200	NACE 19.2: Manufacture of refined petroleum products
1.B.2.a.4	2.2.3.1	8924204	NACE 19,201: Manufacture of refined petroleum products
2.A.1	2.2.3.2	8914300	NACE 23.6: manufacture of articles of concrete, plaster and cement
2.A.2	2.2.3.2	8900205	NACE 10.810 sugar production, lime production
2.A.3	2.2.3.2	8914000	NACE 23.1: manufacture of glass and glassware
2.A.4.a	2.2.3.2	8914101	NACE 23.32: manufacture of ceramic products for the building industies
2.A.4.b	2.2.3.2	8912702	NACE 20.13: Manufacture of inorganic basic chemicals, soda consumption
2.A.4.d	2.2.3.2	0834000	NACE 35.11: Production of electricity, flue gas desulphurization
2.A.4.d	2.2.3.2	8924400	NACE 24.1-24.3: Base metal industry, processing and manufacture of iron and steel, consumption of lime
2.A.4.d	2.2.3.2	N340000	Limestone application in NACE 45: road construction
2.B.1	2.2.3.1	8900900	NACE 20.15: Manufacture of fertilisers and nitrogen compounds
2.B.2	2.2.3.3	8919514	NACE 20,149: Manufacture of organic basic chemicals (no petrochemicals), production of nitric acid
2.B.4.a	2.2.3.4	8919512	NACE 20,149: Manufacture of organic basic chemicals (no petrochemicals), production of caprolactam
2.B.7	2.2.3.1	8912704	NACE 20.13: Manufacture of inorganic basic chemicals, production of soda ash (CBS)
2.B.8.g	2.2.3.1 and 2.2.3.2	8913000	NACE 20.13: manufacture of inorganic basic chemicals
2.B.9.a.1	2.2.3.2	8913005	NACE 20.16: Manufacture of plastics in primary forms, production of HCFK 22
2.B.9.b.3	2.2.3.1	8913002	NACE 20.16: Manufacture of plastics in primary forms, Others (mainly handling F-gases)
2.B.10	2.2.3.2	8901100	NACE 20.1: manufacture of basic chemicals
2.B.10	2.2.3.1	8902302	NACE 26/27: Electrotechnical industry
2.B.10	2.2.3.1	8912700	NACE 20.13: Manufacture of inorganic basic chemicals, production of active carbon
2.B.10	2.2.3.1	8912900	NACE 20.149: manufacture of organic basic chemicals (no petrochemicals)
2.C.1.a	2.2.3.2	8924402	NACE 24.1-24.3: Base metal industry, processing and manufacture of iron and steel

CRT	Paragraph	ES CODE	EMISSION SOURCE
2.C.1.f	2.2.3.2	8924401	NACE 24.1-24.3: Base metal industry, processing and manufacture of iron and steel, anode use with production of electrosteel
2.C.3.a	2.2.3.7	8914700	NACE 24.4/24.53/24.54: Manufacture and casting of light and other non-ferrous metals
2.D.1	2.2.3.1	0020500	Commercial and governmental institutions (use of lubricants)
2.D.1	2.2.3.1	8901100	NACE 20.1: manufacture of basic chemicals
2.D.1	2.2.3.1	8915005	NACE 25-33/95 (excluding NACE 30.1/33.15): metal-electronic industry, metallic products, (electrical) appliances, instruments, parts
2.D.1	2.2.3.1	8924407	NACE 24.1-24.3/24.51/24.52: Base metal: iron and steel
2.D.1	2.2.3.1	N091100	Use of lubricants, railways
2.D.1	2.2.3.1	N091200	Use of lubricants, road traffic
2.D.1	2.2.3.1	N091300	Use of lubricants, inland navigation
2.D.1	2.2.3.1	N091400	Use of lubricants, air traffic
2.E.1	2.2.3.8	8924509	NACE 25-33/95: Metal-electronic industry, production of semi-conductors
2.F.1.	2.2.3.9	8924506	Solvent and other product use: refrigeration and air conditioning equipment, stationary
2,F,1,a	2,2.3.9	8924504	Solvent and other product use: Commercial refrigeration
2,F,1,c	2,2.3.9	8924505	Solvent and other product use: Industrial refrigeration
2,F,1,d	2,2.3.9	8924507	Solvent and other product use: Transport refrigeration
2,F,1,e	2,2.3.10	0120000	Solvent and other product use: air conditioning equipment, mobile
2,F,1,f	2,2.3.9	8924508	Solvent and other product use: Stationary air-conditioning
2.F.6	2.2.3.11	8924502	Solvent and other product use: other (HFCs)
2.G.1	2.2.3.12	8924502	SF_6 emissions from the high-voltage power industry
2.G.2.	2.2.3.13	8924502	Solvent and other product use: other (SF_6)
2.H.2	2.2.3.1	8910600	NACE 10.9: Manufacture of prepared animal feeds
1	2.2.3.14	N000400	Indirect CO_2 from NMVOC: energy
1	2.2.3.14	N000401	Indirect CO_2 from NMVOC: traffic & transport
1	2.2.3.14	N000402	Indirect CO_2 from NMVOC: refineries
2	2.2.3.14	N000403	Indirect CO_2 from NMVOC: consumers
2	2.2.3.14	N000404	Indirect CO_2 from NMVOC: Commercial and governmental institutions
2	2.2.3.14	N000405	Indirect CO_2 from NMVOC: industry
2	2.2.3.14	N000406	Indirect CO_2 from NMVOC: construction and building industies
3	2.2.3.14	N000407	Indirect CO_2 from NMVOC: agriculture
5	2.2.3.14	N000408	Indirect CO_2 from NMVOC: waste

In the Netherlands, many industrial processes take place in only one or two companies. Because of the sensitivity of data from these companies, only the total emissions are reported (according to the Aarhus

Convention). Emissions at installation level and production data are, unless a company has no objection to publication, confidential information. All the confidential information is available for the inventory compilation. The taskforce ENINA has direct access to this confidential data. ENINA can provide the confidential information to official review teams upon request (after signing a confidentiality agreement).

2.2.2 Calculation method of preliminary emission figures

The calculation method of preliminary emission figures is identical to the calculation method of final emission figures. Only the input data for the calculations are different. As far as final (activity) data is not available, preliminary data is used. Sometimes final data is available already when preliminary figures should be presented. In these cases, the final emission figures are calculated and presented already.

2.2.3 Calculation method of final emission figures

2.2.3.1 Fossil process emissions (part of CRT 1B and CRT 2)

This paragraph describes the methodology for determining the fossil process emissions of CO_2 and CH_4.The CO_2 and CH_4 process emissions described in this paragraph are subdivided into two main groups:

A. Emissions resulting from conversion losses when converting one fuel to another:
   1. Solid fuel transformation – (CRT code 1.B.1.b)
   2. Production of charcoal – (CRT 1.B.1.b)
   3. Petroleum refining – (CRT codes 1.A.1.b and 1.B.2.a.4)

B. Emissions directly relating to non-energetic fuel consumption:
   1. Ammonia production – (CRT code 2.B.1)
   2. Soda ash production – (CRT code 2.B.7)
   3. Chemical industry: Petrochemical and carbon black production – (CRT code 2.B.8.g)
   4. Manufacture of basic chemicals (CRT code 2.B.10)
   5. Food and beverages industry - (CRT code 2.H.2)
   6. Lubricants use – (CRT code 2.D.1)

The CO_2 emissions resulting from the use of fossil fuels as feedstocks for the production of silicon carbide, carbon black, ethylene and methanol are included in the Energy sector (CRT 1.A.2.c).

In line with the IPCC 2006 Guidelines (vol. 3, chapter 1, box 1.1), the emissions from the combustion of waste gases within the same sector where the waste gases are produced (i.e. chemical sector) are allocated in the IPPU sector (CRT 2B1 and 2B10). The method for calculating these emissions is described in section 2.1.

A1. **Solid fuel transformation (cokes) - (CRT code 1.B.1.b).**
Fugitive emissions of CO_2 and CH_4 from this category refer to coke manufacture. The Netherlands currently has only one coke production facility at the iron and steel plant of Tata Steel. CH_4 emissions are determined by multiplying the activity data (transformation figures) by the standard IPCC emission factor of 0.1 kg CH_4 per ton of coke. CO_2 emissions related to transformation losses from coke ovens are only a small part of the total emissions from the iron and steel industry in the Netherlands. The CO_2-emission factor for fugitives is determined on the

basis of the conservative assumption that about 1% of the coke oven input is lost in the form of fugitive emissions.

A2. **Production of charcoal - (CRT 1.B.1.b)**
With respect to fugitive CH_4 emissions from 'charcoal production', the Netherlands had one large production location that served most of the Netherlands and also occupied a large share of the market for neighbouring countries. The production at this location stopped in 2010. Charcoal production figures are taken from IEA Renewable Information 2011 to calculate the activity data.

In 1998 the operator changed from traditional production to Twin retort system (Charcoal production with reduced emissions).
Charcoal production figures are taken from IEA Renewable Information 2011.
The following emission factors have been used:

- 1990-1997: 0.03 kg CH_4/kg charcoal. The IPCC 1996 Guidelines (IPCC 1996, Reference Manual, Energy, pg 1.46, Table 1-14) provide an emission factor of 1000 kg CH_4/TJ charcoal. Combined with a heating value of 30 MJ/kg charcoals these results in an emission factor of 0.03 kg CH_4/kg charcoal.

1998-2010: 0.0000111 kg CH_4/kg charcoal (Reumermann e.a., 2002).

A3. **Petroleum refining – (CRT codes 1.A.1.b and 1.B.2.a.4).**
Until the 2007 submission all the CO_2 emissions from refineries were included in CRT code 1.A.1.b. From the 2007 submission onwards, the process emissions of CO_2 from a hydrogen plant of a refinery (about 0.9 Tg CO_2 per year) are reported in 1.B.2.a.4. Refinery data specifying these fugitive CO_2 emissions are available from 2002 onwards (environmental reports from the plant) and re-allocated from 1.A.1.b to 1.B.2.a.4 from 2002 onwards. CO_2 Emissions are determined by multiplying the activity data (transformation figures) by the emission factors. The CH_4 process emissions are taken from the individual company figures in the AERs.

B1. **Ammonia production – (CRT code 2.B.1).**
Natural gas is used as a feedstock for ammonia production. CO_2 is a by-product of the chemical separation of hydrogen from natural gas. During the process of ammonia (NH_3) production, hydrogen and nitrogen are combined and react together. A method equivalent to IPCC Tier 3 is used to calculate CO_2 emissions from ammonia production in the Netherlands. The calculation is based on the consumption of natural gas and a country-specific EF. Data on the use of natural gas is obtained from Statistics Netherlands. Because there are only two ammonia producers in the Netherlands, the consumption of natural gas is confidential information. A part of the CO_2 is emitted, and a part is stored in the urea produced. According to the IPCC-Guidelines, this CO_2 stored in the product should be subtracted from the production emissions. This is implemented in the Dutch inventory since the 2021 submission.

Stored and emitted CO_2 during ammonia production are calculated as follows:

- In urea: production figures of the two production plants are obtained by confidential information of those producers. Stored

CO_2 is calculated by using the Guidebook factor: 44.0095 kg CO_2 for 60,05526 kg urea.
- Melamine produced from urea: production figures of the only melamine production plant in the Netherlands are obtained (confidential information). Urea used for the melamine production is calculated using the factor 360/126, and the stored CO_2 using the factor shown above. This amount is assumed to be emitted for 50% and stored in the melamine for 50%.
- Urea used for fertilizer in agriculture: from fertilizer sales expressed in nitrogen, the amount of urea is calculated by atom weights: 60/28. CO_2 emitted by fertilizer application is calculated using the default emission factor of 0.2 kg C per kg of urea and atom weights 44/12.
- Urea used for Selective Catalytic Reduction in personal cars: CO_2 emission is calculated by figures taken from national traffic schemes.

CO_2 emissions are allocated as follows:
- *2B1:* CO_2 stored as calculated above are subtracted from the production emissions, the rest is emitted
- *2B8g:* CO_2 emissions from melamine production are allocated to 2B8g
- CO_2 emitted by fertilizer application is allocated to Agriculture (3H)
- CO_2 emission from car SCR is allocated to Traffic (2D3).

As the Netherlands is a net exporter of fertilisers, the by far largest amount of the stored CO_2 is exported, and emitted abroad by application. CO_2 emissions from Ammonia production (2B1) in the Netherlands are covered by the scope of EU ETS. For ETS reporting, the CO_2-storage should not be subtracted.

B2. **Soda ash production – (CRT code 2.B.7).**
CO_2 emissions are related to the non-energy use of coke. Before the closure in 2010 of the only soda ash producer, CO_2 emissions were calculated on the basis of the non-energy use of coke and the IPCC default EF (0.415 t/t), assuming 100% oxidation of carbon. The environmental report was used for data on the non-energy use of coke. To avoid double counting, the plant-specific data on the non-energy use of coke is subtracted from the non-energy use of coke and earmarked as feedstock in the national energy statistics.

B3. **Chemical industry: Petrochemical and carbon black production - (2B8).**
Ethylene oxide production - (2B8d): CO_2 emissions are estimated on the basis of capacity data by using a default capacity utilization rate of 86% (based on Neelis et al., 2005) and applying a default EF of 1.79 kg CO_2 /t ethylene oxide. As there is no real activity data available at this moment in the Prodcom database from EUROSTAT, the Netherlands cannot verify this assumption on the activity data for ethylene oxide production.

Titanium dioxide production – (CRT code 2B6): CO_2 emissions arise from oxidation of coke as reductant. Activity data is confidential. Only emissions are reported by the company's AER.

Silicon carbide production - (2B5a): Petrol cokes are used during the production of silicon carbide; the volatile compounds in the petrol cokes form CH_4. The activity data (petcoke) is confidential, only emissions are reported by the company's AER.

Methanol - (2B8a), Ethylene - (2B8b), Acrylonitrile - (2B8e) and Carbon black - (2B8f) production CH_4: The CH_4 process emissions from these sources are calculated by multiplying the specific EF by the annual production.

Acrylonitrile - (2B8e): Since the 2019 submission this N_2O source is included. The N_2O emission data from 2017 on is based on measurements. For the period 1990-1994 and the period 2010-2016 the emissions are calculated by the use of the 2017 emission and the production levels in both periods. Emissions for the period 1995–2009 have been determined by interpolation between 1994 and 2010. Because it is not possible to include N_2O emissions from this source in 2.B.8.g in the CRT table, the N_2O emissions from this source are included in 2.B.10 in the CRT table.

Melamine - (2B8g): See above under 2B1.

B4. **Manufacture of basic chemicals - (2B10).**
Because no IPCC methodologies exist for the aggregated CO_2 emissions included in this source category , country-specific methods and EFs are used. These refer to:

- *The production of industrial gases:* With natural gas as input (chemical feedstock), industrial gases, e.g. H_2 and CO, are produced. During the gas production process, CO_2 is emitted. Process emission data is taken directly from the ETS-reports.
- *Production of carbon electrodes (Anode production):* CO_2 emissions are estimated on the basis of fuel use (mainly petcoke and coke). A small oxidation fraction (5%) is assumed, based on data reported in the AERs.

In line with the IPCC 2006 Guidelines (vol. 3, chapter 1, box 1.1), the emissions from the combustion of waste gases within the same sector where the waste gases are produced (i.e. chemical sector) are allocated in the IPPU sector (CRT 2B1 and 2B10). The method for calculating these emissions is described in section 2.1.

B5. **Lubricants use – (CRT code 2.D.1).**
The CO_2 emissions reported in category 2D1 stem from direct use of specific fuels for non-energy purposes, which results in partial or full oxidation during use (ODU) of the carbon contained in the products.
A Tier 1 method is used to estimate emissions from lubricants using an IPCC default EF and an ODU factor of 20%. The activity data is based on fuel use data from Statistics Netherlands.

B6. **Food and beverages industry - (CRT code 2.H.2).**
This category comprises CO_2 emissions related to Food and drink production (2H2). In the Netherlands this concerns the calcination process in the sugar industry, as described in section 2.2.3.2 under lime production (2A2). CO_2 process emissions in this source category do not only occur from lime production, but are also related to the non-energy use of fuels:

coke and anthracite. Carbon is oxidized during these processes, resulting in CO_2 emissions. The methodology used to estimate the GHG emissions complies with the IPCC 2006 Guidelines, volume 3. CO_2 emissions are calculated on the basis of the non-energy use of fuels by the food and drink industry as recorded by Statistics Netherlands in national energy statistics on coke consumption, multiplied by an EF. The EF is based on the national default carbon content of the fuels, on the assumption that the carbon is fully oxidized to CO_2.

Emission factors
CO_2 emission factors are taken from the standard national fuels list (Zijlema, 2025). The emission factors from oil refining are not known, but an implied emission factor can be calculated per ton of oil input.

In Table 11 the sector-specific storage factors are shown whereby a limited use of the AER was made (Huurman, 2005). In other situations concerning non-energetic use, all fuels are assumed to be stored entirely (storage factor = 1), with the exception of lubricating oils and fats, where the storage factor is set to 0.8.

Table 11 Sector-specific storage factors for situations where emissions are determined directly from non-energetic use

NACE code	Sector description	Fuel	Storage factor
23	Cement and concrete	Petroleum coke	0
26	Other electrical equipment	Petroleum coke	0.95
20.1	Residual base chemicals	Natural gas	0.8
20.1	Residual base chemicals	Petroleum coke	0.3
10-12	Other foodstuffs	Coke	0
20.1	Inroganic base chemicals (excl gas, pigments)	Coke	0
20.15	Fertiliser industry	Natural gas	0
23	Cement and concrete	Lubricant	0
24.1/24.3	Base metal: iron and steel	Coke	0
24.1/24.3	Base metal: iron and steel	Lubricant	0
24.4/24.5	Base metal: non-ferrous	Petroleum coke	0.95
10-12	Meat	Coke	0
23	Glass	Petroleum coke	0
23	Glass	Lubricant	0
23	Glass	Diesel	0

The following CH_4 emission factors from the 2006 IPCC Guidelines (IPCC, 2006: Volume 3; Chapter 4, page 4.26 / Chapter 3, paragraphs 3.6 and 3.9) are used:

- coke production: 0.1 kg CH_4 per ton coke;
- silicon carbide: 11.6 kg CH_4 per ton silicon carbide;
- carbon black: emission factor 28.8 kg CH_4 per ton product;
- ethene: CO_2 emissions are estimated on the basis of capacity data by using a default capacity utilization rate of 86% (based on

Neelis et al., 2005) and applying a default EF of 3 kg CH_4 per ton product;
- methanol: emission factor 2.3 kg CH_4 per ton product.

Activity data
Activity data on the usage of fuels are obtained from the Dutch energy balance sheet (CBS).

2.2.3.2 Non-fossil process emissions (part of CRT 2)
In addition to CO_2 emissions from the combustion or non-energetic use of fossil fuels, relatively small amounts of CO_2 emissions are also caused by the acidification of limestone and dolomite (i.e. $CaCO_3$ and $CaCO_3.MgCO_3$) respectively, plus other minerals that contain carbonate, from carbon in iron ore and the use of soda ash. In the Netherlands this concerns the following sources, listed according to the IPCC guidelines:
- Manufacture of articles of concrete, plaster and cement (CRT 2.A.1);
- Sugar production, lime production (CRT 2.A.2);
- Manufacture of glass and glassware (CRT 2.A.3);
- Manufacture of ceramic products for the building industries (CRT 2.A.4.a);
- Manufacture of inorganic basic chemicals, soda consumption (CRT 2.A.4.b);
- Production of electricity, flue gas desulphurization (CRT 2.A.4.d);
- Base metal industry, processing and manufacture of iron and steel, consumption of limestone and dolomite (CRT 2.A.4.d);
- Limestone application in NACE 45: road construction (CRT 2.A.4.d).

The following other direct CO_2 process emissions are also included:
- Manufacture of inorganic basic chemicals, production of active carbon (CRT 2.B.10);
- Manufacture of inorganic basic chemicals, production of acrylonitrile (CRT 2.B.8.e);
- Base metal industry, processing and manufacture of iron and steel, (2.C.1.a); Base metal industry, processing and manufacture of iron and steel, anode use with production of electro-steel (2.C.1.f);
- Manufacture and casting of light and other non-ferrous metals, anode use (CRT 2.C.3).

Calculation method and emission factors

Manufacture of products of concrete, plaster and cement (CRT 2.A.1)

The CO_2 process emissions during cement production occur when limestone is used to produce cement clinker. Until 2020cCement was only produced by one company in the Netherlands (ENCI). After closing in 2020, no cement production occurs anymore.

Lime production (2.A.2)

CO_2 emissions occur in two plants of the sugar industry, where limestone is used to produce lime. The lime in the sugar process is used for the sugar juice purification. Lime production does not occur in the paper industry in the Netherlands. The limestone use depends on the beet sugar production. Approximately 375 kg of limestone is required for each ton of beet sugar produced (SPIN, 1992). The activity data is obtained from the sugar company's annual reports. The emissions are calculated using the standard IPCC default EF of 440 kg CO_2 per ton of limestone.

Manufacture of glass and glassware (CRT 2.A.3)

The use of limestone, dolomite, soda ash and other substances during glass production results in CO_2 emissions. The emissions are based on the emissions from the verified EU ETS Emission Reports of the glass production companies.

Manufacture of ceramic products for the building industries (CRT 2.A.4.a)

Ceramics include the production of bricks, roof tiles, floor tiles, wall tiles, refractory products and other ceramic products.
Process-related CO_2 emissions from ceramics result from the calcination of carbonates in the clay.
The calculation of CO_2 emissions by the manufacture of ceramic products in the Netherlands complies with the Tier 1 method as described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 2, pg. 2.34).

*CO_2 Emissions = Mc * (0.85EFls + 0.15EFd)*

Where:

- Mc = mass of carbonate consumed (tonnes)
- 0.85 = the default fraction Limestone
- 0.15 = the default fraction Dolomite
- EF ls = emission factor limestone (0.440 ton CO_2/ton Limestone)
- EF d = emission factor dolomite (0.477 ton CO_2/ton Dolomite)

The mass of carbonate consumed (Mc) is determined as follows:

*Mc = Mclay * cc*

Where:
Mclay = the amount of clay consumed; this is calculated by multiplying the national production data for bricks and roof tiles, vitrified clay pipes, and refractory products with a default loss factor of 1.1.
cc = the default carbonate content of clay (0.1)

Use of soda ash (CRT 2.A.4.b)
The use of soda ash can be calculated from the net domestic consumption: production + import – export. The only available source for estimating the production is Struker (NEEDIS report 1994), which mentions a production capacity of 400 ktonnes. For the years 2001 and 2002, the net domestic consumption is estimated by taking this production figure of 400 ktonnes as a basis and then adding the import figures and deducting the export figures for the relevant year. For all other years, the consumption is estimated by extrapolating the figures for 2001 and 2002. For this extrapolation the trend in chemical production is used, since this is an important user of soda ash. The emissions are calculated using the standard IPCC factor of 415 kg CO_2 per ton of soda ash (Na_2CO_3), (2006 IPCC guidelines, Volume 3, Chapter 2, Table 2.1):

Emission CO_2 = soda ash use (Gg) * EF CO_2 (kg/Gg)

In order to prevent double input as soda ash is also used in glass production,the CO_2 emissions from soda ash usage for glass production should be subtracted from the above. However, this procedure has not been implemented in the figures delivered so far, due to lack of data and considerable margin of uncertainty of this small amount of CO_2 emissions.

Production of electricity, flue gas desulphurization (CRT 2.A.4.d)
CO_2 emissions are obtained from the ETS reports of the coal-fired power plants.

Base metal industry, processing and manufacture of iron and steel, consumption of limestone and dolomite (CRT 2.A.4.d);
CO_2 emissions from the use of limestone and dolomite are included in 2.A.4.d. CO_2 emission data is obtained from the company.

Limestone application in NACE 45: road construction (CRT 2.A.4.d);
Dolomite is used to produce agricultural lime and acts as filler for asphalt in the road-construction sector (DWW, the agency for road and hydraulic engineering, 2005).
Until the 2005 submission the CO_2 emissions were calculated as follows:

*CO2 emissions dolomite use = (Total net dolomite use – Dolomite use in agriculture) * EF dolomite*

Where:
EF dolomite = 477 kg CO_2/ton pure dolomite and the dolomite use was obtained from the National Statistics (CBS).

Because the National Statistics (CBS) does not register the dolomite use since 2003 and there are no other sources registering dolomite use, the CO_2 emissions has not been updated since 2003.

Manufacture of inorganic basic chemicals, production of Acrylonitrile (CRT 2.B.8.g);
Acrylonitrile is only produced by one company in the Netherlands. The CO_2 emissions are calculated by multiplying the specific EF by the annual production.
Because of the confidentiality of data only the sum of the CO_2 emissions from acrylonitrile, ethylene oxide and titanium dioxide production are reported in category 2.B.8.g.

Manufacture of inorganic basic chemicals, production of active carbon (CRT 2.B.10);
Norit is one of world's largest manufacturers of activated carbon, for which peat is used as a carbon source, and CO_2 is a by-product. Until the 2013 submission CO_2 emissions were estimated based on the production data for Norit and by applying an EF of 1 t/t Norit. The used EF was derived from the carbon losses from peat use reported in the AERs. As peat consumption is not included in national energy statistics, the production data since 1990 has been estimated on the basis of an extrapolation of the production level of 33 Tg reported in 2002.

From 2013 onwards, CO_2 emissions from activated carbon production in the Netherlands were included in the European Emission Trading Scheme (EU-ETS).

Base metal industry, processing and manufacture of iron and steel (2.C.1.a);
CO_2 produced during the conversion of pig iron to steel is reported in this category. The data necessary to calculate the net CO_2 emissions for converting iron ore into steel are taken from the manufacturers' carbon balance.

Base metal industry, processing and manufacture of iron and steel, anode use with production of electro-steel (2.C.1.f);
During the steel production in electric arc furnaces, CO_2 is produced by oxidation of carbon anodes. The CO_2 emission can be calculated as follows:

*CO_2 (Year t) (in Gg) = Steel Production (year t) (in Mg = ton) * EF anode use*

Where:
EF = 3.5 kg CO_2/ton steel produced (IPCC 2006, Volume 3, ` Chapter 4, sector 4.2.2.5, page 4.29)
Steel production data is taken from the manufacturer.

Manufacture and casting of light and other non-ferrous metals, anode use (CRT 2.C.3);
- CO_2 is produced by oxidation of the carbon anodes. The emission data is taken from the company's AER. The comapy is closed already, but still a small amount of CO_2 is reported for 2022 and 2023, apparently due to some closing down processes.

2.2.3.3 N_2O emissions from nitric acid production (CRT 2.B.2)

This paragraph describes the emissions of nitrous oxide (N_2O) that are released during the industrial production of nitric acid in the Netherlands (IPCC category 2.B.2). This concerns two production locations.
In the Netherlands, nitric acid is used in the production of fertilisers (e.g. lime ammonia nitric acid). Nitric acid production starts by converting (combusting) ammonia (NH_3) with air into nitrogen monoxide (NO), under the influence of a platinum alloy catalyst. This continues with further oxidation into nitrogen dioxide (NO_2) and absorption in water, thus producing nitric acid (HNO_3). N_2O is created as an unwanted by-product during the catalytic oxidation of ammonia with oxygen. In 2007,technical measures were implemented at all nitric acid plants in the Netherlands. These measures has resulted in an emission reduction of 90% in the current situation.

Emission data is taken from the AERs of the two companies.

2.2.3.4 N_2O emissions from caprolactam production (CRT 2.B.4.a)

This paragraph describes the emissions of nitrous oxide (N_2O) released during the industrial production of caprolactam in the Netherlands (IPCC category 2.B.4.a). Caprolactam is produced in the Netherlands as part of the production cycle for nylon materials, and is manufactured (since 1952) by only one company. Emission data is taken from the AERs of this company.

2.2.3.5 HFC 23 emissions during HCFC 22 production (CRT 2.B.9.a.1)

This paragraph describes the methodology and working processes for calculation of HFC 23 (trifluoromethane, CHF3) emissions that are released during the industrial production of HCFC 22 (chlorodifluoromethane, $CHClF_2$). These emissions are reported under IPCC category 2E1. HFC 23 is a by-product of HCFC 22 production and amount to 4% of the production of HCFC 22 if no reduction measures are taken. HCFC 22 is primarily used as an intermediate product during the manufacture of synthetic polymers and, in some cases, a blend may be used as cooling agent or cleaner. The Netherlands has only one manufacturer of HCFC 22, which produces as a raw material for the manufacture of fluoropolymers (Teflon) and also sells HCFC 22 as a cooling agent. The latter was phased out in 2010 and from that date HCFC 22 was only produced for the company’s internal manufacturing processes.

Since 1998 the HFC 23 emissions have been reduced by using a Thermal Converter (TC), which consists of a combustion chamber, a quench chamber and a rinsing tower. The TC is not used throughout the entire year due to necessary maintenance to the combustion chamber. During maintenance work the untreated HFC 23 emissions are released freely into the atmosphere. Since 2001 these maintenance tasks to the combustion chamber have been reduced through technical improvements, thus increasing the removal percentage of the untreated HFC23 emission. In 2003 a spare combustion chamber was also installed, thus better guaranteeing that the increased removal percentage can be maintained.

Calculation method
The following formula is used to calculate HFC 23 emissions by the HCFC22 industry in the Netherlands:

HFC 23 emissions = HFC 23 load in untreated flow - amount of untreated HFC23 destroyed in the TC.

The HFC-23 load in the untreated flow is determined by a continuous flow meter in combination with an in-line analysis of the composition of the stream. The amount of HFC23, destroyed in the TC is registered by the producer. The method complies with the tier 3a method as described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 10, 3.10.1).

Data
Supplying data via the AER
The calculated annual emissions for HFC 23 are reported via the AER.

Confidential information
The following information is confidential:
- HFC 23 load in the untreated flow (kg HFC 23/year).
- Amount of untreated HFC 23, destroyed in the TC (kg HFC 23/year).

2.2.3.6 Other, mainly HFC emissions from handling (CRT 2.B.9.b.3)
This paragraph describes the methodology and working processes for determining HFC (hydrofluorocarbon) emissions that are released when repackaging HFCs from large to small packaging units (IPCC code: 2.B.9.b.3). There is one company in the Netherlands that repackage HFCs from large units (e.g. containers) into smaller units (e.g. cylinders). Small amounts of HFCs can be released during this process. For example, after filling these smaller units a small residue is left behind in the coupling, which is then released when uncoupling the unit.

Calculation methods
The methods used to define emissions are country-specific.
The company uses a calculation method, depending on the type of repackaging activities undertaken:
- Level measurements are taken when repackaging from a bulk tank to smaller containers.
- Emissions are determined via a mass balance when repackaging from containers to smaller cylinders. The containers and cylinders are weighed before and after filling, with the difference being equal to the emission.

The methodology for determining these emissions is not described in 2006 IPCC Guidelines.

The companies report the emissions via the AERs every year.

Confidential information
Production data are confidential.

2.2.3.7 PFC emissions from primary aluminium production (CRT 2.C.3)

PFC (perfluorocarbon) emissions (CF4 and C2F6) are released during the primary industrial production of aluminium (IPCC code 2.C.3). Since no aluminium production takes place anymore in the Netherlands, these emissions are reported NO.

2.2.3.8 SF_6, NF_3 and other PFC emissions from the semiconductor industry (CRT 2.E.1)

This section describes the method and working processes used to calculate the emissions figures for SF_6 (sulfur hexafluoride), NF_3 and other PFCs (perfluorocompounds) as a result of the use of these gases in the semiconductor industry.
F-gases (SF_6, NF_3 and other PFCs) are used in the semiconductor industry to clean process rooms and to etch the semiconductors. F-gases are emitted during these processes. The Netherlands has only one semiconductor manufacturing location.

Emissions of individual PFCs resulting from application in the manufacture of semiconductors are aggregated into a single figure (PFCs Other) and reported under the CRT category 2.E.1 'Integrated circuit or semiconductor' due to the confidentiality of the individual PFC figures.

SF_6 emissions resulting from application in the manufacture of semiconductors, plus the high-voltage electricity sector, double glazing and electromicroscopes are aggregated into a single figure and reported under CRT category 2.G.2 'Other' due to the confidentiality of the figures.

Calculation method
Annual emissions resulting from the use of PFCs consist of emissions of the PFCs itself plus emissions of CF_4, C_2F_6 and C_3F_8 created as by-products during use of PFCs. The emissions are calculated using the following formulas:

Emissions for each PFC used:
$Emission\ PFC_i\ in\ kg = PFC_i * (1-h) * (1-C_i) * (1-A_i)$

Where:
- h = fraction of gas $_i$ remaining in container (heel)
- PFC_I = purchases of gas $_i$ in kg
- C_i = average utilization factor of gas $_i$ (average for all etch and CVD processes)
  = 1-EF_i
- EF_i = average emission factor of gas $_i$ (average for all etch and CVD processes)
- A_i = fraction of PFC $_i$ destroyed by abatement = $a_{i,j}$ * Va
- $a_{i,j}$ = average destruction efficiency of abatement tool $_j$ for gas $_i$
- Va = fraction of gas $_i$ that is fed into the abatement tools

Emissions created as by-products (BPE):

$BPE\ CF_4 = PFC_i * (1-h) * B_i * (1- ACF_4)$

Where:
B_i = mass of CF_4 created per unit mass of PFC $_i$ transformed
ACF_4 = fraction of PFC $_i$ converted to CF_4 and destroyed by abatement
= a CF_4* Va
a CF_4 = average destruction efficiency of abatement tool $_j$ for CF_4
Va = fraction of gas i that is fed into the abatement tools

*BPE C_2F_6 = PFC $_i$ *(1-h) * B $_i$ *(1- AC_2F_6)*

Where:
B_i = mass of C_2F_6 created per unit mass of PFC $_i$ transformed
AC_2F_6 = fraction of PFC $_i$ converted to C_2F_6 and destroyed by abatement
= a C_2F_6 * Va
a C_2F_6 = average destruction efficiency of abatement tool $_j$ for C_2F_6

*BPE C_3F_8 = PFC $_i$ *(1-h) * B $_i$ *(1- A C_3F_8)*

Where:
B_i = mass of C_3F_8 created per unit mass of PFC $_i$ transformed
AC_3F_8 = fraction of PFC $_i$ converted to C_3F_8 and destroyed by abatement
= a C_3F_8 * Va
a C_3F_8 = average destruction efficiency of abatement tool $_j$ for C_3F_8

Emission data is reported confidential by the company.

2.2.3.9 HFC emission from stationary cooling (CRT 2.F.1)

This paragraph describes the methodology and working processes for determining the HFC (hydrofluorocarbon) emissions that are released during the assembly, usage and disposal phases of stationary cooling equipment in the Netherlands.

The stationary cooling situation in the Netherlands includes cargo-bays in refrigerated lorries as well as the air conditioning systems in buses, coaches and trains (as per IPCC) due to the size of the equipment and the techniques applied (IPCC category 2.F.1).

The monitoring of emissions from comfort cooling in smaller vehicles (air conditioning systems up to 3 kg in cars, small vans and lorry cabs, tractors and various equipment) is described in the following paragraph.

In the past stationary cooling plants in the Netherlands used fluor-based gases such as CFC (chlorofluorocarbon) and HCFC (hydrochlorofluorocarbon). Since 1995 HFC (hydrofluorocarbon), plus the 'alternatives' such as propane, butane and ammonia (NH_3) are used.

Calculation methods
For the annual determination of the HFC emissions from stationary cooling installations in the Netherlands, formerly the stock model-method has been used for the period 1990-2012. This method was based on HFC sales figures, but since 2013 these are no more available. Therefore a new calculation method was developed, based on the use of the 'Refrigerants registration system' from 2013 onwards.
This system is the result of a European obligation, whereby building owners are required to register: Regulation (EU) No 517/2014 of the

European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006.

Both calculation methods are described in the paragraphs below.

2.2.3.9.1 Old calculation method: Stock model
This starts with the determination per source, followed by the determination of the total emissions.

Refrigerant management of containers
E tr(t) = V tr(t) * v/100

Where:
E tr(t) = emissions during the refrigerant transfers from bulk containers down to small disposable cans/small containers and also from the remaining quantities in year (t);
V tr(t) = the volume of refrigerant transferred in year(t);
v = percentage lost during the transfers of the refrigerants, expressed as a % of V tr(t)

Filling of (new) installations
E nw(t) = V nwv * v/100

Where:
E nw(t) = emissions during the filling of the (new) installations in year (t);
V nwv(t) = the volume of refrigerant used in (new) installations in year(t);
v = percentage lost during the filling, expressed as a % of V nwv(t)

Emissions from working systems
E sys(t) = (V sys(t-1) + (Vnw(t) * 0.5) - (Vafg(t) * 0.5)) * lk/100

Where:
E sys(t) = emissions from working systems in year(t);
V sys(t-1) = original volume at 31 Dec (t-1) of working systems;
V nw(t) = volume of refrigerant refilled in (new) installations in year(t);
V afg(t) = original volume of dismantled installations in year(t);
Lk = leakage percentage during operation;
0.5 = because both the filling of new and dismantling of old installations takes place throughout the year, it is assumed that each new and dismantled installation are operational for an average of six months in year (t).

Losses from dismantling installations
E afg (t) = V afg(t) * v/100
Where:
E afg(t) = (emission) losses that occur during dismantling of installations;
V afg(t) = original volume of dismantled installations in year(t);
v = percentage lost during dismantling of old installations.

Finally, the total emission of HFCs by stationary cooling installations is determined each year using the following formula:

Annual Emission = E tr(t) + E nw(t) + E sys(t) + E afg(t)

The method used is conform the tier-2a method described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 7, p. 7.49-7.51.

Emission factors

The losses during the filling of new-retrofit installations is set at 0.5% (= between IPCC range 0.1 – 3%). This percentage is also used for the losses during transferring from bulk to smaller storage.

In 2016 a review conducted by the European Commission resulted in a recalculation of the HFC emissions from Stationary refrigeration (2F1) for the period 1994-2014. In this recalculation a leakage percentage of 5.8% has been used instead of 5%.

Also in the 2017 and 2018 submission the leakage percentage of the HFC part of the stock, 5.8%, from "Annual leak rates from surveys (Baedts et al., 2001)" has been used.

The percentage lost during dismantling of old installations is set at 5% of the original filling.

Activity data

Annual sales

The relevant activity data is taken from the sales figures of individual HFCs to the total cooling sector in the Netherlands, which are available annually via the Handelsstromenonderzoek (trade flow study) by PWC (multiple years) until 2014.

Refilling existing installations / Filling new installations

During the period 1990-2012 the trade flow study has been used to gather information on the annual sales figures (Verk(t)), but this was not sufficiently reliable to be split into the annual filling of new installations (V nw(t)) and the refilling (Bijv(t)) of existing installations.

The decision has therefore been made to set up a stock model to show the refilling (Bijv) of existing installations. This stock model uses the following starting points:
The starting year is the year in which a certain HFC is used for the first time.
During this starting year there is no refilling (Bijv=0) of existing installations, only filling of new installations. Therefore, the filling of new installations during this first year is equal to the annual sales, minus any losses during the filling process.

During the following years, refilling is defined as:
*Bijv(t) = Emission(t-1) at 31 Dec (t-1) for working systems * - (V afg(t+1) * Lk)*

Where:
Vafg(t+1) = the original volume of the installations to be dismantled in year(t+1); these will no longer be refilled

Lk = leakage percentage during the operation.
The filling of new installations (V nw(t)) can therefore be determined using the annual sales (Verk(t)) and the refilling (Bijv(t)) figures as:

V nw(t)) = Verk(t) – Bijv(t) – filling losses

Dismantled installations
The coolants that installers remove from dismantled installations[1] are offered to approved collectors. These companies are authorized to destroy or regenerate the coolants, so that they can be reused. There is very little information concerning dismantled installations, destroyed coolants and regeneration of HFCs. This is why the emission calculations during this phase are based on an average lifespan for the installations of 15 years, and 5% during the dismantling of the installation. This means that, in year (t), the installations are dismantled that in year (t-15) were noted as new installations. The original volume of these amounts to (V afg).

2.2.3.9.2 New method: Registration system
The new method uses figures from the 'Refrigerants registration system' to calculate emissions. In this system, detailed information about leakages, filling of installations (new and as a result of leakage during operation) and dismantling can be found and is therefore more accurate than the old stock model method. The system works as follows:

- data at plant level are registered continuously by mechanics of the installation companies;
- the approval of the figures happens once every two years by the inspection authorities;
- after approval, the figures are aggregated and delivered to the Dutch Integral Pollutant Release and Transfer Register (PRTR);
- hereafter, the Dutch PRTR can start with the emission calculations.

The following data are obtained from the "Refrigerants registration system":

- the volume of refrigerant used in new installations;
- the volume of refrigerant to fill operating installations (as a result of leakage);
- the volume of refrigerant won back from retrofit or maintenance;
- the volume of dismantled installations.

All equipment with a content >= 5000 kg CO_2-eq is covered by the 'Refrigerants registration system'. The emissions calculated with this new method are lower than those calculated with the old stock-model method probably due to the assumption in the stock model method that the usage figures were the same as the sales figures and that a fixed leakage percentage of 5.8% was used. According to the new method the average leakage rate for example during the period 2013-2015 was approximately 4%.

[1] Since 1 January 1993 only STEK-authorised companies are allowed to handle CFCs, HCFCs and HFCs in cooling equipment, including the extraction of these substances from dismantled installations. Extracted HFCs are considered commercial waste, and are transported to authorised collectors.

Composition of refrigerants
There are lots of different refrigerants used for stationary cooling, each of them being a blend of one or more HFCs. For example: refrigerant R134a consists of only HFC134, but R404a consists of three different HFCs. The fractions of HFCs in each refrigerant are listed below (source: EPA). Some refrigerants contain also HCFKs, therefore fractions do not always sum up to 100%.

Refrigerant	%HFC125	%HFC134a	%HFC143a	%HFC23	%HFC32
R134a		100			
R23				100	
R404a	44	4	52		
R407a	40	40			20
R407c	24	52			24
R407f	30	40			30
R410a	50				50
R413a	88				
R417a	47	50			
R422a	85	12			
R422d	65	32			
R437a	20	79			
R438a	45	44			9
R448a	26	21			26
R449a	25	26			25
R453a	20	54			20
R507	50		50		
R508b				46	

These fractions are used to calculate the volume of each HFC, by adding the product of the volume of each refrigerant and the corresponding fraction for that HFC from the table:

$$E\ HFC(x) = \sum_{n=1}^{N} V\ refr(n) * Fr(n)$$

Where:
E HFC(x) = emissions of HFC x
V refr(n) = the volume of refrigerant n
Fr(n) = fraction of HFC(x) in refrigerant n
The table lists 18 refrigerants, so N=18.
For example: the volume of HFC143 is equal to 52% of the volume of refrigerant R404a plus 50% of the volume of R507.

Emission calculations
With the calculated volumes of HFCs that are won back, filled and leaked, the emissions can be calculated. Emissions occur during refrigerant management of containers, filling of installations, dismantling

of systems, and leakage from working systems. Calculations are done as follows:

Filling of (new) installations:
Leakages occur during filling installations: new and working (as a result of leakage).

$$E\,nw(t) = V\,nw(t) * \frac{100}{100 - v} - V\,nw(t)$$

Where:
E nw(t) = emissions during the filling of the (new) installations in year (t);
V nwv(t) = the volume of refrigerant used in (new) installations in year(t);
v = percentage lost during the filling, expressed as a % of V nwv(t).

Emissions from working systems:

E sys(t): Leakage emissions from working systems are obtained from the 'Refrigerants registration system'.
V fill(t): Mechanics of the installation companies register the volume that they have to add to working systems during maintenance.

Losses from dismantling installations:
Leakage occurs during dismantling, retrofit and maintenance of systems.

$$E\,dis(t) = V\,dis(t) * \frac{100}{100 - v} - V\,dis(t)$$

Where:
E dis(t) = (emission) losses that occur during dismantling of installations;
V dis(t) = original volume of dismantled installations in year(t);
v = percentage lost during dismantling of old installations.

Refrigerant management of containers:
Emissions occur during the refrigerant transfers from bulk containers down to small disposable cans/small containers, and also from the remaining quantities.

$$E\,tr(t) = V\,used(t) * \frac{100}{100 - v} - V\,used(t)$$

Where:

E tr(t)	=	emissions during the refrigerant transfers in year (t);
V used(t)	=	used refrigerants: V nwt(t) + V fill(t)
v	=	percentage lost during the transfers of the refrigerants

Total emission:

Finally, the total emission of HFCs by stationary cooling installations is determined each year using the following formula:

$$\text{Annual Emission} = E_{nw}(t) + E_{sys}(t) + E_{dis}(t) + E_{tr}(t)$$

These calculation steps are done for commercial-, industrial- and transport refrigeration and stationary air-conditioning. The method is conform the tier-2a method described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 7, p. 7.49-7.51).

Example: results for 2017

The table below shows the results for the emission of R134a (HFC134) from, for example, stationary cooling the commercial sector in the Netherlands for the year 2017.

Source	Emission of R134a in kg
Refrigerant management E tr(t)	440
Filling of (new) installations E nw(t)	301
Leakage from working systems	27.749
dismantling installations E afg (t)	172
Total emissions in kg	**28.662**
Total emissions in Mton CO_2-eq	*0.04*

As can be derived from the table, leakage emissions form the major part of emissions from stationary cooling. Emissions from refrigerant management, filling and dismantling are nearly negligible.

To put the total HFC emissions from stationary cooling in the Netherlands in perspective: the sum of emissions of alle HFCs from all sectors (commercial, Industry, Stationary airconditioning, Freigt transport) is 1.0 Mton CO_2-eq, which is less than 1% of total greenhouse gas emissions in the Netherlands in 2017 (193.7 Mton).

Emission factors

The loss percentage during the filling of new-retrofit installations is set at 0.5% (from IPCC 2006, between IPCC range 0.1 – 3 %). This percentage is also used for the lost during transferring from bulk to smaller storage.

The percentage lost during dismantling of old installations, and winning back during retrofit or maintenance, is set at 5% of the original filling. This percentage is based on a national study into coolant flows (NOKS) was conducted for the year 1999 (De Baedts et al., TNO, 2001). This study concluded the average leakage percentage for working systems to be 5.8% per year.

Time series consistency
For the stock-model method, the only input variables were the sales figures from HFCs to the total cooling sector. Furthermore a fixed leakage percentage has been used. The other parameters were calculated using the stock model. The new method uses figures from the 'Refrigerants registration system' to calculate emisions. In this system data about leakages, filling of (new) installations, dismantling, are not calculated but taken directly from the system. This new method provides more accurate data to calculate emission figures.

Because of the complexity of the registration system, there is a time-lag in the data . This means that in the NIR submission with emission year t, final figures are provided up to and including year t-2. The t and t-1 figures are kept equal to last year for which figures are available (t-2). In the submission with emission year t+1, the t-1 figures from that submission will be replaced by the final figures for t-1.
As a result of (EU) review comments, IPCC extrapolation methods (Trend Extrapolation or Surrogate Data) were investigated to prevent over- or underestimation in the last two years. However, the trend extrapolation method is not recommended if the trend is fluctuating. This is the case, because the mix of high- and lower-GWP refrigerants is very random throughout the years: a trend cannot be detected. Also the Surrogate Data technique is not appropriate, because no data can be found that has any correlation with the random-like use of refrigerants with different GWPs. So the overall conclusion is that an extrapolation cannot be performed and therefore the emissions from the last two years are kept at the same level.

2.2.3.9.3 Time series consistency of both methods
The two methods are completely different. The old method uses default leakage percentages, whereas the new method is based on real refrigerant use schemes. Therefore both series are on a different level, so in order to construct a consistent time series for the whole period 1990-2016 and later, the Overlap splicing technique from the IPCC Guidelines (Volume 1, chapter 5) was used. The overlap period used is 2013-2015, and this formula is used:

EQUATION 5.1
RECALCULATED EMISSION OR REMOVAL ESTIMATE COMPUTED USING THE OVERLAP METHOD

$$y_0 = x_0 \bullet \left(\frac{1}{(n-m+1)} \bullet \sum_{i=m}^{n} \frac{y_i}{x_i} \right)$$

Where:

y_0 = the recalculated emission or removal estimate computed using the overlap method

x_0 = the estimate developed using the previously used method

y_i and x_i are the estimates prepared using the new and previously used methods during the period of overlap, as denoted by years m through n

For this case, y_0, x_0, y_i and x_i are the HFC emisions, m is the first year of the overlap period (2013) and n is the last year of that overlap period (2015).

Based on the new method, real leakage percentages appear lower than the default guidebook factors. This is the reason why the old time series is higher than the new one, and with the Overlap splicing technique the emissions from 1990 tot 2012 are lowered to fit on the 2013-2019 series.

2.2.3.10 HFC emissions from automotive comfort cooling (CRT 2.F.1)

This paragraph describes the estimates of HFC (hydrofluorocarbon) emissions from automotive comfort cooling (IPCC code 2.F.1.e). For the situation in the Netherlands, this includes only air-conditioning units up to 3 kg in cars, small vans and the cabins of lorries, tractors and various other vehicles/equipment. Conform the IPCC guidelines, the cooling of cargo holds in lorries and the air conditioning in buses, trains and coaches are reported under the stationary cooling (transport cooling) sector, due to the size of the equipment and the techniques used.

Emissions from automotive comfort cooling in cars have been drastically reduced over the past few years due to better sealing and thus fewer leaks. However, the number of cars with air conditioning has also increased considerably, resulting in the rise in total emissions from 1995 onwards. In the 2019 submission it is assumed that all automotive comfort cooling systems in cars, constructed in 2017 and later, are not filled with R134a as coolant. Most of the automotive comfort cooling systems in cars, constructed in 2017 and later, are filled with the refrigerant R1234yf, which is known as a HFO, with a small GWP.

Calculation method

HFC134a emissions during the transferring (from bulk to smaller storage), initial filling, usage and demolition phases are calculated using the following formula:

Annual emissions =
(Total transfer emissions in year t) +
(Total first-fill emissions in year t) +
*(Total stock (capacity) in car airco units in year of construction t) * L(t) +*
*(Total stock (capacity) in car airco units in year of construction t-1) * L(t-1) +*
*(Total stock (capacity) in car airco units in year of construction t-2) * L(t-2) +*
…….etc
*+ ((Original capacity * F) –(destroyed + recycled R134a) from scrapped cars with air conditioning)*

Where:
L(t-..) represents the leakage percentage of the stock of the number of cars of year of construction.
F represents the percentage of the Original capacity still present.

The method used conforms to the tier-2a method described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 7, p. 7.49-7.51.). Both country-specific and default emission factors (tier 2) are used. For reasons of confidentiality, the detailed figures are not included in this report and the NIRs, but can be made available for review purposes.
Emission factors

Transfer emissions
The emissions during the refrigerant transfers from bulk containers down to small disposable cans/small containers and also from the remaining quantities in year (t) are calculated by multiplying the percentage lost during transferring by the annual amount of transferred refrigerants. The percentage lost during the transfers of the refrigerants is set at 0.5% (see also 2.F.1.c).

First-fill emissions
Since 2006 the first-fill emissions are obtained from the AERs submitted by the concerning companies. For the period 1990–2000 the emissions have been calculated by multiplying the average IEF of 2006–2010 by the number of first-fill aircos.

Leakage percentages (L)
The leakage percentages (L) for airco usage and their reference per year are shown in Table 12.

Table 12 Leaking % passenger cars / vans / truck cabins. Emissions are negligible in the period 1990-1993.

Year of construction	Leaking %	Reference
2016 and later	4.3	Minnesota Pollution Control Agency, 2010)
2015	4.3	
2014	4.3	
2013	4.3	
2012	4.3	
2011	4.3	
2010	4.3	
2009	4.3	
2008	5.1	Via interpolation between 2004 and 2009
2007	5.9	
2006	6.7	
2005	7.4	
2004	8.2	Yu and Clodic, 2008
2003	9.0	De Baedts, E.E.A. et al., 2001
2002	9.0	
2001	9.0	
2000	9.0	
1999	9.0	
1998	13.0	
1997	13.0	
1996	13.0	
1995	13.0	
1994	13.0	

Activity data

Number of present and scrapped cars

The number of cars, delivery vans and lorries (per year of construction) and the number of scrapped cars (per year of construction) are obtained from Statistics Netherlands (CBS, Statline).

Number of cars with air conditioning

A single study that was implemented by NOKS (national research into coolant flows) for the year 1999 (De Baedts et al., 2001), which covered both stationary cooling and mobile air conditioning. With this study and the import figures for new cars the penetration rate for air conditioning is determined by the RAI Association for three categories: cars, small delivery vans and cabin air conditioners for lorries. The number of cars containing air conditioning is determined, as well as the average capacity thereof. Up to the end of 2002 the RAI Association determined the number of cars with air conditioning. Thereafter, this figure is

estimated based on the total number of cars sold, and an expert evaluation of the airco penetration rate.

Demolition phase
With the number of scrapped cars (per year of construction) and the number of cars containing air conditioning (per year of construction) the annual number of cars with air conditioning can be determined. The amounts of destroyed and recycled coolants from scrapped cars are obtained from Auto Recycling Netherlands.

Also the percentage of coolant that is still present in a car to be scrapped is obtained from ARN. A rest percentage of 75% is used for cars newer than 2010, 45% for cars from building year 2005-2010 and 20% for years 1995-2005. The percentage of cars with airco older than 1993 is negligible , therefore it is set to zero.

2.2.3.11 HFC emissions from other use (CRT 2.F.6)

This section concerns the methodology and working processes for determining HFC (hydrofluorocarbon) emissions that result from Other Use, which includes the following sectors:

- Foam blowing agents (IPCC category 2.F.2);
- Fire protection (IPCC category 2.F.3);
- Aerosols (IPCC category 2.F.4);
- Solvents (IPCC category 2.F.5).

In the Netherlands, many processes related to the use of HFCs take place in only one or two companies. Because of the sensitivity of data from these companies, the HFC emissions of the 2F2-2F5 sectors are aggregated into a single figure and included in 2F6 (HFCs Other).

Foam blowing agents (2.F.2)
This concerns the calculation of HFC245fa, HFC227ea and HFC365mfc emissions that result from the production, usage and demolition phases of PUR (polyurethane) hard foams for the construction sector (2.F.2.a). The large PUR hard foam manufacturers in the Netherlands are members of the NVPU (Netherlands association of polyurethane hard foam manufacturers). PUR hard foams are primarily used in the Dutch construction sector as an insulation material. Smaller amounts are used to insulate refrigerators and freezers. Since pentane is used almost exclusively for this application within the European Union, and there is no production of refrigerator foams in the Netherlands, this application is not included in this part of this paragraph.

Prior to 2003, HFCs were not used in PUR hard foams. However, from 2003 onwards, limited amounts have been used during the production, application and use in-situ foams. The European directive concerning greenhouse gases (no. 2037/2000) was published on 29 June 2000, and included restrictions to the use of HCFCs (hydro chlorofluorocarbons) for the production of plastic foams. The ban on using HCFCs has not led to a one-to-one replacement by HFCs, partly due to the high costs involved. In June 2006 the European F-Gas Directive came into force, including regulations for the use of F-gases.

Fire Extinguishers (2.F.3)
Since 2003, HFK227ea has been used on a small scale in fixed fire extinguishers in the Netherlands. These are mainly used to protect electronic equipment. Emissions occur during the filling, usage and disposal phase and leakages of the system.

Aerosols (2.F.4)
This section concerns the HFC emissions that result from the use of aerosols. The NAV (Dutch aerosol association) represents the majority of the country's aerosol industry. Most manufacturers use propane and dimethyl ether (DME) as propellant, while a small part (<10%) of the companies use HFC134a in their products. One of the manufacturers also uses very small amounts of HFC152a as propellant.

The aerosols are split into PUR-foam (2.F.4.b) in spray cans (OCF: one component foam) and technical aerosols (2.F.4.a). OCF is also used in the construction sector as a sealant. The technical aerosols include, for example "Metered dose inhalers (MDI) for asthma patients"(no production in the Netherlands).

Solvents (2.F.5)
In the Netherlands, HFC43-10mee is used in cleaning processes, such as cleaning of various metals and electronics. Emissions occur during the use of the solvents.

Calculation method
This section covers the general method applied to calculate emission from HFCs per IPCC category. As from 2015, no consumption data of HFCs (foam-blowing agents, aerosols, fire protection and solvents) are available anymore. Therefore, in 2021 a temporary alternative approach was introduced for determining the emissions from these sources from 2015 onwards, where since this submission a more reliable method was developed for foam blowing and aerosols. The calculation method for the period 1990-2014 is still described here, because the emission figures for this series calculated according to that method are kept. Because for solvents and fire extinguishers the temporary method is still used, it is described, after which the new method for the period from 2015 onwards is described.

2.2.3.11.1 Method until emission year 2014
Foam blowing (2.F.2)
HFCs were first used in hard foam production in 2003. HFC emissions from hard foams are calculated as follows:

HFC emission from PUR foams in year t-2 =
(extent of HFC use in new PUR foams in year t-2 x (emission factor production + emission factor installation)) +
(HFCs in recycled foam that was used in year t-2 x emission factor installation) +
(HFC in existing stock of PUR foams[2] x annual emission factor) +

[2] Existing stock = □(new stock 1st year of application - annual emissions) + (new stock 2nd year of application - annual emissions over stock years 1 and 2) + ….etc…..+ (new stock year t-1 - annual emissions over stock years 1 through t-2)□ - □amount destroyed by demolition□.

(HFC in PUR waste foam from construction in year t-2[3] x emission factor demolition phase)

The following assumptions and starting points have been used:

- When determining HFC emissions in the Netherlands it is important to have both production and usage data available for the Dutch situation. It is not known how many (HCF-based) products have been exported and imported. When calculating emissions it is therefore assumed that the use of hard foam products within the Netherlands is entirely due to domestic production.
- Foams taken from the construction sector are generally incinerated during the demolition phase, whereby the HFCs are destroyed (Vehlow et al., 1995); otherwise they are recycled. This recycled portion is also included in the formula.
- The report 'Emissies van CFKs uit PUR-isolatieschuim in de keten van slopen tot verwerken' (CFC emissions from PUR insulation foam in the chain from demolition to processing) (Tauw et al., 2001) assumes a usage phase of 50-60 years for residences, 45 years for non-residential buildings, and 40 years for bituminous roofing. However, this does not include any intermediate demolition. The usage phase for the construction sector is assumed to be 40 years for plates/panels and mouldings. Usage is assumed to be 25 years for materials that are already installed (Kräling et al., 2000).

This calculation method complies with that described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 7, 7.4). This concerns a tier 2 method with country-specific emission factors.

Fire Extinguishers (2F3)
This section describes the annual determination of the HFC emissions from fire extinguishers in the Netherlands. This method corresponds with the the Tier 1b method (with default emission factors) as described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 7, 7.6).

The calculation starts with the determination per source, followed by the determination of the total emissions.

Filling of (new) installations:

*E nw(t) = V nwv * v/100*

Where:

E nw(t)	= emissions during the filling of the (new) installations in year (t);
V nwv(t)	= the volume of HFC used in (new) installations in year(t);
v	= percentage lost during the filling, expressed as a % of V nwv(t).

[3] Deduced from the usage period of the foams: foams used in year t are assumed to be destroyed in the coming years (t + usage period).

Emissions from working systems:

*E sys(t) = (V sys(t-1) + (Vnw(t) * 0.5) - (Vafg(t) * 0.5)) * lk/100*

Where:

E sys(t)	= emissions from working systems in year(t);
V sys(t-1)	= original volume at 31 Dec (t-1) of working systems;
V nw(t)	= volume of HFC refilled in (new) installations in year(t);
V afg(t)	= original volume of dismantled installations in year(t);
Lk	= leakage percentage during operation;
0.5	= because both the filling of new and dismantling of old installations takes place throughout the year, it is assumed that each new and dismantled installation are operational for an average of six months in year (t).

Losses from dismantling installations:

*E afg (t) = V afg(t) * v/100*

Where:

E afg(t)	= (emission) losses that occur during dismantling of installations;
V afg(t)	= original volume of dismantled installations in year(t);
v	= percentage lost during dismantling of old installations.

Finally, the total emission of HFCs by fire extinguishers is determined each year using the following formula:

Annual Emission = E nw(t) + E sys(t) + E afg(t)

Further information on the activity data and emission factors used is available in the corresponding sections of this emission source.

Aerosols (2.F.4)
HFC emissions from aerosols are determined using the following formula:

HFC emissions in year t = ((Amount in products sold in year t) x 50%) + ((Amount in products sold in year t-1) x 50%)

This formula should be used for each individual chemical substance. In addition to HFC134a, this subsector uses very small amounts of HFC152a. The aforementioned method conforms to the calculation method required for HFC emissions from aerosols (tier 2a), as described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 7, 7.3) The largest part of the Dutch production is exported, but it is not known how many products containing HFCs are imported and exported. Emission calculations assume that the use of aerosols in the Netherlands originate entirely from domestic aerosol production until more information is available.

Solvents (2.F.5)
The HFC emissions from solvents and cleaning agents are determined in the same way as aerosols (2.F.4).

Emission factors
The emission factors introduced in the calculation method section are explained in this section.

Foam blowing (2.F.2)
The extent of foam blowing emissions in the various phases varies according to the foam application. Emission percentages per application and per phase are shown in the following table.

Table 13 Emission percentages of three PUR hard foam applications in the various life phases

	1. Continuous, plates/panels [1)]	**2. Discontinuous, forms [2)]**	**3. In situ [1)]**
Production and installation	5%	0.5%	15%
First year usage	-	0.1%	5%
Usage in following years	0.2% per year	0.1% per year	1.2% per year
Dismantling/demolition phase[3)]	1%	-	2-90%

1) Data taken from Krähling (2000).
2) Data taken from Tauw (2001) and Crystal Globe (2002).
3) Data taken from Tauw (2001); percentages concern the dismantling and associated processes for the foams; it is assumed that the foams are then incinerated so that the remaining propellants are destroyed. The 'in situ' emissions largely depend on the material to which the foam is attached and the treatment used: 2% for sorted (attached to wood), 10% for dismantled (attached to stone), 90% for crushed rubble (attached to stone).

Fire Extinguishers (2.F.3)
For this sector the IPCC default values from the the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 7, 7.6) are used.

Aerosols (2.F.4)
Emissions occur every time an aerosol is used. It is assumed that aerosols are used within two years after production, whereby 50% of the propellant is emitted in the first year and 50% in the second year. This 50% conforms to the default value used in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 7, 7.3).

Solvents (2.F.5)
See Aerosols (2.F.4).

Activity data
All activity data described in this section covers all emission sources (foam blowing, fire extinguishers, aerosols and solvents).

The extent of HFC use in these sectors was determined annually via the project 'Use of HCFCs, HFC, and related substances in the Netherlands' (also known as the 'Handelsstromenonderzoek' or trade flow study) which was conducted annually (up to 2003 by KPMG (KPMG, multiple years), from 2004 until 2014 by PWC consultants (PWC, multiple years)) on behalf of the Ministry of Infrastructure and the Environment. Because of the sensitivity of data only the sum (expressed in CO_2-eq) of the use of HFC245fa, HFC227ea and HFC365mfc for the production of hard foams was available from the trade flow study. Differentiation between PUR-foam and technical aerosols is made since the year 2000.

2.2.3.11.2 Temporary alternative approach (for the emissions from 2015 onwards)
Due to the fact that the annual reports by PWC about the emissions of these sources are not available anymore, a new calculation method has been introduced in 2021, and still used for emissions from solvents and fire extinguishers. This alternative approach is based on the total emissions in these subcategories from surrounding countries Germany and Belgium. First, a comparison of the emission trends over the period 2010-2014 in the Netherlands and Germany/Belgium was made to check the trend comparability over these years with known data in the Netherlands. These similar trends in 2010-2014 show that the emissions in Germany and Belgium give a good indication for the emission trends from these sources in the Netherlands and can therefore be used as a starting point for the emissions from 2015 onwards.
A yearly growth factor for the Netherlands is determined by the growth factor of emissions in these two countries, with a weighted average based on GDP. For the most recent year, surrogate data (data from Germany and Belgium) was used and forward extrapolated (see 5.3.3.2. ' surrogate data' and 5.3.3.4. 'trend extrapolation' in chapter 5 ' time series consistency' of the 2006 IPCC guidelines). The average growth factor from 2015 to the most recent year was taken to extrapolate the emission from these sources for the most recent year.

2.2.3.11.3 New calculation method for foam blowing and aerosols
From this 2025 submission on, another calculation method was developed.

Foam blowing (2.F.2)
Although since 2015 no activity data is available for the Netherlands, this data is available for the EU in the EU F-gas portal. A summary of this data is made in the European Topic Centre report on Climate change mitigation on fluorinated greenhouse gases, by order of the European Environmental Agency [ETC CM 2023/04]. These EU activity data were scaled to the Dutch situation by using population numbers as a proxy. In doing so for year 2014, the obtained emission figure slightly differs from the PWC figure. As PWC data are considered to be more reliable for the Dutch situation, emissions are calculated from 2015 on by scaling the calculated emission series as described above by the 2014 PWC / F-gas portal ratio.

Aerosols (2.F.4)
Data om Emissions from Metered Dose Inhalers (the bulk of aerosol use) is available from studies that collect activity data about amounts of inhalers used in the Netherlands, and the amount of HFC-134a per package (Steenmeijer et al). This study directly delivers the emission data for the years after 2014. For the next submission it will be tried to obtain the emission data for years before 2015 by personal contact with the researchers, compare it with the PWC figures, and create a series 1990-2024 by using the Overlap Splicing technique.

2.2.3.12 SF6 emissions from the high-voltage power industry (CRT 2.G.1)
This section describes the method used to determine SF_6 emissions during the production, installation and demolition phases of medium- and high-voltage capacity circuit breakers (insulation and arc extinguishers), including the testing of installations by independent

laboratories. This concerns NACE codes 261, 27, 3313,3314, 3323, 3324 and 35.

SF_6 emissions as a result of using SF_6 in the high-voltage power industry, production of semi-conductors, double glazing and electromicroscopes are all aggregated into a single figure and reported under CRT category 2.G.4 'Other' due to the confidentiality of the data. SF_6 is used to prevent voltage arcs between the various electricity potentials. SF_6 can also be used as a so-called 'extinguisher gas' for overvoltage protection installations.

High-voltage installations refer to units larger than 36 kV, while medium-voltage refers to those less than 36 kV. Compared to high-voltage installations (hundreds of kilos of SF_6), medium-voltage installations use much smaller quantities of SF_6 (only a few kilos). A lot of large corporations in the Netherlands use medium-voltage installations.

Emissions
The aforementioned types of installations can emit SF_6 during the production, installation, usage and demolition phases.

When manufacturing high-voltage components, products are tested in a real production environment. During this test phase, which takes place during production as well as 'on site', the medium-voltage and high-voltage components are filled with SF_6 under working pressure. The components are then emptied until they reach a pressure of 0.05 bars and the remainder is released. Most of the (large) users of medium-voltage and high-voltage circuit breakers, the network managers and electricity generation companies (i.e. around 90%) are members of EnergieNed, the Federation of Energy Companies in the Netherlands. In addition, there are also a limited number of industrial users of high-voltage equipment in the Netherlands.

The Netherlands also has one international test laboratory for power switches, where high-voltage and medium-voltage installations are tested, with or without SF_6 as insulation and/or arc extinguishers.

Calculation method
SF6 emissions are taken from the annual report of Netbeheer Nederland (by DNV). The SF6 emissions are calculated by a mass-balance approach, as follows:

*SF_6 emissions = The annual input of SF_6 in all installations * 100/95 kg + emissions from testing installations*

Where:
Factor 100/95: This incremental factor is used for determining total emissions, including those from several large industrial users (approx. 5% of total emissions).

2.2.3.13 SF6 emissions from other use (CRT 2.G.2)

This section describes the methodology and working processes used to determine the SF_6 emission figure for the production, use and end-of-lifespan activities for sound-insulated glazing (2.G.2.c) and for the minor source "production of electron microscopes".

Emissions by the high-voltage sector, production of semiconductors, double glazing and electron microscopes are all aggregated into a single figure and reported under CRT category 2.G.4 "SF_6 from Other Use".

In 2020 new research is done by (DNV, 2020) whether there are other substantial GHG sources that not have been determined. This appears not to be the case.

Calculation method

Double Glazing (2.G.2)

SF_6 emissions during production and use of sound-insulated double glazing have been calculated using the following formulas:

*Emissions during production = 0.33 * Production capacity (1)*
*Emissions resulting from leakage in year t = 0.01 * stock of SF_6 in glazing in NL (2)*
*Emissions during dismantling phase = amount remaining in glazing * (1-recovery factor) (3)*
Total emissions = sum of (1), (2) and (3)

Where:

- Emissions: in ton SF_6 in year t
- EF_p : Emission factor during production = 0.33 (per year)
- Production capacity = amount of SF_6 used by the sector (in ton SF_6)
- EF_g : Emission factor during use = 0.01 (per year)
- Stock of SF_6 in glazing within the Netherlands (NL) in year t = B_t (in ton SF_6)
  $= B_{(t-1)} - B_{(t-25)} + C + D$
  $= B_{(t-1)} - B_{(t-25)} + 1.33\ D$
  - $B_{(t-1)}$: existing amount of SF_6 in glazing within NL
  - $B_{(t-25)}$: amount remaining in glazing in dismantling phase year t (lifespan is approx. 25 years)
  - C : import = 0.33 * D
  - D : domestic turnover by NL manufacturers: $(1- EF_p)\ A * 0.96 = 0.67\ A * 0.96$
  - Annual new domestic turnover by NL manufacturers: 96% (4% export)
  - Amount remaining in glazing during dismantling in year t = $B_{(t-25)}$ (lifespan is approx. 25 years)
  - Recovery factor: recovery of the gas remaining in the glass at dismantling/demolition phase =0

Emission factors during production

EF_p : Emission factor during production = 0.33 (per year)
This emission factor is taken from the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 8, p. 8.31).

Emission factor during use
EF_g : Emission factor during use = 0.01 (per year)

It is assumed that around 1% of the gas will leak out each year throughout the lifespan of the glazing. This includes the percentage for breakages. With an average lifespan of 25 years, this means that at the end of the lifespan there will still be around 78% of the original filling in the glass. This emission factor is also taken from the the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 8, p. 8.31).

Recovery factor
There is currently no method of recovering the gas (recovery factor =0) remaining at the end of the glazing lifespan (demolition).

Activity data
The datasets required for emission calculations are as follows:

- Production capacity: Annual amounts of SF_6 used by the sector (in ton SF_6).
- Stock in glazing (within the Netherlands): annual new turnover in the Netherlands

  = B_t (in ton SF_6)
  = $B_{(t-1)} - B_{(t-25)} + C + D$
  = $B_{(t-1)} - B_{(t-25)} + 1.33\ D$

  - $B_{(t-1)}$: existing amounts of SF_6 in glazing within NL
  - $B_{(t-25)}$: amounts remaining in glazing during demolition in year t (lifespan is approx. 25 years)
  - C : import = 0.33 * D
  - D : domestic turnover by NL manufacturers: $(1- EF_p)\ A * 0.96 = 0.67\ A * 0.96$
    - Annual new domestic turnover by NL manufacturers: 96% (4% exports)

Assumptions: it was assumed that 96% of the aforementioned production capacity focuses on the market in the Netherlands and the other 4% was exported to foreign countries. It was also assumed that 25% of the annual stock increase is derived from foreign products (primarily from Germany),

- Stock at demolition: this is derived from the range of existing glazing stock, taking into account a 25-year lifespan and a remaining gas stock in the glazing of 78%.

Sources:

- Until 2006 (production has stopped after 2005), the aforementioned information was annually provided by the double glazing manufacturers to the work package leader of the Task Force ENINA.
- Individual company statistics concerning SF_6 usage, production capacity, domestic turnover and import of SF_6 are all competitor-sensitive figures and are therefore treated as confidential information. Reviewers/audit team may access this information via the work package leader.

The aforementioned method complies with the method described in the 2006 IPCC Guidelines (IPCC, 2006: Volume 3, Chapter 8, p. 8.31).
Electron microscopes (2G2)
The emission of this minor source is annually obtained from the only producer in the Netherlands.

2.2.3.14 Indirect CO_2 emissions from NMVOC (CRT Sectors 1, 2, 3 and 5)
This section describes the methodology and working processes used to determine the CO_2 emissions from NMVOC use. Indirect CO_2 emissions originate from the use of NMVOC in the following sectors:

1. Energy (Energy, Traffic & transport and Refineries);
2. IPPU (Consumers, Commercial and governmental institutions, Industry and Construction and building industries);
3. Agriculture;
5. Waste.

Until the 2014 submission country-specific carbon contents of NMVOC emissions (C-factors) have been used to calculate the indirect CO_2 emission from NMVOC use. Because these C-factors are outdated and no recent country specific C-factors are available, the Netherlands has switched to the use of the IPCC default C content from the 2015 submission onwards.

Calculation method
Per sector, the indirect CO_2 emissions from NMVOC use are calculated as follows:

CO_2 (in Gg) = NMVOC emission (in Gg) x C x 44/12

Where:
- C = default IPCC carbon content (C) of 0.6;
- NMVOC emissions data from the use of NMVOC.

The Activity data
NMVOC emissions data per sector are obtained from the Dutch PRTR.

2.3 Emissions from waste (CRT 1A1a and CRT 5)

Emissions from waste are linked to the emission sources listed in *Table 14.* This section describes the emissions from these sources.

Table 14 CRT categories and corresponding emission sources (including a reference to the section describing the method)

CRT	Section	ES CODE	EMISSION SOURCE
1.A.1.a	2.3.1.1 and 2.3.2.1	8921804	NACE 38.2/84.1: Treatment of waste, including communal waste-incineration plants
	2.3.1.2 and 2.3.2.2	E401210	Solid waste disposal on land: managed disposal
5.A.1	2.3.1.2 and 2.3.2.2	E401220	Solid waste disposal on land: managed disposal
	2.3.1.2 and 2.3.2.2	E402200	Solid waste disposal on land: managed disposal
5.B.1	2.3.1.3 and 2.3.2.3	E400313	Digesting of organic waste from households
		E400314	Composting of organic waste from households
	2.3.1.3 and 2.3.2.3	E400315	Digesting of organic horticultural waste
		E400316	Composting of organic horticultural waste
5.D.1	2.3.1.4 and 2.3.2.4	E400107	NACE 90.01: collection and treatment of sewage
	2.3.1.4 and 2.3.2.4	E400108	NACE 90.01: collection and treatment of sewage; venting of biogas
5.D.2	2.3.1.4 and 2.3.2.4	E400102	Anaerobic waste water treatment plants, other industries
	2.3.1.4 and 2.3.2.4	E400103	Anaerobic waste water treatment plants, waste processing industries
	2.3.1.4 and 2.3.2.4	E400104	Anaerobic waste water treatment plants, paper industries
	2.3.1.4 and 2.3.2.4	E400105	Anaerobic waste water treatment plants, food industries
	2.3.1.4 and 2.3.2.4	0910001	NACE 10-11: Food and beverage industry (wastewater treatment)
	2.3.1.4 and 2.3.2.4	0900002	NACE 17: Paper and cardboard industry (wastewater treatment)
	2.3.1.4 and 2.3.2.4	0910003	NACE 20-21: Chemical and pharmaceutical industry (wastewater treatment)
	2.3.1.4 and 2.3.2.4	0910004	NACE 38: Collection and treatment of waste (wastewater treatment)
	2.3.1.4 and 2.3.2.4	0910005	NACE: Other industry (wastewater treatment)
5.D.3	2.3.1.4 and 2.3.2.4	0444900	Indirect N_2O related to waste water
	2.3.1.4 and 2.3.2.4	0460100	Indirect CH4 related to COD discharges in waste water
	2.3.1.4 and 2.3.2.4	E400106	Discharges of domestic waste water: septic tanks, anaerobic processes

For incineration CO_2, CH_4 and N_2O are calculated, and for the period 1990-2004 also hexachlorobenzene and pentachlorobenzene . For landfilled waste CH_4 is calculated. Also non-GHG emissions of combustion of land fill gas (total hydrocarbons, CO, PM, CO_2, NO_x and dioxins) are calculated here but are not part of Air IPCC.
For composting CH_4, NH_3, N_2O, NO_x and SO_2 are calculated.

2.3.1 Calculation method of preliminary emission figures

2.3.1.1 Waste Incineration Plants (CRT 1.A.1.a)

In the summer of each year the preliminary emission values are established. These are the preliminary figures for the emission of the year preceding the year in which the preliminary figures are reported. See 2.3.2.1 for the specifications which incineration plants belong to this emission source.
For the waste incineration plants the preliminary values are the final values of the previous year. This means that the final data of 2022 serve as the preliminary data for 2023. This applies to both the emissions and the activity data.
When the preliminary values are established, the activity data and part of the emission factors are not yet known, i.e. there is no other information available to base the preliminary figures on except the final figures of the previous year.

2.3.1.2 Landfill sites (CRT 5.A.1)

The calculation method of preliminary emissions of last year is identical to the method that is applied for the calculation of the final emission of the year before last year.
At the time the preliminary emissions are established, not all data are available. These values are estimated based on the basis of historical trends.

2.3.1.3 Composting (CRT 5.B.1)

The calculation method of preliminary emissions of last year is identical to the method applied for the calculation of the final emission of the year before last year.

2.3.1.4 Sewer systems and water treatment (CRT 5.D.1, 5.D.2, 5.D.3)

2.3.1.4.1 Emission sources

Activities related to sewer systems and water treatments involve a number of process emissions of the GHGs methane and nitrous oxide. Conversion processes in the treatment basins of public as well as industrial (aerobic) waste water treatment plants produce nitrous oxide. Small quantities of methane are also released under anaerobic conditions, e.g. in the intake cistern of waste water treatment plants. Small quantities of methane escape into the atmosphere during the processing and fermentation of sewage sludge. Biogas is occasionally vented into the air, which also causes methane emissions. Small quantities of methane are produced by the treatment of waste water by dwellings with a septic tank. In a number of industries, including the food, chemical, paper and waste processing industries, anaerobic treatment plants are used. In these installations leakage of small quantities of methane occurs during the capturing of the biogas. The discharges of treated effluents and other discharges containing residual organic pollution and nitrogen, lead to indirect emissions from surface waters of methane and nitrous oxide respectively.
The IPCC category Sewer systems and waste water treatment concerns the emission sources as shown in the table below.

Table 15 Emission sources in the Sewer systems and waste water treatment category

ES CODE	EMISSION SOURCE
E400107	NACE 90.01: Collection and treatment of sewage
E400108	NACE 90.01: Collection and treatment of sewage; venting of biogas
E400106	Discharges of domestic waste water: septic tanks, anaerobic processes
E400102	Anaerobic waste water treatment plants, other industries
E400103	Anaerobic waste water treatment plants, waste processing industries
E400104	Anaerobic waste water treatment plants, paper industries
E400105	Anaerobic waste water treatment plants, food industries
0444900	Indirect N_2O related to nitrogen discharges in waste water
0460100	Indirect CH4 related to COD discharges in waste water
0910001	NACE 10-11: Food and beverage industry (wastewater treatment)
0900002	NACE 17: Paper and cardboard industry (wastewater treatment)
0910003	NACE 20-21: Chemical and pharmaceutical industry (wastewater treatment)
0910004	NACE 38: Collection and treatment of waste (wastewater treatment)
0910005	NACE: Other industry (wastewater treatment)

2.3.1.4.2 Emissions from the collection and treatment of sewage
Because no new activity data are available when the preliminary emissions are calculated the N_2O and CH_4 emissions from this emission source are copied from final emissions of the previous year. The numbers are corrected for treatment plants that were taken out of service. See section 2.3.2.4.2 for the calculation method of the final emission figures.

2.3.1.4.3 Methane emissions from biogas discharge (venting) (CRT 5.D.1)
Due to the collective request for energy data of waste water treatment plants preliminary activity data about the volumes of biogas occasionally vented by WWTPs. The calculation method of preliminary CH_4 emissions is the same as for final emissions and is described in section 2.3.1.4.3.

2.3.1.4.4 Discharges of domestic waste water: septic tanks, anaerobic processes (CRT 5.D.3)
For methane emissions from septic tanks the preliminary data are calculated using up to date activity data. The method is equal to that of the final figures and is described in section 2.3.2.4.4.

2.3.1.4.5 Methane emissions from anaerobic industrial waste water treatment plants (CRT 5.D.2)
Because no new activity data are available when the preliminary emissions are calculated, the CH_4 emissions from this emission source are copied from final emissions of the previous year. See section 2.3.2.4.5 for the calculation method of the final emissions.

2.3.1.4.6 Indirect nitrous oxide emissions from nitrogen discharges via effluents (CRT 5D1)
Because no new activity data are available when the preliminary emissions are calculated the N_2O emissions from this emission source are copied from final emissions of the previous year. See section 2.3.2.4.6 for the calculation method of the final emissions.

2.3.2 Calculation method of final emission figures

2.3.2.1 Waste Incineration Plants (WIPs)
This section describes how GHG emissions are established for the WIPs, including the calculation method of both the activity data and the actual emissions.

Background information
The emissions released from the incineration of waste in dedicated plants are referred to as Waste Incineration Plants (WIPs). These are the plants that are exclusively or largely fed with residual household waste or similar waste. This only concerns the plants included in the reports of the Working Group on Waste Registration (WAR) under 'Incineration'. The waste incineration plants process a small portion of hazardous waste compared to municipal waste. Examples are certain organic liquids from the chemical industry, cleaning cloths contaminated with oil and/or solvents and oil filters. Other hazardous waste is incinerated abroad (mainly in Northwestern Europe) in rotary kilns. Hospital waste is almost always incinerated in a special facility, see Appendix C-5 of the aforementioned report. This installation processes approximately 10 kilotons of hospital waste yearly. The dedicated plants in which sludge or paper are incinerated as well as biomass power plants are not covered in this category. The most important measure WIPs employ to restrict emissions is the flue gas scrubber system after the incineration chamber.

Part of the data established for WIPs on the basis of this methodology report are also used to monitor renewable energy in the Netherlands, the Dutch list of energy carriers and default CO_2 emission factors (Zijlema, 2023), also known as the fuel list, and other reports. This methodology report describes all the calculation methods for waste incineration plants that are used as a basis for all mentioned reports, to prevent incongruence.

Renewable energy monitoring focuses on establishing the proportion of renewable energy in the energy production of WIPs. Renewable energy monitoring is described in the 'Protocol Monitoring Hernieuwbare Energie, herziening 2022' (RVO, 2022) (Protocol on Monitoring Sustainable Energy). The protocol will refer to this methodology report regarding the monitoring of WIPs. This proportion of renewable energy is also used to establish the percentage of renewable electricity of the WIPs as described in the Dutch legislation article 19, first pargraph of 'Regeling garanties van oorsprong en certificaten van oorsprong'.

The data in the fuel list is used to as reference values for companies for completing their eAER. For waste used as fuel an updated value is given each year based on the data calculated using the method described here.

Modification of the WIP method
Future modifications to the method will need to be aligned to renewable energy monitoring, because a single model is used to respond to several monitoring questions. Consultations with the industry and other stakeholders are an integral part of any modification of renewable energy monitoring. This means that the industry must be consulted prior to any modification of the method.

2.3.2.1.1 Calculation method of activity data

Activity data
There are two activity rates: 'Waste incinerated Non-org (TJ)' (non-biomass energy) and 'Waste incinerated Org (TJ)' (biomass energy), both measured in TJ. Together these activity rates provide the total energy content of the incinerated waste. These activity rates apply to all GHG emissions. The purpose of having two activity rates for Air IPCC is to be able to distinguish between biogenic and fossil CO_2. Biogenic CO_2 is a memo item in the NIR report.

The activity rates have been established by taking into account the transfer of foreign waste to WIPs in the Netherlands. Since 2012, Dutch WIPs processed a significant amount of foreign waste. In previous years, very little or no foreign waste was processed and is assumed not occurring. The reason for the method modification is described in Rijkswaterstaat (2013).

Calculating the amounts of biomass and non-biomass energy produced by WIPs involves seven steps, which are described below. These steps are summarised in Table 16, which also references the information sources for the different waste flows in each of the steps.

Table 16 Steps in the calculation of (biomass) energy from waste incineration and its sources

Step	Description	Residual household waste*	Foreign waste	Other waste
1	Amount per flow	Working Group on Waste Registration (WAR)	Working Group on Waste Registration (WAR)	Working Group on Waste Registration (WAR)
2	Component composition	Sorting analyses	Waste shipment permit (Regulation (EC) No 1013/2006) (WSR)	This ENINA method report
3	Energy amount per component	This ENINA method report	This ENINA method report	This ENINA method report
4	Proportion of biogenic energy per component	This ENINA method report	This ENINA method report	This ENINA method report
5	Total energy from incinerated waste			
6	Amount of biogenic energy from incinerated waste			

Step	Description	Residual household waste*	Foreign waste	Other waste
7	Amount of non-biogenic energy from incinerated waste			

* The portion of municipal waste (EURAL 20.03.01) produced by households

The steps are described separately for residual household waste, foreign waste and other waste.

Residual household waste
A number of waste flows are equated with residual household waste regarding composition and net calorific value (NCV), as shown in Table 17.

Table 17 NCV for residual household waste components (source: SenterNovem 2008, table 4.5)

Sorting fractions	NCV (MJ/kg)	NCV biomass (MJ/kg)	Moisture content (weight%)
Biodegradable waste	5.8	5.1	50.9
Or	3.8	3.4	47.9
Paper (excl. diapers)	10.2	8.9	38.8
Diapers	7.1	3.6	59.2
Plastics	23.0	4.6	17.7
Glass	0.0	0.0	0.0
Ferro	0.0	0.0	0.0
Non-ferro	0.0	0.0	0.0
Textile	15.9	7.5	18.5
HHW	0.0	0.0	0.0
Wood	14.2	13.2	22.8
Other, residual	7.4	0.0	4.5
Other, EEA	16.4	0.0	13.5
Other, stony	0.0	0.0	0.0

Step 1
The Working Group on Waste Registration (WAR) produces an annual report about the amounts of incinerated residual household waste (WAR, multiple years). For residual household waste this concerns the residual household waste that is part of the municipal waste flow as defined in European Waste List code 20.03.01.

Step 2
The composition of residual household waste is established on the basis of sorting analyses. For these analyses, representative samples are taken annually from the residual household waste from 1100 addresses. This waste is sorted by component and the total is considered to be a representation of the average composition of residual household waste

in the Netherlands. The result is included in the annual reports by Rijkswaterstaat entitled "Samenstelling van het huishoudelijk restafval" (Composition of residual household waste) (Rijkswaterstaat, multiple years). In the present report, a three-year average is used. This is normally used in reporting of the composition of residual household waste, as this give a more reliable outcome. This means that for the year 2022 the average of 2021 is used, i.e. the average of the years 2020, 2021 and 2022. As the three-year average for 2021 is not yet available at the time the statistics are established, the sorting analyses are one year behind relative to the amounts. Table 18 shows how the components in the different studies are linked. The proportions for components in the sorting analyses have been established for residual household waste originating directly from households. A portion of certain components is removed from the residual household waste through post-collection separation. This will lead to changes in the ratio of component proportions. As plastics is the most important component that is removed from residual household waste through post-collection separation this is taken into account. The amount is yearly known from the reporting for the extended producer responsibility for packaging. The yearly report gives the amount of plastics separated (Afvalfonds verpakkingen, multiple years). From 2022 onwards, the amounts of separated plastics and other waste stream are calculated with data from the Landelijk Meldpunt Afvalstoffen (LMA).

Table 18 Conversion table component sorting analysis to component weight and energy

Weight and energy Components	**Sorting analysis components**
Biodegradable waste	=biodegradable total - or
Or (ondefinieerbare rest (undefinable residue)	=Or
Paper (excl. diapers)	=Paper total - diapers
Diapers	=diapers
Plastics	=plastics total
Glass	=glass total
Ferro	=ferro total
Non-ferro	=non-ferro total
Textile	=textile
HHW	=HHW
Wood	=other wood
Other, residual	=other residual
Other, EEA (electric and electronic equipment)	=other EEA
Other, stony	=other stony
non-combustible	*n/a*

Step 3
For the NCV (Net Calorific Value, i.e. energy content) of residual household waste the component proportions is multiplied by the NCV of the relevant component and these figures are counted up. This is the average NCV of Dutch residual household waste for a certain year. Table 17 shows the NCV of individual components, as well as the proportion of total organic carbon and biogenic carbon (Senternovem, 2008).

Step 4
For the NCV of the total biomass, the component proportion is first multiplied with the NCV of the component and the proportion of biomass of the NCV. Then, all contributions of the components are added up. This is the part of the NCV attributable to biomass in Dutch residual household waste for a certain year.

Foreign waste
Foreign waste fed info Dutch WIPs mainly consists of municipal waste or municipal waste that has been sorted.

Step 1
The amount of foreign waste that is processed in Dutch WIPs is monitored for the import ceiling. This means that the total amount of waste shipments bound for the WIPs registered in the context of the Waste shipment regulation (Regulation (EC) No 1013/2006) is established based on the registered amounts received or processed by the WIPs. The monitoring is executed by Rijkswaterstaat. The data concerning individual waste shipments are not public. Only the total waste amount imported to WIPs can be included in the model. The total amount of foreign waste is reported in WAR (multiple years).

Step 2
Each waste flow shipped to WIPs must be accompanied by a decision confirming permission for the shipment. The composition of the waste must be included in the application for a decision for each waste flow. Based on this composition and data of waste shipments, an average composition of the total foreign waste amount can be calculated. The underlying data related to an order application, including composition-related data, are not made public. Only the average composition can be included in the model.

Step 3
For the NCV of foreign waste the component proportions is multiplied by the NCV of the relevant component and this is counted up. Table 17 shows the NCV of individual components, as well as the proportion of total organic carbon and biogenic carbon (Senternovem, 2008).
The components of foreign waste are equated to the components of Dutch residual household waste, based on the assumption that most of the foreign imported waste is residual household waste with components reasonably similar to those of Dutch residual household waste. Another reason for this approach is the lack of more comprehensive information.

Step 4
For the NCV of the total biomass, the component proportion is first multiplied with the NCV of the component and the proportion of biomass

of the NCV. Then, all contributions of the components are added up. This is the part of the NCV attributable to biomass in foreign waste for a certain year.

Other waste

Step 1

The Working Group on Waste Registration (WAR) produces an annual report about the amounts of incinerated waste (WAR, multiple years) in the year following the report year. The proportion of foreign waste in each waste flow is also known. Other waste is the waste reported in the WAR that is not residual household (Dutch) waste or foreign waste.

Step 2

The various waste flows are divided across 6 standard substance categories about which data is available. The standard substance categories are paper/cardboard, organic, wood, plastic, other, and non-combustible. The division is shown in Table 18a.

Table 18 Division and composition of standard components by waste category

		Combustible (weight %)					non-combustible (weight %)
	waste category	**paper, cardboard**	**wood**	**organic**	**plastics**	**other**	
Mixed urban waste	mixed urban waste	Equal to rhw					
Residual household waste	residual household waste (rhw)	Annually via sorting analysis					
	bulky waste	4	28	11	16	14	27
Business waste	business waste	25	4	34	12	15	10
	agricultural waste					100	
	industrial waste, non-hazardous	25	4	34	12	15	10
	specific hospital waste, non-hazardous					100	0
Residual substances post-separation	shipments from abroad	Annually via orders					
	residual substance separation	Equal to rhw					
Other waste	car tyres			30	70		
	construction and demolition waste, other	8	55	0	14	23	0
	sanitation service waste	9	2	80	9	0	0
	composting/fermentation waste			60	0	0	40
	residual substances WIPs, non-hazardous	25	4	34	12	15	10
	residual substances post-treatment			64	0	0	36
	shredder waste, total	35	10	20	20	7	8
	sewage sludge from communal WWTPs			64	0	0	36
	other waste	Equal to rhw					
Hazardous waste	other waste or non-specified, hazardous					100	0
	residual substances WIPs, hazardous					100	0
	specific hospital waste, hazardous					100	0

Step 3
The NCV per waste flow is the sum per waste flow of the proportions of standard substances multiplied by the NCV of the standard substances. Table 20 shows the NCV of the standard substances. This is the average NCV of the waste flow.

Step 4
The biomass NCV per waste flow is the sum per waste flow of the proportions of standard substances multiplied by the biomass NCV of the standard substances. Table 19 shows the biomass NCV of the standard substances.

Table 19 NCV for standard components and biomass proportion (Rijkswaterstaat 2013)

	combustible					**non-combustible**
	paper, cardboard	**wood**	**organic**	**plastics**	**other**	
NCV (MJ/kg)	10	14	3	33	15	0
of which biomass	100%	100%	100%	0%	50%	0%
biomass proportion by weight	100%	100%	100%	0%	50%	0%

Total waste
Step 5
For the total energy content, the NCV of each waste flow is multiplied by the amount of the waste flow. The results are added up. The energy content of the residual household waste is also taken into account.

Step 6
For the total biomass energy content, the NCV of each waste flow is multiplied by the amount of the waste flow. The results are added up.

Step 7
The amount of non-biomass energy can be established by subtracting the amount of biomass energy from the total amount of energy produced by waste incineration.

Renewable Energy Monitoring Protocol
This data can be used to establish the proportion of renewable energy produced by WIPs. The ratio between the biomass energy content of all waste combined and the total energy content of the waste is used to calculate the percentage of renewable energy generated by waste incineration. The NCV of incinerated waste is the total energy content of incinerated waste divided by the total mass of incinerated waste.

Sustainable energy percentage
The sustainable energy percentage of the WIPs is equal to the proportion of renewable energy referred to above.

Fuel list
The calorific value for waste for the fuel list is calculated by dividing the total energy amount by the total waste amount. The biogenic

percentage of the calorific value is equal to the proportion of biomass energy referred to above.

The corresponding codes in the database for these activity data are listed in table 20.

Table 20 Database codes of AD for Air IPCC

ES code	Process_description	Activity data
8921804	NACE 90022/75: Waste treatment, WIPs	Waste incinerated Non-org (TJ)
8921804	NACE 90022/75: Waste treatment, WIPs	Waste incinerated Org (TJ)

Activity data for amount of waste
For the CRTT the amount of incinerated waste must be included. This amount can only be included in the database (the national database for parties to upload data) as an activity rate, due to the structure of the database. The data is divided between biomass and non-biomass (Waste incinerated Non-org (kt) and Waste incinerated Org (kt)). For an explanation of the calculation method see the emission calculation method for N_2O. Because an activity rate cannot be included in the database without being linked to an emission, it is linked to CH_4. CH_4 was chosen because there are no CH_4 emissions. These activity data cannot be linked as activity data for N_2O because it is required that the activity data of N_2O must be energy for the national database. (See further Rijkswaterstaat 2013).

The data about the division of biomass and non-biomass is also used in other national reports

2.3.2.1.2 Emission calculation method
The emissions of the three greenhouse gases are calculated for the Netherlands as a whole. There are distinct calculation methods for the different emissions:

- CO_2 is calculated based on the carbon content of the incinerated waste;
- N_2O is calculated based on the weight of the incinerated waste;
- CH_4 is calculated based on the energy content of the incinerated waste.

The emissions are divided between the two activity data for Air IPCC. For CO_2 and N_2O this is based on the ratio of the respective biogenic to non-biogenic of carbon content and the biomass and non-biomass weight, and for CH_4 on the ratio of biomass to non-biomass of the energy content.

CO_2, carbon dioxide
Establishing the biomass proportion by weight and energy content and the biogenic proportion in the carbon content for a waste incineration plant is complex due to the inhomogeneity of the fuel. Complicating factors include the lack of a usable protocol for sampling and sample analysis. However, because the composition of residual household waste in the Netherlands is known from years of research, it has been decided to use the data resulting from this research to establish the energy and carbon content as well as the corresponding biomass and biogenic

proportions of the waste flows incinerated in the waste incineration plants (WIPs).

The CO_2 emissions have been established taking account of the transfer of foreign waste to WIPs in the Netherlands. This has only been in use since the monitoring year 2012. In 2012, Dutch WIPs processed a significant amount of foreign waste. In previous years, very little or no foreign waste was processed and is assumed not occurring. The reason for the method modification is described in Rijkswaterstaat (2013).

Calculating the CO_2 emissions for both the biogenic and the non-biogenic portion comprises seven steps, which are described below. These steps are summarised in Table 21, which also references the information sources for the different waste flows in each of the steps.

Table 21 Steps in the calculation of CO2 from waste incineration

Step	Description	Residual household waste	Foreign waste	Other waste
1	Amount per flow	Working Group on Waste Registration (WAR)	Working Group on Waste Registration (WAR)	Working Group on Waste Registration (WAR)
2	Component composition	Sorting analyses	Waste shipment permit (Regulation (EC) No 1013/2006) (EVOA)	This ENINA method report
3	Carbon content per component	This ENINA method report	This ENINA method report	This ENINA method report
4	Proportion of biogenic carbon per component	This ENINA method report	This ENINA method report	This ENINA method report
5	Total emissions of CO_2 from incinerated waste			
6	Amount of biogenic CO_2 from incinerated waste			
7	Amount of non-biogenic CO_2 from incinerated waste			

The steps are described separately for household waste, foreign waste and other waste.

Residual household waste

Step 1

The Working Group on Waste Registration (WAR) produces an annual report (WAR, multiple years) about the amounts of incinerated waste by weight. This is done around the summer and always concerns the previous calendar year. For residual household waste this concerns the flow of mixed urban waste (only household waste) as defined in European Waste List code 200301.

Step 2

The composition of residual household waste is established on the basis of sorting analyses. For these analyses, representative samples are taken annually from the residual household waste from approx. 1100

addresses. This waste is sorted by component and the total is considered to be a representation of the average composition of residual household waste in the Netherlands. The result is included in the annual reports by Rijkswaterstaat[4] entitled "Samenstelling van het huishoudelijk restafval" (Composition of residual household waste) (Rijkswaterstaat, multiple years). In the present report, a three-year average is used. This is normally used in reporting of the composition of residual household waste, as this give a more reliable outcome. This means that for the year x the average of (x-2), (x-1) and x is used.

Step 3
For the Total organic carbon proportion (TOC) of residual household waste the proportion of the component is first multiplied by its proportion of carbon. Then, all contributions of the components are added up. This is the average carbon proportion of Dutch residual household waste for a certain year. The components in the sorting analysis and in the study of carbon proportions are not fully aligned. Table 24 shows how the components in the different studies are linked. The carbon proportion of the various components is shown in Table 25. The source of this data is (SenterNovem 2008, table 4.2).

Table 22 Conversion table component sorting analysis to component carbon list

Carbon components	**Sorting analysis components**
Biodegradable waste	=biodegradable total
Paper	=Paper total
Wood	=other wood
Plastic	=Plastic total
Glass	=glass total
Ferro	=Ferro total
Non-ferro	=Non-ferro total
Textile	=textile
Animal waste	N/A
Stone/ash	=other stony
Carpets/mattresses	=other residual * (4.67/(4.67+0.99+1.45))*
Leather/rubber	=other residual * (0.99/(4.67+0.99+1.45))*
HHW and other	=Hhw
Other	=other residual * (1.45/(4.67+0.99+1.45))*
EEA	-other EEA
non-combustible	n/a

*See Rijkswaterstaat 2013 for explanation of the calculation

[4] For the years 2010 and 2011 data from NL Agency were used, and before that data from SenterNovem.

Table 23 TOC and DOC per component (source: SenterNovem 2008, table 4.2)

Components	TOC (weight %)	DOC (weight %)	Fossil (weight %)
Biodegradable waste	21.6	19.7	1.9
Paper	27.4	24.7	2.7
Wood	39.2	37.4	1.9
Plastic	58.6	15.1	43.5
Glass	0	0	0
Ferro	0	0	0
Non-ferro	0	0	0
Textile	41	20.5	20.5
Animal waste	30	30	0
Stone/ash	0	0	0
Carpets/mattresses	30	3	27
Leather/rubber	49.9	39.9	10
HHW and other	0	0	0
EEA	37.5	0	37.5
Other	0	0	0

Step 4
For the proportion of biogenic carbon is based on the proportion of degradable organic carbon (DOC). It is assumed that these are equal as there are no usable sources for the determination of biogenic carbon. The proportion of a component is first multiplied by its DOC (see Table 25). Then, all contributions of the components are added up. This is the average DOC of Dutch residual household waste for a certain year.

Foreign waste
Step 1
The amount of foreign waste that is processed in Dutch WIPs is monitored for the import ceiling. This means that the total amount of waste shipments bound for the WIPs is registered in the context of European Regulation on waste shipments and based on the registered amounts received or processed by the WIPs. The monitoring is executed by Rijkswaterstaat. The data concerning individual waste shipments is not made public. Only the total waste amount imported to WIPs can be included in the model. The total amount of foreign waste is reported in Rijkswaterstaat (multiple years).

Step 2
Each waste flow shipped to WIPs must be accompanied by a decision confirming permission for the shipment. The composition of the waste must be included in the application for a decision for each waste flow. Based on this composition and data of waste shipments an average composition of the total foreign waste amount can be established. The underlying data related to an order application, including composition-

related data, are usually not made public. Only the average composition can be included in the model.

Step 3
For the carbon proportion (TOC) of foreign waste the sum of component proportions is multiplied by the carbon proportion of the relevant component. This is the average carbon proportion of foreign waste for a certain year. The components in the sorting analysis and in the study of carbon proportions are not fully aligned. Table 24 shows how the components in the different studies are linked. The carbon proportion of the various components is shown in Table 25. The source of this data is (SenterNovem 2008, table 4.2).
The components of foreign waste are equated to the components of Dutch residual household waste, based on the assumption that most of the foreign imported waste is residual household waste with components reasonably similar to those of Dutch residual household waste.

Step 4
For the proportion of biogenic carbon (DOC) the proportion of the component is first multiplied by its DOC (see Table 25). Then, all contributions of the components are added up. This is the average DOC of foreign waste for a certain year.

Other waste
Step 1
The Working Group on Waste Registration (WAR) produces an annual report about the amounts of incinerated waste by weight (Rijkswaterstaat, multiple years). This is done in the year following the report year. The proportion of foreign waste in each waste flow is also taken into account. Other waste is the waste reported in the WAR that is not residual household waste or foreign waste.

Step 2
The various waste flows are divided across 6 standard substance categories about which data is available. The standard substance categories are paper/cardboard, organic, wood, plastic, other, and non-combustible. The division is shown in Table 19. These values have been established based on an expert judgement.

Step 3
The TOC per waste flow is the sum per waste flow of the proportions of standard substances multiplied by the TOC of the standard substances. Table 26 shows the TOC of the standard substances. This is the average TOC of the waste flow. These values have been established based on an expert judgement.

Step 4
The DOC per waste flow is the sum per waste flow of the proportions of standard substances.
Table 26 shows the DOC of the standard substances. This is the average DOC of the waste flow.

Total waste
Step 5
For the total CO_2 emissions, the TOC of each waste flow is multiplied by the amount by weight of the waste flow. The results are added up. Household waste is also taken into account. This quantity is then multiplied by 44/12 for the conversion of carbon into CO_2.

In this step the amount of CO_2 that is captured (carbon capture) in WIP's and will be be subtracted from the total amount of CO2 depending on the type of usage. The deciding factor is if the carbon is fixated in an product, if it is fixated, then it will be subtracted. For the following types of usage that occur in the Netherlands is determined if it is taken into account:

- *use as growth medium in agriculture*. As most of the CO_2 will in the end be emitted to the atmosphere, this amount is not subtracted from the produced CO_2;
- *the captured CO_2 is used as raw material in the production of bicarbonate*. The captured amount is subtracted from the produced CO_2.

In the report of the WAR the amount of captured CO_2 is given with the type of usage. The carbon capture is with reporting year 2019 taken into account. There is no guidance from IPCC on how to take usage of captured CO_2 into account in the inventory.

Step 6
For the total biogenic CO_2 emissions, the DOC of each waste flow is multiplied by the amount by weight of the waste flow. The results are added up and then multiplied by 44/12.

Step 7
The total non-biogenic CO_2 emission is calculated by subtracting the total biogenic CO_2 emissions from the total non-biogenic CO_2 emissions.

The formulas are:

$$CO2_{total} = \sum_i \sum_j mass\ waste_{waste\ stream\ i,component\ j} \times share\ carbon_{i,j} \times 44/12$$

$$CO2_{biogenic} = \sum_i \sum_j mass\ waste_{waste\ stream\ i,component\ j} \times share\ biogenic\ carbon_{i,j} \times 44/12$$

$$CO2_{fossil} = CO2_{total} - CO2_{biogenic}$$

Fuel list
The CO_2 emission factor for waste for the fuel list is calculated by dividing the total CO_2 content by the total energy content of waste. The percentage of biogenic CO_2 is established by dividing the biogenic CO_2 by the total CO_2 content.

Table 24 Conversion table component sorting analysis to component carbon list

Carbon components	**Sorting analysis components**
Biodegradable waste	=biodegradable total
Paper	=Paper total
Wood	=other wood
Plastic	=Plastic total
Glass	=glass total
Ferro	=Ferro total
Non-ferro	=Non-ferro total
Textile	=textile
Animal waste	N/A
Stone/ash	=other stony
Carpets/mattresses	=other residual * (4.67/(4.67+0.99+1.45))*
Leather/rubber	=other residual * (0.99/(4.67+0.99+1.45))*
HHW and other	=Hhw
Other	=other residual * (1.45/(4.67+0.99+1.45))*
EEA	-other EEA
non-combustible	n/a

Table 25 TOC and DOC for standard substances (source: Rijkswaterstaat 2013)

	Combustible (Weight %)					**Non-combustible (weight)**
	Paper, cardboard	**Wood**	**Organic**	**Plastics**	**Other**	
Carbon content (wet)	30	45	20	54	32	1
Carbon content, biogenic, non-fossil (wet)	30	45	20	0	19	0
Carbon content, fossil (wet)	0	0	0	54	13	1

N_2O, nitrous oxide
The N_2O emission depends on the amount of incinerated waste by weight, the type of $DeNO_x$ plant and the contents of the waste streams. The emission factor are based on research on Dutch WIPs. The emission factor depends on the type of $DeNO_x$ the plant uses, SCR or SNCR. Table

26 shows the emission factor and its corresponding source for each $DeNO_x$ plant. The type of $DeNO_x$ plant of a WIP is known from the WAR.

Table 26 N2O Emission factor per $DeNO_x$ plant type

$DeNO_x$ plant	**Emission factor (g/ton)**	**Source**
SCR	20	Spoelstra, 1993
SNCR	100	Oonk, 1995

The total amount of incinerated waste by weight is known from the WAR. As the weight of incinerated waste only can be given divided between biomass and fossil in the used database in the Netherlands a division for the emissions of N_2O also must be made. This distinction between weight in biomass and fossil is also used for other activities. See also '*Activity data for amount of waste*' in paragraph 2.3.2.1.1

The formula for calculating de N_2O emissions is given below. This is followed by a description of the method for calculating the biomass fraction of incinerated waste by weight.
formula for N_2O is:
$N2O_{total} = [\![Mass \times (Share]\!]_{SCR} \times EF_{SCR} + (1 - Share_{SCR}) \times EF_{SNCR})$

The method for calculating fraction of biomass by weight
Establishing the biomass proportion by weight and energy content and the biogenic proportion in the carbon content for a waste incineration plant is complex due to the inhomogeneity of the fuel. Complicating factors include the lack of a usable protocol for sampling and sample analysis. However, because the composition of residual household waste in the Netherlands is known from years of research, it has been decided to use the data resulting from this research to establish the energy and carbon content as well as the corresponding biomass and biogenic proportion of the waste flows incinerated in the waste incineration plants (WIPs).

The N_2O emissions have been established taking account of the transfer of foreign waste to WIPs in the Netherlands. This has only been in use since the monitoring year 2012. In 2012, Dutch WIPs processed a significant weight of foreign waste. In previous years, very little or no foreign waste was processed and is assumed not occurring. The reason for the method modification is described in Rijkswaterstaat (2013).

Calculating the incinerated weight of waste for both biomass and non-biomass is done in five steps, which are described below. These steps are summarised in Table 27, which also references the information sources for the different waste flows in each of the steps.

Table 27 Steps in the calculation of N_2O from waste incineration

Step	Description	Residual household waste	Foreign waste	Other waste
1	Weight per flow	Working Group on Waste Registration (WAR)	Working Group on Waste Registration (WAR)	Working Group on Waste Registration (WAR)
2	Component composition	Sorting analyses	Waste shipment permit (Regulation (EC) No 1013/2006) (EVOA)	This method report
3	Biomass content per component	This method report	This method report	This method report
4	Weight of biomass in incinerated waste			
5	Biomass proportion			

The steps are described separately for residual household waste, foreign waste and other waste.

Residual household waste

Step 1

The Working Group on Waste Registration (WAR) produces an annual report (WAR, multiple years) about the amounts of incinerated waste by weight. This is done around the summer and always concerns the previous calendar year. For residual household waste this concerns the flow of mixed urban waste (only household waste) as defined in EURAL code 20.03.01.

Step 2

The composition of residual household waste is established on the basis of sorting analyses. For these analyses, representative samples are taken annually from the residual household waste from 1100 addresses. This waste is sorted by component and the total is considered to be a representation of the average composition of residual household waste in the Netherlands. The result is included in the annual reports by Rijkswaterstaat entitled "*Samenstelling van het huishoudelijk restafval*" (Composition of residual household waste) (Rijkswaterstaat, multiple years). In the present report, a three-year average is used. This is normally used in reporting of the composition of residual household waste, as this give a more reliable outcome. This means that for the year x the average of (x-2), (x-1) and x is used.

Step 3

For the biomass proportion by weight of residual household waste the proportion of the component is first multiplied by its biomass by weight. Then, all contributions of the components are added up. This is the average biomass proportion by weight of Dutch residual household waste for a certain year.

The components in the sorting analysis and in the study of biomass proportions in the NCV are not fully aligned. Table 17 shows how the components in the different studies are linked. The biomass proportion by weight of the different components is listed in Table 28. The source of this data is (SenterNovem 2008).

Table 28 List of biomass proportions by weight per component

component	biomass proportion (weight %)
Biodegradable waste	88
Or	89
Paper (excl. diapers)	87
Diapers	51
Plastics	20
Glass	0
Ferro	0
Non-ferro	0
Textile	0
HHW	0
Wood	93
Other, residual	0
Other, EEA	0
Other, stony	0

Foreign waste

Step 1

The weight of foreign waste that is processed in Dutch WIPs is monitored for the import ceiling. This means that the total weight of waste shipments bound for the WIPs registered in the context of EVOA is established based on the registered weight received or processed by the WIPs. The monitoring is undertaken by Rijkswaterstaat. The data concerning individual waste shipments is not made public. Only the total waste weight imported to WIPs can be included in the model. The total weight of foreign waste is reported in WAR, multiple years.

Step 2

Each waste flow shipped to WIPs must be accompanied by a decision confirming permission for the shipment. The composition of the waste must be included in the application for a decision for each waste flow. Based on this composition and data of waste shipments an average composition of the total foreign waste weight can be established. The underlying data related to an order application, including composition-related data, are usually not made public. Only the average composition can be included in the model.

Step 3

For the biomass proportion by weight of foreign waste the sum of component proportions is multiplied by the biomass proportion by weight of the relevant component. This is the average biomass proportion by weight of foreign waste for a certain year. The components in the sorting analysis and in the study of biomass proportions by weight are not fully aligned. Table 24 shows how the components in the different studies are linked. The proportion by weight of the different components is listed in Table 29. The source of this data is (SenterNovem 2008, table 4.5).

The components of foreign waste are equated to the components of Dutch residual household waste, based on the assumption that most of the foreign imported waste is residual household waste with components

reasonably similar to those of Dutch residual household waste. Another reason for his approach is the lack of more comprehensive information.

Other waste

Step 1

The Working Group on Waste Registration (WAR) produces an annual report about the amounts of incinerated waste by weight. This is done in the year following the report year. The proportion of foreign waste in each waste flow is also taken into account. Other waste is the waste reported in the WAR that is not residual household waste or foreign waste.

Step 2

The various waste flows are divided across 6 standard substance categories about which data is available. The standard substance categories are paper/cardboard, organic, wood, plastic, other, and non-combustible. The division is shown inTable 19. These values have been established based on an expert judgement.

Step 3

The biomass proportion by weight per waste flow is the sum per waste flow of the proportions of standard substances multiplied by the biomass proportion by weight of the standard substances. This is the average biomass proportion by weight of the waste flow. The biomass proportion by weight of the standard substances is listed in Table 29. These values have been established based on an expert judgement.

Total waste

Step 4

For the total biomass weight in incinerated waste, the biomass proportion by weight of each waste flow is multiplied by the weight of the waste flow. The results are added up.

Step 5

The total amount of incinerated waste by weight is known from the WAR. The biomass proportion by weight is established by dividing the biomass weight in incinerated waste by the total weight of incinerated waste.

Table 29 Biomass proportion of standard substances

	Combustible (Weight %)					**non-combustible (weight %)**
	paper, cardboard	**wood**	**organic**	**plastics**	**other**	
biomass proportion by weight	100	100	100	0	50	0

The N_2O emission is the sum of the emission factor of the plant type multiplied by the proportion of the plant type multiplied by the weight of incinerated waste. This is divided between the two emission explaining factors in the ratio of biomass to non-biomass of incinerated waste by weight.

The formulas are

$$N2O_{biomassgenic} = \sum_i \sum_j mass\ waste_{waste\ stream\ i,component\ j} \times share\ biogenic\ mass_{i,j}$$

$$N2O_{non-biomass} = N2O_{total} - N2O_{biomass}$$

$$N2O_{biogenic} = \sum_i \sum_j mass\ waste_{waste\ stream\ i,component\ j} \times share\ biogenic\ mass_{i,j}$$

CH_4, methane
In October 2010 the Advisory Board NIE approved an amendment of the method for establishing the CH_4 emissions of WIPs. The method amendment applies with retrospective for the period up to and including 1990. Around this period the legal requirements for WIPs were tightened, especially those applying to flue gas scrubbing. It can be assumed that in 1990 methane emissions from WIPs were already structurally lower than the background concentration. The new emission factor for CH_4 is 0 kg per TJ of energy content of incinerated waste. Research (de Groot, 2012) shows that the emission of CH_4 from WIPs is lower than the background concentration of CH_4 in the air. The background for the method amendment is described in de Groot (2012) and in Rijkswaterstaat (2013).
The new method implies that the division by the emission activity rate has become superfluous. The emissions are 0 kg for both activity rates. This item will be included in the CRT as NO, because entering 0 (zero) as a value would cause processing issues in the CRT.

Work package database
The used database codes for the emissions are shown in Table 30 below.

Table 30 Database codes emissions work package 66, Air IPCC

Activity data	substance flow type	Substance code	Substance name
Waste incinerated Org (TJ)	6-2	204	Carbon dioxide
Waste incinerated Org (TJ)	6	205	Nitrous oxide
Waste incinerated Org (kt)	6	523	Methane
Waste incinerated Non-org (TJ)	0	204	Carbon dioxide
Waste incinerated Non-org (TJ)	0	205	Nitrous oxide
Waste incinerated Non-org (kt)	0	523	Methane

2.3.2.1.3 Comparison with IPCC emission factors
The emission factors for CO_2 and N_2O vary due to annual differences in waste composition. This section compares the emission factors , as calculated for monitoring year 2012, to the emission factors as included in IPCC 2006.

IPCC 2006, volume 5, section 5.4.1 does not provide direct emission factors for CO_2 released from waste. Therefore the emission factors used in this work package cannot be compared to the IPCC 2006 guidelines. IPCC 2006, volume 5, section 5.4.3 provides an emission factor for N_2O of 20 g/ton for the Netherlands. This is only the used emission factor in the Netherlands for WIPs with SCR. For WIPs with SNCR the emission factor is 100 g/ton. In principle the emission factor in IPCC 2006 is

similar to the emission factor used in the Netherlands. These are thus comparable.
The emission factor for CH_4 used in this work package is in line with default value in IPCC 2006. In IPCC 2006, volume 5, section 5.4.2 it is good practice to apply an emission factor of zero.

Table 31 shows an overview of emission factors in IPCC 2006 and in this work package for monitoring year 2023.

Table 31 IPCC 2006 emission factors

Emission	IPCC 2006	NL 2023
CO_2	-	106,932 kg/TJ
N_2O	20 g/ton	56 g/ton
CH_4	0 kg/TJ	0 kg/TJ

2.3.2.2 Landfill sites (CRT 5.A.1)
Emissions from landfill sites are calculated for the following emission source categories:
E401210 Solid waste disposal on land: managed disposal
E401220 Solid waste disposal on land: managed disposal
E402200 Solid waste disposal on land: managed disposal

2.3.2.2.1 Introduction
This emission source category includes all waste landfill sites in the Netherlands since 1945[5] and concerns both historic and current public sites that are used to dump waste, plus waste dumped on private ground. Since it is known that these waste sites are (or were) managed and monitored from around 1945 onwards, and are considered to be responsible for most of the methane emissions, these are reported under IPCC category 5A1 (the so-called '*managed landfills*')[6]. The methane emissions from landfill sites before 1945 are small enough to be negligible (Van Amstel et al., 1993).
Dredge material land filled in special sites, intended only for dredging materials, is not part of this work field.

Many landfill sites were situated not far from urban areas. In order to prevent odour and animals (birds and rats) the management of landfill sites has had attention since the beginning of the 20th century. A large study was conducted in 2005 that subsequently was used as further reference information. This study (NAVOS, 2005) was carried out on the older waste disposal sites in the Netherlands. This study investigated about 4,000 old landfill sites and included e.g. investigations on cover materials and layers (through in-situ investigations). This report mentioned among other that from 1930 a method based on placing the waste in defined layers and cover it with ashes, soil or sand like dirt from street sweeping became common practice. Further it was indicated that at the early seventies the waste-sector itself introduced a "code of practice" in which a method for environmental clean land filling was described. During the seventies and early eighties national legislation

[5] The methane emissions from landfill sites before 1945 are small enough to be negligible (Van Amstel et al., 1993).
[6] A managed landfill is a site where solid waste is dumped in a controlled manner (i.e. in a specific location, with a certain amount of controlled degassing and hotbed management) and where one of the following management systems is used: covering materials, mechanical compacting, or spreading of the waste.

came into force introducing an obligation to land filled in a controlled manner. From this moment on a proper site-management is also legally obliged but this was only the result of a process that had been going on for decades.
The emission source category excludes *Unmanaged landfills* that belong to the IPCC category 5A2 and do not exist in the Netherlands. Also excluded is local storage of biodegradable waste (compostable waste from households, trade/services sector, industry and agriculture), the local/central processing of biodegradable waste (into compost and/or biogas), plus the storage and processing of contaminated soil or dredged material. These are reported under IPCC category 5A3 (*uncategorized waste disposal sites*).

This paragraph concerns the calculation procedures on behalf of the monitoring of methane emissions (CH_4) as important component of the landfill gas that is released from landfill sites under anaerobic conditions when organic substances are broken down by micro-organisms (Spakman et al., 1997). This anaerobic process continues many decades, although the amount of landfill gas formed reduces exponentially in time relative to the amount of waste dumped in a specific year.
The composition of landfill gas is changing in time. In the Netherlands landfill gas usually consists of around 50 percent methane and 50 percent carbon dioxide. The carbon dioxide is of organic origin and therefore does not belong to an IPCC source category. The methane content of extracted landfill gas has decreased over the past few years, particularly due to more intensive extraction activities and a change in the composition of biodegradable carbon in waste land filled (Oonk, 2011). More readily digestible components contribute to a significant higher methane production. As a consequence of waste policy in the Netherlands readily digestible components are becoming composted more and more and are less land filled anymore. This may be the explanation of the decrease in the methane concentration in the landfill gas.

The Dutch government has exerted continued political incentive to discourage the dumping of waste, and particularly to discourage the dumping of combustible waste products. These two developments have resulted in a clear and visible effect on the methane production by landfill sites, which has decreased by 80 percent during the forementioned period. This downward trend is expected to continue in the future.

Many companies in the waste sector are making more effort to extract landfill gas. The extracted amounts increased between 1990 and 2004 and, when these gases are combusted (either by flaring, CHP or transfer into the natural gas network) this has led to a decrease of the methane emissions. After 2004 the amounts of extracted landfill gas slowly decreases as part of the decreasing production of landfill gas. By extracting of the gases of a landfill site the methane production also is suppressed. From 2002 onwards the calculation procedure takes these aspects explicitly into account.

2.3.2.2.2 Calculation method

General

The general formula is:

CH_4 *emissions (t) (ktonnes) =* ($CH_{4(gross\ gas\ production)}$ *(t) (ktonnes) –* $CH_{4(landfill\ gas\ extraction}$ *(t) (ktonnes)) * (1-ox) (1)*

where:

1-ox	= (1 – oxidation factor) = the fraction of methane that is not broken down in the landfill. The value 0.1 is used as the value of ox
t	= number of years after dumping

The gross methane production in year t, as a result of the waste dumped in year x, is calculated using the following formula:

$CH_{4(gross\ gas\ production,\ waste\ dumped\ in\ year\ x)}(t)\ (ktonnes) = M_x * DOC_x * f * k_x * e^{-kx*(t-x)} * F * 16/12 * MCF$ *(2)*

Where:

t	= reporting year
x	= year waste was dumped
Prodx(t)	= methane production in year t as a result of waste dumped in year x
Mx	= amount of waste dumped in year x
DOCx	= fraction of biologically degradable carbon in the waste dumped in year x
f	= fraction of biodegradable organic carbon that is actually degraded
kx	= constant reaction
F	= fraction of methane in landfill gas
16/12	= molecular weight ratio CH_4 / C
MCF	= methane correction factor; the Netherlands = 1 because landfills have been managed since 1945

The total gross landfill gas production for the reporting year is calculated via the emissions from waste that was dumped in previous sequential years, i.e.

$CH_{4(gross\ gas\ production)}$ *in year t =* $\Sigma_{x\ (1945,\ t)}$ $CH_{4(gross\ gas\ production,\ waste\ dumped\ in\ year\ x)}$ *(t-x) (3)*

Emissions from the combustion of landfill gas are calculated by multiplying the amount of combusted landfill gas at landfill sites with default emission factors. The emissions factors are presented in Table 34.

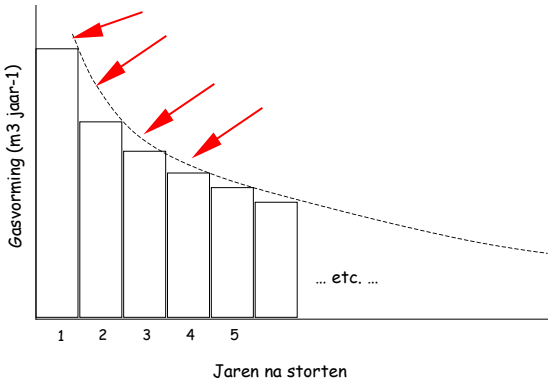
Comparison to the IPCC method

The methane emissions in the Netherlands are calculated using a first-order degradation model, in line with the IPCC 2006 Guidelines (IPCC, 2006; Vol.5, Chapter 3, p.3.8), tier-2 method. Input values are taken from specific circumstances in the Netherlands. This first-order degradation is used for all landfill sites together in the Netherlands, as part of the emissions determination process for the annual emissions and waste report. It is not possible to calculate emissions from

individual landfill sites, because there are insufficient accurate historic data available concerning the waste composition of individual landfill sites.

The normalisation factor (A = (1-exp(-k))/k = correction factor for the sum in formula (3)) used in the tier 2 method was not previously used by the Netherlands model until 2005. The normalization factor is meant to correct a mathematical problem of the model compared to the (assumed!) first order decay. The model without the factor calculates the methane production after each year and uses this result for the whole year. This approach is mathematically not correct as is shown in the figure below. The (assumed) first-order formation is presented by the dotted line whereas the results of the model are presented by the rectangular blocks. The model leads to an underestimation of the methane production since every year the triangle between the dotted line and the rectangular block is not accounted for. The normalization factor is meant to correct this mathematical error.

Figure 1 Representation of the use of the normalization factor



In 2011 (Cuperus et al., 2011) there was an attempt to validate the model. Due to insufficient measurements the model could not be validated. Therefore the IPPC-default values are used from 2005 onwards.

2.3.2.2.3 Emission factors

The Netherlands assumptions used in the model were first developed by Hoeks in 1983, as described in Van Amstel et al. (1993) and Coops et al. (1995), the latter also including an expansion to individual landfill sites. Table 32 shows the parameters used.

Table 32 Comparison of IPCC default values and those used in the Netherlands

Parameters used (IPCC-names)	**Parameter values**		
	IPCC 2006 default (Volume 5, chapter 3)	**Netherlands situation**	**References**
Oxidation factor (OX)	Maximum 0.1 for National Inventory	0.1 (10%)	(Coops et al., 1995)
f = fraction of degradable organic carbon which decomposes (DOC_f)	varies per waste stream (table 3.0 IPCC 2019 refinements)	0.58 from 1945 through 2004, thereafter determined annually by Rijkswaterstaat.	(Oonk et al., 1994)
Degradable speed constant k	0.04 - 0.06 (p3.17)	0.094 from 1945 through 1989 (half-life time 7.5 yr); from 1990 reducing to 0.0693 in 1995; thereafter constant 0.0693 (half-life time 10 yr); reducing to 0,05 in 2005, thereafter constant 0,05 (half-life time 14 yr)	(Oonk et al., 1994)
$DOC_{(X)}$ = concentration of biodegradable carbon in waste that was dumped in year x	Maximum 210 kg C/ton dumped waste	132 kg C/ton dumped waste from 1945 through 1989, from 1990 linear, reducing to 125 kg C/ton in 1995. 120 kg/ton in 1996 and 1997 and after 1997 determined annually by Rijkswaterstaat.	Based on (De Jager et al., 1993), determined by (Spakman et al., 1997) and published in (Klein Goldewijk et al., 2004)
F (fraction of CH_4 in landfill gas)	0.5 (p3.15)	0.574 from 1945 through 2004; thereafter constant 0.5	(Oonk, 2016)
MCF(x) = Methane correction factor for management	1 (p3.14)	1	
Delay Time	6 months (p3.19)	6 months	

It is assumed that, for the Netherlands, an average 10% of the methane in the non-extracted landfill gas in the top layer will be oxidised, and thus 90% will be emitted. The oxidation factor is thus set at 0.1 according to the IPCC 2006 guidelines (Volume 5, Chapter 3, p.3.15).

The value for $DOC_{(x)}$ is published annually in the National Inventory Report (NIR).

Landfill operators have been using codes from the European Waste List (EWL-codes) since 2005 to register the amounts of waste landfilled. Because it is not possible to determine an exact composition of all waste materials, the EWL-codes are subdivided into waste categories. In appendix 6 of the report "Validatie van het nationale stortgas emissiemodel" (Cuperus et al., 2011) all EWL-codes are subdivided into 10 waste categories. Quantities of degradable carbon have been determined for each of these waste categories. Appendix 3 of that report

explains the individual value of the amount of degradable carbon for a number of waste categories. A number of categories are discussed below.

Household residual waste
The composition of household residual waste is based on sorting analyzes from 2007 and chemical analyzes on sorting fractions during the period 2004-2006 (Cuperus et al., 2011). In the chemical analyses, the proportion of biogenic carbon was determined. The results are summarized in Table 34.

Table 34 Composition of household residual waste as received

Fraction	**Share**	**Dry matter**	**Biogenic carbon**	
	(% m/m)	(% m/m)	In fraction (% d.m.)	In waste (% a.r.)
Organic waste + sieve fraction < 20 mm	34	49.1	40.1	6.7
Paper and cardboard	25	61.2	40.4	6.2
Plastics	20	82.3	18.3	3.0
Glass	4.1	98.5	0	0
Metals	4.0	95.5	0	0
Textiles and shoes	3.8	87.0	34.5	1.15
Wood	3.1	77.2	48.5	1.16
Concrete and rubble	2.9	97	0	0
Electr(on)ic equipment	1.0	95	0	0
Other	2.1	90	0	0
Total	100.0			18.2

Bulky household waste
The composition of bulky household waste dates from 1990. The composition concerns collected bulky household waste and not the part that is eventually landfilled. The dry matter contents have been estimated. The main components of biogenic origin are pruning waste and wood. The results are summarized in Table 35.

Table 35 Composition of bulky household waste as received

Fraction	**Share**	**Dry matter**	**Biogenic carbon**	
	(% m/m)	(% m/m)	In fraction (% d.m.)	In waste (% a.r.)
Organic waste	21.9	65	40.1	5.7
Paper and cardboard	4.4	85	40.4	1.5
Plastics and rubber	11.5			0
Glass	1.6			0
Metals	13.2			0
Textiles	6.4	87.5	23.2	1.3
Wood	24.6	90	48.5	10.7
Concrete and rubble	13.3			0
Other	3.1			

Fraction	Share	Dry matter	Biogenic carbon	
	(% m/m)	(% m/m)	In fraction (% d.m.)	In waste (% a.r.)
Total	100.0			19.2

Commercial waste
For commercial waste, the composition of the residual waste in 2005 was examined. It is assumed that the relative composition of the landfilled waste is the same as that of household residual waste. No figures are known about the moisture content, but it can be assumed that industrial waste is a lot drier than household waste. The content of biogenic carbon is set to zero in plastics. The results are summarized in Table 36.

Table 36 Amount and composition commercial waste in 2005 as received

Fraction	Amount	Share[1]	Dry matter	Biogenic carbon
	(kiloton)	(% m/m)	(% m/m)	In waste (% a.r.)
Organic waste + sieve fraction < 20 mm	84	6.5	49.1	1.3
Paper and cardboard	525	40.5	90	9.0
Plastics	437	33.7	0	0
Glass	58	4.5	0	0
Metals	85	6.6	0	0
Textiles	24	1.9	90	0.35
Wood	84	6.5	90	2.19
Other	639		0	0
Total	1936			12.8

1 The category ‘other’ is excluded

Waste that contains high content of degradable organic carbon
For the category 'waste that contains high content of degradable organic carbon' , the composition of various organic sludge flows from municipal and industrial wastewater treatment plants has been used. Table 37 shows the composition of municipal sewage sludge and industrial sewage sludge.

Table 37 Composition communal and industrial sludges as received

Parameter	Communal sludge	Industrial sludges
Dry matter (% m/m)	24.6	43.6
Organic content (% of dry matter)	66.1	65
Carbon (% a.r.)	7.5	13.1
Biogenic carbon (% a.r.)	6.0	10.4

Stabilized organic waste
For the 'stabilized organic waste' category, the composition of sorting residues from construction and demolition waste was examined. The sorting fraction is created after construction and demolition waste has

been post-sorted. It is likely that further processing takes place before the sorting residue is land filled. Table 38 shows a composition of sorting residue from construction and demolition waste. Because it is not clear whether all the sorting residue is landfilled, a degradable carbon content of 130 kilograms per ton has been determined for the 'stabilized organic waste' category.

Table 38 Composition of residue of construction demolition waste as received

Fraction	**Share**	**Dry matter**	**Biogenic carbon**
	(% m/m)	(% m/m)	In waste (% a.r.)
Paper and cardboard	20.8	85	7.1
Plastics	32.1	0	0
Rubber/leather	1.0	0	0.3
Metals	1.5	0	0
Textiles and carpets	5.5	90	0.4
Wood	24.3	85	10.0
Concrete and rubble	14.1	0	0
Tar and other bitumen	0.9	0	0
Total	100		17.8

Waste that contains low content of degradable organic carbon
The composition of shredder waste has been used for the category 'waste that contains low content of degradable organic carbon' . This category also includes other streams containing a low content of biodegradable material. The table shows the composition of shredder waste. The dry matter content is an assumption. The results are summarized in Table 39.

Table 39 Composition of mixed shredder waste as received

Fractie	**Share[1]**	**Dry matter**	**Biogenic carbon**
	(% m/m)	(% m/m)	In waste (% a.r.)
Organic waste + sieve fraction < 20 mm	0	0	0
Paper and cardboard	0.4	90	0.14
Plastics	26.6	0	0
Rubber	5.6	0	2.1
Metals	4.1	0	0
Textiles	3.1	90	0.64
Wood	3.5	90	1.53
Sieve residue < 10mm	55.3	0	0
Total			4.41

Summary degradable organic content
A summary of the degradable carbon fraction and the source per waste category are shown in table 40.

Table 40 Overview of waste categories, DOC-values and source.

	Waste stream group	**DOC value (kg/ton)**	**Source**
1	Waste from households	182	Table 34
2	Bulky household waste	192	Table 35
3	Commercial waste	128	Table 36
4	Cleanishing waste	43.4	Expert judgement
5	Waste that contains high content of degradable organic carbon	112	Table 37, partly based on composition of sludges
6	Stabilized organic waste	130	Table 38, partly based on composition of sorting residues of construction and demolition waste and expert judgement
7	Waste that contains low content of degradable organic carbon	44	Table 39, partly based on the composition of shredder waste
8	Contaminated soil	11.5	Expert judgement
9	Dredging spoils	42.4	Expert judgement
10	Inert waste	0	
11	Wood waste	430	IPCC-default value

DOC_f -Factor

The method to determine the DOC_f factor is refined in the 2019 IPCC refinements. Research shows that different components of biodegradable waste dissimilate differently within a landfill under anaerobic conditions. For example, organic food- and garden waste and sewage sludge are dissimilated by 70 percent, while this is only 10 percent for wood.

Before 2005, the DOCf factor of 0,58 was used as determined in the report by Oonk et al, 1994. From 2005 onwards, the DOCf factor will be calculated annually. By multiplying the composition of the waste with the dissimilation factor by component, the DOCf factor can be calculated. In this calculation only biodegradable components are taken into account. Non-biodegradable components are excluded, while the amount of biodegradable organic carbon already corrects this. Table 41 shows the calculated DOCf factor by waste stream from 2005 onwards.

Table 41 Calculated DOCf factor by waste stream group

Waste stream group	**DOCf value by waste stream group**	**Source**
Waste from households	0,58	Composition as in table 34
Bulky household waste	0,40	Composition as in table 35
Cleanishing waste	0,50	IPCC-default value for moderately decomposable waste

Waste stream group	DOCf value by waste stream group	Source
Waste that contains high level of DOC	0,70	Composition as in table 37
Stabilized organic waste	0,30	Composition as in table 38
Waste that contains low level of DOC	0,21	Composition as in table 39
Contaminated soil	0,50	IPCC-default value for moderately decomposable waste
Dredging spoils	0,50	
Inert Waste	0,50	
Wood waste	0,10	IPCC-default value for less decomposable waste

k-value
The k-value is used for the half-life value for waste to decay to half its initial mass. The assumption is made that the majority of degradable waste landfilled in the Netherlands consists of paper, wood and textiles (slowly degrading) and not of sewage sludge or food waste (rapid degrading). Paper, wood and textiles can for example be found in construction and demolition waste and in waste from shredding vehicles and electronic equipment.
The IPCC default value is between 0.03 and 0.06 for slowly degrading waste (wood, paper, textiles) in a wet and temperate climate zone.
In the period 1989-2004 a country-specific value for k (0.094) was determined with a validation of a landfill gas model (Oonk, 1994). Due to changing waste composition as a result of waste policies in the early 90s, the value was changed to 0.0693 for the years 1990-2004. A new attempt to validate the landfill gas model to derive improved parameters (Cuperus et al., 2011) was unsuccessful. Therefore a IPCC-default value of 0.05 for the k-value is used in the Dutch model from 2005 onwards. Degradable waste is not landfilled in large quantities in the Netherlands.

Other waste streams that are landfilled in large quantities, such as contaminated soil (EWL code 170504) and sludges from physic-chemical treatment (EWL code 190206: in fact mainly residues from soil remediation), have a low DOC value. It is reasonable to assume that these residues contain only slowly degrading waste, because the organic content is stabilised.

Non-GHG emissions from the combustion of captured landfill gas are released both by landfill gas engines and flares. WAR (Working Group on Waste Registration) collects the data related to landfill gas capture and its distribution between landfill gas engines and flares by all operators of landfill sites.

Table 42 shows the emission factors for the combustion of landfill gas.

Table 42 Emission factors used in the combustion of landfill gas

Component	**Emission factor and unit**
Total hydrocarbons (incl. methane)	0.389763 kg/m³
CO	2.7% C flare and 3.4 g/m³ gas engines
Hydrocarbons (CxHy)	0.27% hydrocarbons flare and 6 g/m³ gas engines
Soot	0.05% hydrocarbons flare
CO_2 (biogenic)	total C minus CO minus soot
NO_x (as NO_2)	0.3 g/m³ flare and 3 g/m³ gas engines
Dioxins	0.9 ng/m³ flared and 0.3 ng/m³ gas engines
SO2 (based on all sulphur)	104 mg/m³ of landfill gas

Landfill gas contains other pollutants beside methane. Based on research (Coops et al. 1995) the following micro-pollutants are emitted. Table 43 shows the amount of pollutants in a cubic meter of emitted landfill gas.

Table 43 Emission factors used for the free emission of landfill gas

Component	**Emission factor mg/m³**
Benzene	7
Toluene	120
Trichlorofluoromethane (R-11)	5
1,1,2-Trichloro-1,2,2-trifluoroethane (R-113)	1
1,2-Dichlorotetrafluoroethane (R-114)	2
Chloropentafluoroethane (R-115)	1
Dichlorodifluormethane (R-12)	20
Dichlorofluoromethane (R-21)	10
Chlorodifluoromethane (R-22)	10
1,2-Dichloroethene	1
Dichloromethane	20
Tetrachloroethylene (Perc)	10
1,1,1-Trichloroethane	2
Trichloroethylene (Tri)	10
Chloroform (Trichloromethane)	1
Vinyl chloride (Chloroethene)	10
Methanethiol (methyl mercaptan)	10
Hydrogen sulphide	100
Other hydrocarbons	700

Particulate matter is released during the processing of mineral waste. To calculate dust emissions (TSP, PM10 and PM2.5), the Netherlands uses the tier 3 formula from the Every two years member States must provide data on quantities of waste produced and processed to Eurostat in the context of Regulation 2150/2002/EC. The quantities of waste are reported on a dry matter basis. For dredging spoil, the quantity must be corrected by a factor of 0.5, because dredging spoil consists of approximately 50% water by mass.
The mineral waste stream includes the following categories from Regulation 2150/2002/EC.

Table 44 Waste categories for mineral waste according to regulation 2150/2002/EC

Waste category regulation 2150/2002/EC	**Name**
12.1	Construction and demolition wastes
12.5	Various mineral wastes
12.6	Soils
12.7	Dredging spoil
12.8 & 13.1	Waste from waste treatment and stabilized waste

The moisture content of the waste stream is a parameter that influences the amount of dust. The moisture content for other mineral waste (category 12.1, 12.5, 12.8 & 13.1 combined) is equal to the default value of 11 percent. For contaminated soil (12.6) and dredging spoil (12.7) the moisture content is 25 and 50 percent respectively. These percentages are expert judgments.

2.3.2.2.4 Activity data

The input for the model consists of the following datasets:
Landfill site operators systematically monitor the amount of waste dumped (weight and composition) for each waste site. Since 1993[7] monitoring takes place by weighing the amount of waste dumped, via weighing bridges (= legally imposed by environmental permits). Details on the historical data are provided below.

Amount of waste dumped 1945 – 1970
Between 1945 and 1970 a number of municipalities already held detailed records of the collection of waste. In addition information was available about which municipalities had their waste incinerated or composted. All other municipal waste was landfilled. Using this information in combination with data on landfilling of various sources (SVA, 1973, CBS 1988, CBS, 1989, Nagelhout, 1989) data for the years 1950, 1955, 1960, 1965 and 1970 determined and published (Van Amstel et al., 1993) while it was assumed that during the Second World War hardly any waste was landfilled. These data are also used in the FOD-model, while missing years (1945-1950, 1951-1954, 1956-1959, 1961-1964 and 1966-1969) are linearly extrapolated.

Amount of waste dumped 1970 - today
From 1970 on accurate data on production and waste treatment are available (Spakman et. al, 1997, electronic update, 2003). Landfill site operators systematically monitor the amount of waste dumped (weight and composition) for each waste site. Since 1993 monitoring has occurred by weighing the amount of waste dumped, via weighing bridges (= compulsory environmental permits).
Data concerning the amounts of waste dumped since 1991 are supplied by the Working Group for Waste Registration (WAR), included as part of the annual report 'Afvalverwerking in Nederland' (Waste processing in the Netherlands). Information concerning the way in which these data are

[7] The obligation to weigh incoming waste at the landfill site started when the Dumping Decree came into force in 1993.

gathered and the scope of the information used can be found in the annual publications 'Afvalverwerking in Nederland', available since 1991 from the WAR (Rijkswaterstaat, multiple years).

For historic years, data concerning amounts of extracted landfill gas were supplied (up to 1998) by the Adviescentrum Stortgas (Landfill Gas Advice Centre), which was an independent organisation from 1992-1997, when it was merged with the (former) VVAV. There are no data available concerning amounts of extracted landfill gas for the years 1999 and 2000. The amounts of extracted landfill gas for these years were estimated by the ENINA task force based on the figures from previous years.
When an operator does not fill in a questionnaire, the amount of extracted landfill gas is estimated using amount from previous years. The methane content of extracted landfill gas in this case is also estimated.

Rijkswaterstaat gathers information on the amounts and composition of a large number of waste flows, as part of its work to draw up the annual Netherlands Waste in Figures report (AgentschapNL, 2010). Information concerning these amounts of dumped waste is used. The results of several other research projects also help to determine the composition of the waste dumped. This method was used till 2004.
Since 2005 landfill operators are obliged to register their waste based on European Waste List (EWL) codes. The landfill operators use these EWL codes also for the survey of the WAR. The WAR has a complete overview of the waste that is land filled for every waste code. For each EWL code an amount of degradable carbon is determined (Cuperus et al., 2011). By combining the surveys from the individual landfill sites the total amount of waste land filled and the amount of degradable carbon can be calculated. The data from the WAR is based on questionnaires filled in by operators. When an operator does not fill in a questionnaire the amount processes will be based on data of Landelijk meldpunt afvalstoffen (LMA). The LMA tracks most of the waste transport in the Netherlands. An alternative is the use of historic data.

The quantities of processed mineral waste consist not only of material that is recycled or landfilled, but also of material that may be used directly without a processing step. The direct use of soil and dredging spoil is allowed, as long as the waste meets the requirements of the Dutch soil quality decree (besluit bodemkwaliteit).
The quantities of mineral waste have only been reported to Eurostat since 2010 according to the current classification. Data is not available before 2004 (dredging spoil) and 2010 (soil and other mineral waste). Data has been available since 1992 on the quantities of contaminated soil that have been treated at soil remediation facilities in the Netherland. The amount of soil that is treated in these facilities used, by means of indexation, to estimate the quantities of soil, dredging spoil and other mineral waste released in the period 1992-2009. For the years 1990 and 1991, the assumption has been made that the amounts are the same quantities as in 1992.
Because member states have to report once every two years, no figures on the amount of mineral waste processed are available yet on Eurostat for 2023. The assumption has therefore been made that the quantities of mineral waste for 2023 is the same as 2022. The quantities in odd

years are the average of the intervening even years. Table 45 provides a brief overview of the different activity dates and the estimates.

Table 45 Calculations of activity data mineral waste

Soil and other mineral waste		**Dredging spoil**	
Period	**Activity data**	**Period**	**Activity data**
1990-1991	Same values as 1992	1990-1991	Same values as 1992
1992-2009	Indexing based on processed quantities of soil (2010=100)	1992-2003	Indexing based on processed quantities of soil (2004 = 100)
2010-2022 even years	Reported to Eurostat	2004-2022 even years	Reported to Eurostat
2010-2022 odd years	Average of the intervening even years	2010-2022 odd years	Average of the intervening even years
2023	Same values as 2022	2023	Same values as 2022

The wind speed is measured annually by the Royal Netherlands Meteorological Institute (KNMI), the Dutch national weather service. To determine the average wind speed in the Netherlands, measurements from the measuring point at Cabauw (Utrecht province) are used, because this measuring point is centrally located in the Netherlands.

2.3.2.3 Composting (CRT 5.B.1)

Emissions from composting are calculated for the following emission sources:

E400313 Digesting of organic waste from households
E400314 Composting of organic waste from households
E400315 Digesting of organic horticultural waste
E400316 Composting of organic horticultural waste

Emissions from the use of compost are described in the methodology report for estimating emissions from agriculture in the Netherlands (2022).

2.3.2.3.1 Introduction

This section describes the monitoring of CH_4, N_2O, NH_3, NO_x and SO_2 emissions released from the processing of separately collected biodegradable waste (from households) into compost and/or biogas in the Netherlands (IPCC category: 5B). This concerns NACE code: 3821 Treatment of non-hazardous waste. Emissions released during processing (composting and/or fermentation) of other organic waste, mostly generated by food-processing companies, are not included in this paragraph.
All other composting of separately collected biodegradable waste is part of this section. This is waste with the specific European Waste List codes 02.01.03, 02.01.07 and 20.02.01. This is organic horticulture waste. This does not include installations that treat manure. Emissions from installations that treat manure are described in the methodology report for estimating emissions from agriculture in the Netherlands (2022).

During composting and fermentation, biodegradable waste is converted into compost and/or biogas. These processes are carried out in enclosed facilities (halls, tunnels and/or fermentation tanks), allowing waste gases to be filtered through a biobed before being emitted to the air. The material in the biobed is renewed periodically. Emission measurements are rarely performed at the biobed.

Until now there are no other specific measures known to reduce these emissions. The expansion of the composting/fermentation of biodegradable waste is the result of compulsory separate collection of biodegradable waste that started in 1994. Various local authorities are placing more emphasis on the separate collection of garden waste, and less on the fruit and vegetable fraction. This means that biodegradable waste will not only have a coarser structure, but also that the moisture content will be lower. At the same time more emphasis is placed on the collection of biodegradable waste from households living in tall buildings. Since these households do not have garden waste the biodegradable waste collected from these households will be wetter. These developments may affect emission factors, and thus also the emissions.

2.3.2.3.2 Calculation

In the Netherlands, the emissions released through composting and fermentation of biodegradable waste are calculated by multiplying the processed amount per component by an emission factor for composting or an emission factor for fermentation. Emission factors can differ between biodegradable waste and horticultre waste. The amounts are based on wet weight basis for the whole time series. Table 46 provides emission factors for the different treatment methods and the different waste streams.

Table 46 Emission factors by component, treatment method and waste component

Components	**Treatment method**	**Waste component**	**Emission factor (g/Mg)**
Methane (CH4)	Composting	Biodegradable waste	750
	Composting	Horticulture waste	850
	Fermentation	All	1,100
Nitrous oxide (N2O)	Composting	Biodegradable waste	96
	Composting	Horticulture waste	72
	Fermentation	All	46
Ammonia (NH3)	Composting	Biodegradable waste	200
	Composting	Horticulture waste	350
	Fermentation	All	2.3
Nitric oxide (NOx)	Fermentation	All	180
Sulpher dioxide (SO2)	Fermentation	All	10.7

Methane (CH_4)

$$CH_{4,comp} = EF_{CH4,comp} \times T_{composting}$$

$$CH_{4,ferm} = EF_{CH4,ferm} \times T_{fermentation}$$

Definitions:

$CH_{4,comp}$:	Total methane emissions from composting biodegradable waste (in gram per year)
$EFCH_{4,comp}$:	Emission factor for methane from composting 750 grams per ton composted waste for the whole time series 850 grams per ton composted organic horticulture waste for the whole time series
`$T_{composting}$:	Total amount of composted biodegradable waste (in ton per year)
$CH_{4,ferm}$:	Total methane emissions from fermenting biodegradable waste (in grams per year)
$EFCH_{4,ferm}$:	Emission factor for methane from fermentation 1,100 grams per ton biodegradable waste fermented
$T_{fermentation}$:	Total amount of fermented biodegradable waste (in tons per year).

Ammonia (NH_3)

$$NH_{3,comp} = EF_{NH3,comp} \times T_{composting}$$

$$NH_{3,ferm} = EF_{NH3,ferm} \times T_{fermentation}$$

Definitions:

$NH_{3,comp}$:	Total ammonia emissions from composting biodegradable waste (in grams per year)
$EFNH_{3,comp}$:	Emission factor for ammonia from composting 200 grams per ton of composted biodegradable waste 350 grams per ton of composted horticulture waste
$T_{composting}$:	Total amount of composted biodegradable waste (in tons per year)
$EFNH_{3,ferm}$:	Total ammonia emissions from fermenting biodegradable waste (in grams per year)
$EFNH_{3,ferm}$:	Emission factor for ammonia from fermentation = 2.3 grams per ton of fermented biodegradable waste
$T_{fermentation}$:	Total amount of fermented biodegradable waste (in tons per year).

Nitrous oxide (N_2O)

$$N_2O_{comp} = EF_{N2O,comp} \times T_{composting}$$

$$N_2O_{ferm} = EF_{N2O,ferm} \times T_{fermentation}$$

Definitions:

N_2O_{comp}:	Total nitrous oxide emissions from composting biodegradable waste (in grams per year)

$EFN_2O_{,comp}$:	Emission factor for nitrous oxide from composting 96 grams per ton of composted biodegradable waste 72 grams per ton composted organic horticulture waste for the whole time series
$T_{composting}$:	Total amount of composted biodegradable waste (in tons per year)
N_2O_{ferm}:	Total nitrous oxide emissions from fermentation of biodegradable waste (in grams per year)
$EFN_2O_{,ferm}$:	Emission factor for nitrous oxide from fermentation 46 grams per ton of fermented biodegradable waste
$T_{fermentation}$:	Total amount of fermented biodegradable waste (in tons per year).

Nitric oxide (NO_x)

$$NO_{x,ferm} = EF_{NOx,ferm} \times T_{fermentation}$$

Definitions:

$NO_{x,ferm}$:	Total nitrogen oxide emissions from fermenting biodegradable waste (in grams per year)
$EFNO_{x,ferm}$:	Emission factor for nitrogen oxide from fermentation180 grams per ton of fermented biodegradable waste
$T_{fermentation}$:	Total amount of fermented biodegradable waste (in tons per year).

Sulphur dioxide (SO_2)

$$SO_{2,ferm} = EF_{SO2,ferm} \times T_{fermentation}$$

Definitions:

$SO_{2,ferm}$:	Total sulphur dioxide emissions from fermenting biodegradable waste (in grams per year)
$EF_{SO2,ferm}$:	Emission factor for sulphur dioxide from fermentation 10.7 grams per ton fermented biodegradable waste
$T_{fermentation}$:	Total amount of fermented biodegradable waste (in tons per year).

The aforementioned methods are country-specific.

During the 1990s the Ministry of VROM (Housing, Spatial Planning and the Environment) organised a large-scale monitoring programme concerning the composting and fermenting of biodegradable waste. The results of this programme (emissions per processed amount of biodegradable waste) were incorporated into a report (DHV, 1999). This information was then reflected in the environmental effect report for the national waste management plan 2002-2012 (VROM, 2002) as the average emission factor (of all available sources) for the various components, for both composting and fermentation. These factors are determined based on the processing of one ton of biodegradable waste.

In 2010, DHV carried out an independent study into the emission factors (de Groot, 2012). The current EF is backed up by most of the

data considered relevant discussed in the 2010 study by DHV. DHV used studies of measurements that were carried out at German, Dutch and Austrian composting plants (de GrootDHV, 2012). The emission factor for methane from composting was subsequently modified.
The processed amounts of biodegradable waste in composting and fermentation plants (per year) are taken from the annual report by the Working Group on Waste Registration (WAR) (Rijkswaterstaat, multiple years). The data from the WAR is based on questionnaires filled in by operators. When an operator does not fill in a questionnaire the amount processes will be based on data of Landelijk meldpunt afvalstoffen (LMA). The LMA tracks all waste transport in the Netherlands. An alternative is the use of historic data.
The activity data for composting of organic horticulture waste are based on the amount of the specified waste that is notified to the LMA.

2.3.2.4 Sewer systems and water treatment (CRT 5.D.1,5.D.2,5.D.3)

2.3.2.4.1 Emission sources

See section 2.3.1.4.1 for a description of the various emission sources and codes and subdivisions used.

2.3.2.4.2 Emissions from the water line and sludge line of domestic WWTP (CRT 5.D.1)

N_2O emission calculation method

The nitrification and denitrification of nitrogen compounds during the treatment process produce nitrate, nitrite and nitrogen gas, as well as small quantities of N_2O. Since NIR2024 N_2O emissions from **domestic wastewater handling (5D1**) are calculated with an emission factor taken from Haas & Andrews (2022). This EF builds upon the EF provided by the 2019 Refinement to the IPCC 2006 Guidelines (IPCC, 2019) but uses reviewed and more up to date measurements. The tier 2 method now uses a country-specific emission factor of 0.011 kg N_2O -N/kg N and country-specific activity data on the total influent loads of nitrogen at all domestic WWTP's in the Netherlands. The following formula is used:

$$N_2O\ Plants_{DOM} = EF * TN_{DOM} * 44/28$$

In which:

TN_{DOM} = total Nitrogen load in domestic wastewater to centralized WWT in inventory year, Kg N/yr.

EF = emission factor = 0.011 kg N_2O -N/kg N (Haas, de & Andrews, 2022).

44/28 = factor for conversion of kg N_2O-N into kg N_2O.

The activity data derive from the waste water statistics (see Statline - Nitrogen load in influents) and are based on frequent monitoring of the incoming wastewater at all domestic WWTPs.

The influent data on total-nitrogen includes the loads from households, from industrial and commercial activities as well as loads from urban run-off into the sewerage system. The loads of Nitrogen thus not have to be calculated on basis of equation 6.10 of the 2019 Refinement document. The total nitrogen load in the influent can replace all the terms in the right part of this equation.

CH_4 emission calculation method
In the treatment process small quantities of methane are emitted, both in parts of the process in the so-called water line (a) and in parts of the sludge processing line (b). These two sources are calculated separately.

a) *Methane emissions from the water line of domestic waste water treatment processes*
These emissions are calculated using a tier 2 method with the default emission factor and country-specific activity data. The default emission factor for centralized aerobic treatment is 0.0075 kg CH_4/kg COD and is now based on the B_0 and MCF from the 2019 Refinement to the 2006 IPCC Guidelines (IPCC, 2019).

The emission factor is calculated as:
$EF = B_o * MCF = 0.0075$ kg CH_4/kg COD

Definitions:
B_o = default methane producing capacity for domestic wastewater
= 0.25 kg CH_4/kg COD converted (IPCC, 2019; Volume 5, table 6.2);
MCF = default methane correction factor for advanced aerobic treatment plants = 0.03 (IPCC, 2019; Volume 5, table 6.3);

Using this emission factor, the emissions can be calculated with the formula

$CH_4 = EF * (TOW-S) = 0.0075 * (TOW-S)$
In which:
TOW = Total organics in waste water influent, kg COD per year;
S = Total organics in sludge produced, kg COD per year.

Country specific activity data on the influent-COD as well as the amounts of sludge produced on all public WWTPs are derived from the yearly survey conducted by Statistics Netherlands among the Water boards. Data are available for the years 1990 up till now for every single treatment plant. Due to a reevaluation of the statistical programme, data on sludge produced (S) from 2017 on is only inventoried for the even years. For odd years (starting 2017) the data of the previous year is used as best estimate.

The COD of sludge is calculated using the conversion factor of 1.4 kg COD per kg organic solids (STOWA, 2014). Organic solids are calculated from total dry solids minus the inorganic fraction, measured as ash content. Both total dry solids as well as ash content are derived from the statistical survey by Statistics Netherlands.

Table 46a provides the time series of TOW-S.

Table 46a Time series of TOW-S for calculation of methane emissions from the domestic WWTP

year	TOW-S (1,000 kg COD)	year	TOW-S (1,000 kg COD)
1990	569,344	2007	471,137
1991	561,721	2008	467,108
1992	580,125	2009	458,459
1993	579,010	2010	477,585
1994	572,732	2011	478,370
1995	500,309	2012	481,074
1996	498,352	2013	441,192
1997	493,291	2014	473,989
1998	512,426	2015	495,401
1999	490,432	2016	501,366
2000	489,729	2017	501,123
2001	495,024	2018	501,633
2002	475,285	2019	526,959
2003	473,511	2020	523,325
2004	481,481	2021	510,163
2005	480,791	2022	486,986
2006	449,363	2023	474,721

b) *Emissions of CH_4 from sludge digesters*
These emissions are calculated using the default tier 1 method from the 2019 Refinement (IPCC, 2019) and is based on an EF per kg dry solids of ingoing sludge of the digesters, being 0.002 kg CH_4/kg ingoing dry solids. The IPCC 2019 refinement refers to chapter 4 of Volume 5 of the IPCC 2006 GL. The emissions are calculated per WWTP with sludge digestion facilities. In 2022, 66 urban WWTPs (UWWTPs) were equipped with sludge digesters.

The emissions are calculated per plant according:

$$CH_4\ (kg) = EF * M_{sludge}$$

In which:
EF = Emission factor for anaerobic sludge digestion = 0.002 kg CH_4/kg ingoing dry solids (IPCC, 2006, volume 5 table 4.1)
M_{sludge} = Mass of sludge dry solids digested, kg/yr.

Default activity data on the ingoing dry solids amount at public WWTPs with sludge digesters are derived from the yearly survey conducted by the CBS among the Water Boards. In case this value was not available for a plant in a certain year, then the amount of ingoing dry solids was estimated using the average m^3 biogas production per ingoing dry solids and the total biogas production. Table 47 provides the activity data for the calculation of the methane emissions of Sludge digesting systems for the whole time series.

Table 47 Activity data for calculation of methane emissions from sludge digestion at domestic WWTP

Year	wwtp plants with sludge digestion (number)	M_{sludge} (1,000 kg dry solids)	Year	wwtp plants with sludge digestion (number)	M_{sludge} (1,000 kg dry solids)
1990	127	246,279	2007	92	308,441
1991	127	277,623	2008	83	330,221
1992	113	247,937	2009	84	323,150
1993	119	271,206	2010	82	326,514
1994	112	274,345	2011	82	330,799
1995	110	289,572	2012	81	338,192
1996	108	274,202	2013	81	363,177
1997	107	287,300	2014	80	366,360
1998	102	269,658	2015	79	350,849
1999	103	280,510	2016	77	376,738
2000	98	285,055	2017	73	383,231
2001	97	312,827	2018	72	368,984
2002	97	321,432	2019	72	408,778
2003	96	307,300	2020	72	399,830
2004	95	309,692	2021	67	408,337
2005	95	295,343	2022	66	404,711
2006	96	302,400	2023	65	398,360

2.3.2.4.3 Methane emissions from biogas discharge (venting) (CRT 5.D.1)
For this emission source the calculation of the final emissions is the same as for the preliminary emissions. Final methane emissions for each WWTP are calculated as follows:
*CH_4 Emission = Biogas discharge * 0.440 (kg)*

In which:
Biogas discharge = Volume of vented biogas (m^3)
0.440 = methane content of biogas (kg/m^3) (STOWA, 2014)

The data for each WWTP derive from a combined questionnaire, carried out by Statistics Netherlands and the Union of Water Boards.

2.3.2.4.4 Methane emissions from septic tanks (CRT 5.D.3)
A small percentage of Dutch dwellings is not connected to the sewer system. This percentage is still shrinking. Dwellings that are not connected to the sewer system are obliged to use an individual sewage treatment system (ISTS). A commonly used type of ISTS is the septic tank (or modernised derivatives). Because there is little information about the varieties of ISTS in use and their number, the calculation of IPCC emissions is based on the assumption that all non-connected households use septic tanks.

Conversion processes occurring in septic tanks produce small quantities of methane. The total volume of these emissions depends on the

percentage of the population using a septic tank. Using expert consultation and a number of sources (Rioned (2001), Rioned (2009), Rijkswaterstaat (2013), Rioned (2016) and WHO(2022)), has resulted in a time series for this percentage. Combining this with the population statistics from Statistics Netherlands (CBS), results in the number of citizens using septic tanks per year. By way of illustration, Table 48 shows a time series of the number of residents using septic tanks.

Table 48 Time series of the number of citizens using septic tanks

	1990	**2000**	**2010**	**2015**	**2020**	**2023**
Average resident population (x1,000)	14,952	15,926	16,615	16,940	17,442	17,877
% of population connected to septic tanks	4.00	1.90	0.62	0.57	0.45	0.35
Number of residents using septic tanks	598060	302585	103015	96558	78487	62570

CH_4 emission method

Emissions of methane from septic tanks are calculated using IPCC default values for maximum methane producing capacity ($B_{o)}$ and Methane Correction Factor (MCF) and country-specific value for Total Organics in Wastewater (TOW) of 60 g BOD per connected person per day (IPCC, 2006, table 6.4). The emission factor is calculated as:

$EF_{st} = B_o * MCF_{st} = 0.3$ kg CH_4/kg BOD

In which:
B_o = maximum CH_4 producing capacity
= 0.6 kg CH_4/kg BOD (IPCC, 2006);
MCF_{st} = methane correction factor for septic tanks
= 0.5 (-) (IPCC, 2006)
Total organics in waste water (TOW) are calculated as BOD, using the following formula (IPCC, 2006):

$TOW = Pst * BOD * 0.001 * 365$

In which:
P_{st} = Population connected to septic tanks in inventory year, number
BOD = per capita BOD in wastewater = 60 g/person/day (IPCC, 2006)
0.001 = conversion from grams BOD to kg BOD
365 = number of days per year

Combining the two formulas, the resulting calculation formula for CH_4 emissions from septic tanks is:

$CH_4, st = EFst * TOW = 6.57$ kg $CH_4 * Pst$

2.3.2.4.5 Methane emissions from anaerobic industrial waste water treatment plants (CRT 5.D.2)

The methane emissions due to leakage from anaerobic industrial waste water treatment are calculated using the IPCC default emission factor and Country Specific value for the Total Organics in Wastewater (TOW) and Methane Recovery (MR)

For anaerobic IWWTPs, the CH_4 emission factor is calculated as:

*EF = Bo * MCF = 0.2 kg CH_4/kg COD*

In which:
B_o = maximum CH_4 producing capacity = 0.25 kg CH_4/kg COD (IPCC, 2006)
MCF = methane correction factor (fraction) = 0.8 for anaerobic reactors (IPCC, 2006)

In the Netherlands no information is available on the actual load of TOW (as COD) that is treated in the IWWTPs. The COD load is thus determined by using statistics on the design capacity of the Industrial wastewater treatment plants and an assumed average loading rate of 80% of the design capacity (Oonk, 2004). The design capacity is expressed in a standardised value for quantifying organic pollution in industrial wastewater: the Pollution Equivalents (P.E.). One P.E. equals an amount of 40 kg COD per year. Data on the design capacity are available from Statistics Netherlands . TOW thus can be calculated as:

*TOW = P.E. * 40 kg COD/yr * 0.8 = P.E. * 32*

In which:
TOW = Total Organics in Wastewater influent, expressed as COD (kg)
P.E. = Total design capacity of Industrial waste water treatment, in Pollution Equivalents (-), with 1 P.E. equals 40 kg COD/yr
0.8 = average loading rate (fraction of design capacity) (Oonk, 2004)
There is no correction for sludge removal because anaerobic reactors produce very little or no excess sludge. So the method includes emissions from the simultaneous digestion of surplus sludge in the anaerobic reactors.
The total methane emission is calculated by assuming a methane recovery (MR) of 99% from the anaerobic reactors and thus a loss or leakage of 1%:

*CH_4 emission = EF * TOW * (1-MRind) = 0.2 * 32 * P.E. * 0.01 = 0.64 * P.E.*

In which:
MR_{ind} = Fraction of methane recovered from the treatment process = 0.99 (Oonk, 2004)

To ensure emissions are correctly allocated to activities in the PRTR-sytem, they are calculated for four separate industrial categories, whereas in the CRTT and NIR they are all listed under CRT category 5.D.2.

Activity data
For 1990-2016 the activity data were derived from the results of a yearly survey among companies with an Industrial Wastewater Treatment Plant, conducted by Statistics Netherlands. Due to budget cuts, this survey is no longer existing.

For 2017-2023 the list of treatment plants is updated on basis of a dedicated survey, embedded in the Annual Envrironmental Reporting (AER) system.
Table 48a provides the whole time-series of numer and capacity of the anaerobic IWWTP's

Table 48a Number of anaerobic IWWTPs and capacity (Pollution Equivalents)

Year	Anaerobic IWWTP (number)	Capacity (P.E.)	Year	Anaerobic IWWTP (number)	Capacity (P.E.)
1990	44	4512600	2007	47	5787900
1991	47	4912600	2008	46	5811900
1992	49	5377600	2009	50	5993500
1993	53	5748100	2010	51	6038500
1994	54	5550100	2011	51	5952000
1995	54	5823500	2012	53	6125000
1996	55	5906900	2013	52	5875000
1997	56	5961200	2014	52	5822000
1998	56	5982200	2015	53	5937000
1999	58	6146200	2016	56	6111658
2000	55	6092900	2017	54	5891658
2001	56	6182900	2018	53	6444238
2002	56	6432900	2019	44	6077838
2003	54	6403900	2020	44	6077838
2004	54	6323900	2021	43	5640838
2005	50	6523900	2022	43	5640838
2006	47	5947900	2023	46	5657295

Numerical estimate of the recovered CH4 in anaerobic industrial wastewater treatment plants
In response to a review question it is investigated whether data on biogas production from industrial anaerobic wastewater treatment plants can be derived or estimated from information becoming available via the individual Annual Emission (ePRTR) Reports. In the 2025 NIR this is elaborated on for the years 2019-2023 only (see also table 7.10 of the NIR 2024).

The total amount of IWWTP biogas recovered in 2023 equals 60.6 million m^3, but this only includes data from 32 of the 46 anaerobic IWWTPs, equal to 88% of total TOW treated. For the remaining 14 plants, no data are available. This data is based on the amount of TOW and the missing volume can be estimated at an additional 8.4 million m^3. Total recovery can then be estimated at 69.0 million m^3 biogas.

There is no specific information available on the methane content of biogas from anaerobic industrial wastewater treatment plants. If the average value for biogas from domestic wastewater sludge digestion

(0.44 kg CH_4/m^3 biogas) is used, a total recovery of 30.4 Gg CH_4 can be calculated for 2023. Applying a loss by leakage of 1% of total CH_4 recovered, this results in an emission of 0.304 Gg CH_4. This figure can be compared with the current CS method resulting in an emission of 0.362 Gg CH_4 (19% higher). Given the uncertain factors of both methods, this difference is acceptable.

2.3.2.4.6 Nitrous oxide emissions from aerobic industrial wastewater treatment plants (CFR 5.D.2)

For the calculation of N_2O emissions from aerobic industrial wastewater treatment, a tier 2 method is used based on a country-specific emission factor of 0.011 kg N_2O-N/kg N (see also 2.3.2.4.2) and country-specific activity data on the total influent loads of nitrogen at all industrial aerobic WWTPs in the Netherlands.

Calculation method:

The method stems from the 2019 refinement to the IPCC 2006 GL (IPCC, 2019). The calculation formula (IPCC, 2019, Volume 5, equation 6.11) is:

$$N_2O\ Plants_{IND} = EF * TN_{IND} * 44/28$$

Definitions:

TN_{IND} = total nitrogen load in industrial wastewater to aerobic industrial WWT in inventory year, kg N/yr.

EF = emission factor = 0.011 kg N_2O -N/kg N (Haas, de & Andrews, 2022).

44/28 = factor for conversion of kg N_2O-N into kg N_2O.

Activity data

The activity data stem from a time-series of aerobic industrial wastewater plants derived from statistics on industrial wastewater sludges (see Statline), as well as data of total nitrogen discharged from the Dutch PRTR database in combination with discharge data from Deltares. For most of the IWWTPs an effluent load could be coupled. For the remaining installations, the effluent load was estimated based on the size of the plant and derived estimators like total nitrogen discharged per population equivalent design capacity. Subsequently, influent Nitrogen loads were estimated using the default removal rate of 0.40 for secondary treatment, as provided by table 6.10.c in Volume 5 of the 2019 Refinement document (IPCC,2019).

Table 49 provides the time-series of total Nitrogen in industrial influent of aerobic IWWTPs. In the 2025 submission the data of 2017-2022 were revised and updated based on the results of an embedded survey of the Annual Environmental Reporting System. This new data gave also more insight in the data of years earlier then 2016. In the 2026 submission this data will be slightly adjusted. One can conclude there is a small breach in 2016 but this will disappear next year.

Table 49 Number of aerobic IWWTPs and total nitrogen load in the influent.

Year	Aerobic IWWTPs (number)	Nitrogen in influent (1,000 kg)	Year	Aerobic IWWTPs (number)	Nitrogen in influent (1,000 kg)
1990	226	7,417	2007	172	6,777
1991	228	7,468	2008	173	6,927
1992	233	7,548	2009	174	6,571
1993	226	7,629	2010	161	5,464
1994	228	7,676	2011	160	6,222
1995	231	7,813	2012	156	5,857
1996	236	7,755	2013	157	6,081
1997	229	7,741	2014	153	6,353
1998	232	7,762	2015	156	6,606
1999	228	7,708	2016	147	7,898
2000	229	7,262	2017	147	7,866
2001	218	7,377	2018	147	8,251
2002	194	6,007	2019	149	8,268
2003	195	5,905	2020	148	8,016
2004	192	5,875	2021	145	7,880
2005	184	5,523	2022	148	8,041
2006	174	5,127	2023	147	8,833

Source: Statline, Emissieregistratie.nl and REVIEW database Deltares

2.3.2.4.7 Indirect nitrous oxide emissions from nitrogen discharges (CRT 5.D.3)
For the calculation of indirect (or better: 'delayed') N_2O emissions from wastewater discharges, the Netherlands uses the default EF of 0.005 kg N_2O-N/kg N discharged (IPCC, 2019) and country-specific activity data on $N_{Effluent}$.

Calculation method
Emission factor, EF = 0.005 (kg N_2O-N / kg N), i.e. 0.5% of the nitrogen discharged is converted to N_2O-N (IPCC, 2019, Volume 5, table 6.8a).

The emissions are calculated as follows:

$N_2O_{effluent} = N_{effluent} * EF * 44/28$

$N_2O_{effluent}$ = indirect nitrous oxide emissions from discharging N to surface water (in kg yr^{-1})
$N_{effluent}$ = the sum of the nitrogen present in effluent from waste water treatment plants, industry and consumers
44/28 = conversion from N_2O-N to N_2O

Activity data
The Netherlands uses activity data derived from several sources, including statistical surveys, environmental reporting and models, often based on actual measured loads.

The discharge data are compiled via a number of methods. All methods are documented in factsheets and can be found on the website of the

Emission Registration. Table 49a provides the times-series of discharged eflluents.

Table 49a Activity data for calculation of indirect nitrous oxide emissions from surface waters as a result of nitrogen discharges.

Year	Nitrogen in domestic effluents (1,000 kg)	Nitrogen in industrial effluents (1,000 kg)	Total Nitrogen in effluents (1,000 kg)
1990	39,292	24,500	63,792
1991	41,488	19,761	61,249
1992	40,242	18,465	58,707
1993	39,358	16,806	56,164
1994	40,086	13,535	53,621
1995	36,248	14,830	51,078
1996	34,982	13,571	48,553
1997	32,799	13,228	46,027
1998	34,468	9,033	43,501
1999	31,710	9,266	40,976
2000	28,952	9,498	38,450
2001	29,718	6,990	36,708
2002	27,746	7,221	34,967
2003	23,626	9,599	33,225
2004	23,475	8,009	31,484
2005	21,742	8,000	29,742
2006	19,057	9,162	28,219
2007	17,849	8,847	26,696
2008	16,820	8,353	25,173
2009	15,174	8,476	23,650
2010	16,586	5,541	22,127
2011	15,250	6,204	21,454
2012	15,266	5,515	20,781
2013	14,639	5,437	20,076
2014	14,101	6,638	20,739
2015	14,641	6,707	21,348
2016	14,401	7,257	21,658
2017	14,877	7,233	22,110
2018	14,006	6,966	20,972
2019	14,391	7,279	21,670
2020	14,320	6,961	21,281
2021	14,379	6,906	21,285
2022	12,960	6,942	19,902

Year	Nitrogen in domestic effluents (1,000 kg)	Nitrogen in industrial effluents (1,000 kg)	Total Nitrogen in effluents (1,000 kg)
2023	12,960	6,942	19,902

As actual data are not yet available at the moment of calculation, the data for the last year (in this case 2023) are always a copy of the previous year (in this case 2022).

Rationale for country specific AD and not using the "Note" in the Box 6.1 in 2006 IPCC GL.
For calculating indirect (or better: 'delayed') N_2O emissions from wastewater discharges, The Netherlands uses country specific activity data on $N_{effluent}$ instead of using equation 6.10 in volume 5 of IPCC (2019). As a consequence of using these data, the Netherlands does not take into account the Equation 6.8 in Volume 5 of IPCC (2019). The discharges of N already represent 'end of pipe' values, so they do not need to be adjusted for degree of utilisation and removal rate in advanced centralized waste water treatment.

2.3.2.4.8 Indirect methane emissions from COD discharges (CRT 5.D.3)
Indirect (or better 'delayed') methane emissions from surface water as a result of discharge of domestic and industrial effluents are calculated using the Tier 1 default emission factor of 0.028 kg CH_4/kg COD discharged as provided in volume 5, table 6.3 of the 2019 Refinement (IPCC, 2019) and country specific activity data on COD discharged.

Calculation method
The emission factor is calculated as:
$EF = B_o * MCF = 0.028$ kg CH_4/kg COD discharged

In which:
B_o = default methane producing capacity for domestic wastewater = 0.25 kg CH_4/kg COD converted (IPCC, 2019; Volume 5, table 6.2);
MCF = default methane correction factor for discharge to aquatic environments = 0.11 (IPCC, 2019; Volume 5, table 6.3);

Using this emission factor, the emissions can be calculated with the following formula:

$CH_4 = EF * TOW = 0.028 * TOW$

In which:
TOW = Total organics in discharged waste water effluents, kg COD/yr

Activity data
The country-specific activity data on kg COD discharged per year via industrial and domestic effluents are derived from the wastewater statistics (see Statline) and from the Netherlands' PRTR database. These COD loads to surface water are based on frequent monitoring of all domestic WWTPs and of all industrial discharges.

For industrial discharges, data on 1991-1994 and 1996 and 1997 turned out to be very poor or not available so it has been chosen to estimate the missing years by linear interpolation between 1990 and 1995 and 1995 and 1998 respectively. Table 50 provides the time-series of the discharge of COD via domestic and industrial effluents.

Table 50 Activity data for calculation of indirect methane emissions from surface waters as a result of COD discharges.

Year	COD domestic effluents (1,000 kg)	COD Industrial effluents (1,000 kg)	Total COD effluents (1,000 kg)
1990	131,495	46,805	178,300
1991	128,225	43,450	171,675
1992	124,509	40,095	164,604
1993	123,412	36,740	160,152
1994	122,013	33,385	155,397
1995	100,486	30,030	130,516
1996	95,570	31,812	127,382
1997	89,083	33,595	122,678
1998	103,215	35,378	138,592
1999	98,331	23,458	121,789
2000	91,033	21,060	112,093
2001	94,346	27,737	122,083
2002	90,364	20,744	111,108
2003	78,025	25,796	103,821
2004	80,849	26,100	106,948
2005	77,895	21,627	99,521
2006	77,268	18,743	96,011
2007	79,026	14,727	93,753
2008	75,321	13,911	89,232
2009	71,108	12,235	83,344
2010	75,461	12,297	87,758
2011	73,447	12,132	85,578
2012	70,805	11,508	82,313
2013	68,429	10,724	79,153
2014	67,013	9,294	76,307
2015	69,784	9,457	79,242
2016	67,570	10,463	78,033
2017	71,550	10,114	81,664
2018	69,057	13,263	82,320
2019	73,296	11,370	84,665
2020	72,302	11,226	83,528
2021	72,524	11,662	84,186
2022	67,228	11,884	79,113
2023	76,385	11,884	88,269

Source: Statline, Emissieregistratie.nl and REVIEW database Deltares

For industrial emisions, the latest year (in this case 2023) is always a copy of the previous year because actual data are not yet available.

2.3.2.4.9 Emission not calculated within category 5D
The following emissions are not calculated:

Direct N_2O emissions from septic tanks (5D3, septic tanks)
Direct emissions of N_2O from septic tanks are not calculated since they are unlikely to occur, given the anaerobic circumstances in these tanks. Indirect N_2O emissions from septic tank effluents are included (IE) in CRT category 5D3 'Indirect N_2O emission from surface water as a result of discharge of domestic and industrial effluents'.

CH_4 emissions from industrial sludge treatment (5D2)
Data from the survey among IWWTPs conducted by Statistics Netherlands shows that only 2 out of a total of 160 IWWTPs are equipped with anaerobic sludge digestion reactors. This data is not published on www.cbs.statline.nl for reasons of confidentiality. Via a rough estimate, it was calculated that the methane emissions from this source amounts approximately 6.2 kg CH_4 per year, equaling 0.0009% of national methane emissions in 2016. Forthcoming CH_4 emissions are therefore reported as NE for 1990-2021.

2.3.2.5 Mechanical Biological treatment and sewage sludge incineration
MBT
Mechanical Biological Treatment (MBT) of waste occurs in the Netherlands by a few installations. In these installations waste is separated. The separated waste streams are treated in different manners:

- Recycling, this occurs in other installations and gives no emissions within the MBT;
- as fuel, this occurs in other installations and gives no emissions within the MBT;
- flammable residues are treated in waste incineration plants. This is taken into account within the work package WIPs;
- dumping of waste. This is taken into account in the work package of landfill sites;
- Digestion of organic wet fraction (ONF), further explained hereafter.

Composting of residues does not occur.

Digestion of ONF
In IPCC 2006, V5, CH_4, by Anaerobic digestion of organic waste is stated that "where technical standards for biogas plants…CH_4 emissions are likely close to zero. N_2O emissions from the process are assumed to be negligible…". Thus no emissions are given for digestion of ONF.

In IPCC 2006, V5, CH_4.1.1 it is stated that "Emissions during mechanical operations can be assumed negligible." Thus no emissions are stated for the mechanical operations.

Emissions of combustion of the recovered biogas are reported in the energy sector.

There are no emissions to be reported by MBT in the Netherlands. This is noted as NO.

2.3.2.5.1 Sewage sludge incineration

There are installations that incinerate sewage sludge. These installations produce energy. Thus these installations are part of the energy sector.

2.4 Emissions from oil and gas extraction, transport and distribution (CRT 1A1c, 1A3ei gaseous and 1B)

The emissions from oil and gas extraction, oil and gas transport, and gas distribution consists of the ten Emission Sources (ESs) listed in Table 51.

Oil and gas extraction

Since 1999 the Dutch oil and gas extraction companies publish annual environmental reports (AERs). This means that, from 2002 onwards, the following emissions sources have been reported separately, for both onshore and offshore applications:

- Captive consumption, for gas production (including energy generation);
- Captive consumption for oil production (including energy generation);
- Venting gas production;
- Flaring gas production;
- Venting oil production;
- Flaring oil production;
- Drilling activities.

Background information about emission estimation methods can be found in NOGEPA (2009); NOGEPA (2018) and NOGEPA (2021).

Gas transport

Gasunie Transport Services BV (a subsidiary of NV Nederlandse Gasunie) is responsible for the transport of natural gas in the Netherlands. The Gasunie has an extensive gas transport network that consists of underground pipelines totalling around 11,000 km. Ten mixing stations supply the gas to various groups of customers at the required quality. Ten compressor stations provide the necessary pressure for transporting the natural gas to the end-users. Measurement and control stations at 92 locations throughout the national gas transport network ensure the transfer of natural gas from the main network to regional networks, which have a lower transport pressure. The gas is eventually supplied to the (industrial) end-users and to the distribution network and countries via around 971 gas distribution points and 14 export stations. Also the Zuidbroek nitrogen plant and the Eems Energy Terminal, a LNG terminal in Eemshaven came into use in 2022. Compressors driven by gas turbines and reciprocating gas engines enable pressurised gas transport. These turbines and engines produce combustion emissions, including CO_2 and CH_4. Fugitive emissions of CH_4 and a small amount of CO_2 emissions are released from leakages of equipment as flanges, connections and valves and during maintenance activities.

Oil transport
Crude oil is transported through the Netherlands territory via underground pipelines to Belgium and Germany.

Gas distribution
The gas distribution system ensures that natural gas is distributed at low, medium and high pressures. The system consists of main underground pipelines and connections, plus a number of above-ground gas pressure measurement and control installations, which all function as a single system. Within this main system, there are also various local gas distribution systems that distribute the gas to the end-users. These low-pressure networks include gas distribution systems with a working pressure of 30-100 mbar. The medium-pressure networks operate at 1-4 bar, and the high-pressure gas distribution networks operated at a working pressure of 8 bar. The main pipelines are made of the following types of materials: polythene (PE), hard PVC, impact-resistant PVC, steel, grey cast iron, nodular cast iron, asbestos cement, or other unknown materials.
CH_4 (and a small amount of CO_2) emissions evade during leakages and accidents with the distribution network (main pipelines and connections to the home) and/or through activities at the distribution stations. A relative high amount of emissions are caused by the grey-cast-iron network (Gastec, 2004, Hendriks and De Jager, 2001). During the 1970s and 1980s the largest leaks were repaired in the old grey-cast-iron pipelines when was switched from (wet) town gas to (dry) natural gas. Many leaking lead-based connections were replaced or permanently sealed. Urban areas in particular still have old cast iron pipes. These have gradually been replaced over time, and therefore currently make up a smaller percentage of the total distribution network; from 10% in 1990 to 1% in 2022 (KIWA,2023).

The next part of this section describes the calculation method for each emission source.

Table 51 Emission sources in the sector NACE 06-09 Oil/gas extraction & oil and gas transport and distribution

CRT	ES CODE	EMISSION SOURCE
1.A.1.c	0020400	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, onshore
1.A.1.c	0020502	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, drilling activities
1.A.1.c	8120001	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, offshore
1.A.3.ei gaseous (combustion CO2 and N2O),1.B.2.b.iv (other emissions)	6800100	Gas transport
1.B.2.a.iii	8120503	NACE 495: Transport of oil via pipelines
1.B.2.b.v	0800200	Gas distribution
1.B.2.c.i3 Venting (Combined)	8120002	NACE 06: Extraction of crude oil and natural gas, venting, offshore

CRT	ES CODE	EMISSION SOURCE
1.B.2.c.i.3 Venting (Combined)	8120502	NACE 06: Extraction of crude oil and natural gas, venting, onshore
1.B.2.c.ii.3 Flaring (Combined)	8120000	NACE 06: Extraction of crude oil and natural gas, flaring, offshore
1.B2.c.ii.3 Flaring (Combined)	8120500	NACE 06: Extraction of crude oil and natural gas, flaring, onshore

2.4.1 Calculation method of preliminary emission figures

2.4.1.1 Oil and Gas extraction (CRT 1.A.1.c, 1.B.2.c.i.3, 1.B.2.c.ii.3)
The calculation of preliminary emissions is done the same way as the calculation of the final emissions. See the description in section 2.4.2. If the eAERs have not all been accepted by the competent authorities the preliminary data are equated with the final data of the previous year, for both the emissions and the activity data.

2.4.1.2 Oil and Gas transport (CRT 1.A.3.ei gaseous, 1.B.2.b.iv
The preliminary emissions are calculated by multiplying the emission data of the previous year with the ratio Transported amount of natural gas reporting year / Transported amount of natural gas previous year, as published by Gasunie in their annual report.

2.4.1.3 Gas distribution (CRT 1.B.2.B.v)
The calculation of preliminary emissions is done the same way as the calculation of the final emissions. See the description in section 2.4.2. In the event that the delivery of data is delayed and the report 'Methaanemissie door Gasdistributie' was not available for establishing the preliminary data, these data can be established by multiplying the final data of the previous year by the ratio Domestic natural gas consumption reporting year / Domestic natural gas consumption previous year as published by Statistics Netherlands (CBS) on Statline.

2.4.2 Calculation method of final emission figures

2.4.2.1 Oil and Gas extraction (CRT 1.A.1.c, 1.B.2.c.i.3, 1.B.2.c.ii.3)
The various companies calculate emissions for each of their plants, using company-specific emission factors and (measured) volumes. These company-specific emission factors are determined according to the (crude) gas composition. The (measured) volumes are the amounts of crude gas consumed, vented and flared. The method used by the companies complies with the Tier-3 method, as described in the 2006 IPCC Guidelines (Volume 2, Chapter 4, p.4.46). Each company totals its emission figures from all plants and these figures are included in the Annual Environmental Reports (eAERs).

For the period 1990-2001 the total emissions, excluding drilling activities, were taken from the annual reports by the oil and gas extraction companies as drawn up by Fugro-Ecodata. The differentiation into captive consumption, venting and flaring for the years 1990-2001 (inclusive) was carried out using the Natural Gas Balances for the Oil and Gas Production Industry from Statistics Netherlands, plus the Venting (including removed CO_2) and flaring data (1990-2003) published by operators NAM and GDF.

Regarding review questions to increase the transparency and possibilities to disaggregate data it is explained that the oil- and gascompanies not consistently provided the AD and GHG emissions disaggregated by activity. The data are provided under a covenant, a voluntary agreement since these companies are not obliged monitoring their data under the current European Pollutant Release and Transfer Register (E-PRTR). When the Industrial Emissions Portal Regulation (IEPR) replaces the E-PRTR it is expected that more detailed reporting data will become available. Until these data become available no actions are planned to disaggregate the data.

The calculation methods for each emission source are described below.

Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, drilling activities (ES_CODE 0020502 NACE 06/09.1)

Emission estimates of CO_2 and CH_4

Because of their low volumes the emissions of drilling activities are not split up into onshore and offshore but reported in the eAERs as a sum. For all substances this is equal to the sum of the emissions from drilling activities reported in the AERs of the extraction companies. The total CO_2 and CH_4 emissions are included in the database as combustion emissions.

Activity data

For In the CRT the volume of natural gas (TJ) used as fuel ; this value is established by dividing CO_2 emissions by 56.8. The CO_2 emissions are established by adding up the total reported CO_2 emissions from drilling activities of the individual extraction companies as reported in the eAERs.

Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, onshore (ES_CODE 0020400 SBI 06/09.1)

Emission estimates of the CO_2, N_2O, CH_4

- CO_2: Sum of the emissions reported under 'Production' and 'Energy Generation' from the individual eAERs of the extraction companies. The choice to add up these emission was made because the division between Production and Energy Production emissions has not yet been implemented consistently; the competent authority is actively pursuing improvement in this respect.
- CH_4: Volume of natural gas used by the extraction companies * EF CH_4 natural gas: country specific value of 5.7 g CH_4/GJ
- N_2O: Sum of all N_2O emissions from the individual eAERs.

The total CO_2, N_2O and CH_4 emissions are all included in the database as combustion emissions.

Activity data

Volume of natural gas (TJ) used as fuel.

As the monitoring of the total volume of natural gas by the Netherlands Enterprise Agency (RVO) has been discontinued since 2021, the activity data are taken from Netherlands Statistics for the whole time frame as

from the 2022 submisson (CBS, 2021). The total volume of natural gas used as fuel is divided to onshore and offshore according to the onshore and offshore CO_2 emissions.

Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, offshore. (ES_CODE 8120001 SBI 06/09.1)
The emissions and activity data are established in the same way as for "onshore extraction".

Extraction of crude oil and natural gas, flaring, offshore (ES_CODE 8120000 SBI 06)
Emission estimates of CO_2 en CH_4
The sum of all flaring emissions from the individual eAERs of the extraction companies. The total CO_2 and CH_4 emissions are both included in the database as process emissions.

Activity data
Total volume of flared natural gas (TJ). This is calculated as the sum of the reported volumes of flared natural gas in the individual eAERs.

Extraction of crude oil and natural gas, flaring, onshore. (ES_CODE 8120500 SBI 06)
The emissions of CO_2 and CH_4 as well as the activity data are established in the same way as for "offshore flaring".

Extraction of crude oil and natural gas, venting, offshore (ES _CODE 8120002 SBI 06)
Emission estimates of CO_2 en CH_4
The total CO_2 and CH_4 emission is the sum of the venting emissions from the AERs of the extraction companies. In addition, the fugitive CH_4 emissions from Oil and Gas Extraction are regarded as venting emissions because the split between these sources was not always reported consistently. The total CO_2 and CH_4 emissions are all included in the database as process emissions.

Activity data
Total volume of vented natural gas (TJ), as reported in the eAERs.

Extraction of crude oil and natural gas, venting, onshore (ES_CODE 8120502 SBI 06)
The CO_2 and CH_4 emissions, and the activity data are established in the same way as for "offshore venting".

2.4.2.2 Oil and gas transport (CRT 1A3ei gaseous, 1.b.2.b.iv)

Gas transport (ES_CODE 6800100)
Emission estimates of CO_2 and CH_4 from gas transport were obtained from Gasunie Nederland. Up to and including 2008 and from 2013 on these data were taken from the Gasunie Annual Reports. From 2009-2012 these data were published in the separate Gasunie CSR Annual Reports, in which all environment-related data are included.
Emissions are listed in the PRTR database as follows:

- Total CO_2 emissions are included in the database counting towards Air IPCC combustion emissions In 1A3ei gaseous

- Total CH_4 emissions are included in the database counting towards Air IPCC process emissions in 1.b.2.b.iv.

The method used by Gasunie Nederland is a bottom-up assessment which complies with the Tier 3 method as described in the 2006 IPCC Guidelines (Volume 2, Chapter 4, p4.46).

Fugitive CO_2 emissions and the combustion emission of N_2O during the transportation of natural gas are not included in the total emissions obtained from Gasunie Nederland. For completeness, the (very small) amount of fugitive CO_2 emissions from gas transportation is calculated using a Tier 1 method with the default IPCC emission factor of 8.8E-7 Gg per 10^6 m^3 of marketable gas as taken from the IPCC Guidelines 2006 (Volume 2, Chapter 4, table 4.2.4). The small amount of combustion emissions of N_2O from natural gas transport is calculated using a Tier 1 method with the default IPCC emission factor of 0.1 kg/TJ of consumed natural gas as taken from the IPCC Guideliness 2006 (see also sector 2.1.3.3 Emission factors).

From the NIR 2016 submission onwards, CO_2 and N_2O combustion emissions for gas transport are allocated to CRT 1A3ei Pipeline transport gaseous fuels. CO_2 process emissions- and CH_4- emissions of gas transport can still be found in CRT category 1B2b4 Gas transmission and storage and CO_2 and CH_4 emissions from pipelines for oil are allocated to CRT category 1B2a3 Oil transport.
For NIR 2016 submission the emissions of methane from Gas transmission were evaluated and improved. For CRT category 1B2b4 gas transmission, improved emission data of methane (CH_4) for 1990-2014 became available as a result of the ongoing implementation of the LDAR (Leak Detection and Repair) programme of Gasunie (Gasunie SHE 2014; Gasunie/Kema 2011). Leakages at larger facilities such as the compressor stations were all fully measured and the fugitive emissions of methane from each of those facilities were added to the emissions the year after the facilities came into operation. The adjustments of the methane emissions for the smaller facilities were based on the measurements of a sample of those facilities and plus emissions were added for the whole time-series 1990-2014 (Gasunie 2015; Gasunie/DNV-GL 2015).

At the moment there are no planned actions to investigate if it is possible to disaggregate the CH_4- combustion emissions from fugitive emissions of gastransport since this will not change the total emissions but only would reallocate the emissions.

Activity data
Volume of transported natural gas in billion m^3 obtained from Gasunie Nederland.
Captive consumption of natural gas in million m^3: converted to TJ using the lower heating value of Dutch natural gas 31.65 MJ/m^3.

Transport of oil via pipelines (ES_CODE 8120503 SBI 495)
Emission estimates of CO_2 and CH_4
The emissions are calculated using the Tier 1 method of multiplying the volume of transported crude oil (kton/year) with an emission factor. The

emission factors for CO_2 and CH_4 from the transport of crude oil are calculated on the basis of the default Tier 1 IPCC emission factors (IPCC 2006, Table 4.2.4) which are converted from kg/m^3 to kg/kton for the situation in the Netherlands. The used values are5,85E-06 kton CH_4/kton transported oil and 5,31E-07 kton CO_2/kton transported oil.

Activity data
The volume of crude oil transported through the Netherlands to Germany and Belgium as reported annually by Statistics Netherlands (CBS, multiple years) in the Statline database.

2.4.2.3 Gas distribution (CRT 1.B.2.b.v)

Gas distribution (ES_CODE 0800200)

Emission estimates of CH_4 and CO_2
The CH_4 emission in m^3 is calculated using a bottom up method which complies with a Tier 3 method as described IPCC 2006 Chapter 4. The IPCC Tier 3 method for CH_4 emissions from gas distribution due to leakages (1B2bv) is based on company-specific EFs calculated from leakage measurements.
From 2004 onwards, the gas distribution sector annually recorded the number of leaks found per material and detailed information of pipeline length per material. Also a yearly survey of leakages per length, material and pressure range is carried out in which the whole length of the grid is covered roughly every three to five years.
Because of the availability of new sets of leakage measurements Netbeheer Nederland commissioned an evaluation of the used emission factors. With this evaluation the emissions of methane from Gas distribution were improved for NIR 2016 . As a result of a total of fourty additional leakage measurements an improved set of emission factors could be derived. Based on the (total of) 65 leakage measurements, the pipeline material mix in 2013 and the results of the leakage survey three new emission factors were calculated: 323 m^3 methane per km of pipeline for grey cast iron, 51 m^3 methane per km of pipeline for other materials with a pressure of <= 200 mbar and 75 m^3 methane per km of pipeline for other materials with a pressure of >200 mbar (KIWA, 2015)
From the NIR 2025 submission on the emissions of 1.B.2.b.v. Gas distribution are improved as a result of monitoring and improvement actions from the six Dutch gas distribution companies in the Oil and Gas Methane Partnership (OGMP). The method of estimating the methane emissions of the main lines is now used by the separate companies and ongoing investigations resulted in additional emission estimates of emissions from methane (e.g. systematic review of leaks of service pipelines, 3rd party damage of main pipelines and 3rd party damage of service pipelines). To create new time series the overlap splicing technique from the IPCC Guidelines was used. This technique can be found in Guidebook chapter 5 Times series consistency, section 5.3.3.1. Overlap data were made available for the period 2018-2023 and recalculation took place for the years 1990-2017 (KIWA 2024a, KIWA 2024b).

The CH_4 and CO_2 emission in kg using the following formulas:

CH_4 emission in kg = CH_4 emission in m^3 * 0.716

Where: 0.716 is the relative density of CH_4

Emission of CO_2 in kg = CH_4 emission in m^3 * 100/80 * 0.89 * 1.98

Where:

- 100/80 is required to convert the volume of CH_4 to the total volume of natural gas.
- 0.89 is the percentage of CO_2 in the volume of natural gas and 1.98 is the relative density of CO_2.

The proportion of CO_2 in natural gas originates from Gasunie (Gasunie, various years).

Activity data
The length of the distribution network is taken from the annual report 'Methaanemissie door Gasdistributie '(KIWA, 2023). This report is commissioned by Netbeheer Nederland (Association of Energy Network Operators in the Netherlands) and compiled by KIWA

3 Emission calculations according to the Air Actual method

Methods for calculation of industrial emissions comprise five different source categories that have distinct pathways of data collection and calculation methodologies.

1. Industrial emissions of individual companies in the PRTR are largely based on data reported by the companies themselves, mostly via the e-AER (see paragraph 3.1).
2. A supplemental estimate of combustion emissions is made for all remaining emissions released by combustion of a range of different fuels (see paragraph 3.2).
3. A supplemental estimate of process emissions is made for all remaining emissions released by industrial processes (which have not been reported in the e-AER) (see paragraph 3.3).
4. A separate calculation is made for emissions released from waste (see paragraph 3.4).
5. Emissions released by extraction, transport and distribution of oil and gas are also included separately (see paragraph 3.5).

Emissions are calculated for both the greenhouse gases and the other substances. See paragraph 1.1 for the differences between the Air IPCC and the Air Actual methodology.

3.1 Emissions of individually registered companies

The following section of the report explains how the preliminary and final emission figures of individual companies are established.

3.1.1 Calculation method of preliminary emission figures

Preliminary emission figures are calculated annually (april) using the following method:

$$\text{Preliminary emission}_{t} = \text{Emission}_{t-1} \times \text{Incremental factor}_{t}$$

Definitions:
Preliminary emission = Preliminary emission of year t (kg/year)
$Emission_{t-1}$ = Final emission of year t-1 (kg/year)
Incremental factor = Representative factor for the change in emission

The calculation of preliminary emissions is company-specific. The incremental factors however are calculated per sector, which are linked to a NACE code. This automatically links the company to the incremental factor applicable to its NACE code. This implies that all individual companies within the same NACE code are given the same incremental factor.

Because the incremental factor has not been calculated for every sector due to lack of complete high quality data, there are companies whose emissions are not incremented. In those cases the preliminary emissions are the same as the final emissions of one year earlier.
The method used to establish the incremental factors is explained below, followed by an explanation of the other calculation factors.

Calculating incremental factors:
For the sectors 'Chemical industry', 'Commercial and governmental institutions', 'Refineries' and 'Energy sector', the incremental factors are calculated based on the preliminary emission reports of the largest companies in the sector for year t-1 and year t (annual environmental reports (AER) or reports for the emissions trading scheme (ETS)). For the other sectors, the incremental factors are based on the ratio between the production index of year t-1 and year t.
The incremental factors of non-relevant preliminary emissions are set at unit value (1.00).
As an example, Table 52 shows the incremental factors for the different sectors in 2016.

Table 52 Incremental factors for emission year 2016 compared to emission year 2015

Sector	NACE code	CH_4	CO_2	N_2O	NMVOS	NO_x	PM_{10}	SO_2
Waste sector	38.2	1.00	**1.14**	1.00	1.00	**1.03**	1.00	1.00
Chemical industry	20.1	1.00	**1.04**	**0.81**	**0.85**	**1.07**	**1.14**	**0.74**
Commercial and governmental institutions		1.00	**1.04**	1.00	1.00	1.00	**0.94**	1.00
Refineries	19.2	**1.04**	**1.00**	**0.95**	**0.93**	**0.96**	**0.80**	**1.01**
Energy sector, NACE35	35	1.00	**0.98**	1.00	1.00	**0.84**	**0.66**	**0.68**
Energy sector, NACE6	06/09.1	1.00	**0.89**	1.00	1.00	**0.82**	1.00	1.00
Other		1.00	1.00	1.00	1.00	1.00	1.00	1.00
Other Industry, Base metal	24	1.00	**1.00**	1.00	**1.00**	**0.98**	**1.02**	**0.95**
Other Industry, Food products, beverages and tobacco	10 -- 12	1.00	**1.03**	1.00	**0.78**	**0.95**	**1.11**	1.00
Other Industry, Paper industries	17	1.00	**0.99**	1.00	1.00	**1.02**	1.00	1.00
Other Industry, Construction material	23	1.00	**1.01**	1.00	1.00	**0.96**	1.00	1.00
Other Industry, Other		1.00	1.00	1.00	1.00	1.00	1.00	1.00

3.1.2 Calculation method of final emission figures

The final figures are calculated using the emission data the companies have included in their annual environmental reports. For that reason, this method is more complex than the one used to calculate the preliminary figures. Paragraph 3.1.2.1 describes the emission figures reported in the annual environmental reports and paragraph 3.1.2.2 describes the other individual emission estimates.

3.1.2.1 Emission figures reported in the e-AER

The National Institute for Public Health and the Environment (RIVM) takes the figures from the e-AER (electronic Annual Environmental Report) once a year (1 August) for inclusion in the PRTR. On the 1st of October, the data are checked again to incorporate any changes companies may have made. This process is repeated on the 1st of November, but then only taking into account companies and changes in emissions that have a significant impact on the national total emissions. After that, any changes a company makes to the e-AER will not be

included in the PRTR until the following year (unless there is an urgent reason to include these changes in the Emissions Registry, for example when the changes have a significant effect on the total emissions in the Netherlands).
The data from the e-AERs must be processed to create a database of which the structure, the usability and the quality is compatible with the PRTR. The data should also be suitable for estimating the emissions of companies not individually registered (supplemental estimate of industrial emissions). The method for the supplemental estimates is explained in sections 3.2 and 3.3. To ensure the quality of the emission data, several inspections take place. Also, the emissions are linked to the fuel types used (a distinction is made between process and combustion emissions) and to the installations and emission points (e.g. chimneys). The emissions are already correctly linked to fuels, installations and emission points in most of the e-AERs, but these links need to be added or corrected for some parts of the e-AER data. This paragraph describes the processing of the data and the quality checks.

Processing of e-AER data
The processing of the emission data consists of the following steps:

1. Selection of the emissions per plant (and per installation, emission point and fuel type)
2. Adjustment of the distribution of emissions across fuel types and across installations and emission points
3. Changes to particulate matter and NMVOC
4. Conversion to the PRTR format

1. Selection of all emissions per plant (and per installation, emission point and fuel type)
TNO receives a file containing e-AER data from RIVM for processing. A selection is made of those companies that need to be included in the PRTR. This means for example that waste water treatment plants (WWTPs), airports and landfill sites are excluded from further processing (approx. 30 companies), because their emissions are included in the PRTR via a different pathway (see chapter 3.4 for the WWTPs and landfill sites and the transport methodology report for airports).

2. Adjustment of the distribution of emissions across fuel types and across installations and emission points
The link between emission and fuel use, installation and emission point is not always reported completely or explicitly in the annual environmental reports. The link between fuel use and the emission is necessary for calculating implied emission factors which can be used in the supplemental emission calculation (see paragraph 3.2). The following changes in the data are made:

- The e-AER format requires all emissions to be reported per installation, from the 2023 eAER onwards. The eAERs up to 2022 only required NOx, SO2 and PM10 combustion emissions to be reported per installation, while the other pollutants could be reported as a combustion total. In those cases, these total emissions were distributed over installations and fuel used based on default emissions factors. These default emission factors are not used to calculate emissions, but only to divide the emissions across fuel types as efficiently as possible. For E-PRTR

substances there are default emission factors based on the literature (EMEP/EEA, 2019; Veldt, 1993) and the reference values in the e-AER. For the other substances the emissions are divided based on the quantity of energy consumed. The total emission per company is not changed. From the 2023 eAER onwards, this redistribution is not necessary anymore, and the distribution of emissions per installation are only corrected when there is a clear mistake in the eAER. Companies sometimes report a number of fuel types for a single installation combined with one emission value. To prevent these emissions being counted multiple times (i.e. for each fuel type) the emission is divided across the fuel types in the same way as the other combustion emissions (see previous bullet).

- Companies sometimes do not report a correct emission point for an installation. For example, the standard emission point for diffuse emissions (in the e-AER (in Dutch): 'diffuus') is often used for combustion emissions where a chimney would be expected. The correct link between the emissions and the emission point is needed when the emissions are used in air quality modelling. When it is clear that the emission point used in incorrect, then the correct emission point is manually changed to a more suitable emission point for that installation.
- The changes made do not influence the total emission estimate from companies.

3. Changes to particulate matter and NMVOC
Companies report an NMVOC total in their e-AER sometimes with a specification of individual substances. If the emissions of both the NMVOC total and the specific substances would be included in the PRTR, this would result in duplication of the total NMVOC emission. For that reason, only the specific substances are included in the PRTR and the NMVOC total is not. The sum of the emissions of specific substances has to be equal to the NMVOC emissions in the e-AER. In some cases, however, the specified substances do not add up to the reported NMVOC total. In those cases, a substance 'NMVOC other' is added in order to warrant that the presented NMVOC total remains equal to the total NMVOC figure in the e-AER.

With regard to particulate matter, companies report Total Suspended Particulates (TSP) and have the opportunity to specify the amount of particulates that are PM_{10} and $PM_{2.5}$. The specification however is not always reported by companies. If the emissions of both the TSP and PM_{10} would be included in the PRTR, this would result in duplication of the TSP emission in the emission reporting. For that reason, PM_{10} and coarse particulates (here defined as TSP minus PM_{10}) are included in the PRTR and the TSP is not. If the company did not report PM_{10}, then it is assumed that TSP consists of coarse particulates only (but this occurs only for a small fraction of the companies with relatively low emissions). If the company did not report $PM_{2.5}$, then this is estimated with default $PM_{2.5}/PM_{10}$ ratios (see paragraph 3.1.2.2).

4. Converting e-AER data to PRTR data
The conversion of the final e-AER data to PRTR data involves a number of steps to implement the data encoding required for the PRTR

database. The e-AER emission substances and fuels are converted to PRTR emission substances and fuels. In addition, depending on a company's economic core activity, an emission source category will be assigned to its emissions (see annex 1 for the list of emission sources), which is also used to link the emissions to the correct NFR category as needed for international reporting obligations under CLRTAP and the NEC Directive. It is possible that this economic core activity differs each year, and that emissions of a company are allocated to different emission source categories each year.

Checks on e-AER data
The e-AER data is checked on several parts:

1. Checking CO_2 emissions and fuels consumption
2. Checking the trends and the emission factors
3. Other checks on emission data

The checks may allow for revision of emission figures in the PRTR (compared to the figures reported in the e-AER). Any changes will be communicated to the relevant companies and competent authorities. In some cases, the competent authority and/or the company decide to alter the emissions reported in the e-AER. The emission data as included in the PRTR have no official status for the company. Only the data in the e-AER represent the company's official figures And theseemission figures in the e-AER are used for official individual international reporting, such as E-PRTR.

1. Checking plant-level CO_2 emissions and fuel consumption
All plant-level CO_2 emissions and fuel consumption figures are selected and checked manually to verify that the reported fuel consumption and CO_2 emission are a realistic match. The first criterion applied is the assumption that company-level emission factors cannot be more than 5% higher or lower than the official Dutch standard emission factors (Zijlema, 2025).
If the company-level emission factor shows a difference of more than 5%, the cause will be investigated. There are several possible causes. The following cases have been reported so far:

- A company has reported CO_2 process emissions. If the plant-level emission matches the fuel consumption, no adjustment is required. If the reported emission has not been split up into combustion and process emissions, this can be done as part of the checking phase. However, these adjustments will never result in a change of the total CO_2 emission reported by the company.
- A company has reported a fuel type other than natural gas. The emission factor of the natural gas used will always be close to the standard emission factor. However, for some other fuels (biomass, waste, residual gases, etc), the emission factor can vary considerably based on its composition. In that case the non-compliant emission factor is often accepted (depending on the fuel type and provided it differs by no more than a factor of 3) and the reported CO_2 emission is not amended.
- The company reported a CO_2 emission but no fuel consumption. In that case the company's reported energy consumption will be taken from the energy section of the AER. If a company has reported a fuel consumption that is clearly erroneous (e.g. differs

by a factor of 1000), the energy consumption from the energy section of the AER will be used. However, these adjustments will not result in a change of the total CO_2 volume reported by the company.
- The company reported its fuel consumption but no CO_2 emissions. In that case the CO_2 emission will be calculated using the standard emission factors (Zijlema, 2025). This leads to a change in the CO_2 emission included in the PRTR compared to the value reported by this company.
- The company did not report all CO_2 emissions. In rare cases a company may report the same CO_2 emissions that are used in ETS (Emissions trading scheme). However, this value often does not include the total emission of all installations and fuel types that are required for inclusion in the PRTR (e.g. no CO_2 emissions from biomass). The missing CO_2 emissions are calculated using the standard emission factors (Zijlema, 2025), and this leads to a change in the CO_2 emission included in the PRTR compared to the value reported by this company.
- The emissions are incorrect, e.g. by a factor of 1000. In that case the emission is corrected by using the standard emission factors (Zijlema, 2025), before inclusion in the PRTR. This leads to a change in the CO_2 emission included in the PRTR compared to the value reported by this company.
- In rare cases it is impossible to account for or correct improbable figures. In such cases the respective companies and corresponding emissions are not included in the PRTR. This is only the case for companies with relatively small emissions (see Table 53). For a company with relatively large emissions (as seen in previous years), every effort is made to correct the emissions (if possible, in collaboration with the company).

To illustrate the order of magnitude of the emissions and the number of companies in Table 53 the summary of the CO_2 check for 2016 is presented.

Table 53 Summary of the CO_2 and fuel type check for 2016.

Category	**Number**	**CO_2 in eAER (ktonnes)**	**CO_2 in PRTR (ktonnes)**	**CO_2 difference (ktonnes)**	**CO_2 difference (%)**
No changes	344	20,790	20,790	0	0.0%
Change, total CO_2 emission unchanged	181	69,914	69,914	0	0.0%
Change, total CO_2 emission changed	28	13,015	13,109	94	0.7%
Not included in PRTR	7	29	0	-29	100.0%
Total	560	103,748	103,813	65	0.06%

Remark: Fuel and/or CO_2 emissions were reported by a total of 560 companies, of which 553 were included in the PRTR.

2. Checking the trend and emission factor

A general check of emission data is performed on the trend, emission factor and emission factor trend (see Table 50). Depending on the substance the emission is subject to a specific criterion it must meet. The emission factor check is not performed for NH_3, heavy metals and PAH, because the range in potential emission factors (as reported in literature like the EMEP/EEA Guidebook) is very large. The emission

factor check is also not performed for the greenhouse gases, because CO_2 was already checked at a very detailed level and CH_4 and N_2O are not relevant for LRTAP reporting. The trend check is not performed for heavy metals and PAH, because these emissions are often measured, which can result in larger yearly differences. Table 54 shows the substances that are subject to the checks.

Table 54 List of substances subject to checks. X indicates that the substance is included in a specific check.

Substance name	SO_2	CO	PM_{10}	NO_x	PCDD/F	NH_3	CO_2	N_2O	CH_4	Heavy metals	PAH
Emission factor check	X	X	X	X	X						
Trend check	X	X	X	X	X	X	X	X	X		
Unit check										X	X

The criteria used to determine if further examination of an emission is required are defined as follows:

- *Emission factor check*: the implied emission factor of these substances is calculated for the complete company. If the calculated value is outside the specified range, the emission will be examined further. Table 55 shows the range of emission factors, based on emission factors from literature (mainly the EMEP/EEA Guidebook, 2009).
- *Trend check:*
  - If the difference between the emission of this year and the emission of the previous two years is more than a factor of 4, the emissions will be examined further.
  - If the difference between the emission of this year and the average emission of the last five years exceeds the standard difference of emissions during the last five years by more than a factor of 2, the emissions will be examined further.
- *Unit check*: if the difference between the present year's emission and the emission of the previous two years is more than a factor of 200. This criterion is used for error checking in units (factor-1000 errors). A factor of 200 is used in the check (instead of a factor 1000) to take year-to-year variances into account.

Table 55 Specified range of emission factors for a selection of substances. If the derived emission factor is outside this range, the emission figures will be examined further.

Substance	Unit	Minimum emission factor	Maximum emission factor
NO_x (nitrogen oxide)	g/GJ	10	1000
SO_2 (sulphur dioxide)	g/GJ	0.2	900
CO (carbon monoxide)	g/GJ	1	2000
PM_{10} (particulate matter)	g/GJ	0.2	150
PCDD and PCDF (dioxins)	µg/GJ	0.0005	3

This check results in a list of emissions requiring further examination in the explanatory sections or the written annex to the e-AER. In many cases companies have an explanation for the changes in emissions, such as the implementation of emission abatement installations or

temporarily suspension thereof as a consequence of maintenance activities. If the explanation fits in with the reported emission, it will be included in the PRTR (with no further changes). Finally, this process results in only a few emissions that require adjustment (e.g. if a factor-1000 error or a double-reported emission is found).

3. Other checks of emission data
Apart from the standard checks referred to above, other checks are performed that differ from year to year. These can involve a further examination of e.g. a group of companies or a series of emissions of a certain substance. If there are indications on inconsistencies in a group of companies concerning a certain substance, the entire group of companies will be examined further.

3.1.2.2 Other emission estimates
In addition to emissions registered by the individual companies that maintain an emissions report in the e-AER format, the PRTR also uses other emission estimates for individual companies. The reasons and methods are explained in the following section.

Additional estimates of company-specific emissions
Companies do not report emissions of all substances that are released, e.g. because the emissions do not exceed the threshold value for reporting in the eAER. Emissions that have not been reported are calculated using an emission estimate. For a number of substances/sectors emissions are estimated at the level of individual companies. These estimates have not been reported by the relevant companies and therefore do not get official status.

$PM_{2.5}$ emissions
PM2.5 emissions are estimated for all installations in all sectors that do not report PM2.5 emissions, but do report PM10 emissions. Emission of PM2.5 is calculated from the reported PM10 emission. For each sector and fuel type the fraction of particulate matter (PM10) consisting of PM2.5 has been estimated (see Visschedijk & Dröge, 2019 and Appendix 3 of this report). This fraction can be used to estimate the PM2.5 emission, that is included in the PRTR.

Individual estimates
Many annual environmental reports do not contain all emissions that are significant for the PRTR. A typical situation is when a company does not report emissions because they do not exceed the threshold value. For a number of different sectors emissions are therefore estimated individually to enable inclusion of an estimate in the PRTR. The emission calculated in this way provides an estimate of the emission for the sector as a whole. However, individual differences between companies are not known, so the company-specific emission is more uncertain than the emission for the sector as whole. The PRTR-website presents emissions as a company-specific value, with a remark that it is a PRTR estimate.
The individual estimates are made for the following pollutants and sectors:

- Waste incineration plants (NOx, CO, SOx, metals, dioxin, HCB and PCB emissions)

- Tile and brickworks sector (fluor, NOx, CO and mercury emissions)
- Metal emissions for refineries, non-ferro sector, chemical sector and mineral products sector
- PAH, dioxin and HCB emissions for all industrial stationary combustion
- PCB emission in the iron and steel sector

Individual estimates for waste incineration plants
Calculation of individual estimates is based on emissions reported by the few companies who do report emissions for the relevant substances. The reported emission of these companies is divided by the fuel consumption in order to assess company-specific implied emission factors. For waste incineration plants a three-year average of these derived emission factors is calculated, and this is used to estimate the emissions of missing substances.

Individual estimates for tile and brickworks sector
To estimate the emission of omitted substances for the tile and brickworks sector, the ratio between the reported CO_2 emission and the emission of the relevant substances is calculated (for the companies that have reported these emissions now or in earlier years). If companies have reported the relevant emissions in earlier years, then individual implied ratios have been used to estimate emissions. If companies have never reported these emissions before, then the median of the reported ratios of other companies is used. The median-based estimate was chosen because the derived emission factor of some companies is very high, which would result in an unrealistically high emission factor in case an average-based estimate was used.

Individual estimates of metal emissions for refineries, non-ferro sector and the chemical sector
Metal emissions are released from fuel combustions, but it is rarely reported by individual companies, because the emissions are often below the reporting threshold. Individual estimates of these metal emissions have been made for the refineries, the non-ferro sector and the chemical sector. The metal emissions have been calculated top-down, by multiplying the fuel consumption statistics of each sector with tier 1 emissions factors from chapter 1A1 and 1A2 of the EMEP/EEA Guidebook (2019) and an assumed abatement efficiency of 50% for mercury, 90% for selenium and 95% for the other metals (from: EMEP/EEA Guidebook, 2019, chapter 1A1, page 78). In the next step, the metal emissions have been divided over the companies that use other fuels than natural gas. It has been divided over the companies in proportion to the reported CO_2 emissions of these companies (which is used as a proxy for fuel consumption). If the individual emission is higher than the reporting threshold, then it is assumed that the emission is equal to the reporting threshold (assuming that a company would have reported these emissions if they were above the reporting threshold). If a company has already reported a certain metal emission, then the individual estimate of that metal emission is discarded for that company, and only the reported emission is used.

Individual estimates of metal emissions for the mineral products sector
Metal emissions for the mineral products sector have been calculated for 2 companies only, as these are the only two companies who combust a significant amount of fuels (other than natural gas). Emissions have been calculated by multiplying the fuel consumption with tier 1 emissions factors from chapter 1A2 of the EMEP/EEA Guidebook (2019) and an assumed abatement efficiency of 50% for mercury, 90% for selenium and 95% for the other metals (from: EMEP/EEA Guidebook, 2019, chapter 1A1, page 78). If the individual emission is higher than the reporting threshold, then it Is assumed that the emission is equal to the reporting threshold (assuming that a company would have reported these emissions if they were above the reporting threshold). If a company has already reported a certain metal emission, then the individual estimate of that metal emission is discarded for that company, and only the reported emission is used.

Individual estimates of PAH, dioxin and HCB emissions for all industrial stationary combustion
PAH, dioxin, HCB and PCB emissions are released from fuel combustions and is reported by individual companies with the highest emissions. Individual estimates of these emissions have been made for all industrial stationary combustion sectors and for solid fuels, liquid fuels (except diesel and LPG), gaseous fuels (except natural gas) and biomass (except biogas). The emissions have been calculated as a fraction of the reported hydrocarbon emission. The fraction is based on ratio between the tier 1 emissions factors of PAH/dioxin/HCB/PCB with NMVOC from chapter 1A1 and 1A2 of the EMEP/EEA Guidebook (2019) and an assumed abatement efficiency of 90%. If the individual emission is higher than the reporting threshold, then it is assumed that the emission is equal to the reporting threshold (assuming that a company would have reported these emissions if they were above the reporting threshold). If a company has already reported a certain emission, then the individual estimate of that emission is discarded for that company, and only the reported emission is used.

Individual estimates for the iron and steel sector (PCB)
The PCB emissions from iron and steel production have been calculated. Up to 2000, the emissions have been estimated based on the dioxin emission and the ratio between dioxin and PCB in the EMEP/EEA Guidebook (2019), 2C1, table 3.1. From 2001 onwards, the company has measured these emissions, and provides the emission data via personal communication (but these were not reported in the eAER).

Other information sources
The substance emissions of large dry bulk storage and transhipment companies are not reported in the e-AERs. Instead these emissions are assessed annually by the competent authorities and added to the PRTR. For earlier years (1990-2005), an annual assessment is made of the industries for which more data was required (to improve supplemental estimates, etc.). Establishing individual emission data took place in consultation with companies based on data pertaining to fuel consumption, production or measurements performed. Emissions were calculated by multiplying fuel consumption or production data by process-dependent emission factors. The emission factors used were taken from sources

including Mulder (1997), Scheffer & Jonker (1997) and various industry-specific reports. Any measurements were also included in the calculation when available.

3.2 Supplemental estimates of combustion emissions

The purpose of the supplemental estimates is to calculate the supplemental emissions from stationary sources related to fuel consumption of the companies that are not individually registered in order to obtain a correct national total for all emission sources. The Annual Environmental Reports (e-AER) of registered companies serve as source material.
Not all companies that use fossil fuels submit an e-AER and for that reason the total energy consumption in the Netherlands is taken from the CBS Dutch Energy balance sheet.

The emission calculations are based on e-AER data because the emission amounts are largely determined by optimisation of the combustion process and possible flue gas scrubbing.
Apart from the emissions, the energy consumption of e-AER companies is also included in the data. The energy balance sheet managed by Statistics Netherlands (CBS) lists the total energy consumption in the Netherlands for each sector, subdivided by fuel type. The difference in consumption between the CBS Dutch Energy balance sheet and consumption reported by e-AER companies is referred to as supplemental fuel consumption. Because the emissions are caused by the combustion of fuels, this supplemental fuel consumption underlies the calculation of missing emissions.

The emissions related to this supplemental energy consumption are calculated by multiplying supplemental energy consumption by the source-specific emission factor for each fuel type and "consumer group".

3.2.1 Emission sources

An emission source is defined as any stationary source in the Netherlands where fuel combustion takes place. Table 56 shows the emission sources described in this section.

Table 56 List of combustion emission sources defined by NACE 2008 classification

ES CODE	EMISSION SOURCE
0012101	Residential combustion, appliances, gas leakage before ignition
0012102	Residential combustion, space heating
0020401	NACE 41-43: construction and building industries
0020405	NACE 84: public administration, governmental institutions and compulsory social insurance
0020500	Commercial and governmental institutions
0020500	Commercial and governmental institutions
0401201	Combustion in agricultural buildings
0401202	Combustion in agricultural greenhouses
0800700	Residential combustion, cooking
0800800	Residential combustion, hot water
8900200	NACE 10-12: manufacture of food products, beverages and tobacco

ES CODE	EMISSION SOURCE
8900300	NACE 13/14: manufacture of textiles and textile apparel
8900400	NACE 15: leather industry and fur preparation
8900600	NACE 17.1/17.2: manufacture of pulp, paper and paperboard
8900700	NACE 18/58: publishing, printing and reproduction of recorded media
8900900	NACE 20.15: manufacture of fertilizers and nitrogen compounds
8900900	NACE 20.15: manufacture of fertilizers and nitrogen compounds
8901100	NACE 20.1: manufacture of basic chemicals
8901100	NACE 20.1: manufacture of basic chemicals
8901100	NACE 20.1: manufacture of basic chemicals
8901702	NACE 22: manufacture of rubber and plastic products
8902100	NACE 25: manufacture of metal structures and parts of structures
8902200	NACE 28: manufacture of machinery
8902301	NACE 26/28: manufacture of machinery and electronic apparatus
8902303	NACE 27: manufacture of electrical apparatus
8902304	NACE 26: manufacture of computers and electronic and optical apparatus
8902400	NACE 29: motor-industry
8908000	NACE 31/32: manufacture of furniture and other goods
8908100	NACE 30: manufacture of other transport equipment
8912101	NACE 16: manufacture of wooden products
8912500	NACE 19.202: manufacture of refined petroleum products - not oil refineries
8913700	NACE 20.2-20.5: chemical products industry
8914501	Road paving with asphalt
8914600	NACE 23: construction material and glass industry
8915300	NACE 26/31/32: manufacture of electronic apparatus and furniture
8916000	NACE 38.3: preparation to recycling of metal and non-metal waste and scrap
8920100	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals
8920100	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals
8920400	NACE 35: production and distribution of electricity and gas
8920500	NACE 36: collection, purification and distribution of water
8921800	NACE 38.1/38.2 (partly): waste-incineration plants
8921900	NACE 39: sanitation and other waste management
8922000	NACE 38.1/38.2 (partly): landfill gas companies
8922701	NACE 08: other quarrying and mining
8924200	NACE 19.2 (excluding NACE 19.202): manufacture of refined petroleum products
8924200	NACE 19.2 (excluding NACE 19.202): manufacture of refined petroleum products
8924407	NACE 24.1-24.3/24.51/24.52: base metal iron and steel
8924407	NACE 24.1-24.3/24.51/24.52: base metal iron and steel
8924407	NACE 24.1-24.3/24.51/24.52: base metal iron and steel
8930401	NACE 35: decentral production of electricity, general
8930410	NACE 35: production of electricity, heat

Emissions from oil and gas extraction are calculated by RIVM. Emissions from waste incineration are calculated by the Department of Public Works and Water Management (*Rijkswaterstaat*) and are therefore not included in this section. These emission sources are described in paragraphs 3.4 and 3.5.

3.2.2 Calculation method of preliminary emission figures

Calculation of preliminary emissions is based on the energy statistics without the large corporations. Emissions from large corporations can be omitted here because these will be added to the PRTR-I (Pollutant Release and Transfer Register-Individual) on a preliminary basis via e-AER (see paragraph 3.1).

The preliminary emissions are calculated as follows:
*Preliminary emission = preliminary energy consumption / energy consumption t-1 * emissions t-1*

Where:

Preliminary emissions	= Emissions of last year (kg)
Emissions t-1	= Emissions of the year before last year (kg)
Preliminary energy consumption	= Energy consumption of last year (GJ)
Energy consumption t-1	= Energy consumption of the year before last year (GJ)

Additional adjustment may be required if literature shows an emission source has changed.

3.2.3 Calculation method of final emission figures

3.2.3.1 Introduction

The calculation is based on the fuel consumption figures from the CBS Dutch Energy balance sheet and the data reported by companies in their e-AER. The e-AER data is used to create the PRTR-I. The method to create PRTR-I is described in section 3.1.

The combustion emissions of a proportion of Dutch companies are known through their e-AERs. However, the emissions of households, commercial and governmental institutions, agriculture and non-registered companies are not. Combustion emissions of these sources are calculated based on fuel consumption.

Emissions are linked to fuel consumption. The CBS Dutch Energy balance sheet provides a comprehensive overview of energy consumption in the Netherlands. The difference in consumption between the energy statistics and consumption by PRTR-I companies is referred to as supplemental fuel consumption. As a formula:
Supplemental fuel consumption = (Consumption in energy statistics) – (Consumption PRTR-I)

Where:

Supplemental fuel consumption	= Fuel consumption of companies that are not individually registered (GJ)

Consumption in energy statistics = Fuel consumption according to the CBS Energy Balance Sheet (GJ)
Consumption PRTR-I = Fuel consumption of companies that are individually registered (GJ)

Supplemental emissions are established by multiplying the supplemental consumption by the relevant emission factor. As a formula:
*EMIS_supplemental = supplemental fuel consumption * EF*

Where:
EMIS_supplemental = Supplemental emission (kg)
EF = emission factor (kg/GJ)

The supplemental consumption is calculated for each company category and each fuel type.

3.2.3.2 Activity data

Emissions are caused by fuel combustion. The CBS Energy Statistics provides a comprehensive overview of energy consumption in the Netherlands.

Two files are provided by CBS Energy Statistics:
1. The energy consumption of individual companies, obtained by CBS through a survey;
2. Fuel consumption as published by CBS in the energy statistics (file data subdivided by company group and fuel type, including supplemental estimates of consumption, not covered by CBS survey).

These files are combined in one emission calculation database including energy statistics of individual companies and energy statistics of supplemental estimates.

The result is a file containing the total energy consumption in the Netherlands including the data of individual companies covering all reporting years, allowing company-specific calculations to be made.

The emissions of mobile equipment are covered by the calculation of emissions from mobile sources, which is described in the transport methodology report (Witt et al., 2025).

Apart from the emissions, the fuel consumption from the e-AER companies is included in the Annual Environmental Reports.

Before the supplemental consumption can be calculated, the energy statistics and PRTR-I first need to be cleared. This covers a large number of companies with the same unit listed in both the energy statistics and the PRTR-I. These companies will be removed from the system.

The reasons include:
1. allocation
2. incomplete PRTR-I data (no link between fuel and emission)

Re 1. For instance, in the AERs a number of cogeneration plants are allocated to the corresponding company, while in the energy statistics they are allocated to the energy sector.
Re 2. This is done if the energy consumption data in the PRTR-I are incomplete or unavailable. Cases like this are rare though.
The difference in consumption between the CBS Energy balance and consumption reported by AER companies is referred to as supplemental fuel consumption.

3.2.3.3 Type Emission factors

In order to calculate the emission, the supplemental fuel consumption is multiplied by an emission factor, i.e. out of three possible sets of emission factors:

1. Standard emission factors
2. Specific emission factors
3. Factors from a recent study

The emission factors from the first set (standard emission factors) are most commonly used.

Standard emission factors

Standard emission factors are available in the EMEP/EEA air pollutant emission inventory guidebook 2019. For greenhouse gases, the emissions factors are shown in paragraph 3.2.3.4.

Specific emission factors

The emission factors are determined for each company category, subdivided by fuel type, for:

- Hydrocarbons
- SO_2
- NO_x
- CO
- Particulate matter

These specific emission factors are determined using eAER data from the PRTR-I file from which a selection of companies has been removed (see paragraph 3.2.3.3).
The emission factors are determined by adding up the emission for each homogeneous category following standard industrial classification, subdivided by fuel type, and the corresponding consumption, and dividing the totals:

EF_spec = emission / fuel consumption

Considering individually registered companies it has to be noted that in some cases not all substances are reported (e.g. CO_2 and NO_x are reported, but CO is not).
In the calculation of emission factors, the energy consumption related to a substance is only included in the calculation of the specific emission factors if the emission has been reported. For that reason, the fuel consumption can vary when the emission factors for different substances are calculated.

Application of specific emission factors is subject to the following pragmatic conditions:

- The consumption used to calculate the specific emission factor must be more than half of the consumption in the company category;
- The variation of emission factors over the previous three years must be below 10%.

For waste gases, the emission factor is calculated differently because waste gases as fuel have company specific characteristics (emissions depend on the type of waste gas and the production process). The majority of companies using waste gas are large companies, i.e. obliged to submit AERs and therefore listed in the PRTR-I. When a company misses the deadline for submission or if inclusion in the PRTR-I is rejected because the AER fails to meet quality standards then the emission factors for waste gas is determined by calculating the average of the previous three years.

Emission factors from a recent study
Sometimes the emission factor for a certain emission source differs from the standard emission factor. In those cases additional research is required. Examples of such research are the reports by Visschedijk, 2007 and Kok, 2014. These reports deal with emission factors of metals and PAH in certain sectors and with the effects on NO_x emission factors of the introduction of CHP-plants and the evolution of residential equipment.

3.2.3.4 Used emission factors

Separate sets of emission factors are available for different company categories. These are shown below. Specific emission factors are derived yearly. In these tables, the specific emission factors for the last year are shown.

Table 57a General combustion emission factors for industry and electricity production (g/GJ), Natural gas

Substance name	**1a1a**	**1a2b**	**1a2c**	**1a2d**	**1a2e**	**1a2g**
NMVOC *1	2.6	5.2 *4	2.6	5.2 *4	3.8 *4	5.2 *4
Hydrocarbons *3	6.5	13.0	6.5	13.0	9.5	13.0
Sulphur dioxide *1	0.281	0.281	0.281	0.281	0.281	0.281
Nitrogen oxides as NO_2 *4	19.1	39.8	17.9-55.0	43.0	30.0	37.0
Carbon monoxide *4	15.0	35.0 *2	40.0	35.0	40.0	35.0
Particulate matter (PM10) *2	0.2	0.297	0.297	0.297	0.297	0.297
Particulate matter (PM2.5) *5	0.15	0.297	0.223-0.297	0.297	0.045	0.089-0.297
Elementary Carbon *5	0.004	0.012	0.008-0.012	0.012	0.002	0.004-0.012

References:
*1 EMEP/EEA Guidebook (2019), 1A1, table 4.6, average value
*2 For 1A1a: EMEP/EEA Guidebook (2019), 1A1, table 3.17, default value. For 1A2: EMEP/EEA Guidebook (2019), 1A1, table 4.6, minimum value
*3 Calculated from NMVOC emission factor. It is assumed that 40% of the hydrocarbon consist of NMVOC.
*4 Specific emission factors derived from reported emissions in eAER

*5 PM2.5 fraction and EC2.5 fraction available in Visschedijk & Dröge (2019), and these can vary per subsector.

Table 57b General combustion emission factors for industry and electricity production (g/GJ), solid, liquid and biomass fuels

Substance name	**Coal**	**Fuel oil**	**Biogas**	**Wood 1a1a**	**Wood 1a2e NACE 31**	**Wood 1a2e NACE 16**
NMVOC	10.0 *1	50.0 *10	2.6 *11	1.33 *3	1.33 *3	8.4 *3
Hydrocarbons *7	20.0	25.0	5.2	3.33	3.33	21.0
Sulphur dioxide	450 *1	47 *9	0.281 *11	10.8 *13	11 *12	11 *12
Nitrogen oxides as NO_2	150 *1	64 *5	89 *11	70 *3	75 *3	150 *3
Ammonia				1.2 *12	1.2 *12	1.2 *12
Carbon monoxide	150 *1	66 *9	39 *11	150 *3	16 *3	750 *3
Particulate matter (PM10)	60 *1	20 *9	0.89 *11	10 *3	12 *3	27 *3
Particulate matter (PM2.5) *6	30	17.0	0.13	10	12	25
Elementary Carbon *6	1.92	9.52	0.005	0.33	3.36	7.0

References:
*1 EMEP/EEA Guidebook (2019), 1A2, table 3.2, minimum value
*3 From 'Kennisdocument Houtstook in Nederland' (Koppejan and de Bree, 2018)
*5 Methodology report of Guis (2006)
*6 PM2.5 fraction and EC2.5 fraction available in Visschedijk & Dröge, 2019.
*7 Calculated from NMVOC emission factor. NMVOC percentages in hydrocarbon are: 50% for coal, 50% for fuel oil, 65% for biogas, 40% for wood.
*9 EMEP/EEA Guidebook (2019), 1A2, table 3.4, default value
*10 EMEP/EEA Guidebook (2019), 1A4, table 3.31, default value
*11 EMEP/EEA Guidebook (2019), 1A1, table 3.4, default value
*12 EMEP/EEA Guidebook (2019), 1A2, table 3.5, default value
*13 EMEP/EEA Guidebook (2019), 1A1, table 3.7, default value

Table 58 Combustion emission factors for commercial and institutional sectors (g/GJ)

Substance name	**Natural gas**	**Diesel oil**	**Coal**	**Biogas**	**Wood**
NMVOC	2.0 *1	20 *4	10 *3	23 *16	5 *18
Hydrocarbons *8	5.0	40	20	57.5	12.5
Sulphur dioxide	0.2 *2	94 *4	450 *3	0.67 *16	8 *18
Nitrogen oxides as NO_2	20.6 *10	60 *15	150 *3	74 *16	91 *17
Ammonia					37 *17
Carbon monoxide	15 *2	93 *4	150 *3	29 *16	50 *18
Particulate matter (PM10)	0.27 *2	21 *4	60 *3	0.78 *16	91 *18
Particulate matter (PM2.5) *9	0.27	16.8	60	0.78	88.6
Elementary Carbon *9	0.011	9.408	3.84	0.031	24.8

References:
*1 EMEP/EEA Guidebook (2019), 1A4, table 3.27, default value
*2 EMEP/EEA Guidebook (2019), 1A4, table 3.27, minimum value
*3 EMEP/EEA Guidebook (2019), 1A4, table 3.7, minimum value
*4 EMEP/EEA Guidebook (2019), 1A4, table 3.9, default value
*8 Calculated from NMVOC emission factor. NMVOC percentages in hydrocarbon are: 40% for natural gas, 50% for coal, 50% for diesel, 65% for biogas, 40% for wood.
*9 PM2.5 fraction and EC2.5 fraction available in Visschedijk & Dröge, 2019.
*10 Visschedijk (2022). From 2005 onwards the NOx-emission factor decreased due to the further implementation of low NOx technologies (EF2005: 42,5 to EF2021: 20.6).
*15 Van Soest-Vercammen et al., 2002
*16 EMEP/EEA Guidebook (2019), 1A4, table 3.8, default value

*17 EMEP/EEA Guidebook (2019), 1A4, table 3.10, default value
*18 EMEP/EEA Guidebook (2019), 1A4, table 3.10, minimum value

Table 59 Combustion emission factors in the residential sector (g/GJ)

Substance name	**Natural gas**	**Natural gas Cooking**	**Diesel Oil**	**LPG**	**Petroleum**	**Coal**
NMVOC	1.8 *1	2.0 *2	0.69 *3	1.9 *11	0.69 *3	300 *4
Hydro carbons *8	4.5	5.0	1.38	3.8	1.38	600
Sulphur dioxide	0.3 *1	0.3 *2	70 *3	0.3 *11	70 *3	450 *4
Nitrogen oxides as NO_2	14,4*10	57 *10	51 *3	40 *12	51 *3	150 *4
Carbon monoxide	22 *1	30 *2	57 *3	26 *11	57 *3	2000 *4
Particulate matter (PM10)	0.2 *1	2.2 *2	1.9 *3	1.2 *11	1.9 *3	240 *4
Particulate matter (PM2.5) *9	0.2	2.2	1.9	1.2	1.9	216
Elementary Carbon *9	0.011	0.119	0.162	0.102	0.162	13.824

References:
*1 EMEP/EEA Guidebook (2019), 1A4, table 3.16, default value
*2 EMEP/EEA Guidebook (2019), 1A4, table 3.13, default value
*3 EMEP/EEA Guidebook (2019), 1A4, table 3.5, default value
*4 EMEP/EEA Guidebook (2019), 1A4, table 3.19, default value
*8 Calculated from NMVOC emission factor. NMVOC percentages in hydrocarbon are: 40% for natural gas, 50% for coal, 50% for diesel, 40% for wood.
*9 PM2.5 fraction and EC2.5 fraction available in Visschedijk & Dröge, 2019.
*10 See Visschedijk,2022.
*11 EMEP/EEA Guidebook (2019), 1A4, table 3.4, default value
*12 Van Soest-Vercammen et al., 2002

Table 60 Combustion emission factors in the agricultural sector (g/GJ)

Substance name	**Natural gas (gas turbines)**	**Natural gas (boilers)**	**LPG**	**Biogas**	**Wood**
NMVOC	25.6 *1	2.0 *11	1.3 *5	23 *13	1.33 *3
Hydrocarbons *9	64.0	5.0	2.0	57.5	3.33
Sulphur dioxide	0.2 *2	0.2 *2	0.22 *5	0.67 *13	11 *7
Nitrogen oxides as NO_2	35.0 *1	41.0 *1	40 *5	74 *13	80 *3
Ammonia					37 *7
Carbon monoxide	56.0 *1	15.0 *2	10 *5	29 *13	170 *3
Particulate matter (PM10)	0.2 *12	0.27 *2	2.0 *5	0.78 *13	17 *3
Particulate matter (PM2.5) *10	0.2	0.27	2.0	0.78	16
Elementary Carbon *10	0.008	0.011	1.12	0.031	5.1

References:
*1 Visschedijk, 2022
*2 EMEP/EEA Guidebook (2019), 1A4, table 3.27, minimum value
*3 From 'Kennisdocument Houtstook in Nederland' (Koppejan and de Bree, 2018)
*5 Methodology report Zonneveld (Guis, 2006)
*7 EMEP/EEA Guidebook (2019), 1A4, table 3.10, average value
*9 Calculated from NMVOC emission factor. NMVOC percentages in hydrocarbon are: 40% for natural gas, 50% for diesel, 65% for biogas, 40% for wood.
*10 PM2.5 fraction and EC2.5 fraction available in Visschedijk & Dröge, 2019.
*11 EMEP/EEA Guidebook (2019), 1A4, table 3.27, default value
*12 EMEP/EEA Guidebook (2019), 1A4, table 3.28, default value
*13 EMEP/EEA Guidebook (2019), 1A4, table 3.8, default value

All companies in the CRT categories 1A1b, 1A1c, 1A2b report an e-AER, so supplemental emissions are not calculated in these categories.

The PCB emissions are not reported in the e-EARs of the companies. In order to be able to determine these emissions, the method used for the other emitters is unsuitable. Therefore, the PCB emissions are calculated top down on the basis of the total use of solid fuels and biomass reported in the CBS Energy Statistics, multiplied with the emission factors from Table 61.

Table 61 List of PCB emission factors of solid fuels (Microgram/GJ)

Year	Solid fuels (1A1 and 1A2)	Solid fuels (1A4)	Biomass
1990	52.4	170	0.06
1991	42.1	170	0.06
1992	31.7	170	0.06
1993	21.4	170	0.06
1994	11.0	170	0.06
1995-2024	0.67	170	0.06

The PCB emission factor of solid fuels in 1A4 is from the EMEP/EEA Guidebook (2019), chapter 1A4, table 3.7. The PCB emission factor of biomass is from the EMEP/EEA Guidebook (2019), chapter 1A2, table 3.5.

The PCB emission factor of solid fuels in 1A1 and 1A2 is based on the correlation between the dioxin and PCB emission factors in the guidebook and in the Dutch emission inventory. This is calculated as follows:
The implied dioxin emission factor in electricity production form solid fuels is 62.57 ng/GJ in 1990 and 0.7968 ng/GJ in 2015-2017. Compared to the dioxin emission factor in chapter 1A2, table 3.2 of the EMEP/EEA Guidebook (2019) of 203 ng dioxin/GJ, the Dutch implied emission factor is a factor 3.2 lower in 1990 and a factor 255 lower in 2015-2017. It is assumed that emission reduction technologies for dioxin will also result in a similar emission reduction of PCB. Therefore, the emission factor is calculated by dividing the default PCB emission factor from chapter 1A2, table 3.2 of the EMEP/EEA Guidebook (2019) of 170 microgram PCB/GJ with the factor difference of 3.2 in 1990 and 255 in 2015-2017. This results in an emission factor of 52.4 microgram/GJ in 1990 and 0.67 microgram/GJ in 2015-2017. In the early 90s, dioxin emissions have reduced significantly, and it is therefore assumed that the low emission factor is valid from 1995 onwards. The emission factors in the period 1990-1995 have been interpolated. See Table 54 for the emission factors used.

The mercury emissions caused by combustion of natural gas are based on a study from the Gasunie in which country specific emission factors are determined:

- 1990 – 2009 emissionfactor 0.039 mg/GJ
- 2010 – 2016 emissionfactor 0.023 mg/GJ
- 2017 – 2023 emissionfactor 0.010 mg/GJ

Emission factors (mg/GJ) from natural gas combustion of the metals listen below are taken from the EMEP guidebook 2019

Plumbum	0.0015
Cadmium	0.00025
Arsenic	0.12
Chrome	0.00076
Nickel	0.00051
Selenium	0.0112
Zinc	0.0015
Copper	0.076

3.2.3.5 Aggregation

The energy statistics and AER data are aggregated to the same fuel names and NACE level. The energy file and PRTR file are now in the same format to ensure the files can be compared and used to make the calculations. This is required for the calculation of the emission factor and to establish the supplemental consumption.

Table 62 List of aggregated fuels

CBS name	**AER aggregation name**
Coal and coal briquettes	Coal
Lignite	Lignite
Coal cokes	Cokes
Coke oven gas	coke oven gas
Blast furnace gas	Blast furnace gas
Coal bitumen	tar, pitch, asphalt
Crude oil	crude oil
Natural gas condensate	Condensate
Other crude oil raw materials	waste oil
Refinery gas	waste gas
Chemical waste gas	waste gas
LPG, propane, butane	Lpg
Naphthas	Naphtha
Crude oil aromatics	Aromatics
Aviation fuel	avgas (aviation fuel)
Jet fuel (kerosene base)	aviation kerosene
Petrol / gasoline	petrol/gasoline
Other light oils	Dfo
Petroleum	Petroleum
Gas oil, diesel oil, heating oil < 15cSt	Dfo
Heavy heating oil >= 15cSt	fuel oil
Lubricating oils and fats	Lubricants
Bitumen	tar, pitch, asphalt
Mineral turpentine	Lubricants
Mineral waxes	Lubricants
Raw materials for carbon black	other oil products
Petroleum cokes	Pcokes
Total anti-knock preparations	other oil products
Additives for lubricants	other oil products
Other crude oil products H27	other oil products
Other products (not H27)	other oil products
Natural gas	natural gas (Slochteren)
Fermentation gas	Biogas

CBS name	AER aggregation name
Sewage gas	Biogas
Landfill gas	Biogas
Industrial fermentation gas	Biogas
Biomass, liquid	Biomass
Biomass, solid	Biomass
Wood	Wood

3.3 Supplemental estimation of process emissions

Within the PRTR the industrial company category data usually consists of a part with the process emissions from the available individual company data and a part with the process emissions from the missing companies grouped by NACE-category, the so-called supplemental estimate.
The eAERs are the source material for the individual company data. The eAER data and additional information from non-AER companies make up the PRTR-I file. The method is described in section 3.1.
The total process emissions of a company category are established by adding up the individual company data and the supplemental estimate.

This chapter describes the methods for calculation of the supplemental estimates of the process emissions of a number of industrial company categories.

3.3.1 Emission sources

Table 63 shows the emission source (following the NACE = general industrial classification of Economic activities in the European communities) for which supplemental estimates are established.

Table 63 List of process emission sources defined by NACE 2008 classification described in this section

ES CODE	EMISSION SOURCE
0833400	NACE 52.10/52.24: Cargo handling and storage
8900200	NACE 10-12: Food, beverages and tobacco industry
8900700	NACE 18/58: Publishing, printing and reproduction of recorded media
8900900	NACE 20.15: Manufacture of fertilisers and nitrogen compounds
8901700	NACE 22.1: Manufacture of rubber products
8901706	NACE 22.1: Manufacture of rubber products, fugitive
8910000	NACE 10.1: Processing and preserving of meat and poultry
8910300	NACE 10.4: Manufacture of oils and fats
8910400	NACE 10.5: Dairy industry
8910406	NACE 10.5: Dairy industry, fugitive
8910500	NACE 10.6: Manufacture of grain mill products, excl. starches and starch products
8910506	NACE 10.6: Manufacture of grain mill products, excl. starches and starch products, fugitive
8910600	NACE 10.9: Manufacture of prepared animal feeds
8910606	NACE 10.9: Manufacture of prepared animal feeds, fugitive
8911700	NACE 15.11: Tanning of leather and fur preparation
8911900	NACE 16.1: Sawmilling and planing of wood; impregnation of wood
8912100	NACE 16.23: Manufacture of builders' carpentry and joinery
8912106	NACE 16: Manufacture of wooden products, fugitive
8912406	NACE 17: Manufacture of paper, paperboard and articles of paper and paperboard, fugitive
8913002	NACE 20.16: Manufacture of plastics in primary forms, handling of F-gases

ES CODE	EMISSION SOURCE
8913005	NACE 20.16: Manufacture of plastics in primary forms, production of HCFK 22
8913900	NACE 22.2: Manufacture of plastics products
8913906	NACE 22.2: Manufacture of plastic products, fugitive
8914501	Road paving with asphalt
8914503	Manifacturing of other non-metallic mineral products: Asphalt production
8914602	NACE 24.2: Manufacture of tubes and pipes
8914606	NACE 23: Construction material and glass industry, fugitive
8914800	NACE 30.1: Ship-building, painting
8914900	NACE 24.5: Casting of metals
8915000	NACE 25-33/95: Metal-electronic industry
8915003	NACE 25-33/95: Metal-electronic industry, painting and dyeing
8915006	NACE 25-33/95: Metal-electronic industry, fugitive release of PM_{10}
8918000	NACE 10.8: Other manufacture of food products
8918006	NACE 10.8: Other manufacture of food products, fugitive
8918106	NACE 13: Manufacture of textiles, fugitive
8919700	NACE 13.20: Textile weaving
8920400	NACE 35: Production and distribution of gas and electricity
8924202	NACE 19.2: Manufacture of refined petroleum products, terminals
8924406	NACE 24.1-24.3: Base metal industry, processing and manufacture of iron and steel
8924407	NACE 24.1-24.3/24.51/24.52: Base metal: iron and steel
8924502	Solvent and other product use: other
8924506	Solvent and other product use: refrigeration and air conditioning equipment, stationary
8914702	NACE 24.45: Manufacture of non-ferrous metals, aluminium
8914704	NACE 24.45: Manufacture of non-ferrous metals, copper
8914705	NACE 24.45: Manufacture of non-ferrous metals, lead
8914706	NACE 24.45: Manufacture of non-ferrous metals, zinc
8911400	NACE 13.3: Finishing of textiles
8911500	NACE 13.93: Manufacture of carpets and rugs
8912200	NACE 17.1: Manufacture of pulp, paper and paperboard
8912300	NACE 17.2: Manufacture of articles of paper and paperboard
8912600	NACE 20.12: Manufacture of dyes and pigments
8913000	NACE 20.13: Manufacture of inorganic basic chemicals
8912900	NACE 20,149: Manufacture of organic basic chemicals (no petrochemicals)
8913100	NACE 20.2: Manufacture of pesticides
8913200	NACE 20.3: Manufacture of paints, varnishes and similar coatings, printing ink and mastics
8913400	NACE 20.41: Manufacture of detergents
8913600	NACE 20.52: Manufacture of glues and adhesives
8919300	NACE 20.59: Manufacture of other chemical products n.e.c.
8913800	NACE 20.6: Manufacture of synthetic and artificial fibres
8914000	NACE 23.1: Manufacture of glass and glassware
8914200	NACE 23.32: Manufacture of bricks and tiles
8914300	NACE 23.6: Manufacture of articles of concrete, plaster and cement
8914500	NACE 23.9: Manufacture of other non-metallic mineral products

3.3.2 Calculation method of preliminary emission figures

3.3.2.1 Emissions of industrial processes in product manufacturing

Calculation of the preliminary emissions is based on the production index figures of Statistics Netherlands (CBS).

The t-1 emissions are calculated as follows:

(Preliminary prod. index figure year(t+1) / Final prod. index figure (Year t)) * Emission(Year t)

Note: Year t = last year for which final emission figures have been calculated.

If reduction measures are known to have been implemented, the emission will be reduced by the reduction percentage achieved by these measures.

3.3.3 Calculation method of final emission figures

3.3.3.1 General estimation method for supplemental emissions of industrial processes in product manufacturing

For the emission sources summed in Table 64 a generic method is used to estimate the supplemental emissions for all substances, because no additional data is available for a substance-specific estimation of the supplemental emissions.

Table 64 Emission sources using the general method to estimate the supplemental emissions

ES CODE	**EMISSION SOURCE**
8910500	NACE 10.6: Manufacture of grain mill products, excl. starches and starch products
8911400	NACE 13.3: Finishing of textiles
8911500	NACE 13.93: Manufacture of carpets and rugs
8912200	NACE 17.1: Manufacture of pulp, paper and paperboard
8912300	NACE 17.2: Manufacture of articles of paper and paperboard
8912600	NACE 20.12: Manufacture of dyes and pigments
8913000	NACE 20.13: Manufacture of inorganic basic chemicals
8912900	NACE 20,149: Manufacture of organic basic chemicals (no petrochemicals)
8913100	NACE 20.2: Manufacture of pesticides
8913200	NACE 20.3: Manufacture of paints, varnishes and similar coatings, printing ink and mastics
8913400	NACE 20.41: Manufacture of detergents
8913600	NACE 20.52: Manufacture of glues and adhesives
8919300	NACE 20.59: Manufacture of other chemical products n.e.c.
8913800	NACE 20.6: Manufacture of synthetic and artificial fibres
8914000	NACE 23.1: Manufacture of glass and glassware
8914300	NACE 23.6: Manufacture of articles of concrete, plaster and cement
8914500	NACE 23.9: Manufacture of other non-metallic mineral products
8914602	NACE 24.2: Manufacture of tubes and pipes
8914900	NACE 24.5: Casting of metals
8919700	NACE 13.20: Textile weaving
8911700	NACE 15.11: Tanning of leather and fur preparation

Up to 2007, the emissions of the non-reporting facilities (Em_non_IF) were calculated as follows:
*Em non_IF = IEF * (TP –P_IF)*

Where
IEF = the implied emission factor

TP = Total production (Production Statistics, Statistics Netherlands)
P_IF = Production of individual facilities (Production Statistics, Statistics Netherlands)

The implied emission factors were calculated as follows:

IEF = Em_IF / P_IF
Where
Em_IF = the sum of the emissions from individual facilities;
(since 1999 most of the emissions of the individual facilities were derived from the Annual Environmental Reports (AER))

Since 2007, due to a lack of production figures, emissions from non-reporting facilities are calculated as follows:

$Em\ non_IF = (PI_{(t)} / PI_{(t-1)}) * Em\ non\text{-}IF_{(t-1)}$

Where
PI = production indices at 2 digit level (Statistics Netherlands)
t = year

If reduction measures are known to have been implemented, the emission will be reduced by the reduction percentage achieved by these measures.

3.3.3.2 Substance-specific estimation for supplemental emissions of industrial processes in product manufacture

In addition to emission sources where a generic method is applied to estimate supplemental emissions of all substances, there are also emission sources whereby substance-specific methods are applied. This section describes these substance-specific methods.
For the sake of clarity emission sources are subdivided into groups (referencing emission sources) based on the substances released. Depending on the substances released from each source a number of emission sources may appear in several groups. The subdivision into groups is as follows:

- Group 1: PM_{10} / $PM_{2.5}$
- Group 2: Other NMVOCs, toluene, hexane and ethanol
- Group 3: F-gases
- Group 4: Fugitive PM_{10} / $PM_{2.5}$ emissions in industrial sectors due to industrial building ventilation
- Group 5: NMVOC emissions from industrial coating application
- Group 6: Other

The calculation methods for definitive emissions for each group with emission sources are described below.

Group 1: PM_{10}/$PM_{2.5}$
The group PM_{10} / $PM_{2.5}$ includes emission source categories summed in Table 65.

Table 65 Emission sources using the substance-specific method to estimate supplemental PM_{10} and $PM_{2.5}$ emissions

Code	ES_CODE	PROCESS_DESCRIPTION
A	0833400	NACE 52.10/52.24: Cargo handling and storage
B	8910000	NACE 10.1: Processing and preserving of meat and poultry
C	8910300	NACE 10.4: Manufacture of oils and fats
D	8910400	NACE 10.5: Dairy industry
F	8910600	NACE 10.9: Manufacture of prepared animal feeds
G	8918000	NACE 10.8: Other manufacture of food products

PM_{10} emission calculation

Code: A

Normally, all storage and transhipment companies are listed in the PRTR-I and the $PM_{10}/PM_{2.5}$ emission from this source is 0. If emissions from one or more companies are not listed in the PRTR-I a copy of the emissions from the most recent year from the PRTR-I will be included in this emission source. When necessary, these emissions can be adjusted using production indices.

Code: D

Total emissions of the (sub)categories are calculated as follows:
Em Total (sub)category(t) = Em Total (sub)category(t-1) * (PI(t) / PI(t-1))

Where:
t = year
PI = production indices (Statistics Netherlands)

The emissions from this source are calculated as follows:

Em = TOTAL Em –EmComp

Where:
TOTAL Em = total emissions of the (sub)categories
EmComp = emissions from the individually registered companies (PRTR-I)

If reduction measures are known to have been implemented, the emission will be reduced by the reduction percentage achieved by these measures.

Codes: B, C, F and G

Until 2000, the emissions of the non-reporting facilities (Em non_IF) were calculated as follows:

*Em non_IF = IEF * (TP –P_IF)*

Where:
IEF = The implied emission factor
TP = Total production (sub)category (Production Statistics, Statistics Netherlands)
P_IF = Production of individual facilities (Production Statistics, Statistics Netherlands)

The implied emission factors were calculated as follows:

IEF = Em IF / P_IF

Where:
Em_IF = the sum of the data from the individual facilities

Due to lack of production figures and emission data from individual facilities, the total emissions of the (sub)categories are calculated as follows, since 2000:
*Em Total (sub)category(t) = Em Total (sub)category(t-1) * (PI(t) / PI(t-1))*

Where:
t = year
PI = production indices (Statistics Netherlands)

Finally, the emissions (Em_sup) from these emission sources are calculated as follows:

Em_sup = Em Total (sub)category(t) –EmComp

Where:
Em Total (sub)category$_{(t)}$ = total emissions of the (sub)categories
EmComp = emissions from individually registered companies (PRTR-I)
If reduction measures are known to have been implemented, the emission will be reduced by the reduction percentage achieved by these measures.

$PM_{2.5}$ emission calculation
A source specific TNO conversion table (Visschedijk and Droge, 2019), included in Appendix 3,was used to derive the $PM_{2.5}$ emissions from the PM_{10} emissions.

Group 2: Other NMVOCs, toluene, hexane and ethanol
The group other NMVOCs includes emission sources summed in Table 66.

Table 66 Emission sources using the substance-specific method to estimate supplemental NMVOCs, toluene, hexane and ethanol emissions

Code	ES CODE	EMISSION SOURCE
A	0833400	NACE 52.10/52.24: Cargo handling and storage
B	8900700	NACE 18/58: Publishing, printing and reproduction of recorded media
C	8901700	NACE 22.1: Manufacture of rubber products
D	8910300	NACE 10.4: Manufacture of oils and fats
E	8911900	NACE 16.1: Sawmilling and planing of wood; impregnation of wood
F	8913900	NACE 22.2: Manufacture of plastic products
G	8915000	NACE 25-33/95: Metal-electronic industry
H	8918000	NACE 10.8: Other manufacture of food products
I	8924202	NACE 19.2: Manufacture of refined petroleum products, terminals

Code: A

Based on the revised *Handboek Emissiefactoren* (Emission Factors Manual; RIVM/MNP, 2004) the sector association submitted a new NMVOC emission figure for the entire category for 2006.
After 2006 the total NMVOC emission is estimated by multiplying the emission of the previous year by the production index figure of the present year / production index figure of the previous year. The supplemental emissions are estimated by subtracting the PRTR-I emissions from the total emissions. If reduction measures are known to have been implemented, the emission will be reduced by the reduction percentage achieved by these measures.

Code: B
Up to and including the emission year 2007 the total NMVOC emissions were taken from the annual reports on the Evaluation of the Environmental Policy Agreement for the Printing Industry and Packaging Printers (FO-Industrie, 2008).
After 2007 the total NMVOC emissions are estimated as follows:

*EM Total = (SPI(t)/SPI(t-1) * *EM Total of the previous year.*

Where:
SPI = sales of printing ink (https://www.vvvf.nl/home-en/factsandfigures
t = year
The supplemental NMVOC emissions are estimated by subtracting the PRTR-I emissions from the total emissions. If reduction measures are known to have been implemented, the emission will be reduced by the reduction percentage achieved by these measures.

Codes: C and F
These sources account for the NMVOC emissions released in the manufacture of rubber and plastic products. The underlying data for the supplemental estimate were the total NMVOC emission figures of these (sub)categories (up to and including 2000 based on the KWS2000 project; from 2001 up to and including 2003 based on Infomil). The supplemental emissions were estimated by subtracting the PRTR-I emissions from the total emissions of these (sub)categories.

Due to lack of production figures and emission data from individual facilities, the total emissions of the (sub)categories are calculated as follows, since 2003:
$Em\ Total\ (sub)category_{(t)} = Em\ Total\ (sub)category_{(t-1)} * (PI_{(t)} / PI_{(t-1)})$

Where:
t = year
PI = production indices (Statistics Netherlands)

The emissions from this source are calculated as follows:

Em = TOTAL Em –EmComp

Where:
TOTAL Em = total emissions of the (sub)categories

EmComp = emissions from the individually registered companies (PRTR-I)

If reduction measures are known to have been implemented, the emission will be reduced by the reduction percentage achieved by these measures.

Code: D
This source accounts for hexane and ethanol emissions released from the processing of soybeans and oil- and fat-rich seeds.
The hexane and ethanol emissions of this source are 0, because all companies have been listed in the PRTR-I since 2002. If emissions from one or more companies are not listed in the PRTR-I a copy of the emissions from the most recent year from the PRTR-I will be included in this emission source. If necessary, these emissions can be adjusted using production indices.

Code: E
This emission source accounts for NMVOC emissions released from wood preservation processes. Up to and including 2000 the emission estimations were based on data from the KWS2000 project. After that, no emissions have been made available through other sources. For that reason the emission has not been changed since 2000. For that reason, the emission of NMVOC from wood treatment processes have been kept stable at 1.100 ton per year since 2003.

In 2018 this emission source has been re-examined to find out whether the current emission trend is still applicable or if it needs to be updated. For this purpose, literature was examined and contact was made with the VHN (the Dutch association of companies in the wood treatment business). The VHN represents wood treatment company's, suppliers of treatment fluids & production equipment and dealers/traders of preserved wood and wood products.

On basis of information provided by the VHN it can be concluded that the emissions of NMVOC from wood preservation processes have abated from 2000 onward. The main reasons for the emission reduction are a combination of smaller amounts of NMVOC in the impregnation- and dip fluids, improvements in the production process and a reduction in the produced volume of preserved wood from 2000 onwards.

As a result, the following trend of NMVOC emissions can be deduced:

YEAR	**NMVOC (tonnes)**
1990-2000	1,100
2001	900
2002	700
2003	500
2004	300
2005 onwards	100

As mentioned earlier, the steep emission reduction from 2000 to 2005 are the result of stricter regulations on the NMVOC emissions.

The latter stabilisation of the NMVOC emission trend is mainly due to the fact that currently only 2 companies within the Netherlands produce creosote preserved wood. Although their exact annual production numbers are not known, the VHN estimates that the annual production of preserved wood and the related amount of impregnation fluid needed is fairly stable.

The VHN predicts that the annual amount of creosote preserved wood produced by these 2 companies will further decrease in the future due to stricter regulations within the Netherlands and the EU. In the end it is expected that the amount of creosote preserved wood produced in the Netherlands will decrease to zero and thereby the NMVOC emissions of this emission source.

Code: G
This emission source concerns NMVOC emissions released from the "cleaning and degreasing" process. The NMVOC emissions from this emission source have not been subject to any structural monitoring since 1995. This has resulted in the following series of emissions:

1981: 8.0 ktonnes
1992: 5.1 ktonnes
1993: 4.5 ktonnes
1994: 4.0 ktonnes
1995 up to and including 1999: 3.5 ktonnes
2000 up to now: 2.9 ktonnes

The up to and including 1999 figures were taken from the KWS2000 Final Report (Infomil, 2002) and the 2000 figure from the 2010 VOC Reduction Plan for the Metal-Electronic Industry (FME-CWM, 2003). After that, no emissions have been made available through other sources. For that reason the emission has not been changed since 2000.

Code: H
This emission source includes ethanol emissions released from bread bakeries. Ethanol emissions from bakeries originate from the yeast fermentation of all yeast containing bakery products. These mainly include: all types of bread, rolls (a.o. hamburgers, hot dogs, etc.) and sweet yeast products (a.o. brioche, doughnuts, etc.). NMVOC emissions from bakeries are not being registered, calculated or estimated and therefore emissions from bakeries will have to be deduced from sales data.
On basis of the annual amount of bread sold/consumed in the Netherlands and the average amount of ethanol emitted per unit of bread, the annual amount of ethanol produced by bakeries can be calculated.

The annual amount of bread sold in the Netherlands is calculated by Statistics Netherlands (CBS) and the Dutch Bakery Centre (NBC):

- 1990-2008: Bread consumption per inhabitant from CBS (https://opendata.cbs.nl/statline/#/CBS/nl/dataset/37154/table?dl=1D9AB) combined with number of inhabitants.

- From 2009 onwards: Statistics from NBC (https://www.nbc.nl/nieuws/steeds-meer-brood-wordt-buitenshuis-gegeten).

According to chapter 2H2, table 3.11 in the EMEP/EEA Guidebook (2019), the average amount of ethanol produced per unit of typical European bread is 4.5 kg/ton of bread.

The Total annual NMVOC emissions from the bread production are calculated as follows:

*TOTAL Em = (ConsPP * InhNL) * 4.5*

Where:
ConsPP = annual average bread consumption per person
InhNL = annual number of inhabitants in the Netherlands

These calculated emissions are exclusive of any possible emission-reducing measures. Out of contacts with multiple Dutch industrial bakeries (Industrial bakeries have a market share of between 80–85% in the Netherlands - European Bread Market Reports 2010-2013), it appears that no emission reducing measures are being taken.
The emissions coming from the yeast fermentation are only being diluted in order to reduce the NMVOC concentrations.

Code: I
This concerns four oil terminals whose total emissions are provided by DCMR on an annual basis.

Group 3: F-gases
The group F-gases includes the emission sources summed in Table 67.

Table 67 Emission sources using the substance-specific method to estimate supplemental F-gas emissions

ES CODE	EMISSION SOURCE
8913002	NACE 20.16: Manufacture of plastics in primary forms, handling of F-gases
8913005	NACE 20.16: Manufacture of plastics in primary forms, production of HCFK 22
8924502	Solvent and other product use: other
8924506	Solvent and other product use: refrigeration and air conditioning equipment, stationary

The methods to determine the total HFC/PFC/CH_4 emissions from several sources are described in paragraph 2.2. The supplemental estimate is determined by subtracting the HFC/PFC/CH_4 emissions from the industry listed in the PRTR-I from the total emission.

Group 4: Fugitive PM_{10} / $PM_{2.5}$ emissions in industrial sectors due to industrial building ventilation
The group fugitive PM_{10}/$PM_{2.5}$ emissions includes the emission sources summed in Table 68.

Table 68 Emission sources using the substance-specific method to estimate supplemental PM_{10} and $PM_{2.5}$ emissions due to interior ventilation

ES CODE	EMISSION SOURCE
8901706	NACE 22.1: Manufacture of rubber products, fugitive
8910406	NACE 10.5: Dairy industry, fugitive
8910506	NACE 10.6: Manufacture of grain mill products, excl. starches and starch products, fugitive
8910606	NACE 10.9: Manufacture of prepared animal feeds, fugitive
8912106	NACE 16: Manufacture of wooden products, fugitive
8912406	NACE 17: Manufacture of paper, paperboard and articles of paper and paperboard, fugitive
8913906	NACE 22.2: Manufacture of plastic products, fugitive
8914606	NACE 23: Construction material and glass industry, fugitive
8915006	NACE 25-33/95: Metal-electronic industry, fugitive release of PM_{10}
8918006	NACE 10.8: Other manufacture of food products, fugitive
8918106	NACE 13: Manufacture of textiles, fugitive
8924406	NACE 24.1-24.3: Base metal industry, processing and manufacture of iron and steel

This concerns fugitive PM_{10} and $PM_{2.5}$ emissions due to ventilation of production buildings.
PM_{10}-emissies from these sources (2.7 ktonnes/year) were estimated for the first time in 2000 (DHV, 2000b). An update of this study was performed in 2012 (DHV, 2012). This has resulted in new emission estimates for 2010. For the period up to and including 2000 the emissions from the 2000 study were used, and for the period 2001-2010 the emissions were determined by linear interpolation. The total emission has not been changed since 2010 because actual emissions could deviate a factor of 2 to 3 from estimated emissions. A source specific TNO conversion table (Visschedijk and Droge, 2019) was used to erive the $PM_{2.5}$ emissions from the PM_{10} emissions.

Group 5: NMVOC emissions from industrial coating application
The group NMVOC from industrial coating application includes the emission sources summed in Table 69.

Table 69 mission sources using the substance-specific method to estimate supplemental NMVOCs, emissions from industrial coating application

Code	ES CODE	EMISSION SOURCE
A	8912100	NACE 16.23: Manufacture of builders' carpentry and joinery
B	8914800	NACE 30.1: Ship-building, painting
C	8915003	NACE 25-33/95: Metal-electronic industry, painting and dyeing

These emission sources are responsible for a part of the NMVOC emissions from industrial coating applications.

Codes: A and B:
The annual national paint sales in ton are provided by the annual paint sales statistics of the Netherlands Association of Paint Producers (VVVF). Up to and including
2016 these Statistics also included information on the NMVOC contents. For that reason the 2015 NMVOC contents are used since 2017.
The VVVF represents 100% of the total market of these industrial sectors.
It is assumed that all paint sold will be used the same year and the NMVOC emitted is 100% of the NMVOC content. So, the total NMVOC emissions (TOTAL Em) from these industrial sectors are equal to the NMVOC content (in ton).

The NMVOC emissions from these emission sources are calculated as follows:

Em =TOTAL Em –EmComp

Where:
EmComp = NMVOC emissions from the individually registered companies (PRTR-I)

Code: C
The annual national paint sales are provided by the annual paint sales statistics of the Netherlands Association of Paint Producers (VVVF). Until 2016 these Statistics also included information on the NMVOC content. For that reason the 2015 NMVOC contents in % are used since 2017. Until 2000 the VVVF represents about 95% of the total market and from 2000 onwards this share is 90%. The remaining part (5/10%) consists of directly imported paint.
The Total NMVOC emissions from the metal-electronic industry are calculated as follows:

*TOTAL Em = (EmN +EmI + EmCA) * (1 - 0.34)*

Where:
EmN = NMVOC content of national paint sales
EmI = NMVOC content of directly imported paint.

It is assumed that:

- all paint sold will be used the same year and that the NMVOC emitted is 100% and the imported paint contains the same amount of NMVOCs as the paint sold by VVVF.
- 50% of the directly imported paint is used by this source.

EmCA (Emission by using cleaning agent) = 0.3 * Used amount of cleaning agent.
Used amount of cleaning agent = 0.15 * Paint consumption

0.34 = Destruction factor for abatement technology (afterburner)

The factors 0.3, 0.15 and 0.34 have been derived from the NMVOC reduction plan 2010 (FME/CWM, 2003)
The NMVOC emissions from this emission source are calculated as follows:

Em =TOTAL Em – EmComp

Where:
EmComp = NMVOC emissions form the individually registered companies (PRTR-I)

Group 6: Other
The group other includes various emission sources summed in Table 70.

Table 70 Emission sources using the substance-specific method to estimate supplemental emissions of other substances

Code	ES CODE	EMISSION SOURCE
A	8915000	NACE 25-33/95: Metal-electronic industry
B	8920400	NACE 35: Production and distribution of gas and electricity
C	8924407	NACE 24.1-24.3/24.51/24.52: Base metal: iron and steel
D	8914702	NACE 24.45: Manufacture of non-ferrous metals, aluminium
E	8900200	NACE 10-12: Food, beverages and tobacco industry
F	8900900	NACE 20.15: Manufacture of fertilisers and nitrogen compounds
G	8914704	NACE 24.45: Manufacture of non-ferrous metals, copper
H	8914705	NACE 24.45: Manufacture of non-ferrous metals, lead
I	8914706	NACE 24.45: Manufacture of non-ferrous metals, zinc
K	8914501	Road paving with asphalt
L	8914503	Manufacturing of other non-metallic mineral products: Asphalt production

Code: A
This concerns the emissions of chrome, copper, nickel and zinc, as well as PM_{10}/$PM_{2.5}$. Up to and including 2000 (emissions of 1998) the total emissions of this sector were calculated using production/consumption figures provided by VOM (Materials Surface Treatment Association) and VELATEC (Welding Technology Association), and emission factors were taken from SPIN (Cooperative Project for Process Descriptions in Dutch Industry) process descriptions. The supplemental estimate is determined by subtracting the PRTR-I emissions of these substances from the total.

Due to lack of production figures and emission data from individual facilities, the total emissions of this sector are calculated as follows, since 2000:

$Em\ Total_{(t)} = Em\ Total_{(t-1)} * (PI_{(t)} / PI_{(t-1)})$

Where
T = year
PI = production indices (Statistics Netherlands)

The emissions from this source are calculated as follows:

$Em = Em\ Total_{(t)} - EmComp$

Where:
Em Total $_{(t)}$ = total emissions of the sector
EmComp = emissions form the individually registered companies (PRTR-I)

A source specific TNO conversion table (Visschedijk and Droge, 2019) was used to derive the $PM_{2.5}$ emissions from the PM_{10} emissions.
If reduction measures are known to have been implemented, the emission will be reduced by the reduction percentage achieved by these measures.

Code: B
In general, all fluoride emissions from coal-fired power stations are listed in the PRTR-I and the fluoride emission from this source is 0. If emissions from one or more companies are not listed in the PRTR-I a copy of the emissions from the most recent year from the PRTR-I will be included in this emission source. If necessary, these emissions can be adjusted using production indices.

Codes: C and D
For the supplemental estimate of the emissions from these sources a separate supplemental estimation method is used for the PAH emissions. For all other substances the generic supplemental estimation method (described in section 3.3.3.1) is used.
If there is no complete registration for the 4 individual PAHs a set of specific factors can be used for the calculation of the emissions of the missing individual PAHs. These factors were obtained from a specific study (Visschedijk, 2007).

Code: E
This concerns leakage of ammonia from cooling installations. A constant emission is maintained for this emission source.

Code: F
In general, all fertilizer manufacturers are listed in the PRTR-I and the CO_2 emission from this source is 0. If emissions from one or more companies are not listed in the PRTR-I a copy of the emissions from the most recent year from the PRTR-I will be included in this emission source. If necessary, these emissions can be adjusted using production indices.

Codes: G, H and I
In general, all companies in these company categories are listed in the PRTR-I and the emissions from this source are 0. If emissions from one or more companies are not listed in the PRTR-I a copy of the emissions from the most recent year from the PRTR-I will be included in this emission source. If necessary, these emissions can be adjusted using production indices.

Code: K
Emissions from road paving with asphalt are calculated using the Tier1 method from the EMEP/EEA air pollutant emission inventory guidebook. This concerns emissions of MNVOC, TSP, PM10, PM2.5 and BC.
Total annual emissions are calculated as follows:

$E_{pollutant} = AsphAD * EF_{pollutant}$

Where:
$E_{pollutant}$ = emission of the above mentioned pollutants
$AsphAD$ = annual amount of used asphalt
$EF_{pollutant}$ = Tier1 – emission factor per pollutant

Furthermore, for TSP, PM_{10}, $PM_{2.5}$ and BC it is assumed that abatement technology (fabric filter) is applied. Abatement efficiency of 99%, as mentioned in the guidebook, is assumed. Therefore, fot his pollutants the above calculated emission rate is corrected as follows:

$E_{PM\text{-}pollutant}\text{-}abated = (1 - n_{abatement}) * EF_{PM\text{-}pollutant}$

Where $n_{abatement}$ is 0.999

Code: L
The EMEP/EEA air pollutant emission inventory guidebook does not provide methods for calculating emissions from asphalt production. Because in the Netherlands asphalt production plants sometimes are located close to populated areas, there were requests for emission data. To calculate these, a Tier1 method was developed, based on US-EPA emission factors. This concerns emissions of MNVOC, PM10, benzene, PAH and cadmium.
Total annual emissions are calculated as follows:

$E_{pollutant} = AsphAD * EF_{pollutant}$

Where:
$E_{pollutant}$ = emission of the above mentioned pollutants
$AsphAD$ = annual amount of produced asphalt
$EF_{pollutant}$ = Tier1 – emission factor per pollutant

Tier 1 emission factors are taken from US-EPA stydy AP-42, chapter 11 section 1 [referentie AP-42, Vol. I: Section 11.1 Hot Mix Asphalt Plants]. From this section, emission factors are taken from the appropriate tables, and for each table the abated/controlled factor is taken: using fabric filter as abatement technology is assumed.

Substance	Table
PM10	11.1-2
NMVOC	11.1-6
Benzene	11.10 (gas fired)
PAH	11.10 (gas fired)
Cadmium	11.11

3.4 Emissions from waste treatment

3.4.1 Emission sources

This section covers the emissions that arise from waste disposal and treatment. The following source categories are identified:

- Waste incineration;
- Landfills;
- Composting;
- Wastewater treatment.

3.4.2 Calculation method of preliminary emission figures

3.4.2.1 Waste incineration

The emission of Waste incineration plants (WIPs) are for Air actual calculated as part of the individual emissions (see chapter 3.1), except for three priority substances, hexachlorobenzene (HCB), pentachlorobenzene (PeCB) and Polychlorinated Biphenyls (PCBs). The preliminary values are the final values of the previous year.

3.4.2.2 Landfill sites

The emissions for the Air Actual method are calculated in the same way as for the Air IPCC method See the description in section 2.3.2.2.

3.4.2.3 Composting

The emissions for the Air Actual method are calculated in the same way as for the Air IPCC method See the description in section 2.3.2.3.

3.4.2.4 Sewer systems and wastewater treatment

The calculations of preliminary combustion emissions according to Air Actual are executed in the same way as final emissions. The activity data are established in the period May-August, depending on external data-deliveries. This means in some years the preliminary emissions are identical to the final emissions, but could also be a copy of the previous years. For calculation methods, see the description in section 3.4.2.4. For emissions of total NMVOC from domestic wastewater treatment and total NMVOC emissions of industrial biological waste water treatment, the preliminary figures are a copy of the previous year. For calculation of the final emission figures, see section 3.4.3.4.

3.4.3 Calculation method of final emission figures

3.4.3.1 Waste incineration

The emission of Waste incineration plants (WIPs) are for Air actual calculated part of the individual emissions (see chapter 3.1), except for three priority substances, hexachlorobenzene (HCB), pentachlorobenzene (PeCB) and Polychlorinated Biphenyls (PCB's). The emission of hexachlorobenzene (HCB) and pentachlorobenzene (PeCB) are calculated based on the weight of the incinerated waste. The emissions of these two substances have been calculated for the period

from 1990 up to and including 2004. From 2005 the emissions are included in the supplements of the individual plants.

Hexachlorobenzene (HCB)
TNO 2011 contains an estimation of the HCB emission factor, which is 0.2 mg/ton. The total emission for HCB was calculated based on the total amount of incinerated waste by weight. The emissions are linked to the activity data for the amount of incinerated waste in ktonnes based on the ratio of biomass to non-biomass by weight. These values are calculated for the period from 1990 up to and including 2004. From 2005 the emissions of this substance are factored into the supplemental estimates of the emissions.

In 2013, TNO (TNO, 2013) conducted additional research (included in Annex 3) about the emission factor of HCB and it was concluded that in the early 1990s flue gas scrubbing systems were less effective than in later years. Based on this conclusion, the emission factor for the period from 1990 up to and including 1994 was amended. The emission factor trend was brought in line with the trend of the PCDD/P emission decrease. The emission factors for each year are shown in Table 71.

Table 71 Emission factors HCB, (mg/ton waste)

Year	**1990**	**1991**	**1992**	**1993**	**1994**	**1995->**
HCB	16.08	12.91	10.36	6.72	3.31	0.20

Pentachlorobenzene (PeCB)
TNO 2011 contains an estimation of the PeCB emission factor, which is 0.29 mg/ton. The total emission for HCB was calculated based on the total amount of incinerated waste by weight. The emissions are linked to the activity data for the amount of incinerated waste in ktonnes based on the ratio of biomass to non-biomass by weight. These values are calculated for the period from 1990 up to and including 2004. From 2005 the emissions of this substance are factored into the supplemental estimates of the emissions.

In 2013, TNO (TNO 2013) conducted additional research into the emission factor of PeCB, which concluded that in the early 1990s flue gas scrubbing systems were less effective than in later years. Based on this conclusion, the emission factor for the period from 1990 up to and including 1994 was amended. The emission factor trend was brought in line with the trend of the PCDD/P emission decrease. The emission factors for each year are shown in Table 72.

Table 72 Emission factors PeCB, (mg/ton waste)

Year	**1990**	**1991**	**1992**	**1993**	**1994**	**1995->**
PeCB	23.32	18.71	15.01	9.74	4.80	0.29

Polychlorinated Biphenyls (PCB's)
The EMEP/EEA air pollutant emission inventory guidebook - 2016 gives in gives in the sectoral guidance chapter 5.C.1.a Municipal waste incineration 2016 emission factors for PCB's. A tier 1 approach is used. In table 3-1 of the guidance chapter the given emission factor is 3.4 ng/Mg. As stated in the Guidebook is this emission factor "*…can*

be assumed to be representative for modern waste incineration plants and are based on measurements carried out in Denmark (Nielsen et al., 2010) following the implementation of the EU waste incineration directive". As waste incinerators in the Netherlands must comply with the same regulation a similar emission factor is to be expected.
The emissions are linked to the activity data for the amount of incinerated waste in ktonnes based on the ratio of biomass to non-biomass by weight which are calculated for the Air IPCC method in section 2.3.2.1.1.
With the new guidebook 2019 (EMEP/EEA air pollutant emission inventory guidebook – 2019) the emission factor remains the same.

3.4.3.2 Landfill sites

The emissions for the Air Actual method are calculated in the same way as for the Air IPCC method See the description in section 2.3.2.2.

3.4.3.3 Composting

The emissions for the Air actual method are calculated in the same way as for the Air IPCC method. See the description in section 2.3.2.3.

3.4.3.4 Sewer systems and water treatment

Like many other industrial plants, waste water treatment plants produce combustion emissions. Natural gas is used for space heating and sludge drying installations, and domestic fuel oil is also used in small volumes. Small fractions of biogas are released by sludge fermentation. The bulk of the biogas is used as fuel in CHP plants to generate electricity, while another portion is flared or converted into natural gas. Occasionally biogas may be vented directly into the atmosphere. The latter emissions (methane) are factored into the IPCC process emissions for waste water treatment plants (see section 2.3.1.4). Biotransformation processes occurring in treatment tanks and during sludge processing also cause the release of N_2O and CH_4. The calculation of these emissions is described in section 2.3.1.4.
Domestic waste water treatment plants also emit small amounts of NMVOC, among which benzene en toluene from the biological treatment basins (see 3.4.3.4.3 for calculation method and emission factors). Total NMVOC emissions from industrial biological waste water treatment are also estimated; for the method and emission factor see section 3.4.3.4.2 and 3.4.3.4.3.

3.4.3.4.1 Emission sources

Table 73 Emission sources in the sector sewer systems and wastewater treatment.

ES CODE	EMISSION SOURCE
E400109	NACE 37: Collection and treatment of sewage
0910001	NACE 10-11: Food and beverage industry (wastewater treatment
0910002	NACE 17: Manufacturing of paper and cardboard (waste water treatment)
0910003	NACE 20-21: Manufacturing of chemical and pharmaceutical products (waste water treatment)
0910004	NACE 38: Waste collection, processing and treatment (waste water treatment)

ES CODE	EMISSION SOURCE
0910005	NACE unknown: Industry not specified, Other industrial processes (waste water treatment)

3.4.3.4.2 Activity data

Fuel consumption data for calculating combustion emissions based on the Air Actual method is collected by means of a separate inventory performed by Statistics Netherlands (CBS) in partnership with the Union of Dutch Water Boards and consultancy firm Arcadis. This so-called collective retrieval of energy consumption data from waste water treatment plants is initiated in January using spreadsheets in Excel format, which are sent out to plant operators by Arcadis.
All consumption figures of each plant are entered into the spreadsheet, and – in the case of biogas – the flared and vented volumes as well. Coverage is 100%.

The data is validated by Statistics Netherlands and Arcadis. Plant operators may be contacted if any corrections are required. When the final consumption figures are established, Statistics Netherlands will calculate the current combustion emissions for each plant, and submit these data as such to the PRTR. Energy statistics are included in the consumption figures in the file for calculating the IPCC greenhouse gas emissions (Energy statistics). See section 2.1 for a detailed description of the calculation and processing of the IPCC combustion emissions.

Information on volumes of wastewater treated by domestic wastewater treatment plants is inventoried by Statistics Netherlands and used to calculate NMVOC emissions. See Statline .

Information on the population of industrial biological wastewater treatment plants and related volumes of wastewater treatment is compiled from several sources:
Treated volumes were only known for the years 2010-2023, for most of the iwwtp's. This information stems from the e-AER's.
For each wwtp the Pollution Equivalent Design Capacity (PE) is known. These data come from a survey by Statistics Netherlands that was conducted annually during the period 1993-2016.
Based on the volume of wastewater per VE from wwtp's with a known volume, the unknown volumes of treated wastewater have been estimated by multiplying the PE design capacity by an average value for volume per PE design capacity.
For better estimation, the wwtp's ultimately were aggregated into 6 main types, and 5 relevant economic activities (like Food and beverage, Chemical industry,...).
The following steps were used to estimate the volume of wastewater for 1990-2009 per iwwtp:
a. If the volume is known, this value is used.
b. If the volume is unknown, the weighted average coefficient (m3/PE) of the same installation over 2010-2016 was used (after removing outliers).
c. If the volume is unknown and the installation is not present in the dataset 2010-2016, the weighted average coefficient (m3/VE) per installation type group and per industry group (5 groups) is used.

At some of the companies, the reported volumes are the sum of purified (process) wastewater and cooling water. That cooling water is often considerably more than the wastewater. By looking at data on abstraction of surface water, a correction has been made for cooling water.

In 2024 a survey via the AER among all relevant companies, provided data that is used for update of the time-series of 2016-2022.

Because the share of NMVOC emissions from industrial wastewater treatment in the total NMVOC emissions is very small, namely 0.002 percent, this pragmatic and straightforward approach is sufficient; an extensive and expensive survey is therefore not necessary.

For a more elaborate description of the method to determine the volumes of industrial wastewater treated in industrial biological wastewater treatment plants, see Geertjes & Baas, 2022 (in Dutch).

A time-series of the data is provided in table 74.

Table 74 Wastewater volume data of biological industrial wastewater treatment plants (IWWTP's)

Year	**Number of biological Iwwtp's**	**Total wastewater treated (Mio m^3)**	**Year**	**Number of biological Iwwtp's**	**Total wastewater treated (Mio m3)**
1990	223	338	2015	180	248
1995	227	316	2020	150	245
2000	229	316	2021	147	243
2005	188	239	2022	150	244
2010	177	369	2023	152	244

3.4.3.4.3 Emission factors

The emission factors for combustion used are the standard emission factors as presented in section 3.2.
The emissions are calculated by multiplying fuel consumption (in GJ) by the emission factors. No supplemental estimate is made because observational data are complete here.

The total NMVOC emissions are calculated according to the Default TIER 1 method provided by the EMEP/EEA air pollutant emission inventory guidebook – 2019 (EMEP/EEA, 2019).

Emission = Volume treated * EF

Definitions:

Volume treated = total volume of domestic wastewater biologically treated (m^3)

EF = emission factor NMVOC = 15 mg NMVOC/m^3 wastewater biologically treated (default)

The process emissions of toluene and benzene from domestic wastewater handling are determined on the basis of specific emission factors and country-specific activity data for the number of capita connected including the extra fraction of industrial and commercial wastewater. For description of the full methodology, see STOWA (2014).
Emission = PE * EFPLANT

Definitions
PE = actual load in inventory year, expressed in Pollution Equivalents (persons)
EFPLANT = emission factor
For benzene EFPLANT = 7 mg per PE (STOWA, 2014)
For toluene EFPLANT = 250 mg per PE (STOWA, 2014)

The number of Pollution Equivalents in fact is a proxy for the total number of persons connected to the public WWTPs, including the industrial, commercial and urban run-off fraction of the incoming wastewater. One PE equals the average amount of wastewater - and degradable pollutants contained in it - from one person per day. The PE is implemented as national standard in Dutch wastewater management and is determined at all public WWTPs on basis of measurements of (average) daily COD and Nitrogen-Kjeldahl loads in the influent. The PE is calculated as

PE = (COD + 4,57*Nkjeldahl)/150

Definitions:
COD = daily load of COD in influent of WWTP, gram COD/day
Nkjeldahl = daily load of Nkjeldahl-N in influent of WWTP, gram Nkjeldahl-N/day
150 = gram of oxygen needed to convert degradable pollutants of one person per day
The activity data needed to calculate the PE are taken from yearly statistics on Urban Wastewater Treatment, compiled by Statistics Netherlands.

The total NMVOC emissions as calculated by the EMEP method are corrected for the Benzene and Toluene emissions and reported as 'Other NMVOC emission'. Total NMVOC emissions can be calculated from the database as the sum of the 'other NMVOC emissions' plus benzene emissions plus toluene emissions.

The process emission of NMVOC emissions from biological industrial wastewater treatment is calculated using the TIER 1 method from the EMEP/EEA air pollutant emission inventory guidebook – 2019:

Emission = Volume treated * EF

Definitions:
Volume treated = total volume of industrial wastewater biologically treated (m^3)
EF = emission factor NMVOC = 15 mg NMVOC/m^3 wastewater biologically treated (default)

For method of compiling the activity data on volumes of wastewater: see 3.4.3.4.2.

3.5 Emissions from oil and gas extraction, transport and distribution

The emissions from oil and gas extraction, oil and gas transport, and gas distribution are established for the ten Emission Sources (ESs) listed in Table 75.

Table 75 Emission sources in the sector NACE 06-09 Oil/gas extraction & oil and gas transport and distribution

ES CODE	EMISSION SOURCE
0020400	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, onshore
0020502	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, drilling activities
0800200	Gas distribution
6800100	Gas transport
8120000	NACE 06: Extraction of crude oil and natural gas, flaring, offshore
8120001	NACE 06/09.1: Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, offshore
8120002	NACE 06: Extraction of crude oil and natural gas, venting, offshore
8120500	NACE 06: Extraction of crude oil and natural gas, flaring, onshore
8120502	NACE 06: Extraction of crude oil and natural gas, venting, onshore
8120503	NACE 495: Transport of oil via pipelines

3.5.1 Calculation method of preliminary emission figures

3.5.1.1 Oil and gas extraction

Generally the calculation of preliminary emissions is performed in the same way as the calculation of the final emissions. See the description in section 3.5.2. Only emissions for gas transport are calculated in a different way.

Gas transport (ES_CODE 6800100)

The preliminary emissions from gas transport are calculated by increasing the emissions of the previous year by the factor *Emission reporting year / Emission previous year* from Gasunie's Annual Corporate Social Responsibility Report (Gasunie SHE, various years).

3.5.2 Calculation method of final emission figures

The calculation methods for each emission source of the emission to air are described below. The calculation method for the greenhouse gases is similar to the Air IPCC method and is described in paragraph 2.4.

3.5.2.1 Extraction of crude oil and natural gas

Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, drilling activities (ES_CODE 0020502 NACE 06/09.1)

Emission estimates of SO_2 and NO_x.

Because of their low volumes the emissions are not split up into onshore and offshore but reported in the eAERs as a sum. For all substances this is equal to the sum of the emissions from drilling activities reported in the AERs of the extraction companies. The total SO_2 and NO_x emissions are included in the database as combustion emissions.

Activity data
Volume of natural gas (TJ) used as fuel. This value is established by dividing CO_2 (IPCC) emissions (in ton) by the emission factor of 56.8 (ton/TJ). The CO_2 emissions are established by adding up the total reported CO_2 emissions from drilling activities of the individual extraction companies from the e-AERs.
If the e-AERs have not all been accepted by the competent authorities the preliminary data are equated with the final data of the previous year. The preliminary activity rates are established using the same method as the emissions.

Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, onshore (ES_CODE 0020400 SBI 06/09.1)
Emission estimates of the NMVOS, benzene, NO_x and SO_2.

Method:
- NMVOC, NO_x and SO_2: Sum of all emissions from the individual eAERs.
- Benzene is not reported in the e-AERs, but the emission is derived from the e-AERs by using a VOC profile based on a benzene/methane ratio of *20.6/1000*. The benzene emission from onshore activities is allocated to this ES_CODE in its entirety, but is derived from the sum of all CH_4 emissions reported in the individual e-AERs under onshore venting, fugitive, flaring and production.

The total NO_x and SO_2 emissions are all included in the database as combustion emissions. The total NMVOC and benzene emissions as process emissions.

Activity data
Volume of natural gas (TJ) used as fuel.
As the monitoring of the total volume of natural gas by the Netherlands Enterprise Agency (RVO) are discontinued the activity data are taken from Netherlands Statistics for the whole time frame as from the 2022 submission (CBS, 2021) The total volume of natural gas used as fuel is divided to onshore and offshore according to the onshore and offshore CO_2 emissions.

If the eAERs have not all been accepted by the competent authorities the preliminary data are equated with the final data of the previous year. The preliminary activity rates are established using the same method as the emissions.

Extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, offshore. (ES_CODE 8120001 SBI 06/09.1)
The emissions and activity data are established in the same way as described above for "onshore extraction".

3.5.2.2 Oil and gas transport

Gas transport (ES_CODE 6800100) Emission estimates of NMVOC and NO_x

The total NO_x, CO_2 and CH_4 emissions of gas transport were obtained from Gasunie Nederland (GUN). Up to and including 2008 and from 2013 on these data were taken from the Gasunie Annual Report, section on Safety, Health and Environment (SHE). From 2009-2012 these data were published in the separate Gasunie Annual Corporate Social Responsibility Report, in which all environment-related data are included (Gasunie SHE, various years).

The total NMVOC emission is calculated as follows:

- Total VOC = 1.09 * volume of CH_4
- NMVOC = Total VOC –CH_4 volume

The factor of 1.09 is based on a profile used by Gasunie (Gasunie, various years).

Some of these emissions are already listed in the PRTR under individual companies (PRTR-I). The emission of the supplemental estimate is calculated as follows:

Supplemental estimate emission = Total emission – PRTR-I emission

Activity data

Volume of transported natural gas in billion m^3 obtained from Gasunie Nederland (GUN). Captive consumption of natural gas in million m^3 is converted to TJ using a factor 31.65 MJ/m^3.

3.5.2.3 Gas distribution

Gas distribution (ES_CODE 0800200)

Emission estimate NMVOS

The NMVOC emission is established as follows:

- Total VOC = 1.09 * volume of CH_4
- NMVOC = Total VOC – volume of CH_4

Where:

The factor of 1.09 is based on a substance profile used by Gasunie (Gasunie, various years).

The total NMVOC emissions are all included in the database as process emissions. As described in paragraph 2.4, the total CH_4 emissions in m^3 are taken from the "Methaanemissie door Gasdistributie" Netbeheer Nederland (Association of Energy Network Operators in the Netherlands) and compiled by KIWA.

Activity data:

The CRTLength of the gas distribution network is used in the CRT. Data Source was the annual report "*Methaanemissie door Gasdistributie"* (KIWA, several years).

4 Quality

The annual project plan of the Dutch Pollutant Release and Transfer Register RIVM (RIVM, 2024) describes the tasks and responsibilities of the parties involved in the PRTR process, such as deliverables, time schedules (planning) and emissions estimation methods as well as those of the members of several Task Forces. The annual work plan also describes the general QC activities to be performed by the Task Forces before the annual database is consolidated. As part of its National System regarding greenhouse gases, the Netherlands has developed and implemented a QA/QC programme.
In the annual National Inventory Report (NIR) and Informative Inventory Report (IIR) the quality verification actions are described in more detail.

4.1 General quality control

The ER work package leaders check that:

1. the basic data are well documented and adopted (check for typing errors, use of the correct units and correct conversion factors);
2. the calculations have been implemented correctly;
3. assumptions are consistent, also whether specific parameters (e.g. activity data) are used consistently;
4. complete and consistent data sets have been supplied.

Any actions that result from these checks are noted on an 'action list' by the ER secretariat. The work package leaders carry out these actions and they communicate by e-mail regarding these QC checks, actions and results with the ER secretariat.

While adding a new emission year the work package leader performs a trend analysis, in which data from the new emission year are compared with data from the previous emission year(s). The work package leader provides an explanation to the ER secretariat if the increase or decrease of emissions exceeds the minimum level of 5% at target group level or 0.5% at national level. The ER secretariat keeps a logbook of all these QC checks and trend explanations and archives all concerned e-mails on the ER network. This shows explicitly that the required checks and corrections have been carried out. Based on the results of the trend analysis and the feedback on the control and correction process ('action list') the Working Group on Emissions Monitoring (WEM) gives advice to the institute representatives (Deltares on behalf of Rijkswaterstaat, Statistics Netherlands (CBS) and Netherlands Environmental Assessment Agency (PBL)) to approve the dataset. The ER project leader at RIVM defines the dataset, on receipt of an e-mail by the institute representatives, in which they give their approval.
Furthermore, all changes of emissions in the whole time series as a result of recalculations are documented in CRT table 8(b).
In order to check the quality of the emission figures for the sources, general QA/QC procedures are followed that are in line with the IPCC guidelines. These are described further in the QA/QC programme used

by the National System and the annual working plans published by the ER.

4.2 Quality of the several emission sources

The quality of emission figures depends on the method. For that reason, the quality of the figures is described for each section.

Quality of individual company emissions
The emission figures of individually registered companies are yearly collected, revised, supplemented and reported in a consistent manner. The reports are validated by several relevant competent authorities after publication. Therefore, the basis for these figures is considered as relatively robust.

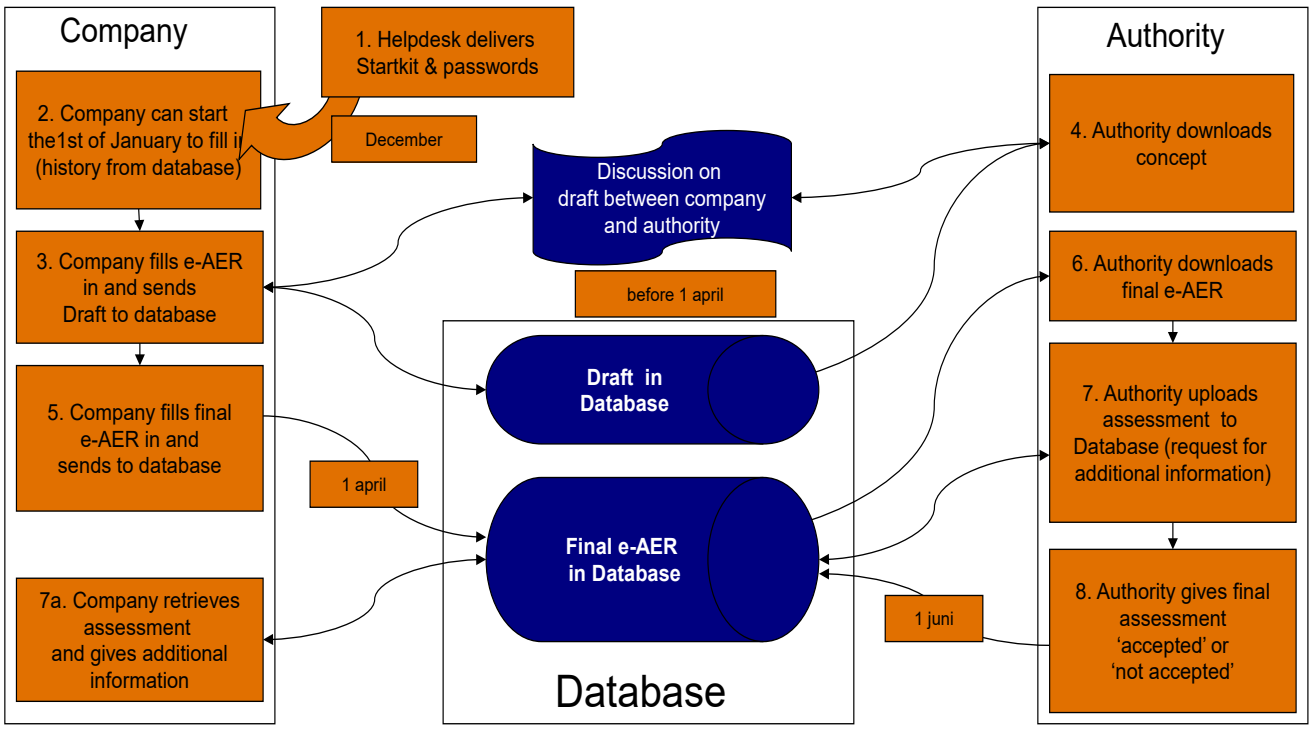
There are three mechanisms in place to maximise the data quality before publication.
In the first place, in the software (producing the e-AER) several checks and balances are integrated, supporting the companies and the competent authorities as well. As a basis there is a check on consistency with earlier reported years: depending on the pollutant, new emission data is marked red when the emission entered differs more than a certain percentage from the emission assessed the year before. The percentages depend on the pollutant. When a pollutant is introduced that was not reported in earlier years the new emission is shown by a different colour.
Furthermore, within the software there is a consistency check on the total amount of fuels used and the total amount of CO_2 emission reported. CO_2 emissions are calculated by multiplying the reported fuel consumption with the heat content (specified by the company) and default emission factors. These reported and calculated CO_2 emissions are compared and a warning is shown if there is a difference of more than a certain percentage. Also the fuel usage is compared for all fuels that has been entered in the air emissions module and for all fuels that has been entered in the independent energy module (which is part of the e-AER).
When the company users specify energy contents of fuels outside the expected ranges, they are prompted for explanation. The total mass consistency of the various fractions of PM (TSP, PM_{10}, $PM_{2.5}$) is checked within e-AER. Analogous checks have been built in the e-AER software for NMVOCs, where the companies either can specify NMVOC components adding up to the total VOC-emission or can choose a default profile.
Generally speaking, the e-AER software allows the companies to overrule all checks and balances, but in such cases an explanation is prompted.

The e-AER tooling has a second mechanism to ensure the quality of the data: before a dataset of a facility can be published to the competent authority the data is electronically checked to avoid inconsistencies. For example, when companies enter an emission of a certain pollutant they are requested to make reference to the methodology used.

And as a third general mechanism members of the ENINA taskforce assist the local competent authorities every year by checking the most relevant emissions. The e-AER system is used to advice the company users and competent authorities by placing specific remarks and questions for additional explanations at specific points when the yearly e-AERs are still in preliminary stage.

Also after publication and acceptance of the data by the competent authority the emission reports are systematically screened for errors by the ENINA taskforce. Most striking example probably is the CO_2 screening, which involves a comparison of the reported fuel consumption with the reported CO_2 emissions using standard emission factors (Zijlema, 2023). Deviant emissions are deleted from the emission file if no adequate explanation is provided (see also 3.1.2.1).

Supplemental estimates for individually registered companies whose emissions are below reporting threshold are compared to previous years and to the emissions from the entire sector. These emissions are less accurate, since they do not take into account the differences between the individual companies.



Quality of the combustion emissions
Quality checks for GHG emissions:
The fuel consumption according to the Energy statistics corresponds to the fuel consumption which is used in the calculation of greenhouse gas emissions. Since the energy use by mobile sources is calculated by the Task Force Traffic and Transport, it is checked that the consumption by mobile sources is not included in the calculation of emissions from stationary sources.
Furthermore, the energy consumption of the final year is compared with the energy consumption of the previous year. It is also verified that the changes in the activity data can be explained by known developments, such as the shift to coal (due to the lower prices) or the reduced natural gas use (due to a warmer winter).

The emissions of the final year are compared to emissions from the previous year. It is verified that the changes can be explained by known developments.
Also additional checks are performed:

- Is the emission factor applicable for that year used for natural gas?
- Are the company-specific emission factors for coal and residual gases used in the calculation?
- Are the additional CH_4 emissions from gas engines added?

Quality checks for non GHG emissions:
The following checks are performed:

- The energy consumption of year t is compared with the energy consumption of year t-1. It is verified that the changes in the activity data can be explained by known developments.
- The emissions of year t are compared with emissions from year t-1. It is verified that the changes can be explaned by trends in the energy consumption or changes in emission abatement techniques.

Quality of the process emissions
Quality checks for process emissions are part of the overall QA/QC. In addition the consistency of the fractions of PM_{10} and $PM_{2.5}$ is checked.

Quality of the emissions from waste disposal
Quality checks for incineration, landfilling and composting are part of the overall QA/QC (Wever, 2020).

Quality of the emissions in the oil and gas sector.
Quality checks for emissions in the oil and gas sector are part of the overall QA/QC procedures of the Dutch Pollutant Release and Transfer Register.
Until 2013 the e-AER emissions of the oil- and gas operators were not included in the checking mechanism of members of the ENINA taskforce to assist the local competent authorities. This situation was historically caused by a different competent authority of the oil and gas industries compared to other industrial companies. Competent authority for the oil and gas operators is State Supervision of Mines (Ministry of Economic Affairs). From 2014 on arrangements were made with State Supervision

of Mines to include the oil and gas operators in the advising process of ENINA.

4.3 Uncertainty

Uncertainty of the emissions is estimated based on expert judgements. The uncertainty of greenhouse gases has been estimated in 2013 by the several emission experts with individual expert elicitation discussions (for each expert separately).
The uncertainty of emissions from waste incineration and landfilling has been estimated with an approach 1 uncertainty calculation (error propagation).

The uncertainty of NEC-pollutants (NO_x, SO_x, NH_3, NMVOC, PM) has been estimated in 2016 by the several emission experts in an expert elicitation workshop (with all the experts together).

Both the individual expert elicitation and the expert elicitation workshop were set up following the expert elicitation guidelines in the IPCC 2006 Guidelines. The expert elicitation contained the following steps:

1. Motivating: The expert elicitation method was explained to the experts, including a description of possible biases.
2. Structuring: The emission sources for which the uncertainty needed to be estimated were provided to the experts prior to the elicitation. Uncertainty needed to be estimated for activity data and emission factor separately, unless the expert indicated that it was not possible to define these separately from each other.
3. Conditioning: The expert explained the method, and all relevant data have been discussed.
4. Encoding: The expert quantifies the uncertainty for each emission source.
5. Verification: The uncertainty is analysed and checked with the expert. Afterwards, an overview of the uncertainty estimates is provided to the experts and the experts could provide feedback on the uncertainty estimates.

The uncertainty estimates are used in a Monte Carlo analysis to evaluate the total uncertainty of the emissions. For most emission sources, the uncertainty is estimated for the activity data and emission factor of a specific emission source and this uncertainty is included in the Monte Carlo analysis. For some emission sources, other expert judgements were made that deviated from the standard uncertainty estimate:

- For some emissions sources, only an estimate of the emission was made (without an uncertainty estimate for the activity data and emission factor separately). In this case, the uncertainty is included in the Monte Carlo analysis as an emission factor uncertainty. The uncertainty of the activity data is set to 0.
- In some cases, there was only an uncertainty estimation for a group of emission sources together. For example, there was an uncertainty estimate of the natural gas use in industry and not for all of the industrial sectors separately. If uncertainty is only estimated for a group of emission sources, then this is included in the Monte Carlo analysis as one grouped (correlated) uncertainty for all the relevant emission sources. When samples of the

activity data are drawn in the Monte Carlo analysis, it is ensured that the total of the individual samples of activity data (for example the samples for natural gas use in each sector separately) is equal to the sample of the total activity data (for example the sample for the total natural gas use in industry).

In some cases, the emission factor in one emission source is correlated to a similar emission factor in another emission source. For example, the CO_2 emission factor of natural gas in different industrial sectors are correlated to each other. This means that it is expected that the emission factors will show similar deviations. If the CO_2 emission factor of natural gas in the food industry would be 2% too low, then it is expected that the CO_2 emission factor of natural gas in the clothing industry is also 2% too low. In this case, the emission factor uncertainty is included in the Monte Carlo analysis as one (correlated) uncertainty estimate for all the emission factors of natural gas in the several sectors. When a sample is drawn in the Monte Carlo analysis for the CO_2 emission factor of natural gas, this sample is used for all the relevant emission sources where this emission factor is used. Results of the Monte Carlo analyses are shown in the National Inventory Report for greenhouse gases (NIR) and the Informative Inventory Report of air pollutants (IIR).

Information about uncertainties of greenhouse gases and NEC-pollutants are included in a confidential report.
The ENINA Task Force can provide this information to official review teams (after they have signed a confidentiality agreement).

5 Recalculations

The task forces responsible for the emission calculations may decide to amend the method between two subsequent years if it becomes apparent that improvements are possible. The recalculations for the IPCC methodology (chapter 2) are approved by the Advisory Board NIE before they are implemented. The method amendments are explained in this chapter.

Air IPCC

- A new estimation method is introduced to recalculate the series 2F6 (HFC's from other use) from 2015 tot 2020, instead of keeping constant.

Air Actual

- New NOx emission factors were determined for small combustion installations (services and agriculture sectors).

6 Emission characteristics

Emission characteristics are supplemental data needed by atmospheric dispersion and transformation models in order to enable the operation of these models. The emission characteristics are very specific for the emission sources and are therefore most efficiently collected simultaneously with the emission data.
Characteristics of emissions concern all specifications of emissions, including height, outflow area and coordinates of the sources and the thermal content of the emission flow. These are important parameters for modelling the dispersal of air pollutants. The emission characteristics of the different sectors have been established and elaborated by Dröge et al. (2010). These emission characteristics are used to model the air quality for the GCN maps showing large-scale concentrations.

Emission characteristics of individual companies have been established. All emission points (fluxes, ventilation registers, storage yards, etc.) are included in this. For the other sectors, sector-specific emission characteristics have been established by derivation. The table below shows these emission characteristics (from Dröge et al., 2010).

Table 76 Sector-specific emission characteristics. H = Height above ground level (metre) and T = Thermal content of the emission plume (MW)

GCN	**Sector**	**SO_2**		**NO_x**		**PM_{10}**		**$PM_{2.5}$**	
		H	**T**	**H**	**T**	**H**	**T**	**H**	**T**
1100	Food, beverages and tobacco	15	0.34	15	0.34	22	0.92	22	0.92
1300	Chemical	12	0.13	12	0.175	11	0.10	11	0.10
1400	Construction materials	24	0.59	17	0.44	10	0	10	0
1500	Base metal	12	0.04	13	0.05	15	0	15	0
1700	Machining	10	0	10	0	10	0	10	0
1800	Other industry	22	0.28	22	0.28	10	0	10	0
2100	Energy production	40	0.22	40	0.22	40	0.22	40	0.22
2200	Onshore oil and gas extraction	5	0.15	5	0.15	5	0.15	5	0.15
2200	Offshore oil and gas extraction	50	0.15	50	0.15	50	0.15	50	0.15
4300	Greenhouse heating	8	0.4	8	0.4	8	0.4	8	0.4
5100	Waste processing	3.5	0.5	3.5	0.5	3.5	0.5	3.5	0.5
6100	WWTPs	10	0.375	10	0.375	10	0.375	10	0.375
6200	Collection/purification/distribution of drinking water	8	0.014	8	0.014	8	0.014	8	0.014
6400	Other Commercial & Governmental Institutions	4	0	11	0.014	4	0	4	0
7100	Construction	4.5	0	4.5	0	4.5	0	4.5	0
8100	Residential combustion	10	0	11	0	9	0	9	0

Table 77 Sector-specific emission characteristics. H = Height above ground level (metre) and T = Thermal content of the emission plume (MW), continued

GCN	**Sector**	**NH_3**		**CO**		**C_6H_6**	
		H	**T**	**H**	**T**	**H**	**T**
1100	Food, beverages and tobacco	50	1.22	15	0.34	15	0.34
1300	Chemical	12	0.13	12	0.13	12	0.13
1400	Construction materials	24	0.59	24	0.59	24	0.59
1500	Base metal	13	0.05	13	0.05	13	0.05
1700	Machining	10	0	10	0	10	0
1800	Other industry	22	0.28	22	0.28	22	0.28
2100	Energy production	40	0.22	40	0.22	40	0.22
2200	Onshore oil and gas extraction	5	0.15	5	0.15	5	0.15
2200	Offshore oil and gas extraction	50	0.15	50	0.15	50	0.15
4300	Greenhouse heating	8	0.4	8	0.4	8	0.4
5100	Waste processing	20	0	3.5	0.5	3.5	0.5
6100	WWTPs	10	0.375	10	0.375	10	0.375
6200	Collection/purification/ distribution of drinking water	8	0.014	8	0.014	8	0.014
6400	Other Commercial & Governmental Institutions	6	0	11	0.014	11	0.014
7100	Construction	4.5	0	4.5	0	4.5	0
8100	Residential combustion	9	0	9	0	9	0

7 Spatial allocation

Emissions are calculated on the national level. Because the emission figures are also used for air quality modelling, spatial allocation of emissions is important. For emissions sources that are not registered individually, national emission totals are allocated according suitable proxy data. In this way for instance, road traffic emissions are allocated on the basis of the number of vehicles per road type and agricultural emissions based on the number of livestock per shed type. Emissions of individual companies are directly linked to a coordinate. Many of the supplemental estimations mentioned in this report are spatially allocated by the number of employed persons of companies with NACE codes that are connected to the emission sources (ES). Each emission source has a specific allocation proxy. See www.emissieregistratie.nl for more information about the proxies applied for spatial allocation.

8 Terminology

AD	Activity Data
AER	Annual Environmental Report (Dutch acronym: MJV)
CBS	Statistics Netherlands
CFC	Chlorofluorocarbons
CH_4	Methane
CHP	Combined Heat and Power
CLRTAP	Convention on Long-Range Transboundary Air Pollution (UN-ECE)
CO	Carbon monoxide
CO_2	Carbon dioxide
CRT	Common Reporting Format (of emission data files, annexed to an NIR)
DOC	Degradable Organic Carbon
e-AER	electronic Annual Environmental Report (Dutch acronym: eMJV)
EEA	European Environment Agency
EF	Emission Factor
EMEP	European programme for Monitoring and Evaluation of long-range transmission of air Pollutants
ENINA	Task Group Energy, Industry and Waste Handling
EPRTR	European Pollutant Register and Transfer Register
ER-I	Emission Registration, Individual facilities
ES	Emission source
ETS	Emission Trading System
ESR	Effort Sharing Regulation
EU	European Union
EURAL	European unified list of waste categories
EVOA	EVOA: Waste shipment permit (Regulation (EC) No 1013/2006)
F-gases	Group of fluorinated compounds comprising HFCs, PFCs, CH_4, NF_3
FGD	Flue Gas Desulphurisation
FO-I	Dutch Facilitating Organisation for Industry
GCN	Maps of background concentrations with legal status on behalf of environmental permitting
GHG	Greenhouse Gas
GPG	Good Practice Guidance
GR	EU Governance Regulation
GWP	Global Warming Potential
GUN	Gasunie Nederland
HCB	Hexachlorobenzenes
HCFC	Hydrochlorofluorocarbons
HFC	Hydrofluorocarbons
HHW	Household Hazardous Waste
IEA	International Energy Agency
IEF	Implied Emission Factor
IPCC	Intergovernmental Panel on Climate Change
ISTS	Individual Sewage Treatment System
IWWTP	Industrial Wastewater Treatment Plant
KNB	Royal Dutch Construction Ceramics Association

LEI	agricultural economics institute
LMA	National registration centre for waste
MCF	Methane Conversion Factor
MJA	Multiple year agreement about energy efficiency
MJV	annual environmental report
MSW	Municipal Solid Waste
MW	Mega Watt
N_2O	Nitrous oxide
NACE	statistical classification of economic activities in the European Union of 2008: Nomenclature générale des Activités économiques dans les Communautés Européennes (Dutch acronym: SBI)
NAM	Nederlandse Aardolie Maatschappij
NAV	Dutch association of aerosol producers
NCV	Net Calorific Value
NEa	Dutch emissions authority
NEC	National Emission Ceilings
NH_3	Ammonia
NF_3	Nitrogentrifluoride
NIE	National Inventory Entity
NIR	National Inventory Report (annual greenhouse gas inventory report to UNFCCC)
NMVOC	Non Methane Volatile Organic Compounds
NOGEPA	Netherlands Oil and Gas Exploration and Production Association
NO_x	Nitrogen oxides
NVPU	Netherlands Association of polyurethane hard foam manufacturers
ODS	Ozone Depleting Substances
PAH	Polycyclic Aromatic Hydrocarbons
PBL	Netherlands environmental assessment agency
PFC	Perfluorocarbons
PM	Particulate matter
PM_{10}	Particulate matter (< 10 micrometer)
$PM_{2.5}$	Particulate matter (< 2.5 micrometer)
PRTR	Pollutant Release and Transfer Register
PRTR-I	Pollutant Release and Transfer Register – of Individual companies
PeCB	Pentachlorobenzenes
QA	Quality Assurance
QC	Quality Control
RHW	Residual Household Waste
RIVM	National institute for public health and the environment
RVO	Netherlands Enterprise Agency
SBI	Standaard bedrijven indeling (see NACE)
SCR	Selective Catalytic Reduction
CH_4	Sulphur hexafluoride
SNCR	Selective Non-Catalytic Reduction
SO_2	Sulphur dioxide
t-1	Last year
t-2	Year before last year
TOC	Total Organic Carbon
TNO	Netherlands organisation for applied scientific research
TSP	Total Suspended Particulates

UNFCCC	United Nations Framework Convention on Climate Change
UR	Undefinable Residues
VOC	Volatile Organic Compound
VELATEC	Welding technology association
VOM	Materials Surface Treatment Association
VVVF	Association of Paint and Printing Ink Manufacturers
WAR	Working group on waste registration
WIP	Waste Incineration Plant
WWTP	Wastewater Treatment Plant

9 References

Afvalfonds verpakkingen, mutiple years. Monitoring verpakkingen (*monitoring packagingen*) In Dutch

AgentschapNL, 2010. Nederlands afval in cijfers: gegevens 2000-2008 *(Dutch waste statistics, data on 2000-2008*), Agentschap NL Uitvoering Afvalbeheer, Utrecht. ISBN 978-90-5748-084-3. In Dutch.

Amstel, van et al., 1993. Methane, the other greenhouse gas. Research and policy in the Netherlands. RIVM report 481507-001, Bilthoven, the Netherlands, 1993

Capiel, 2001. Methodology to quantify emission of CH_4 for CH_4 switchgear production and use

CBS, multiple years. Statistics Netherlands, Statline, statline.cbs.nl/statweb/

CBS, 1988. Bedrijfsafvalstoffen, 1986. Kwartaalbericht Milieustatistieken (CBS), 5:14-18.

CBS, 1989. Bedrijfsafvalstoffen 1986. Voorburg, the Netherlands.

CBS, 2013. StatLine data: Energiebalans; aanbod, omzetting en verbruik (Energy balance sheet; input, conversion and consumption). Available via: statline.cbs.nl/StatWeb/publication/?VW=T&DM=SLNL&PA=70846NED

CBS, 2021. Energiebalans; aanbod en verbruik sector Olie- en Gaswinning. Available at StatLine - Energiebalans; aanbod en verbruik, sector (cbs.nl).

Coops, O., Luning, L., Oonk, H., Boom, J., 1995. Emissies van stortplaatsen (Emissions from landfill sites). VROM Hoofdinspectie Milieuhygiene, Publicatie Emissieregistratie 28, Den Haag, 1995. In Dutch.

Cuperus, G. et al., 2011. Validatie van het nationale stortgas emissiemodel (Validation of the national landfill gas emission model). Tauw, Deventer, 2011. In Dutch.

Crystal Globe, 2002. verbal information.

De Baedts, E.E.A. et al., 2001: Koudemiddelgebruik in Nederland (Use of coolants in the Netherlands). STEK. In Dutch.

De Jager, D., Blok, K, 1993. Onderzoek naar het gehalte aan organische stof in de verschillende afvalcomponenten (Research into volatile solids content in the various waste components), Utrecht, 1993. In Dutch.

DHV, 1999. Eindevaluatierapport meetprogramma GFT-verwerkingsinstallaties SMB, SOW/CAW en Arcadis (Final evaluation report of the measurement programme for biodegradable waste processing facilities of SMB, SOW/CAW en Arcadis). Final report by DHV, commissioned by the Ministry of Housing, Spatial Planning and the Environment (VROM), registration number MLTE981217, January 1999. In Dutch.

DHV, 2000a. Identificatie van onbekende bronnen van overige broeikasgassen (Identification of unknown sources of other greenhouse gases).

DHV, 2000b. Diffuse emissies van fijn stof door (semi-)industriële activiteiten (Fugitive pariculate emissions from (semi-)industrial activities), February 2000, Nijmegen. In Dutch.
DHV, 2012. Actualisatie ventilatie emissies fijn stof industrie. Referentie 9X5408.01/R003/903009/Nijm. 1 february 2013.
DNV, Update on the potential greenhouse gas sources in the Netherlands, DNV GL, July 16, 2020 Report no.: 20-1000
Dröge, R., Hulskotte, J.H.J., Visschedijk, A.J.H., Jansen, B.I., Heslinga, D.C., 2010. Verbetering en onderbouwing van de emissiekarakteristieken van individueel en collectief geregistreerde bronnen (Improvement and substantiation of the emission characteristics of individually and collectively registered sources). TNO report 2010-01108. Utrecht, June 2010. In Dutch.
EMEP/EEA, 2009. EMEP/EEA Air pollutant emission inventory guidebook 2009. Technical guidance to prepare national emission inventories. Available via http://www.eea.europa.eu/publications/emep-eea-emission-inventory-guidebook-2009
Fly-Ash Association, 2005: Rookgasontzwavelinggips (Flue-gas desulphurisation gypsum), on website www.vliegasunie.nl/producten/rogips.htm
FME-CWM, 2003. VOS reductieplan 2010 (VOC reduction plan for 2010). 31 maart 2003.
FO-Industrie, multiple years. . Jaarrapportages zuivelindustrie (Yearly reports from the dairy industry). In Dutch.
FO-Industrie, 2008. Evaluatie MBO Grafische Industrie en Verpakkingsdrukkerijen 2007 (Evaluation of the Environmental Policy Agreement for the Printing Industry and Packaging Printers). Available via: www.fo-industrie.nl. In Dutch.
Gastec, 2004. Methaanemissie bij aardgasdistributie in Nederland. Periode 1990-2004 en vooruitblik naar 2010 (Methane emissions from natural gas distribution in the Netherlands. Period 1990-2004 and outlook for 2010). Gastec, 23 June 2004, report no. GT-040208. In Dutch.
Gasunie SHE, multiple years. Safety, Health and Environment annual report 2009 and annual updates. N.V. Nederlandse Gasunie, Groningen. Available via: http://www.gasunie.nl/bibliotheek, multiple years. Personal information from coördinator emissions and environment Gasunie A.Liemburg/R. Kenter .
Gasunie/DNV.GL, 2015. Background information on LDAR leakage measurements; Onderbouwing LDAR rekenfactoren. In Dutch.
Gasunie/KEMA, 2011. Gasunie’s experiences with leak detection and repair as a part of footprint reduction, International Gas Union Research Conference 2011.
Guis, B. (CBS), 2006. Meta informatie Emissieregistratie: Vuurhaarden bijschatting luchtemissies (In Dutch). Available via http://www.emissieregistratie.nl/erpubliek/documenten/Lucht%20(Air)/Industrie%20en%20Energieopwekking%20(Industry%20and%20Energy)/Industrie%20en%20Energie/Vuurhaarden%20bijschatting%20luchtemissies.doc
Geertjes, K and K. Baas (both Statistics Netherlands), 2022 (in preparation). Methode NMVOS emissies uit industriële biologische AWZI. CBS-notitie, februari 2022, Den Haag, In Dutch.

Groot,M. de, 2012. Update of emission factors for N2O and CH4 for composting, anaerobic digestion and waste incineration. DHV, Amersfoort, 2012

Guis B. (CBS), R. de Ridder (NEA), P.J. Zijlema (SenterNovem), Verklaring verschillen tussen CO*2*-emissies in EU-ETS en andere rapportages *(Explanation of the differences between the CO2 emissions in EU-ETS and in other reports)*, 15 januari 2009

Hendriks, C. and de Jager, D., 2001. Economic Evaluation of Sectoral Emission Reduction; Objectives for Climate Change. Economic Evaluation of Methane Emission Reduction in the Extraction, Transport and Distribution of Fossil Fuels in the EU. Bottom-up Analysis. Ecofys, Utrecht, Final Report, January 2001. Contribution to a Study for DG Environment, European Commission by Ecofys Energy and Environment, AEA Technology Environment and National Technical University of Athens

Huizinga, K., Verburgh, J.J., Matthijsen, A.J.C.M., Coenen, P.W.H.G., 1995. Grofkeramische industrie (ceramic industry). SPIN document. RIVM report 736301112. In Dutch.

Huurman, J.W.F., 2005: Recalculation of Dutch stationary Greenhouse Gas Emissions based on sectoral energy statistics 1990-2002. Statistics Netherlands (CBS), Voorburg.

Infomil, 2002. KWS 2000 Eindrapportage (Final report of the Hydrocarbon 2000 project). Infomil, Den Haag. In Dutch.

Infomil and Novem, Reduction of nitrous oxide (N2O) in the nitric acid industry, Den Haag/Utrecht, The Netherlands, October 2001.

IPCC, 1997. Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Volumes 1, 2 and 3. Houghton, J.T., Meira Filho, L.G., Lim, B., Tréanton, K., Mamatry, I., Bonduki, Y., Griggs, D.J. and Callander, B.A. (eds). Intergovernmental Panel on Climate Change (IPCC), IPCC/OECD/IEA, Paris, France.

IPCC, 2001. Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. Penman, J., Kruger, D., Galbally, I., Hiraishi, T., Nyenzi, B., Emmanuel, S., Buendia, L., Hoppaus, R., Martinsen, T., Meijer, J., Miwa, K. and Tanabe, K. (eds). Intergovernmental Panel on Climate Change (IPCC), IPCC/OECD/IEA/IGES, Hayama, Japan.

IPCC, 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme. Eggleston, H.S., Buendia, L., Miwa, K., Ngara, T. and Tanabe, K. (eds). Published: IGES, Japan.

KEMA, 2007. TDC 07-63788A. Research performed for SenterNovem. Confidential information.

KEMA, 2010. TDC 09-72559A. Research performed for Netbeheer Nederland. Confidential information.

KIWA, 2023. Methaanemissie door Gasdistributie (Methane emissions from gas distribution). Annual report commissioned by Netbeheer Nederland. In Dutch.

KIWA, 2024a. RIVM Notitie Trendlijn ME - 2024-09 v1.1. Wijziging trendlijn rapportjaar 2023. Commissioned by Netbeheer Nederland. Confidential information. In Dutch

KIWA 2024b. Implementation plan_OGMP 2.0 update 2024 - RIVM versie. Commissioned by Netbeheer Nederland. Confidential information.

KIWA, 2015. Evaluatie emissiefactoren, GT-1402019. Evaluation of emission factors Gas distribution commissioned by Netbeheer Nederland. In Dutch.
KIWA/Gastec ,2006. Improvement in de the determination of methane emissions from gas distribution in the Netherland, 23rd World Gas Conference, presentation J.B.W. Wikkerink, Amsterdam 2006. Available via: www.igu.org/html/wgc2006/index0856.html
Witt, H. et al., Methodology for the calculation of emissions from the transport sector (RIVM 2025-0006).
Klein Goldewijk, K; Olivier, J. G.J.; Peters, J.A.H.W; Coenen, P.W.H.G; Vreuls, H.H.J., 2004. Greenhouse gas emissions in the Netherlands 1990-2002. National Inventory Report 2004. RIVM report 773201008/2004.
KNB, multiple years. Annual report of the Royal Dutch Construction Ceramics Association. Available via : www.knb-keramiek.nl/publicaties/jaarverslag-knb-2012/
Kok, H.J.G., 2014. Update NOx-emissiefactoren kleine vuurhaarden (Update of NOx emission factors for small combustion sources) greenhouse horticultural sector and households. TNO report 2014-R10584. In Dutch.
Koppejan, J. and de Bree, F., 2018. Kennisdocument Houtstook in Nederland. Procede Biomass BV. Enschede, September 2018.
KPMG, multiple years. Gebruik van HCFK's, HFK's, Methylbromide en aanverwante stoffen in Nederland (Use of HCFCs, HFCs, methyl bromide and related substances in the Netherlands). The Hague, the Netherlands. In Dutch.
Krähling H. and Krömer S., 2000. HFC-365mfc as blowing- and insulation agent in polyurethane rigid foams for thermal insulation. Life Cycle Assessment accompanying application development and market positioning.
Matthijsen, A.J.M.C. and Kroeze C., 1996. Emissies van HFK's, PFK's FIK's en CH4 in Nederland in 1990, 1994, 2000, 2005, 2010 en 2020 (Emissions of HFCs, PFCs, FICs, and CH4 in the Netherlands). RIVM report 773001-008. Bilthoven, the Netherlands. In Dutch.
Minnesota Pollution Control Agency, 2009. Minnesota Air Conditioner leakrate database, Model Year 2009. Minnesota Pollution Control Agency, September 2009, Minnesota.
Minnesota Pollution Control Agency, 2010. Minnesota Air Conditioner leakrate database, Model Year 2010. Minnesota Pollution Control Agency, September 2010, Minnesota.
Mulder, 1997. Emissiefactoren fijn stof bij de op- en overslag van stortgoederen. (Emission factors for particulate matter resulting from the transshipment of bulk cargo). TNO rapport R86/205, modified in deceber 1997. In Dutch.
Nagelhout, D., Wieringa, K. and Joosten, J.M., 1989. Afval 2000. National Institute of Public Health and Environment (RIVM), the Netherlands.
NAVOS (Nazorg voormalige stortplaatsen), 2005: Achtergronden bij het advies nazorg voormalige stortplaatsen. Tauw BV, afdeling stedelijk gebied & infrastructuur. Deventer
Neelis, M.L., Patel, M.K., Bach, P.W., Haije, W.G., 2005. Analysis of energy use and carbon losses in the chemical and refinery industries. ECN unit Energy Efficiency in industry, Utrecht, the Netherlands.

NOGEPA, 2009. Industry Guideline no. 23, Emissiebepaling en rapportage Onderdeel Emissies naar Lucht (Establishing and reporting emissions, section on air emissions). www.nogepa.nl/nl/Home/DownloadCenter.aspx. In Dutch.
NOGEPA, 2018. Bepalingsprotocol Methaanemissies e-MJV 02-08-18. NOGEPA - Milieu. In Dutch.
NOGEPA, 2021. Bepalingsprotocol methaan-benzene template v3 21-5-21. NOGEPA - Milieu.
Oonk, H., Weenk, A., Coops, O., Luning, L., 1994. Validation of landfill gas formation models, 1994. TNO report 94-315, Apeldoorn, 1994
Oonk, H., 1995, Nitrous oxide from stationary combustion and industry - emissions and options for control (confidential). TNO-MEP, Apeldoorn. Report no. R95-376/112320-26048 (Table 4.1).
Oonk, J., 2004. Methaan- en lachgasemissies uit afvalwater (Methane and nitrous oxide emissions from waste water), TNO report R2004/486, 2004. In Dutch.
Oonk, H., 2011. Peer review 2011 Dutch national inventory report, Oonkay, Apeldoorn, 2011
Oonk, H., 2016. Correction factor F for adsorption CO2 in leachate, Oonkay, Apeldoorn, 2016
PWC, multiple years. Handelstromenonderzoek: Onderzoek naar het gebruik van fluorverbindingen in Nederland (Trade flow study: Research into the use of fluor-based compounds in the Netherlands), Utrecht, the Netherlands. In Dutch.
Reumermann,P.J., Frederiks, B., 2002. Proceedings 12th European conference on Biomass for Energy, Industry and Climate protection, Amsterdam, 2002
Rijkswaterstaat, multiple years. Samenstelling van het huishoudelijk restafval (Composition of residual household waste): sorting analyses results of multiple years.
Rijkswaterstaat, 2013. Methodiekrapport werkveld 66, AVI's Lucht IPCC: update 2013 (Method report work package 66, WIPs Air IPCC). Rijkswaterstaat, Utrecht. ISBN 978-94-91750-05-2. In Dutch.
Rijkswaterstaat, 2014a. Onzekerheid emissies afval voor stortplaatsen, AVI's en gft-afvalverwerking. (Uncertainty regarding waste emissions for landfill sites, WIPs and biodegradable waste processing). Rijkswaterstaat. ISBN 978-94-91750-06-9. In Dutch.
Rioned, 2001. Riool in cijfers 2000-2001 (Urban Drainage Statistics 2000-2001). Stichting Rioned, Ede. Available via www.riool.net. In Dutch
Rioned, 2009. Urban Drainage Statistics 2009-2010. Available via: http://www.riool.net/riool/binary/retrieveFile?itemid=1089
Rioned, 2016: Het nut van stedelijk waterbeheer; Monitor gemeentelijke watertaken. Stichting Rioned, November (ISBN 97-890-73645-57-8, in Dutch).
RIVM, Werkplan emissieregistratie 2023-2024 (Project plan 2023-2024). In Dutch.
RIVM/MNP, 2004. Diffuse emissies en emissies bij op- en overslag. Handboek emissiefactoren (Fugitive emissions and emissions from transshipment). Rapportagereeks MilieuMonitor 14.
RVO, 2020. The Netherlands National System: QA/QC programme 2020/2021. Available at Netherlands Enterprise Agency (RVO) for review purposes.

RVO/CBS, 2015. Protocol Monitoring Hernieuwbare Energie (herziening 2015). April 2015, publication number: RVO-268-1501/BR-DUZA.D. Available via: https://www.rvo.nl/sites/default/files/Protocol%20Monitoring%20HE%20Interactief%20V3.pdf

RVO, 2022. Protocol Monitoring Hernieuwbare Energie, herziening 2022. Den Haag, June 2022. Publication number: RVO-125-2022/RP-BUZA. In Dutch.

Scheffer, C.B. and Jonker, W.J., 1997. Excerpt of internal TNO manual for establishing combustion emissions, update January 1997

SenterNovem, 2008. Biomassa in fracties huishoudelijk restafval (Biomass in residual household waste fractions) SenterNovem, Uitvoering Afvalbeheer, Utrecht, 2008, ISBN 9789057480706. In Dutch.

Spakman, J., Van Loon, M.M.J, Van der Auweraert, R.J.K, Gielen, D.J., Olivier, J.G.J., Zonneveld, E.A., 1997. Methode voor de berekening van broeikasgasemissies (Method of calculating greenhouse gas emissions), VROM, Emissions registration 37. In Dutch.

Spoelstra, 1993. N2O emission from combustion processes used in the generation of electricity. KEMA Arnhem/RIVM. NOP report no 410100049. Bilthoven.

Steenmeijer et al. Het effect van de Nederlandse zorg op het milieu.

Stoep, J.W. van der, Verhaart, H.F.A., 2007. CH4–emissie elektriciteitsnetbeheerders (CH4 emissions from electricity grid operators) 2006. In Dutch.

STOWA, 2014. Luchtgerelateerde emissies vanuit rwzi's in het kader van i-PRTR. STOWA report 2014-09.

Struker, A., 1994. Sectorstudie anorganische chemie (Sector study anorganic chemistry), Ecofys,NEEDIS study. In Dutch.

SVA, 1973. Inventarisatie benodigde stortruimte. Amersfoort, the Netherlands.

Tauw, 2001. PRC-Bouwcentrum, Crystal Globe, July 2001: Emissies van CFK's uit PUR-isolatieschuim, in de keten van slopen tot verwerken (CFC emissions from PUR insulation foam, from demolition to processing). In Dutch.

TNO, 2013, Personal communication P. Coenen on HCB and PeCB emission from waste combustion.

TNO, 2011, Improvements emission inventory 2007-2008. TNO 2011, draft.

Vehlow J. et al., 1995. Co-combustion of building insulation foams with municipal solid waste, Technical paper from APME, Exiba, Isopa October 1995, Forschum Centrum, Karlsruhe, Germany.

Veldt, C. and van der Most, P.F.J., 1993. Emissiefactoren Vluchtige organische stoffen uit verbrandingsmotoren (Emission factors for volatile organic compunds from combustion engines). VROM, Den Haag, Publication series on emission registration No. 10. In Dutch.

Visschedijk, A.J.H., 2007. Onderhoud van methodieken Emissieregistratie 2006-2007 (Maintenance of emission registration methods). TNO report. 2007-A-R0865/B. Apeldoorn, August 2007. In Dutch.

Visschedijk, A.J.H. and Dröge, R., 2019. Ratio between PM2.5 and PM10 for emissions from the energy and industry sector. TNO report 2019 R10320.

Vreuls H.H.J., Zijlema, P.J., 2013. Nederlandse lijst van energiedragers en standaard CO2-emissiefactoren (Dutch list of fuels and standard CO2 emission factors).
VROM, 2002. MilieuEffectRapport Landelijk afvalbeheerplan (Environmental Impact Report National Waste Management Plan) 2002-2012, Ministry of Housing, Spatial Planning and the Environment (VROM), VROM 02.0115/04-03 21770/206, 2002. In Dutch.
Rijkswaterstaat, multiple years. Afvalverwerking in Nederland (Waste processing in the Netherlands): multi-year data. Working Group on Waste Registration (WAR), Utrecht. In Dutch.
Visschedijk, A. et al., Methodology for the calculation of emissions from product usage by consumers, construction and services. RIVM report 2025-0004.
Wanders, J., 2021. QA/QC of outside agencies in the Greenhouse Gas Inventory. Update of the background information in the Netherlands National System. RIVM report 2020-0066.
Yu and Clodic, 2008. Generic approach of refrigerant HFC-134a emission modes from MAC systems. Laboratory tests, fleet tests and correlation factor. Center for energy and processes, Ecole des Mines de Paris, France. 23 October 2008
Van der Zee, T.C. et al., Methodology for the calculation of emissions from agriculture. Calculations for methane, ammonia, nitrous oxide, nitrogen oxides, non-methane volatile organic compounds, fine particles and carbon dioxide emissions using the National Emission Model for Agriculture (NEMA). RIVM report 2025-0003.
Zijlema, P.J., 2024. The Netherlands: list of fuels and standard CO_2 emission factors.

Appendix 1 Emission Sources

ES code	Process description (English)	Process description (Dutch)	CRT	Section
0012100	Residential combustion	SBI: Huishoudens, verbrandingsemissies	1.A.4.b.i	2.1
0012101	Residential combustion, appliances, gas leakage before ignition	SBI: Huishoudens, verbrandingsemissies (gasslip)	1.A.4.b.i	2.1 and 3.2
0012102	Residential combustion, space heating	Vuurhaarden consumenten, hoofdverwarming woningen		3.2
0020400	NACE 06/09.1: extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, onshore	SBI 06/09.1: Aardolie- en gaswinning en dienstverlening voor de aardolie- en aardgaswinning, onshore (PBL)	1.A.1.c	2.4 and 3.5
0020401	NACE 41-43: construction and building industries	SBI 41-43: Bouwnijverheid	1.A.2.g.v	2.1 and 3.2
0020405	NACE 84: public administration, governmental institutions and compulsory social insurance	SBI 84: Openbaar bestuur, overheidsdiensten en verplichte sociale verzekeringen		3.2
0020500	Commercial and governmental institutions	Handel, diensten, overheid	1.A.4.a.i and 2.D.1	2.1, 2.2 and 3.2
0020502	NACE 06/09.1: extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, drilling activities	SBI 06/09.1: Aardolie- en gaswinning en dienstverlening voor de aardolie- en aardgaswinning, booractiviteiten	1.A.1.c	2.4 and 3.5
0120000	Solvent and other product use: air conditioning equipment, mobile	Wegverkeer airco mobiel	2.F.1	2.2
0401200	NACE 0: other agriculture, hunting and services to agriculture and hunting	SBI 0: Overig landbouw, jacht en dienstverlening voor de landbouw en jacht	1.A.4.c.i	2.1
0401201	Combustion in agricultural buildings	Vuurhaarden landbouw	1.A.4.c.i	2.1 and 3.2
0401202	Combustion in agricultural greenhouses	Vuurhaarden landbouw, glastuinbouw		3.2
0444900	Indirect related to waste water	Emissies indirect t.g.v. N-emissies afvalwater N_2O	5.D.1	2.3 and 3.4
0800200	Gas distribution network	Gasdistributie	1.B.2.b.5	2.4 and 3.5
0800700	Residential combustion, cooking	Vuurhaarden consumenten, koken		3.2
0800800	Residential combustion, hot water	Vuurhaarden consumenten, warm water voorziening		3.2
0811301	Propellants and solvents in aerosol cans consumers	Drijfgassen en oplosmiddellen spuitbussen consumenten	2.F.4	2.1 and 3.3
0811302	Propellants and solvents in aerosol cans commercial and governmental institutions	Drijfgassen en oplosmiddel spuitbussen HDO	2.F.4	3.3
0833400	NACE 52.10/52.24: cargo handling and storage	SBI 52.10/52.24: Laad-, los- en overslagactiviteiten en opslag		3.3
0834000	NACE 35.11: production of electricity, flue gas desulphurization	SBI 35.11: Productie van elektriciteit, rookgasontzwaveling	2.A.4.d	2.2

ES code	Process description (English)	Process description (Dutch)	CRT	Section
1810100	Cleaning solvents commercial and governmental institutions	Oplosmiddelen/reiningen HDO	2.F.5	3.3
1810400	Fire extinguishers commercial and governmental institutions	Brandblussers HDO	2.F.3	3.3
6800100	Gas transport network	Gastransport	1.A.3ei gaseous and 1.B.2.b.4	2.4 and 3.5
6800201	Natural gas use CHP agriculture	Aargasverbruik WKK landbouw	1.A.4.c.i	3.2
6800202	Natural gas use non-CHP agriculture	Aargasverbruik niet-WKK landbouw	1.A.4.c.i	3.2
8120000	NACE 06: extraction of crude oil and natural gas, flaring, offshore	SBI 06: Aardolie- en gaswinning, flaring, offshore (PBL)	1.B.2.c.2.iii	2.4 and 3.5
8120001	NACE 06/09.1: extraction of crude oil and natural gas and services to extraction of crude oil and natural gas, offshore	SBI 06/09.1: Aardolie- en gaswinning en dienstverlening voor de aardolie- en aardgaswinning, offshore (PBL)	1.A.1.c	2.4 and 3.5
8120002	NACE 06: extraction of crude oil and natural gas, venting, offshore	SBI 06: Aardolie- en gaswinning, venting, offshore (PBL)	1.B.2.c.1.iii	2.4 and 3.5
8120500	NACE 06: extraction of crude oil and natural gas, flaring, onshore	SBI 06: Aardolie- en gaswinning, flaring, onshore (PBL)	1.B.2.c.2.iii	2.4 and 3.5
8120502	NACE 06: extraction of crude oil and natural gas, venting, onshore	SBI 06: Aardolie- en gaswinning, venting, onshore (PBL)	1.B.2.c.1.iii	2.4 and 3.5
8120503	NACE 495: Transport of oil via pipelines	SBI 495: Olietransport via pijpleidingen	1.B.2.a.3	2.4 and 3.5
8900200	NACE 10-12: manufacture of food products, beverages and tobacco	SBI 10-12: Voedings- & genotmiddelenindustrie	1.A.2.e	2.1, 3.2 and 3.3
8900205	NACE 10.810 sugar production, lime production	SBI 10.810: Vervaardiging van suiker: productie van kalk	2.A.2.	2.2
8900300	NACE 13/14: manufacture of textiles and textile apparel	SBI 13/14: Vervaardiging van textiel en kleding	1.A.2.g.vi	2.1 and 3.2
8900400	NACE 15: leather industry and fur preparation	SBI 15: Lederindustrie en bontbereiding	1.A.2.g.vi	2.1 and 3.2
8900600	NACE 17.1/17.2: manufacture of pulp, paper and paperboard	SBI 17.1/17.2: Vervaardiging van pulp, papier, karton, papier- en kartonwaren	1.A.2.d	2.1 and 3.2
8900601	NACE: unknown industry	SBI onbekend: Industrie, n.n.b. Overige industrie	1.A.2.g.vii	2.1
8900700	NACE 18/58: publishing, printing and reproduction of recorded media	SBI 18/58: Uitgeverijen, drukkerijen, reproductie van opgenomen media	1.A.2.d	2.1, 3.2 and 3.3
8900900	NACE 20.15: manufacture of fertilizers and nitrogen compounds	SBI 20.15: Vervaardiging van kunstmeststoffen en stikstofverbindingen	1.A.2.c and 2.B.1	2.1, 3.2 and 3.3
8901100	NACE 20.1: manufacture of basic chemicals	SBI 20.1: Vervaardiging van chemische basisproducten	1.A.2.c, 2.B.8.g and 2.D.1	2.1, 2.2 and 3.2
8901700	NACE 22.1: manufacture of rubber products	SBI 22.1: Vervaardiging van producten van rubber		3.3

ES code	Process description (English)	Process description (Dutch)	CRT	Section
8901702	NACE 22: manufacture of rubber and plastic products	SBI 22: Vervaardiging van producten van rubber en kunststof	1.A.2.c	2.1 and 3.2
8901706	NACE 22.1: manufacture of rubber products, diffuse	SBI 22.1: Vervaardiging van producten van rubber, diffuus		3.3
8902100	NACE 25: manufacture of metal structures and parts of structures	SBI 25: Metaalproductenindustrie (exclusief machinebouw)	1.A.2.g.viii	2.1 and 3.2
8902200	NACE 28: manufacture of machinery	SBI 28: Machinebouw	1.A.2.g.i	2.1 and 3.2
8902301	NACE 26/28: manufacture of machinery and electronic apparatus	SBI 26/28: Machinebouw en electronische aparaten	1.A.2.g.viii	2.1 and 3.2
8902302	NACE 26/27: electro technical industry	SBI 26/27: Elektrotechnische industrie	2.C.7	2.2
8902303	NACE 27: manufacture of electrical apparatus	SBI 27: Vervaardiging van elektrische apparatuur	1.A.2.g.viii	2.1 and 3.2
8902304	NACE 26: manufacture of computers and electronic and optical apparatus	SBI 26: Vervaardiging computers en elektronische en optische apparatuur	1.A.2.g.viii	2.1 and 3.2
8902400	NACE 29: motor-industry	SBI 29: Auto-industrie	1.A.2.g.ii	2.1 and 3.2
8908000	NACE 31/32: manufacture of furniture and other goods	SBI 31/32: Vervaardiging van meubels en overige goederen	1.A.2.g.viii	2.1 and 3.2
8908100	NACE 30: manufacture of other transport equipment	SBI 30: Overige transportmiddelen	1.A.2.g.ii	2.1 and 3.2
8910000	NACE 10.1: processing and preserving of meat and poultry	SBI 10.1: Slachterijen en vleesverwerking		3.3
8910300	NACE 10.4: manufacture of oils and fats	SBI 10.4: produktie oliën en vetten		3.3
8910400	NACE 10.5: dairy industry	SBI 10.5: Zuivelindustrie		3.3
8910406	NACE 10.5: dairy industry, diffuus	SBI 10.5: Zuivelindustrie, diffuus		3.3
8910500	NACE 10.6: manufacture of grain mill products, excl. starches and starch products	SBI 10.6: Meelproduktie (excl. zetmeel)		3.3
8910506	NACE 10.6: manufacture of grain mill products, excl. starches and starch products, diffuse	SBI 10.6: Meelproduktie (excl. zetmeel), diffuus		3.3
8910600	NACE 10.9: manufacture of prepared animal feeds	SBI 10.9: Diervoederindustrie	2.H.2	2.2 and 3.3
8910606	NACE 10.9: manufacture of prepared animal feeds, diffuse	SBI 10.9: Diervoederindustrie, diffuus		3.3
8911400	NACE 13.3: finishing of textiles	SBI 13.3: Textielveredeling		3.3
8911500	NACE 13.93: manufacture of carpets and rugs	SBI 13.93: Vervaardiging van vloerkleden en tapijt		3.3
8911700	NACE 15.11: tanning of leather and fur preparation	SBI 15.11: Leerlooierijen en bontbereiding		3.3
8911900	NACE 16.1: sawmilling and planing of wood; impregnation of wood	SBI 16.1: Primaire houtbewerking en verduurzamen van hout		3.3
8912100	NACE 16.23: manufacture of builders' carpentry and joinery	SBI 16.23: Vervaardiging van overig timmerwerk voor de bouw		3.3

ES code	Process description (English)	Process description (Dutch)	CRT	Section
8912101	NACE 16: manufacture of wooden products	SBI 16: Houtindustrie en vervaardiging van artikelen van hout, kurk, riet en vlechtwerk (geen meubels)	1.A.2.g.iv	2.1 and 3.2
8912106	NACE 16: manufacture of wooden products, diffuse	SBI 16: Houtindustrie en vervaardiging van artikelen van hout, kurk, riet en vlechtwerk (geen meubels), diffuus		3.3
8912200	NACE 17.1: manufacture of pulp, paper and paperboard	SBI 17.1: Vervaardiging van papierpulp, papier en karton		3.3
8912300	NACE 17.2: manufacture of articles of paper and paperboard	SBI 17.2: Vervaardiging van papier- en kartonwaren		3.3
8912406	NACE 17: manufacture of paper, paperboard and articles of paper and paperboard, diffuse	SBI 17: Vervaardiging van papier, karton en papier- en kartonwaren, diffuus		3.3
8912500	NACE 19.202: manufacture of refined petroleum products - not oil refineries	SBI 19.202: Aardolieverwerking, excl. raffinage	1.A.1.c	2.1 and 3.2
8912600	NACE 20.12: manufacture of dyes and pigments	SBI 20.12: Vervaardiging van kleur- en verfstoffen		3.3
8912700	NACE 20.13: manufacture of inorganic basic chemicals, production of active carbon	SBI 20.13: Basischemie anorganisch, productie actieve kool	2.B.8.g	2.2
8912702	NACE 20.13: manufacture of inorganic basic chemicals, soda consumption (PBL)	SBI 20.13: Basischemie anorganisch, soda verbruik (PBL)	2.A.4.b	2.2
8912704	NACE 20.13: manufacture of inorganic basic chemicals, production of soda ash (CBS)	SBI 20.13: Basischemie anorganisch, productie soda ash (CBS)	2.B.7	2.2
8912800	NACE 20.14: manufacture of inorganic basic chemicals, charcoal production	SBI 20.14: Basischemie anorganisch, productie van houtskool	1.B.1.b	2.2
8912900	NACE 20.149: manufacture of organic basic chemicals (no petrochemicals)	SBI 20.149: Basischemie organisch (geen petrochemische producten)	2.B.8.g	2.2 and 3.3
8913000	NACE 20.13: manufacture of inorganic basic chemicals	SBI 20.13: Basischemie anorganisch	2.B.8.g	2.2 and 3.3
8913002	NACE 20.16: manufacture of plastics in primary forms, handling of F-gasses	SBI 20.16: Vervaardiging van kunststof in primaire vorm, handling F-gassen	2.B.9	2.2 and 3.3
8913005	NACE 20.16: manufacture of plastics in primary forms, production of HCFK 22	SBI 20.16: Vervaardiging van kunststof in primaire vorm, productie HCFK 22	2.B.9	2.2 and 3.3
8913100	NACE 20.2: manufacture of pesticides	SBI 20.2: Chemische bestrijdingsmiddelenindustrie		3.3
8913200	NACE 20.3: manufacture of paints, varnishes and similar coatings, printing ink and mastics	SBI 20.3: Vervaardiging van verf, lak, vernis, inkt en mastiek		3.3
8913400	NACE 20.41: manufacture detergents	SBI 20.41: Vervaardiging van was- en schoonmaakmiddelen		3.3
8913600	NACE 20.52: manufacture of glues and adhesives	SBI 20.52: Vervaardiging van lijm en bereide kleefmiddelen		3.3

ES code	Process description (English)	Process description (Dutch)	CRT	Section
8913700	NACE 20.2-20.5: chemical products industry	SBI 20.2-20.5: Chemische producten industrie	1.A.2.c	2.1 and 3.2
8913800	NACE 20.6: manufacture of synthetic and artificial fibres	SBI 20.6: Vervaardiging van synthetische en kunstmatige vezels		3.3
8913900	NACE 22.2: manufacture of plastic products	SBI 22.2: Vervaardiging van producten van kunststof		3.3
8913906	NACE 22.2: manufacture of plastic products, diffuse	SBI 22.2: Vervaardiging van producten van kunststof, diffuus		3.3
8914000	NACE 23.1: manufacture of glass and glassware	SBI 23.1: Vervaardiging van glas en glaswerk	2.A.3	2.2 and 3.3
8914100	NACE 23.2-23.4: Manufacture of ceramic products	SBI 23.2-23.4: Vervaardiging van keramische producten	2.A.4	3.3
8914101	NACE 23.32: manufacture of ceramic products for the building industries (no (floor) tiles)	SBI 23.32: Vervaardiging van keramische producten voor de bouw (geen tegels en plavuizen)	2.A.4.a	2.2
8914200	NACE 23.32: manufacture of bricks and tiles	SBI 23.32: Vervaardiging van bakstenen en dakpannen		3.3
8914300	NACE 23.6: manufacture of articles of concrete, plaster and cement	SBI 23.6: Vervaardiging van producten van beton, gips en cement	2.A.1	2.2 and 3.3
8914500	NACE 23.9: manufacture of other non-metallic mineral products	SBI 23.9: Vervaardiging van overige niet-metaalhoudende minerale producten		3.3
8914600	NACE 23: construction material and glass industry	SBI 23: Bouwmaterialen- en glasindustrie	1.A.2.f	2.1 and 3.2
8914602	NACE 24.2: manufacture of tubes and pipes	SBI 24.2: Vervaardiging van stalen buizen en pijpen		3.3
8914606	NACE 23: construction material and glass industry, diffuse	SBI 23: Bouwmaterialen- en glasindustrie, diffuus		3.3
8914700	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals	SBI 24.4/24.53/24.54: Vervaardiging en gieten van lichte en overige non-ferrometalen	2.C.3	2.2
8914702	NACE 24.45: manufacture of non-ferrous metals, aluminium	SBI 24.45: Vervaardiging van overige non-ferrometalen, aluminium		3.3
8914704	NACE 24.45: Manufacture of non-ferrous metals, copper	SBI 24.45: Vervaardiging van overige non-ferrometalen, koper		3.3
8914705	NACE 24.45: Manufacture of non-ferrous metals, lead	SBI 24.45: Vervaardiging van overige non-ferrometalen, lood		3.3
8914706	NACE 24.45: Manufacture of non-ferrous metals, zinc	SBI 24.45: Vervaardiging van overige non-ferrometalen, zink		3.3
8914800	NACE 30.1: ship-building, painting	SBI 30.1: Scheepsbouw, verven		3.3
8914900	NACE 24.5: casting of metals	SBI 24.5: Gieten van metalen		3.3
8915000	NACE 25-33/95 (excluding NACE 30.1/33.15): metal-electronic industry	SBI 25-33/95: Metalelektro (exclusief SBI 30.1/33.15)		3.3
8915003	NACE 25-33/95 (excluding NACE 30.1/33.15): metal-electronic industry, painting and dyeing	SBI 25-33/95: Metalelektro (exclusief SBI 30.1/33.15), verven en lakken		3.3

ES code	Process description (English)	Process description (Dutch)	CRT	Section
8915005	NACE 25-33/95 (excluding NACE 30.1/33.15): metal-electronic industry, metallic products, (electrical) appliances, instruments, parts	SBI 25-33/95: Metalelektro (exclusief SBI 30.1/33.15), metalen producten, (electrische) apparaten, instrumenten, onderdelen	2.D.1	2.2
8915006	NACE 25-33/95 (excluding NACE 30.1/33.15): metal-electronic industry, diffuse release of PM_{10}	SBI 25-33/95: Metalelektro (exclusief SBI 30.1/33.15), diffuus vrijkomend PM_{10}		3.3
8915300	NACE 26/31/32: manufacture of electronic apparatus and furniture	SBI 26/31/32: Vervaardiging van electronische aparaten en meubels	1.A.2.g.viii	2.1 and 3.2
8916000	NACE 38.3: preparation to recycling of metal and non-metal waste and scrap	SBI 38.3: Voorbereiding tot recycling	1.A.4.a.i	2.1 and 3.2
8918000	NACE 10.8 (excluding NACE 10.81 and 10.82): other manufacture of food products	SBI 10.8: Overige voedingsmiddelenindustrie (exclusief SBI 10.81 en 10.82)		3.3
8918006	NACE 10.8 (excluding NACE 10.81 and 10.82): other manufacture of food products, diffuse	SBI 10.8: Overige voedingsmiddelenindustrie (exclusief SBI 10.81 en 10.82), diffuus		3.3
8918106	NACE 13: manufacture of textiles, diffuse	SBI 13: Vervaardiging van textiel, diffuus		3.3
8919200	NACE 24.3: Manufacture of other products of first processing of steel	SBI 24.3: Overige eerste verwerking van ijzer en staal	1.A.2.a	3.2
8919300	NACE 20.59: manufacture of other chemical products n.e.c.	SBI 20.59: Vervaardiging van overige chemische producten n.e.g.		3.3
8919504	NACE 20.11: Manufacture of industrial gases, production of methanol	SBI 20.11: Vervaardiging van industriële gassen, productie methanol	1.A.2.c	3.2
8919512	NACE 20.149: manufacture of organic basic chemicals (no petrochemicals), production of caprolactam (PBL)	SBI 20.149: Basischemie organisch (geen petrochemische producten), productie caprolactam (PBL)	2.B.4	2.2
8919514	NACE 20.149: manufacture of organic basic chemicals (no petrochemicals), production of nitric acid (PBL)	SBI 20.149: Basischemie organisch (geen petrochemische producten), productie salpeterzuur (PBL)	2.B.2	2.2
8919700	NACE 13.20: textile weaving	SBI 13.20: Weven van textiel		3.3
8920100	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals	SBI 24.4/24.53/24.54: Vervaardiging en gieten van lichte en overige non-ferrometalen	1.A.2.b and 2.C.3	2.1 and 3.2
8920400	NACE 35: production and distribution of electricity and gas	SBI 35: Productie en distributie van elektriciteit en gas	1.A.1.a	2.1, 3.2 and 3.3
8920500	NACE 36: collection, purification and distribution of water	SBI 36: Winning en distributie van water	1.A.4.a.i	2.1and 3.2
8921800	NACE 38.1/38.2 (partly): waste-incineration plants	SBI 38.1/38.2 (ged.): Afvalverbrandingsinstallaties (AVI's)	1.A.1.a	2.1 and 3.2

ES code	Process description (English)	Process description (Dutch)	CRT	Section
8921804	NACE 38.2/84.1 treatment of waste, including communal waste-incineration plants	SBI 38.2/84.1: Behandeling van afval inclusief gemeentelijke AVI's	1.A.1.a	2.3 and 3.4
8921900	NACE 39: sanitation and other waste management	SBI 39: Sanering en overig afvalbeheer		3.2
8922000	NACE 38.1/38.2 (partly): landfill gas companies	SBI 38.1/38.2 (ged.): Stortgasbedrijven	1.A.4.a.i	2.1 and 3.2
8922701	NACE 08: other quarrying and mining	SBI 08: Winning van delfstoffen (geen olie en gas)	1.A.2.g.iii	2.1 and 3.2
8924100	NACE 19.1: manufacture of coke oven products	SBI 19.1: Vervaardiging van cokesovenproducten	1.B.1.b	2.2 and 3.3
8924102	NACE 19.1: manufacture of coke oven products (ACZ)	SBI 19.1: Vervaardiging van cokesovenproducten (ACZ)	1.A.1.c and 1.B.1.b	2.1 and 2.2
8924103	NACE 19.1: production of coke, coke factory Corus	SBI 19.1: Vervaardiging van cokesovenproducten, cokesfabriek Corus	1.A.1.c and 1.B.1.b	2.1 and 2.22.2
8924200	NACE 19.2 (excluding NACE 19.202): manufacture of refined petroleum products	SBI 19.2: Aardolieverwerking (exclusief SBI 19.202)	1.A.1.b and 1.B.2.a.4	2.12.1, 2.2 and 3.2
8924202	NACE 19.2 (excluding NACE 19.202): manufacture of refined petroleum products, terminals	SBI 19.2: Aardolieverwerking (exclusief SBI 19.202), terminals		3.3
8924204	NACE 19.201: manufacture of refined petroleum products	SBI 19.201: Aardolieraffinage	1.B.2.a.4	2.2
8924400	NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel, consumption of lime (PBL)	SBI 24.1-24.3: Basismetaalindustrie, verwerking en vervaardiging ijzer en staal, kalkgebruik (PBL)	2.A.4.d	2.2
8924401	NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel, anode use with production of electrosteel	SBI 24.1-24.3: Basismetaalindustrie, verwerking en vervaardiging ijzer en staal, anode-gebruik bij electrostaal productie	2.C.1.c	2.2
8924402	NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	SBI 24.1-24.3: Basismetaalindustrie, verwerking en vervaardiging ijzer en staal	2.C.1.a	2.2
8924406	NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel, diffuse	SBI 24.1-24.3: Basismetaalindustrie, verwerking en vervaardiging ijzer en staal, diffuus		3.3
8924407	NACE 24.1-24.3/24.51/24.52: base metal iron and steel	SBI 24.1-24.3/24.51/24.52: Basismetaal ijzer en staal	1.A.2.a, 2.C.1.f and 2.D.1	2.1, 2.2, 3.2 and 3.3
8924500	Solvent and other product use: aerosol propellant	Oplosmiddel- en ander productgebruik: aerosolen drijfgas	2.F.4	3.3
8924501	Solvent and other product use: foam blowing agents	Oplosmiddel- en ander productgebruik: harde schuimen als isolatiemedium	2.F.2	3.3

ES code	Process description (English)	Process description (Dutch)	CRT	Section
8924502	Solvent and other product use: other	Oplosmiddel- en ander productgebruik: overig	2.F.6 and 2.G.2	2.2 and 3.3
8924506	Solvent and other product use: refrigeration and air conditioning equipment, stationary	Oplosmiddel- en ander productgebruik: Stationair koelen, vriezen en airco	2.F.1	2.2 and 3.3
8924509	NACE 25-33/95 (excluding NACE 30.1/33.15): metal-electronic industry, production of semi-conductors	SBI 25-33/95: Metalelektro (exclusief SBI 30.1/33.15), productie van halfgeleiders (PBL)	2.E.1	2.2
8930401	NACE 35: decentral production of electricity, general	SBI 35: Decentrale productie elektriciteit, algemeen	1.A.1.a	2.1 and 3.2
8930410	NACE 35: production of electricity, heat	SBI 35: Productie elektriciteit, warmte	1.A.1.a	2.1 and 3.2
E400102	Anaerobic waste water treatment plants, other industries	Emissies methaan door lekverliezen uit anaërobe aWZI's	5.D.2	2.3 and 3.4
E400103	Anaerobic waste water treatment plants, waste treatment plants	Emissies methaan door lekverliezen uit anaërobe aWZI's, afvalverwijderingsbedrijven	5.D.2	2.3 and 3.4
E400104	Anaerobic waste water treatment plants, paper industries	Emissies methaan door lekverliezen uit anaërobe aWZI's, papierindustrie	5.D.2	2.3 and 3.4
E400105	Anaerobic waste water treatment plants, food industries	Emissies methaan door lekverliezen uit anaërobe aWZI's, voeding/genotmidd. ind.	5.D.2	2.3 and 3.4
E400106	Discharges of domestic waste water: septic tanks, anaerobic processes	Emissies septic tanks	5.D.1	2.3 and 3.4
E400107	NACE 90.01: collection and treatment of sewage	RWZI emissies water- en sliblijn, individueel	5.D.1	2.3 and 3.4
E400108	NACE 90.01: collection and treatment of sewage	RWZI spui van slibgistingsgas, individueel	5.D.1	2.3 and 3.4
E400109	NACE 37: collection and treatment of sewage	SBI 37: Afvalwaterinzameling en -behandeling	1.A.4.a.i	2.3 and 3.4
E400313	Digesting of organic waste from households	Gft-afval vergisting	5.B.2.a	2.3 and 3.4
E400314	Composting of organic waste from households	Gft-afval compostering	5.B.1.a	2.3 and 3.4
E400315	Digesting of organic horticultural waste	Groenafval vergisting	5.B.2.b	2.3 and 3.4
E400316	Composting of organic horticultural waste	Groenafval compostering	5.B.1.b	2.3 and 3.4
E401200	Solid waste disposal on land: managed disposal	Emissies vanuit stortplaatsen verbranding stortgas	1.A.1.a	2.3 and 3.4
E402200	Solid waste disposal on land: managed disposal	Emissies vanuit stortplaatsen	5.A.1	2.3 and 3.4
N000400	Indirect CO_2 from NMVOC: energy	Indirect CO_2 van NMVOC, Energie	1.	2.2
N000401	Indirect CO_2 from NMVOC: traffic & transport	Indirect CO_2 van NMVOC, Verkeer en Vervoer	2.	2.2
N000402	Indirect CO_2 from NMVOC: refineries	Indirect CO_2 van NMVOC, Raffinaderijen	1.	2.2
N000403	Indirect CO_2 from NMVOC: consumers	Indirect CO_2 van NMVOC, Consumenten	2.	2.2

ES code	Process description (English)	Process description (Dutch)	CRT	Section
N000404	Indirect CO_2 from NMVOC: combustion in commercial and governmental buildings	Indirect CO_2 van NMVOC, HDO	2.	2.2
N000405	Indirect CO_2 from NMVOC: industry	Indirect CO_2 van NMVOC, Industrie	2.	2.2
N000406	Indirect CO_2 from NMVOC: construction and building industies	Indirect CO_2 van NMVOC, Bouw	2.	2.2
N000407	Indirect CO_2 from NMVOC: agriculture	Indirect CO_2 van NMVOC, Landbouw	2.	2.2
N000408	Indirect CO_2 from NMVOC: waste	Indirect CO_2 van NMVOC, Afvalsector	5.	2.2
N091100	Use of lubricants, railways	Railverkeer smeermiddelen gebruik	2.D.1	2.2 and 3.3
N091200	Use of lubricants, road traffic	Wegverkeer smeermiddelen gebruik	2.D.1	2.2 and 3.3
N091300	Use of lubricants, inland navigation	Binnenvaart smeermiddelen gebruik	2.D.1	2.2 and 3.3
N091400	Use of lubricants, air traffic	Luchtvaart smeermiddelen gebruik	2.D.1	2.2 and 3.3
N339000	NACE 06-33: Industry not specified	SBI 06-33: Industrie, niet gespecificeerd	1.A.2.g.viii	2.1
N340000	Limestone application in NACE 45: road construction	Overig kalksteen gebruik (wegenbouw) (CBS)	2.A.4.d	2.2
T100100	Facilities NACE 13.20: textile weaving	SBI 13.20 (per bedrijf): Weven van textiel		3.1
T100201	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	SBI 10-12 (per bedrijf): Voedings- & genotmiddelenindustrie		3.1
T100202	Facilities NACE 16.21/16.22: manufacture of veneer sheets; manufacture of plywood, laminboard, particle board, fibre board and other panels and boards	SBI 16.21/16.22 (per bedrijf): Vervaardiging van fineer en plaatmateriaal en parketvloeren		3.1
T100300	Facilities NACE 13/14: manufacture of textiles and textile apparel	SBI 13/14 (per bedrijf): Vervaardiging van textiel en kleding		3.1
T100400	Facilities NACE 15: leather industry and fur preparation	SBI 15 (per bedrijf): Lederindustrie en bontbereiding		3.1
T100600	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	SBI 17 (per bedrijf): Vervaardiging van papier, karton en papier- en kartonwaren		3.1
T100601	Facilities NACE 20/21: manufacture of chemical products	SBI 20/21 (per bedrijf): Vervaardiging van chemische producten		3.1
T100700	Facilities NACE 20.1:manufacture of basic chemicals, corp. 101103	SBI 20.1 (per bedrijf): Vervaardiging van chemische basisproducten, bedr. 101103		3.1
T100701	Facilities NACE 20.1:manufacture of basic chemicals, corp. 62	SBI 20.1 (per bedrijf): Vervaardiging van chemische basisproducten, bedr. 62		3.1
T100800	Facilities NACE 19: manufacture of coke oven and refined petroleum products	SBI 19 (per bedrijf): Vervaardiging van cokesovenproducten en aardolieverwerking		3.1

ES code	Process description (English)	Process description (Dutch)	CRT	Section
T100801	Facilities NACE 23.51: manufacture of cement	SBI 23.51 (per bedrijf): Vervaardiging van cement		3.1
T100901	Facilities NACE 24: manufacture of metals in primary forms	SBI 24 (per bedrijf): Vervaardiging van metalen in primaire vorm		3.1
T101001	Facilities NACE 35.111:production of electricity	SBI 35.111 (per bedrijf): Elektriciteitsproduktie		3.1
T101100	Facilities NACE 20.1:manufacture of basic chemicals	SBI 20.1 (per bedrijf): Vervaardiging van chemische basisproducten		3.1
T101300	Facilities NACE 52.10/52.24: cargo handling and storage	SBI 52.10/52.24 (per bedrijf): Laad-, los- en overslagactiviteiten en opslag		3.1
T101500	Facilities NACE 13.3: finishing of textiles	SBI 13.3 (per bedrijf): Textielveredeling		3.1
T101600	Facilities NACE 13.93: manufacture of carpets and rugs	SBI 13.93 (per bedrijf): Vervaardiging van vloerkleden en tapijt		3.1
T101702	Facilities NACE 20.5: manufacture of other chemical products	SBI 20.5 (per bedrijf): Overige chemische producten		3.1
T101800	Facilities NACE 15.11: tanning of leather and fur preparation	SBI 15.11 (per bedrijf): Leerlooierijen en bontbereiding		3.1
T101900	Facilities NACE 16.1: sawmilling and planing of wood; impregnation of wood	SBI 16.1 (per bedrijf): Primaire houtbewerking en verduurzamen van hout		3.1
T102000	Facilities NACE 16.23: manufacture of builders' carpentry and joinery	SBI 16.23 (per bedrijf): Vervaardiging van overig timmerwerk voor de bouw		3.1
T102100	Facilities NACE 17.1: manufacture of pulp, paper and paperboard	SBI 17.1 (per bedrijf): Vervaardiging van papierpulp, papier en karton		3.1
T102101	Facilities NACE 19.1: manufacture of coke oven products	SBI 19.1 (per bedrijf): Vervaardiging van cokesovenproducten		3.1
T102102	Facilities NACE 23: construction material and glass industry	SBI 23 (per bedrijf): Bouwmaterialen- en glasindustrie		3.1
T102200	Facilities NACE 17.2: manufacture of articles of paper and paperboard	SBI 17.2 (per bedrijf): Vervaardiging van papier- en kartonwaren		3.1
T102201	Facilities NACE 19.201: manufacture of refined petroleum products	SBI 19.201 (per bedrijf): Aardolieraffinage		3.1
T102202	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	SBI 24.1-24.3 (per bedrijf): Basismetaalindustrie, verwerking en vervaardiging ijzer en staal		3.1
T102300	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	SBI 24.4/24.5 (per bedrijf): Basismetaalindustrie, vervaardiging van non-ferro metalen en gieten van metalen		3.1
T102400	Facilities NACE 20.12: manufacture of dyes and pigments	SBI 20.12 (per bedrijf): Vervaardiging van kleur- en verfstoffen		3.1

ES code	Process description (English)	Process description (Dutch)	CRT	Section
T102401	Facilities NACE 20.13: manufacture of inorganic basic chemicals, corp. 104710	SBI 20.13 (per bedrijf): Basischemie anorganisch, bedr. 104710		3.1
T102402	Facilities NACE 20.13: manufacture of inorganic basic chemicals, corp. 105014	SBI 20.13 (per bedrijf): Basischemie anorganisch, bedr. 105014		3.1
T102403	Facilities NACE 20.13: manufacture of inorganic basic chemicals	SBI 20.13 (per bedrijf): Basischemie anorganisch		3.1
T102500	Facilities NACE 20.13: manufacture of inorganic basic chemicals	SBI 20.13 (per bedrijf): Basischemie anorganisch		3.1
T102501	Facilities NACE 20.141: manufacture of petrochemicals	SBI 20.141 (per bedrijf): Vervaardiging van petrochemische producten		3.1
T102601	Facilities NACE 20.149: manufacture of organic basic chemicals (no petrochemicals)	SBI 20.149 (per bedrijf): Basischemie organisch (geen petrochemische producten)		3.1
T102700	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	SBI 20.15 (per bedrijf): Vervaardiging van kunstmeststoffen en stikstofverbindingen		3.1
T102701	Facilities NACE 26: manufacture of computers and electronic and optical apparatus	SBI 26 (per bedrijf): Vervaardiging computers en elektronische en optische apparatuur		3.1
T102800	Facilities NACE 20.16: manufacture of plastics in primary forms	SBI 20.16 (per bedrijf): Vervaardiging van kunststof in primaire vorm		3.1
T102900	Facilities NACE 20.2: manufacture of pesticides	SBI 20.2 (per bedrijf): Chemische bestrijdingsmiddelenindustrie		3.1
T103000	Facilities NACE 20.3: manufacture of paints, varnishes and similar coatings, printing ink and mastics	SBI 20.3 (per bedrijf): Vervaardiging van verf, lak, vernis, inkt en mastiek		3.1
T103001	Facilities NACE 21.20: manufacture of pharmaceutical preparations (no raw materials)	SBI 21.20 (per bedrijf): Vervaardiging van farmaceutische producten (geen grondstoffen)		3.1
T103002	Facilities NACE 30: manufacture of other transportation	SBI 30 (per bedrijf): Overige transportmiddelen		3.1
T103100	Facilities NACE 21.1: manufacture of pharmaceutical preparations	SBI 21.1 (per bedrijf): Vervaardiging van farmaceutische producten		3.1
T103101	Facilities NACE 20.41: manufacture detergents	SBI 20.41 (per bedrijf): Vervaardiging van was- en schoonmaakmiddelen		3.1
T103200	Facilities NACE 20.4: manufacture of detergents, perfumes and cosmetics	SBI 20.4 (per bedrijf): Vervaardiging was- en schoonmaakmiddelen, parfums en cosmetica		3.1
T103201	Facilities NACE 20.51: manufacture of explosives	SBI 20.51 (per bedrijf): Vervaardiging van kruit en springstoffen		3.1

ES code	Process description (English)	Process description (Dutch)	CRT	Section
T103300	Facilities NACE 20.52: manufacture of glues and adhesives	SBI 20.52 (per bedrijf): Vervaardiging van lijm en bereide kleefmiddelen		3.1
T103600	Facilities NACE 20.59: manufacture of other chemical products n.e.c.	SBI 20.59 (per bedrijf): Vervaardiging van overige chemische producten n.e.g.		3.1
T103601	Facilities NACE 23.1: manufacture of glass and glassware	SBI 23.1 (per bedrijf): Vervaardiging van glas en glaswerk		3.1
T103700	Facilities NACE 20.6: manufacture of synthetic and artificial fibres	SBI 20.6 (per bedrijf): Vervaardiging van synthetische en kunstmatige vezels		3.1
T103900	Facilities NACE 49-53: transport; communications	SBI 49-53 (per bedrijf): Transport, communicatie		3.1
T104101	Facilities NACE 24.2: manufacture of tubes and pipes	SBI 24.2 (per bedrijf): Vervaardiging van stalen buizen en pijpen		3.1
T104200	Facilities NACE 23.2-23.4: manufacture of ceramic products	SBI 23.2-23.4 (per bedrijf): Vervaardiging van keramische producten		3.1
T104201	Facilities NACE 38.2 collection and treatment of waste	SBI 38.2 (per bedrijf): Afvalinzameling/beh, AVI's		3.1
T104300	Facilities NACE 23.32: manufacture of bricks and tiles	SBI 23.32 (per bedrijf): Vervaardiging van bakstenen en dakpannen		3.1
T104301	Facilities NACE 96: wellness and other services, funeral sector	SBI 96 (per bedrijf): Wellness en overige dienstverlening; uitvaartbranche		3.1
T104400	Facilities NACE 24.3: other first processing of iron and steel	SBI 24.3 (per bedrijf): Overige eerste verwerking van ijzer en staal		3.1
T104500	Facilities NACE 20.59: manufacture of other chemical products n.e.c.	SBI 20.59 (per bedrijf): Vervaardiging van overige chemische producten n.e.g.		3.1
T104501	Facilities NACE 23.9: manufacture of other non-metallic mineral products	SBI 23.9 (per bedrijf): Vervaardiging van overige niet-metaalhoudende minerale producten		3.1
T104600	Facilities NACE 13.99 manufacture of other textiles n.e.c.	SBI 13.99 (per bedrijf): Vervaardiging van overige textielproducten n.e.g.		3.1
T104700	Facilities NACE 20.11: manufacture of industrial gasses	SBI 20.11 (per bedrijf): Vervaardiging van industriële gassen		3.1
T104701	Facilities NACE 24.45: manufacture of other non-ferrous metals	SBI 24.45: (per bedrijf) Vervaardiging van overige non-ferrometalen		3.1
T104702	Facilities NACE 24.45: manufacture of non-ferrous metals, aluminium	SBI 24.45 (per bedrijf) Vervaardiging van overige non-ferrometalen, aluminium		3.1

ES code	Process description (English)	Process description (Dutch)	CRT	Section
T104704	Facilities NACE 24.45: manufacture of non-ferrous metals, copper	SBI 24.45 (per bedrijf) Vervaardiging van overige non-ferrometalen, koper		3.1
T104705	Facilities NACE 24.45: manufacture of non-ferrous metals, lead	SBI 24.45 (per bedrijf) Vervaardiging van overige non-ferrometalen, lood		3.1
T104706	Facilities NACE 24.45: manufacture of non-ferrous metals, zinc	SBI 24.45 (per bedrijf) Vervaardiging van overige non-ferrometalen, zink		3.1
T104801	Facilities NACE 20.17: manufacture of synthetic rubber products in primary forms	SBI 20.17 (per bedrijf): Vervaardiging van synthetische rubber in primaire vorm		3.1
T104900	Facilities NACE 13.20: textile weaving	SBI 13.20 (per bedrijf): Weven van textiel		3.1
T104901	Facilities NACE 24.5: casting of metals	SBI 24.5 (per bedrijf): Gieten van metalen		3.1
T105000	Facilities NACE 10.1: processing and preserving of meat and poultry	SBI 10.1 (per bedrijf): Slachterijen en vleesverwerking		3.1
T105100	Facilities NACE 10.3: processing and preserving of fruit and vegetables	SBI 10.3 (per bedrijf): Groente- en fruitverwerking		3.1
T105200	Facilities NACE 10.4: manufacture of oils and fats	SBI 10.4 (per bedrijf): produktie oliën en vetten		3.1
T105300	Facilities NACE 10.5: dairy industry	SBI 10.5 (per bedrijf): Zuivelindustrie		3.1
T105400	Facilities NACE 10.6: manufacture of grain mill products, excl. starches and starch products	SBI 10.6 (per bedrijf): Meelproduktie (excl. zetmeel)		3.1
T105500	Facilities NACE 10.9: manufacture of prepared animal feeds	SBI 10.9 (per bedrijf): Diervoederindustrie		3.1
T105600	Facilities NACE 10.8 (excluding NACE 10.81 and 10.82): other manufacture of food products	SBI 10.8 (per bedrijf): Overige voedingsmiddelenindustrie (exclusief SBI 10.81 en 10.82)		3.1
T105700	Facilities NACE 11.07: manufacture of soft drinks and other beverages	SBI 11.07 (per bedrijf): Vervaardiging van dranken		3.1
T105800	Facilities NACE 12: manufacture of tobacco products	SBI 12 (per bedrijf): Verwerking van tabak		3.1
T105900	Facilities NACE 18/58: publishing, printing and reproduction of recorded media	SBI 18/58 (per bedrijf): Uitgeverijen, drukkerijen, reproductie van opgenomen media		3.1
T106000	Facilities NACE 22.1: manufacture of rubber products	SBI 22.1 (per bedrijf): Vervaardiging van producten van rubber		3.1
T106100	Facilities NACE 22.2: manufacture of plastic products	SBI 22.2 (per bedrijf): Vervaardiging van producten van kunststof		3.1
T106200	Facilities NACE 25: manufacture of metal structures and parts of structures (excluding manufacture of machinery)	SBI 25 (per bedrijf): Metaalproductenindustrie (exclusief machinebouw)		3.1
T106300	Facilities NACE 28: manufacture of machinery	SBI 28 (per bedrijf): Machinebouw		3.1

ES code	Process description (English)	Process description (Dutch)	CRT	Section
T106600	Facilities NACE 29: motor-industry	SBI 29 (per bedrijf): Auto-industrie		3.1
T106700	Facilities NACE 30 (excl 30.1): manufacture of other transportation	SBI 30 (per bedrijf): Overige transportmiddelen (exclusief SBI 30.1)		3.1
T106900	Facilities NACE 31/32: manufacture of furniture and other goods	SBI 31/32 (per bedrijf): Vervaardiging van meubels en overige goederen		3.1
T107000	Facilities NACE 38.3: preparation to recycling of metal and non-metal waste and scrap	SBI 38.3 (per bedrijf): Voorbereiding tot recycling		3.1
T107001	Facilities NACE 84.1: public administration services	SBI 84.1 (per bedrijf): Openbaar bestuur		3.1
T107100	Facilities NACE 08: other quarrying and mining	SBI 08 (per bedrijf): Winning van delfstoffen (geen olie en gas)		3.1
T107200	Facilities NACE 41-43: construction and building industries	SBI 41-43 (per bedrijf): Bouwnijverheid		3.1
T107201	Facilities NACE 85-88: education and healthcare	SBI 85-88 (per bedrijf): Onderwijs en gezondheids- en welzijnszorg		3.1
T107300	Facilities NACE 06/09.1: extraction (and related services) of crude oil and natural gasses	SBI 06/09.1 (per bedrijf): Aardolie- en gaswinning en dienstverlening voor de aardolie- en aardgaswinning		3.1
T107400	Facilities NACE 68-82: renting and consultancy activities	SBI 68-82 (per bedrijf): Verhuur en zakelijke dienstverlening (niet financieel)		3.1
T107500	Facilities NACE 45: trade and repair of motor vehicles and motorcycles	SBI 45 (per bedrijf): Handel en reparatie van auto's en motorfietsen		3.1
T107600	Facilities NACE 01: agriculture, hunting and services to agriculture and hunting	SBI 01 (per bedrijf): Landbouw, jacht en dienstverlening voor de landbouw en jacht		3.1
T107601	Facilities NACE 59/60/90/91/93/96: culture, sports, leisure and other community services	SBI 59/60/90/91/93/96 (per bedrijf): Cultuur, sport, recreatie en overige dienstverlening		3.1
T108300	Facilities NACE 23.6: manufacture of articles of concrete, plaster and cement	SBI 23.6 (per bedrijf): Vervaardiging van producten van beton, gips en cement		3.1
T108400	Facilities NACE 30.1: ship-building	SBI 30.1 (per bedrijf): Scheepsbouw		3.1
T108500	Facilities NACE 35: production and distribution of electricity and gas	SBI 35 (per bedrijf): Productie en distributie van elektriciteit en gas		3.1
T109000	Facilities NACE 16: manufacture of wooden products	SBI 16 (per bedrijf): Houtindustrie en vervaardiging van artikelen van hout, kurk, riet en vlechtwerk (geen meubels)		3.1
T109300	Facilities NACE 23.5: manufacture of cement, lime and plaster	SBI 23.5 (per bedrijf): Vervaardiging van cement, kalk en gips		3.1

ES code	Process description (English)	Process description (Dutch)	CRT	Section
T111200	Facilities NACE 38.2/84.1 treatment of waste, including communal waste-incineration plants	SBI 38.2/84.1 (per bedrijf): Behandeling van afval inclusief gemeentelijke AVI's		3.1
T111201	Facilities NACE 38.2: waste treatment	SBI 38.2 (per bedrijf): Behandeling van afval		3.1
T111300	Facilities NACE 37: collection and treatment of sewage	SBI 37 (per bedrijf): Afvalwaterinzameling en -behandeling		3.1
T112200	Facilities NACE 19.202: manufacture of refined petroleum products - not oil refineries	SBI 19.202 (per bedrijf): Aardolieverwerking, excl. raffinage		3.1
T137300	Facilities NACE 26/27: electro technical industry	SBI 26/27 (per bedrijf): Elektrotechnische industrie		3.1
T137400	Facilities NACE 26/31/32: manufacture of electronic apparatus, furniture and other goods	SBI 26/31/32 (per bedrijf): Vervaardiging van electronische apparaten, meubels en overige goederen		3.1
T151100	Facilities NACE 46/47: retail and wholesale trade	SBI 46/47 (per bedrijf): Detail- en groothandel		3.1
T151301	Facilities NACE 39: sanitation and other waste management	SBI 39 (per bedrijf): Sanering en overig afvalbeheer		3.1
T165202	Facilities NACE 64: Financial services (excl. insurances and pension funds)	SBI 64 (per bedrijf): Financiele dienstverlening (excl. verzekeringen en pensioenfondsen)		3.1
T400100	NACE 90.01: collection and treatment of sewage	RWZI spui van slibgistingsgas, CO_2, individueel		3.4

Appendix 2 List of company data

Introduction

The database of the Dutch Pollutants Release and Transfer Registry (PRTR) includes data on individual sources concerning emissions of and data on the companies, as well as WWTPs, airports and other possible localised sources. The method descriptions of individual emissions of companies and WWTPs into the air are described in this Method Report (see sections 3.1 and 3.4.2.4). The method descriptions of individual emissions of companies and airports into water are available on www.emissieregistratie.nl.

The list of company data includes background information on all individual localised sources. The most important purpose of the list of company data is to ensure that all data related to company sites whose individual emission data are collected by the PRTR can be linked to a single unique company number. This Annex describes the data management method these individual localised sources (hereafter referred to as 'companies') are subject to.

Data in the list of company data

The most important purpose of the list of company data is to ensure that all data related to company sites whose individual emission data are collected by the PRTR can be linked to a single unique company number. The list of company data also includes the following data:

- Company code
- Name
- Address, registered office
- Start date
- End date
- Reason of end
- X coordinate (*Rijksdriehoeksmeting*, Dutch national triangulation system)
- Y coordinate (*Rijksdriehoeksmeting*, Dutch national triangulation system)
- Chamber of Commerce registration number
- ETS trade number
- NACE code (varies per year)

The list of company data is part of the Reference Set (Access database). The data model and the content of the reference file is managed by RIVM. The latest version of the Reference Set is available, for PRTR staff only, on the restricted-access web site (*Documenten -> exports*). Historical information of companies can be found in previous versions of the TNO Reference Set (available to PRTR staff on request).

Contributing institutions:

The Pollutant Release and Transfer Register project is directed by RIVM. The contributors to the production process of individual company data are in the first place individual companies and facilities and responsible

people working there and secondly:
- RIVM
- TNO
- CBS
- Deltares

The list of company data is managed by the PRTR moderator, currently RIVM. RIVM manages the data in the eAER and CBS manages the data of WWTPs in the Netherlands. TNO, CBS and Deltares are also responsible for the inclusion of emission data of individual companies in the PRTR.

This Annex does not describe the processing of company emission data. Agreements about the processing of emission data and their annual submission are laid down in the PRTR's annual working plan and the method description of the various task forces. This Annex only describes the processing of general company data included in the list of company data.

Input for the list of company data

Companies are included in the list of company data based on the following information sources:
- Company data, IPPC permits and annual environmental reports (RIVM)
- WWTP data (CBS)

These files will be described below.

RIVM manages a file for its management tasks related to the processing of IPPC environmental permits and annual environmental reports of companies. This mainly pertains to the individual companies obligated to submit environmental and energy data via the eAER, and includes all contact with the competent authority (air, water) and/or executive services (Environmental Services, Regional Executive Services). This concerns companies reporting in the context of the Comprehensive PRTR Report, the long-range agreement (MJA) covenant, the Oil & Gas covenant, as well as companies "volunteering" reports in connection with their permit obligations.
This file contains all data needed for communication with the companies, as well as the most recent data sets about the companies.

CBS manages a file containing the data on all WWTPs in the Netherlands, and keeps various sets of company data linked to statistical information.

Each file has its own structure and data content. The company number serves as the link between files. Emission registration uses a unique code for each company site. This is typically a physical location for which a permit pursuant to the Environmental Permitting (General Provisions) Act (Wabo) or Water Act has been issued (Installations Decree). This company site is represented by a unique number, the company number (also referred to as NIC code). In the event of a company's relocation, division or merger, or of parts of a company, the link to the company number (NIC) will be reconsidered in accordance with applicable

(international) regulations. Of each company to which a number has been assigned a number of data will be kept up to date using a prearranged format. The numbering is unique and will not be reused.
Company name, address, registered office, coordinates, Chamber of Commerce registration number and ETS trade number are taken from the RIVM- file. Address and registered office must match those in the Basic Register of Addresses and Buildings (BAG). The BAG is also used for the (initial) linking of coordinates; for the company name, the wording/spelling used in the Trade Register (NHR) is leading.
The annual SBI/NACE code will be submitted by CBS for those companies whose emissions have been included in the PRTR.

Annual process

The reference file of the previous round is the starting point. Data submitters submit their data (amended or new data) to the moderator. This will take place on an ad-hoc basis over the course of the year by means of a notification (change request) to the moderator. This concerns a few dozen changes a year at most. The data submitter is the source owner for all data to be submitted in accordance with the data model.

Around 95% of data (emissions and company data) is submitted annually via the eAER (electronic annual environmental report). The database infrastructure is managed by RIVM. Data is entered into the database by the companies (or competent authority) themselves. Missing or incomplete data, such as zip code, Chamber of Commerce registration number and coordinates, are completed by RIVM. The database content is managed by RIVM and the moderator must be notified of changes on 1 October each year. The moderator will implement the changes in the Reference Set before 1 December.

In October CBS will be notified of the companies whose emissions from the previous year will be included in the PRTR. CBS will provide information about the economic core activity of these companies in that year, which determines the SBI/NACE code entered into the Reference Set.

History of the list of company data and archiving of company data

The old list of company data in the PRTR (TNO PRTR-I database) contained the company-specific data of thousands of companies whose emission data have been collected over a number of years. The data set of several hundreds of companies was updated each year. Data of currently registered companies, including registered name, contacts and other data, were changed where necessary. Any changes in connection with closures, divisions/mergers or new start-ups were also implemented. For start-ups new company sets were created. The company file was dynamic and could therefore be changed at any given time. Once a year, a subset was extracted from the dynamic file, which would be ‘frozen’ and served as a representation of the registration of that year. The database was managed by TNO.
From 2008 the PRTR reference database is used as the source file instead of the old list of company data. As the moderator, RIVM is also responsible for this data in the PRTR database. This implies that all changes to the reference database are handled by RIVM.

Appendix 3 Ratio between $PM_{2.5}$ and PM_{10} for emissions from the energy and industry sector

Table 1 New PM2.5 fractions (to be used in 2019 reporting), compared to the old PM2.5 fractions (which were used in 2018 reporting). This table shows the PM2.5 fractions for the supplementary emission estimates. PRTR codes are internal codes used within the Dutch PRTR.

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T107600	V	405	Facilities NACE 01: agriculture, hunting and services to agriculture and hunting	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T107600	P	352	Facilities NACE 01: agriculture, hunting and services to agriculture and hunting	Process		0.35	0.16	CEPMEIP default for mechanically formed fugitive emissions
T107300	V	1	Facilities NACE 06/09.1: extraction (and related services) of crude oil and natural gasses	Combustion	natural gas	1.00	1.00	Assumption for emissions from compressor station
T107300	P	36	Facilities NACE 06/09.1: extraction (and related services) of crude oil and natural gasses	Process	other fuel	1.00	1.00	Assumption for emissions from compressor station
T107300	P	49	Facilities NACE 06/09.1: extraction (and related services) of crude oil and natural gasses	Process	waste gas	1.00	1.00	Assumption for emissions from compressor station
T107300	P	352	Facilities NACE 06/09.1: extraction (and related services) of crude oil and natural gasses	Process		0.00	1.00	Assumption for emissions from compressor station
T107100	V	384	Facilities NACE 08: other quarrying and mining	Combustion	lignite	0.80	0.63	Average of last AERs, Nedmag
T107100	V	361	Facilities NACE 08: other quarrying and mining	Combustion	natural gas	0.80	0.13	Average of last AERs, Nedmag
T107100	P	361	Facilities NACE 08: other quarrying and mining	Process	natural gas	0.80	1.00	Average of last AERs, Nedmag

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T107100	P	352	Facilities NACE 08: other quarrying and mining	Process		0.80	0.77	Average of last AERs, Nedmag
T105000	P	352	Facilities NACE 10.1: processing and preserving of meat and poultry	Process		0.35	0.16	CEPMEIP default for mechanically formed fugitive emissions
T105100	P	352	Facilities NACE 10.3: processing and preserving of fruit and vegetables	Process		0.35	0.16	CEPMEIP default for mechanically formed fugitive emissions
T105200	P	352	Facilities NACE 10.4: manufacture of oils and fats	Process		0.15	0.13	Average of last AERs, crushing/grinding installation
T105300	P	352	Facilities NACE 10.5: dairy industry	Process		0.20	0.98	Average of last AERs, drying of milk powder
T105400	P	352	Facilities NACE 10.6: manufacture of grain mill products, excl. starches and starch products	Process		0.35	0.16	Average of last AERs, crushing/grinding installation
T105600	P	352	Facilities NACE 10.8 (excluding NACE 10.81 and 10.82): other manufacture of food products	Process		0.35	0.16	Average of last AERs, sugar production and drying installations
T105500	P	352	Facilities NACE 10.9: manufacture of prepared animal feeds	Process		0.15	0.16	CEPMEIP, average for storage
T100201	H	8	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	biomass gaseous	0.15	1.00	Average of last AERs, crushing/grinding installation
T100201	H	466	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	biomass gaseous	0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T100201	H	382	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	biomass liquid	0.75	0.67	CEPMEIP default for combustion of industrial black liquor
T100201	V	351	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	coal	0.50	0.57	Average of last AERs, drying installation

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T100201	V	51	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	coal	0.50	0.57	CEPMEIP default for combustion of coal in a medium sized combustor
T100201	V	392	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	coking coal	0.50	0.43	CEPMEIP default for combustion of coal in a medium sized combustor
T100201	V	482	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	crude oil	0.85	1.00	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T100201	V	52	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	fuel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T100201	V	480	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	fuel oil	0.85	0.67	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T100201	V	405	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T100201	V	410	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T100201	V	18	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T100201	V	1	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	natural gas	0.15	1.00	Average of last AERs, crushing/grinding installation
T100201	V	4	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	natural gas	0.15	1.00	Average of last AERs, crushing/grinding installation
T100201	V	361	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	natural gas	0.35	0.16	CEPMEIP default for mechanically formed fugitive emissions
T100201	V	440	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	other solid fuel	0.50	0.67	Average of last AERs, drying installation
T100201	H	25	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	wood	0.75	0.77	CEPMEIP/Ehrlich medium sized wood-fired boiler

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T100201	V	352	Facilities NACE 10-12: manufacture of food products, beverages and tobacco	Combustion		0.15	0.16	Average of last AERs, crushing/grinding installation
T105700	P	352	Facilities NACE 11.07: manufacture of soft drinks and other beverages	Process		0.35	0.00	CEPMEIP default for mechanically formed fugitive emissions
T105800	P	352	Facilities NACE 12: manufacture of tobacco products	Process		0.35	0.16	CEPMEIP default for mechanically formed fugitive emissions
T100100	P	352	Facilities NACE 13.20: textile weaving	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T104900	P	352	Facilities NACE 13.20: textile weaving	Process		0.35	0.16	CEPMEIP default for mechanically formed fugitive emissions
T101500	P	352	Facilities NACE 13.3: finishing of textiles	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T101600	P	352	Facilities NACE 13.93: manufacture of carpets and rugs	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T104600	P	352	Facilities NACE 13.99 manufacture of other textiles n.e.c.	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T100300	V	351	Facilities NACE 13/14: manufacture of textiles and textile apparel	Combustion	coal	0.50	1.00	CEPMEIP default for combustion of coal in a medium sized combustor
T100300	V	52	Facilities NACE 13/14: manufacture of textiles and textile apparel	Combustion	fuel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T100300	V	405	Facilities NACE 13/14: manufacture of textiles and textile apparel	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T100300	V	1	Facilities NACE 13/14: manufacture of textiles and textile apparel	Combustion	natural gas	0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T100300	V	360	Facilities NACE 13/14: manufacture of textiles and textile apparel	Combustion	natural gas	0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T101800	P	352	Facilities NACE 15.11: tanning of leather and fur preparation	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T100400	V	52	Facilities NACE 15: leather industry and fur preparation	Combustion	fuel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T100400	V	17	Facilities NACE 15: leather industry and fur preparation	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T100202	P	352	Facilities NACE 16.21/16.22: manufacture of veneer sheets, manufacture of plywood, laminboard, particle board, fibre board and other panels and boards	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T102000	P	352	Facilities NACE 16.23: manufacture of builders' carpentry and joinery	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T109000	H	25	Facilities NACE 16: manufacture of wooden products	Combustion	wood	0.75	0.77	CEPMEIP/Ehrlich medium sized wood-fired boiler
T109000	H	26	Facilities NACE 16: manufacture of wooden products	Combustion	wood, wood waste	0.75	0.77	CEPMEIP/Ehrlich medium sized wood-fired boiler
T102100	P	352	Facilities NACE 17.1: manufacture of pulp, paper and paperboard	Process		0.75	1.00	Average of last AERs, Parenco
T102200	P	352	Facilities NACE 17.2: manufacture of articles of paper and paperboard	Process		0.75	0.33	Average of last AERs, Parenco

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T100600	H	381	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	Combustion	biomass solid	0.75	1.00	CEPMEIP/Ehrlich medium sized wood-fired boiler
T100600	V	51	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	Combustion	coal	0.50	0.43	CEPMEIP default for combustion of coal in a medium sized combustor
T100600	V	52	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	Combustion	fuel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T100600	V	1	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	Combustion	natural gas	0.75	1.00	Average of last AERs, Parenco
T100600	V	361	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	Combustion	natural gas	0.75	1.00	Average of last AERs, Parenco
T100600	H	37	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	Combustion	other solid fuel	0.67	0.79	CEPMEIP default for industrial waste fuels
T100600	H	444	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	Combustion	other solid fuel	0.67	0.75	CEPMEIP default for industrial waste fuels
T100600	V	68	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	Combustion	waste	0.67	1.00	CEPMEIP default for industrial waste fuels
T100600	V	358	Facilities NACE 17: manufacture of paper, paperboard and articles of paper and paperboard	Combustion	waste	0.67	0.79	CEPMEIP default for industrial waste fuels
T105900	P	352	Facilities NACE 18/58: publishing, printing and reproduction of recorded media	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T102101	V	387	Facilities NACE 19.1: manufacture of coke oven products	Combustion	coke oven gas	0.50	0.75	CEPMEIP default for coke oven
T102101	V	352	Facilities NACE 19.1: manufacture of coke oven products	Combustion		0.50	0.40	CEPMEIP default for coke oven
T102101	P	352	Facilities NACE 19.1: manufacture of coke oven products	Process		0.50	0.40	CEPMEIP default for coke oven
T102201	H	471	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	biomass gaseous	0.70	1.00	Ehrlich, cat cracker regenerator
T102201	V	471	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	biomass gaseous	0.70	1.00	Ehrlich, cat cracker regenerator
T102201	H	382	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	biomass liquid	0.70	0.83	Ehrlich, cat cracker regenerator
T102201	V	388	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	chemical waste gas	0.70	0.75	Ehrlich, cat cracker regenerator
T102201	V	52	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	fuel oil	0.85	0.89	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T102201	V	480	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	fuel oil	0.85	0.89	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T102201	V	57	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	fuel oil	0.85	1.00	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T102201	V	405	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	gas/diesel oil	0.70	0.81	Ehrlich, cat cracker regenerator
T102201	V	17	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	gas/diesel oil	0.70	0.83	Ehrlich, cat cracker regenerator
T102201	V	1	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	natural gas	0.70	1.00	Ehrlich, cat cracker regenerator
T102201	V	361	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	natural gas	0.70	0.74	Ehrlich, cat cracker regenerator
T102201	V	39	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	other fuel	0.85	0.74	CEPMEIP/Ehrlich default for combustion of heavy fuel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T102201	V	443	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	other gaseous fuel	0.70	0.75	Ehrlich, cat cracker regenerator
T102201	V	445	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	other liquid fuel	0.70	0.89	Ehrlich, cat cracker regenerator
T102201	V	448	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	other oil	0.85	0.89	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T102201	V	454	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	petroleum coke	0.70	0.79	Ehrlich, cat cracker regenerator
T102201	V	44	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	refinery gas	0.70	0.75	Ehrlich, cat cracker regenerator
T102201	V	458	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	refinery gas	0.70	0.81	Ehrlich, cat cracker regenerator
T102201	V	45	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	refinery gas	0.70	0.75	Ehrlich, cat cracker regenerator
T102201	V	472	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	tar and asphalt	0.85	0.89	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T102201	V	436	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	unknown	0.70	0.74	Ehrlich, cat cracker regenerator
T102201	V	46	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion	waste gas	0.70	0.75	Ehrlich, cat cracker regenerator
T102201	V	352	Facilities NACE 19.201: manufacture of refined petroleum products	Combustion		0.70	0.72	Ehrlich, cat cracker regenerator
T102201	P	352	Facilities NACE 19.201: manufacture of refined petroleum products	Process		0.70	1.00	Ehrlich, cat cracker regenerator
T112200	V	52	Facilities NACE 19.202: manufacture of refined petroleum products - not oil refineries	Combustion	fuel oil	0.95	0.79	CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T112200	V	405	Facilities NACE 19.202: manufacture of refined petroleum products - not oil refineries	Combustion	gas/diesel oil	0.95	0.95	CEPMEIP default for combustion of gas/diesel oil
T112200	V	411	Facilities NACE 19.202: manufacture of refined petroleum products - not oil refineries	Combustion	gas/diesel oil	0.95	0.80	CEPMEIP default for combustion of gas/diesel oil
T112200	V	19	Facilities NACE 19.202: manufacture of refined petroleum products - not oil refineries	Combustion	gas/diesel oil	0.95	0.80	CEPMEIP default for combustion of gas/diesel oil
T112200	V	458	Facilities NACE 19.202: manufacture of refined petroleum products - not oil refineries	Combustion	refinery gas	1.00	0.96	CEPMEIP default for combustion of gaseous fuels
T112200	P	352	Facilities NACE 19.202: manufacture of refined petroleum products - not oil refineries	Process		0.70	0.80	Ehrlich, cat cracker regenerator
T100800	V	52	Facilities NACE 19: manufacture of coke oven and refined petroleum products	Combustion	fuel oil	0.50	0.89	CEPMEIP default for cokesoven
T101100	H	377	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	biomass gaseous	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T101100	H	422	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	biomass gaseous	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T101100	H	466	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	biomass gaseous	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T101100	V	383	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	bitumen	0.85	0.66	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T101100	V	427	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	carbon monoxide	0.75	0.75	Average of last AERs, production of chemical products
T101100	V	388	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	chemical waste gas	0.75	0.81	Average of last AERs, production of chemical products

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T101100	V	351	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	coal	0.50	0.62	CEPMEIP default for combustion of coal in a medium sized combustor
T101100	V	51	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	coal	0.50	0.43	CEPMEIP default for combustion of coal in a medium sized combustor
T101100	V	393	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	coke oven / gas coke	0.50	0.62	CEPMEIP default for combustion of coal in a medium sized combustor
T101100	V	363	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	crude oil	0.85	0.83	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T101100	V	52	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	fuel oil	0.85	0.83	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T101100	V	57	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	fuel oil	0.85	0.79	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T101100	V	405	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T101100	V	17	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	gas/diesel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T101100	V	410	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T101100	V	56	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	hydrogen	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T101100	V	509	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	naphtha	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T101100	V	1	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	natural gas	0.75	1.00	Average of last AERs, production of chemical products
T101100	V	361	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	natural gas	0.75	0.73	Average of last AERs, production of chemical products

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T101100	V	445	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	other liquid fuel	0.85	0.79	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T101100	V	448	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	other oil	0.85	0.79	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T101100	V	454	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	petroleum coke	0.90	0.58	Assumed low ashlow ash incineration with a high PM2.5 fraction
T101100	V	31	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	refinery gas	0.95	0.75	CEPMEIP default for combustion of gas/diesel oil
T101100	V	44	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	refinery gas	0.75	0.75	Average of last AERs, production of chemical products
T101100	V	458	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	refinery gas	0.75	0.95	Average of last AERs, production of chemical products
T101100	V	472	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	tar and asphalt	0.85	0.79	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T101100	V	54	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	tar and asphalt	0.85	0.79	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T101100	V	16	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	unknown	0.75	0.75	Average fraction for process emissions in AER, because this sector contains a large diversity of different processes
T101100	V	358	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	waste	0.67	0.80	CEPMEIP default for industrial waste fuels
T101100	V	46	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	waste gas	0.75	0.75	Average of last AERs, production of chemical products
T101100	V	48	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	waste liquids	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T101100	H	25	Facilities NACE 20.1:manufacture of basic chemicals	Combustion	wood	0.75	0.77	CEPMEIP/Ehrlich medium sized wood-fired boiler

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T101100	V	352	Facilities NACE 20.1:manufacture of basic chemicals	Combustion		0.75	0.73	Average of last AERs, production of chemical products
T101100	P	352	Facilities NACE 20.1:manufacture of basic chemicals	Process		0.75	0.61	Average of last AERs, production of chemical products
T100700	P	352	Facilities NACE 20.1:manufacture of basic chemicals, corp. 101103	Process		0.75	0.73	Average of last AERs, production of chemical products
T100701	P	352	Facilities NACE 20.1:manufacture of basic chemicals, corp. 62	Process		0.63	0.73	Average of last AERs of fertilizer production and Ehrlich for chemical industry
T104700	P	352	Facilities NACE 20.11: manufacture of industrial gasses	Process		0.55	0.73	Ehrlich, average for chemical industry
T102400	P	352	Facilities NACE 20.12: manufacture of dyes and pigments	Process		0.35	0.73	CEPMEIP default for mechanically formed fugitive emissions
T102500	P	361	Facilities NACE 20.13: manufacture of inorganic basic chemicals	Process	natural gas	0.95	0.75	Average of last AERs, average combustion in inorganic chemical sector
T102500	P	352	Facilities NACE 20.13: manufacture of inorganic basic chemicals	Process		0.45	0.37	Average of last AERs, process emissions in the inorganic chemical sector
T102403	P	352	Facilities NACE 20.13: manufacture of inorganic basic chemicals	Process		0.55	0.90	Ehrlich, average for chemical industry
T102401	P	352	Facilities NACE 20.13: manufacture of inorganic basic chemicals, corp. 104710	Process		0.35	0.70	Average of AER 2014, silicium carbide production
T102402	P	352	Facilities NACE 20.13: manufacture of inorganic basic chemicals, corp. 105014	Process		0.65	0.70	Average of AER 2009, Brunner Mond
T102501	P	352	Facilities NACE 20.141: manufacture of petrochemicals	Process		0.85	0.82	CEPMEIP/Ehrlich default for combustion of heavy fuel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T102601	P	361	Facilities NACE 20.149: manufacture of organic basic chemicals (no petrochemicals)	Process	natural gas	0.63	1.00	Average of last AERs of fertilizer production and Ehrlich for chemical industry
T102601	P	352	Facilities NACE 20.149: manufacture of organic basic chemicals (no petrochemicals)	Process		0.63	0.73	Average of last AERs of fertilizer production and Ehrlich for chemical industry
T102700	V	52	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	Combustion	fuel oil	0.95	0.34	CEPMEIP default for combustion of gas/diesel oil
T102700	V	57	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	Combustion	fuel oil	0.85	0.34	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T102700	V	405	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	Combustion	gas/diesel oil	0.95	0.34	CEPMEIP default for combustion of gas/diesel oil
T102700	V	33	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	Combustion	lpg	0.70	0.34	Average of last AERs, drying installations in fertilizer production sector
T102700	V	361	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	Combustion	natural gas	0.70	0.34	Average of last AERs, drying installations in fertilizer production sector
T102700	V	352	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	Combustion		0.70	0.34	Average of last AERs, drying installations in fertilizer production sector
T102700	P	410	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	Process	gas/diesel oil	0.70	0.34	Average of last AERs, drying installations in fertilizer production sector
T102700	P	33	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	Process	lpg	0.70	0.34	Average of last AERs, drying installations in fertilizer production sector
T102700	P	352	Facilities NACE 20.15: manufacture of fertilizers and nitrogen compounds	Process		0.70	0.34	Average of last AERs, drying installations in fertilizer production sector

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T102800	P	361	Facilities NACE 20.16: manufacture of plastics in primary forms	Process	natural gas	0.63	1.00	Average of last AERs of fertilizer production and Ehrlich for chemical industry
T102800	P	352	Facilities NACE 20.16: manufacture of plastics in primary forms	Process		0.63	0.10	Average of last AERs of fertilizer production and Ehrlich for chemical industry
T102900	V	52	Facilities NACE 20.2: manufacture of pesticides	Combustion	fuel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T102900	V	405	Facilities NACE 20.2: manufacture of pesticides	Combustion	gas/diesel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T102900	V	410	Facilities NACE 20.2: manufacture of pesticides	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T102900	V	1	Facilities NACE 20.2: manufacture of pesticides	Combustion	natural gas	0.55	1.00	Ehrlich, average for chemical industry
T102900	V	361	Facilities NACE 20.2: manufacture of pesticides	Combustion	natural gas	0.55	1.00	Ehrlich, average for chemical industry
T102900	P	352	Facilities NACE 20.2: manufacture of pesticides	Process		0.55	0.73	Ehrlich, average for chemical industry
T103000	V	361	Facilities NACE 20.3: manufacture of paints, varnishes and similar coatings, printing ink and mastics	Combustion	natural gas	0.50	0.73	Assumption for fugitive emissions from ovens
T103000	P	352	Facilities NACE 20.3: manufacture of paints, varnishes and similar coatings, printing ink and mastics	Process		0.50	0.73	Assumption for fugitive emissions from ovens
T103200	V	405	Facilities NACE 20.4: manufacture of detergents, perfumes and cosmetics	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T103200	V	17	Facilities NACE 20.4: manufacture of detergents, perfumes and cosmetics	Combustion	gas/diesel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T103200	V	410	Facilities NACE 20.4: manufacture of detergents, perfumes and cosmetics	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T103200	V	18	Facilities NACE 20.4: manufacture of detergents, perfumes and cosmetics	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T103101	P	352	Facilities NACE 20.41: manufacture detergents	Process		0.55	0.73	Ehrlich, average for chemical industry
T101702	H	382	Facilities NACE 20.5: manufacture of other chemical products	Combustion	biomass liquid	0.75	0.16	CEPMEIP default for combustion of industrial black liquor
T101702	H	381	Facilities NACE 20.5: manufacture of other chemical products	Combustion	biomass solid	0.75	0.16	CEPMEIP/Ehrlich medium sized wood-fired boiler
T101702	V	383	Facilities NACE 20.5: manufacture of other chemical products	Combustion	bitumen	0.85	0.99	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T101702	V	52	Facilities NACE 20.5: manufacture of other chemical products	Combustion	fuel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T101702	V	405	Facilities NACE 20.5: manufacture of other chemical products	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T101702	V	33	Facilities NACE 20.5: manufacture of other chemical products	Combustion	lpg	1.00	0.86	CEPMEIP default for combustion of gaseous fuels
T101702	V	1	Facilities NACE 20.5: manufacture of other chemical products	Combustion	natural gas	0.55	1.00	Ehrlich, average for chemical industry
T101702	V	361	Facilities NACE 20.5: manufacture of other chemical products	Combustion	natural gas	0.55	0.73	Ehrlich, average for chemical industry
T101702	V	46	Facilities NACE 20.5: manufacture of other chemical products	Combustion	waste gas	1.00	0.75	CEPMEIP default for combustion of gaseous fuels
T103300	P	352	Facilities NACE 20.52: manufacture of glues and adhesives	Process		0.55	0.73	Ehrlich, average for chemical industry
T103600	P	352	Facilities NACE 20.59: manufacture of other chemical products n.e.c.	Process		0.55	0.66	Ehrlich, average for chemical industry
T104500	P	352	Facilities NACE 20.59: manufacture of other chemical products n.e.c.	Process		0.55	0.73	Ehrlich, average for chemical industry
T103700	V	1	Facilities NACE 20.6: manufacture of synthetic and artificial fibres	Combustion	natural gas	0.55	0.64	Ehrlich, average for chemical industry

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T103700	V	358	Facilities NACE 20.6: manufacture of synthetic and artificial fibres	Combustion	waste	0.67	0.64	CEPMEIP default for industrial waste fuels
T103700	V	352	Facilities NACE 20.6: manufacture of synthetic and artificial fibres	Combustion		0.55	0.64	Ehrlich, average for chemical industry
T103700	P	352	Facilities NACE 20.6: manufacture of synthetic and artificial fibres	Process		0.55	0.64	Ehrlich, average for chemical industry
T103100	V	52	Facilities NACE 21.1: manufacture of pharmaceutical preparations	Combustion	fuel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T103100	V	405	Facilities NACE 21.1: manufacture of pharmaceutical preparations	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T103100	V	1	Facilities NACE 21.1: manufacture of pharmaceutical preparations	Combustion	natural gas	0.55	1.00	Ehrlich, average for chemical industry
T103001	P	352	Facilities NACE 21.20: manufacture of pharmaceutical preparations (no raw materials)	Process		0.55	0.73	Ehrlich, average for chemical industry
T106000	V	52	Facilities NACE 22.1: manufacture of rubber products	Combustion	fuel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T106000	P	352	Facilities NACE 22.1: manufacture of rubber products	Process		0.35	0.25	CEPMEIP default for mechanically formed fugitive emissions
T106100	V	52	Facilities NACE 22.2: manufacture of plastic products	Combustion	fuel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T106100	V	405	Facilities NACE 22.2: manufacture of plastic products	Combustion	gas/diesel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T106100	V	33	Facilities NACE 22.2: manufacture of plastic products	Combustion	lpg	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T106100	V	361	Facilities NACE 22.2: manufacture of plastic products	Combustion	natural gas	0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T106100	V	358	Facilities NACE 22.2: manufacture of plastic products	Combustion	waste	0.67	0.83	CEPMEIP default for industrial waste fuels
T106100	H	25	Facilities NACE 22.2: manufacture of plastic products	Combustion	wood	0.75	0.77	CEPMEIP/Ehrlich medium sized wood-fired boiler
T106100	V	352	Facilities NACE 22.2: manufacture of plastic products	Combustion		0.35	0.25	CEPMEIP default for mechanically formed fugitive emissions
T106100	P	352	Facilities NACE 22.2: manufacture of plastic products	Process		0.35	0.27	CEPMEIP default for mechanically formed fugitive emissions
T103601	P	352	Facilities NACE 23.1: manufacture of glass and glassware	Process		0.95	0.97	Average of last AERs, glass production
T104200	P	352	Facilities NACE 23.2-23.4: manufacture of ceramic products	Process		0.25	0.92	Ehrlich, fugitive emissions from ceramic industry
T104300	P	352	Facilities NACE 23.32: manufacture of bricks and tiles	Process		0.25	0.92	Ehrlich, fugitive emissions from ceramic industry
T109300	P	352	Facilities NACE 23.5: manufacture of cement, lime and plaster	Process		0.10	0.12	Ehrlich, cement production fugitive emissions
T100801	V	1	Facilities NACE 23.51: manufacture of cement	Combustion	natural gas	0.85	0.74	Average of last AERs, cement production
T100801	V	361	Facilities NACE 23.51: manufacture of cement	Combustion	natural gas	0.85	0.74	Average of last AERs, cement production
T100801	P	393	Facilities NACE 23.51: manufacture of cement	Process	coke oven / gas coke	0.50	0.74	CEPMEIP default for combustion of coal in a medium sized combustor
T100801	P	11	Facilities NACE 23.51: manufacture of cement	Process	lignite	0.50	0.74	CEPMEIP default for combustion of coal in a medium sized combustor
T100801	P	1	Facilities NACE 23.51: manufacture of cement	Process	natural gas	0.85	0.74	Average of last AERs, cement production

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T100801	P	361	Facilities NACE 23.51: manufacture of cement	Process	natural gas	0.85	0.74	Average of last AERs, cement production
T100801	P	444	Facilities NACE 23.51: manufacture of cement	Process	other solid fuel	0.67	0.74	CEPMEIP default for industrial waste fuels
T100801	P	454	Facilities NACE 23.51: manufacture of cement	Process	petroleum coke	0.90	0.74	Assumed low ash incineration with a high PM2.5 fraction
T100801	P	352	Facilities NACE 23.51: manufacture of cement	Process		0.10	0.87	Ehrlich, cement production fugitive emissions
T108300	P	352	Facilities NACE 23.6: manufacture of articles of concrete, plaster and cement	Process		0.10	0.12	Ehrlich, cement production fugitive emissions
T104501	P	352	Facilities NACE 23.9: manufacture of other non-metallic mineral products	Process		0.80	0.32	PRTR for Denmark, non-metallic mineral products
T102102	H	381	Facilities NACE 23: construction material and glass industry	Combustion	biomass solid	0.75	0.79	CEPMEIP/Ehrlich medium sized wood-fired boiler
T102102	V	51	Facilities NACE 23: construction material and glass industry	Combustion	coal	0.50	0.79	CEPMEIP default for combustion of coal in a medium sized combustor
T102102	V	393	Facilities NACE 23: construction material and glass industry	Combustion	coke oven / gas coke	0.50	0.78	CEPMEIP default for combustion of coal in a medium sized combustor
T102102	V	52	Facilities NACE 23: construction material and glass industry	Combustion	fuel oil	0.95	0.79	CEPMEIP default for combustion of gas/diesel oil
T102102	V	57	Facilities NACE 23: construction material and glass industry	Combustion	fuel oil	0.90	0.79	Average of last AERs, cement and glass production
T102102	V	405	Facilities NACE 23: construction material and glass industry	Combustion	gas/diesel oil	0.95	0.79	CEPMEIP default for combustion of gas/diesel oil
T102102	V	17	Facilities NACE 23: construction material and glass industry	Combustion	gas/diesel oil	0.95	0.79	CEPMEIP default for combustion of gas/diesel oil
T102102	V	1	Facilities NACE 23: construction material and glass industry	Combustion	natural gas	0.90	0.79	Average of last AERs, cement and glass production

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T102102	V	361	Facilities NACE 23: construction material and glass industry	Combustion	natural gas	0.90	0.79	Average of last AERs, cement and glass production
T102102	V	352	Facilities NACE 23: construction material and glass industry	Combustion		0.90	0.79	Average of last AERs, cement and glass production
T102202	V	113	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	blast furnace gas	0.65	0.75	CEPMEIP average integrated iron and steel plant class 2
T102202	V	23	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	blast furnace gas	0.65	0.75	CEPMEIP average integrated iron and steel plant class 2
T102202	V	351	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	coal	0.65	0.75	CEPMEIP average integrated iron and steel plant class 2
T102202	V	387	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	coke oven gas	0.65	0.75	CEPMEIP average integrated iron and steel plant class 2
T102202	V	394	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	coke oven gas	1.00	0.75	CEPMEIP default for combustion of gaseous fuels
T102202	V	52	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	fuel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T102202	V	405	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	gas/diesel oil	0.65	1.00	CEPMEIP average integrated iron and steel plant class 2
T102202	V	17	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	gas/diesel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T102202	V	1	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	natural gas	0.65	1.00	CEPMEIP average integrated iron and steel plant class 2
T102202	V	2	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	natural gas	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T102202	V	361	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	natural gas	0.65	0.64	CEPMEIP average integrated iron and steel plant class 2
T102202	V	440	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	other solid fuel	0.65	0.43	CEPMEIP average integrated iron and steel plant class 2
T102202	V	452	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion	oxy gas	1.00	0.75	CEPMEIP default for combustion of gaseous fuels
T102202	V	352	Facilities NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel	Combustion		0.65	0.64	CEPMEIP average integrated iron and steel plant class 2
T104101	P	410	Facilities NACE 24.2: manufacture of tubes and pipes	Process	gas/diesel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T104101	P	352	Facilities NACE 24.2: manufacture of tubes and pipes	Process		0.70	0.38	Ehrlich, metallurgical sector
T104400	P	352	Facilities NACE 24.3: other first processing of iron and steel	Process		0.70	0.50	Ehrlich, metallurgical sector
T102300	V	387	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion	coke oven gas	1.00	0.67	CEPMEIP default for combustion of gaseous fuels
T102300	V	391	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion	coking coal	0.50	0.67	CEPMEIP default for combustion of coal in a medium sized combustor

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T102300	V	405	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion	gas/diesel oil	0.70	0.21	Ehrlich, metallurgical sector
T102300	V	17	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T102300	V	18	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T102300	V	33	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion	lpg	1.00	0.21	CEPMEIP default for combustion of gaseous fuels
T102300	V	1	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion	natural gas	0.70	0.67	Ehrlich, metallurgical sector
T102300	V	361	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion	natural gas	0.70	0.67	Ehrlich, metallurgical sector
T102300	V	454	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion	petroleum coke	0.90	0.58	Assumed low ash incineration with a high PM2.5 fraction
T102300	V	352	Facilities NACE 24.4/24.5: base metal industry, manufacture of non-ferrous metals and casting of metals	Combustion		0.70	0.67	Ehrlich, metallurgical sector
T104702	V	405	Facilities NACE 24.45: manufacture of non-ferrous metals, aluminium	Combustion	gas/diesel oil	0.95	0.73	CEPMEIP default for combustion of gas/diesel oil
T104702	P	361	Facilities NACE 24.45: manufacture of non-ferrous metals, aluminium	Process	natural gas	0.85	0.73	Average for all AERs, Pechiney and Aldel
T104702	P	352	Facilities NACE 24.45: manufacture of non-ferrous metals, aluminium	Process		0.85	0.73	Average for all AERs, Pechiney and Aldel

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T104704	P	352	Facilities NACE 24.45: manufacture of non-ferrous metals, copper	Process		0.75	0.67	CEPMEIP default for secondary copper
T104705	P	352	Facilities NACE 24.45: manufacture of non-ferrous metals, lead	Process		0.70	0.83	Ehrlich, metallurgical sector
T104706	V	405	Facilities NACE 24.45: manufacture of non-ferrous metals, zinc	Combustion	gas/diesel oil	0.75	1.00	Average of last AERs, Budel Zink
T104706	P	352	Facilities NACE 24.45: manufacture of non-ferrous metals, zinc	Process		0.75	0.67	Average of last AERs, Budel Zink
T104901	P	352	Facilities NACE 24.5: casting of metals	Process		0.55	0.74	Average of last AERs, Alucast
T100901	P	361	Facilities NACE 24: manufacture of metals in primary forms	Process	natural gas	0.65	0.75	CEPMEIP average integrated iron and steel plant class 2
T100901	P	352	Facilities NACE 24: manufacture of metals in primary forms	Process		0.65	0.65	CEPMEIP average integrated iron and steel plant class 2
T106200	V	52	Facilities NACE 25: manufacture of metal structures and parts of structures (excluding manufacture of machinery)	Combustion	fuel oil	0.30	0.67	Average of last AERs, selection of companies in metal industry
T106200	V	1	Facilities NACE 25: manufacture of metal structures and parts of structures (excluding manufacture of machinery)	Combustion	natural gas	0.30	1.00	Average of last AERs, selection of companies in metal industry
T106200	V	361	Facilities NACE 25: manufacture of metal structures and parts of structures (excluding manufacture of machinery)	Combustion	natural gas	0.30	1.00	Average of last AERs, selection of companies in metal industry
T106200	V	458	Facilities NACE 25: manufacture of metal structures and parts of structures (excluding manufacture of machinery)	Combustion	refinery gas	0.30	0.75	Average of last AERs, selection of companies in metal industry

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T106200	P	352	Facilities NACE 25: manufacture of metal structures and parts of structures (excluding manufacture of machinery)	Process		0.30	0.36	Average of last AERs, selection of companies in metal industry
T137300	V	352	Facilities NACE 26/27: electro technical industry	Combustion		0.20	0.25	Average of last AERs, Aluchemie
T137300	P	352	Facilities NACE 26/27: electro technical industry	Process		0.20	0.28	Average of last AERs, Aluchemie
T137400	P	352	Facilities NACE 26/31/32: manufacture of electronic apparatus, furniture and other goods	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T106300	V	52	Facilities NACE 28: manufacture of machinery	Combustion	fuel oil	0.95	0.67	Average last AERs, Komeco
T106300	V	405	Facilities NACE 28: manufacture of machinery	Combustion	gas/diesel oil	0.95	1.00	Average last AERs, Komeco
T106300	V	33	Facilities NACE 28: manufacture of machinery	Combustion	lpg	0.95	1.00	Average last AERs, Komeco
T106300	V	1	Facilities NACE 28: manufacture of machinery	Combustion	natural gas	0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T106300	V	352	Facilities NACE 28: manufacture of machinery	Combustion		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T106300	P	352	Facilities NACE 28: manufacture of machinery	Process		0.95	0.33	Average last AERs, Komeco
T106600	V	52	Facilities NACE 29: motor-industry	Combustion	fuel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T106600	V	405	Facilities NACE 29: motor-industry	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T106600	V	17	Facilities NACE 29: motor-industry	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T106600	P	352	Facilities NACE 29: motor-industry	Process		0.85	0.85	Ehrlich, spray coating
T106700	P	352	Facilities NACE 30 (excl 30.1): manufacture of other transportation	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T108400	V	405	Facilities NACE 30.1: ship-building	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T108400	V	17	Facilities NACE 30.1: ship-building	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T108400	V	33	Facilities NACE 30.1: ship-building	Combustion	lpg	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T108400	P	352	Facilities NACE 30.1: ship-building	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T106900	V	46	Facilities NACE 31/32: manufacture of furniture and other goods	Combustion	waste gas	1.00	0.75	CEPMEIP default for combustion of gaseous fuels
T106900	H	25	Facilities NACE 31/32: manufacture of furniture and other goods	Combustion	wood	0.75	0.77	CEPMEIP/Ehrlich medium sized wood-fired boiler
T106900	H	26	Facilities NACE 31/32: manufacture of furniture and other goods	Combustion	wood, wood waste	0.75	0.77	CEPMEIP/Ehrlich medium sized wood-fired boiler
T106900	P	352	Facilities NACE 31/32: manufacture of furniture and other goods	Process		0.75	0.33	Average of last AERs, Forbo linoleum
T101001	P	27	Facilities NACE 35.111:production of electricity	Process	coal	0.75	0.78	Average of last AERs, large coal fired power plants
T101001	P	352	Facilities NACE 35.111:production of electricity	Process		0.10	0.08	CEPMEIP default Storage and handling of coal
T108500	H	8	Facilities NACE 35: production and distribution of electricity and gas	Combustion	biomass gaseous	1.00	0.87	CEPMEIP default for combustion of gaseous fuels

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T108500	H	377	Facilities NACE 35: production and distribution of electricity and gas	Combustion	biomass gaseous	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T108500	H	471	Facilities NACE 35: production and distribution of electricity and gas	Combustion	biomass gaseous	1.00	0.83	CEPMEIP default for combustion of gaseous fuels
T108500	H	382	Facilities NACE 35: production and distribution of electricity and gas	Combustion	biomass liquid	0.75	0.78	Average of AER 2013, biomass combustion in power plants
T108500	H	385	Facilities NACE 35: production and distribution of electricity and gas	Combustion	biomass other	0.75	0.78	Average of last AERs, co-firing in coal fired power plants
T108500	H	381	Facilities NACE 35: production and distribution of electricity and gas	Combustion	biomass solid	0.75	0.75	Average of last AERs, biomass in large coal fired power plants
T108500	V	113	Facilities NACE 35: production and distribution of electricity and gas	Combustion	blast furnace gas	1.00	0.75	CEPMEIP default for combustion of gaseous fuels
T108500	V	23	Facilities NACE 35: production and distribution of electricity and gas	Combustion	blast furnace gas	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T108500	V	388	Facilities NACE 35: production and distribution of electricity and gas	Combustion	chemical waste gas	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T108500	V	351	Facilities NACE 35: production and distribution of electricity and gas	Combustion	coal	0.75	0.78	Average of last AERs, large coal fired power plants
T108500	V	27	Facilities NACE 35: production and distribution of electricity and gas	Combustion	coal	0.75	0.78	Average of last AERs, large coal fired power plants
T108500	V	467	Facilities NACE 35: production and distribution of electricity and gas	Combustion	coal	0.75	0.78	Average of last AERs, large coal fired power plants
T108500	V	51	Facilities NACE 35: production and distribution of electricity and gas	Combustion	coal	0.75	0.78	Average of last AERs, large coal fired power plants
T108500	V	387	Facilities NACE 35: production and distribution of electricity and gas	Combustion	coke oven gas	1.00	0.75	CEPMEIP default for combustion of gaseous fuels
T108500	V	394	Facilities NACE 35: production and distribution of electricity and gas	Combustion	coke oven gas	1.00	0.75	CEPMEIP default for combustion of gaseous fuels
T108500	V	482	Facilities NACE 35: production and distribution of electricity and gas	Combustion	crude oil	0.75	0.89	Average of last AERs, co-firing in coal fired power plants

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T108500	V	52	Facilities NACE 35: production and distribution of electricity and gas	Combustion	fuel oil	1.00	0.89	Average of last AERs, combustion of light fuel oil
T108500	V	480	Facilities NACE 35: production and distribution of electricity and gas	Combustion	fuel oil	0.75	0.89	Average of last AERs, co-firing in coal fired power plants
T108500	V	57	Facilities NACE 35: production and distribution of electricity and gas	Combustion	fuel oil	0.75	0.89	Average of last AERs, co-firing in coal fired power plants
T108500	V	405	Facilities NACE 35: production and distribution of electricity and gas	Combustion	gas/diesel oil	0.95	0.97	CEPMEIP default for combustion of gas/diesel oil
T108500	V	17	Facilities NACE 35: production and distribution of electricity and gas	Combustion	gas/diesel oil	0.95	0.83	CEPMEIP default for combustion of gas/diesel oil
T108500	V	410	Facilities NACE 35: production and distribution of electricity and gas	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T108500	V	18	Facilities NACE 35: production and distribution of electricity and gas	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T108500	H	26	Facilities NACE 35: production and distribution of electricity and gas	Combustion	hout, houtmot	0.75	0.71	Average of last AERs, co-firing in coal fired power plants
T108500	V	1	Facilities NACE 35: production and distribution of electricity and gas	Combustion	natural gas	0.75	1.00	Average of last AERs, co-firing in coal fired power plants
T108500	V	361	Facilities NACE 35: production and distribution of electricity and gas	Combustion	natural gas	0.75	0.83	Average of last AERs, co-firing in coal fired power plants
T108500	V	443	Facilities NACE 35: production and distribution of electricity and gas	Combustion	other gaseous fuel	0.67	0.75	CEPMEIP default for industrial waste fuels
T108500	V	445	Facilities NACE 35: production and distribution of electricity and gas	Combustion	other liquid fuel	0.75	0.89	Average of last AERs, co-firing in coal fired power plants
T108500	V	448	Facilities NACE 35: production and distribution of electricity and gas	Combustion	other oil	0.75	1.00	Average of last AERs, co-firing in coal fired power plants
T108500	V	440	Facilities NACE 35: production and distribution of electricity and gas	Combustion	other solid fuel	0.75	0.78	Average of last AERs, co-firing in coal fired power plants

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T108500	V	444	Facilities NACE 35: production and distribution of electricity and gas	Combustion	other solid fuel	0.75	0.78	Average of last AERs, large coal fired power plants
T108500	V	452	Facilities NACE 35: production and distribution of electricity and gas	Combustion	oxy gas	1.00	0.75	CEPMEIP default for combustion of gaseous fuels
T108500	V	402	Facilities NACE 35: production and distribution of electricity and gas	Combustion	phosphor oven gas	1.00	0.87	CEPMEIP default for combustion of gaseous fuels
T108500	V	68	Facilities NACE 35: production and distribution of electricity and gas	Combustion	waste	0.75	0.87	Average of last AERs, co-firing in coal fired power plants
T108500	V	358	Facilities NACE 35: production and distribution of electricity and gas	Combustion	waste	0.75	0.78	Average of last AERs, co-firing in coal fired power plants
T108500	H	378	Facilities NACE 35: production and distribution of electricity and gas	Combustion	wood	0.75	0.71	Average of last AERs, co-firing in coal fired power plants
T108500	H	25	Facilities NACE 35: production and distribution of electricity and gas	Combustion	wood	0.75	0.71	Average of last AERs, co-firing in coal fired power plants
T111300	P	352	Facilities NACE 37: collection and treatment of sewage	Process		0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T104201	H	8	Facilities NACE 38.2 collection and treatment of waste	Combustion	biomass gaseous	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	H	471	Facilities NACE 38.2 collection and treatment of waste	Combustion	biomass gaseous	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	H	382	Facilities NACE 38.2 collection and treatment of waste	Combustion	biomass liquid	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	H	381	Facilities NACE 38.2 collection and treatment of waste	Combustion	biomass solid	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	V	52	Facilities NACE 38.2 collection and treatment of waste	Combustion	fuel oil	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	V	405	Facilities NACE 38.2 collection and treatment of waste	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T104201	V	17	Facilities NACE 38.2 collection and treatment of waste	Combustion	gas/diesel oil	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	V	1	Facilities NACE 38.2 collection and treatment of waste	Combustion	natural gas	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	V	361	Facilities NACE 38.2 collection and treatment of waste	Combustion	natural gas	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	V	448	Facilities NACE 38.2 collection and treatment of waste	Combustion	other oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T104201	V	440	Facilities NACE 38.2 collection and treatment of waste	Combustion	other solid fuel	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	V	68	Facilities NACE 38.2 collection and treatment of waste	Combustion	waste	0.95	0.99	Average of last AERs, modern waste incineration.
T104201	V	358	Facilities NACE 38.2 collection and treatment of waste	Combustion	waste	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	V	6	Facilities NACE 38.2 collection and treatment of waste	Combustion	waste oil	0.95	1.00	Average of last AERs, modern waste incineration.
T104201	V	352	Facilities NACE 38.2 collection and treatment of waste	Combustion		0.95	1.00	Average of last AERs, modern waste incineration.
T111200	P	352	Facilities NACE 38.2/84.1 treatment of waste, including communal waste-incineration plants	Process		0.95	1.00	Average of last AERs, modern waste incineration.
T111201	P	361	Facilities NACE 38.2: waste treatment	Process	natural gas	0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T111201	P	352	Facilities NACE 38.2: waste treatment	Process		0.95	1.00	Average of last AERs, modern waste incineration.
T107000	H	382	Facilities NACE 38.3: preparation to recycling of metal and non-metal waste and scrap	Combustion	biomass liquid	0.80	0.71	Average of last AERs, waste sector

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T107000	V	405	Facilities NACE 38.3: preparation to recycling of metal and non-metal waste and scrap	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T107000	P	352	Facilities NACE 38.3: preparation to recycling of metal and non-metal waste and scrap	Process		0.80	0.33	Average of last AERs, waste sector
T151301	V	52	Facilities NACE 39: sanitation and other waste management	Combustion	fuel oil	0.95	0.79	CEPMEIP default for combustion of gas/diesel oil
T151301	P	352	Facilities NACE 39: sanitation and other waste management	Process		0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T107200	P	352	Facilities NACE 41-43: construction and building industies	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T107500	V	52	Facilities NACE 45: trade and repair of motor vehicles and motorcycles	Combustion	fuel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T107500	V	17	Facilities NACE 45: trade and repair of motor vehicles and motorcycles	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T107500	H	25	Facilities NACE 45: trade and repair of motor vehicles and motorcycles	Combustion	wood	0.75	0.77	CEPMEIP/Ehrlich medium sized wood-fired boiler
T107500	P	352	Facilities NACE 45: trade and repair of motor vehicles and motorcycles	Process		0.15	0.89	CEPMEIP, average for storage
T151100	V	51	Facilities NACE 46/47: retail and wholesale trade	Combustion	coal	0.50	0.57	CEPMEIP default for combustion of coal in a medium sized combustor
T151100	V	405	Facilities NACE 46/47: retail and wholesale trade	Combustion	gas/diesel oil	0.95	0.80	CEPMEIP default for combustion of gas/diesel oil
T151100	P	352	Facilities NACE 46/47: retail and wholesale trade	Process		0.55	0.81	Ehrlich, average for chemical industry

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T103900	H	377	Facilities NACE 49-53: transport, communications	Combustion	biomass gaseous	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T103900	V	388	Facilities NACE 49-53: transport, communications	Combustion	chemical waste gas	1.00	0.80	CEPMEIP default for combustion of gaseous fuels
T103900	V	52	Facilities NACE 49-53: transport, communications	Combustion	fuel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T103900	V	405	Facilities NACE 49-53: transport, communications	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T103900	V	17	Facilities NACE 49-53: transport, communications	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T103900	V	410	Facilities NACE 49-53: transport, communications	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T103900	V	411	Facilities NACE 49-53: transport, communications	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T103900	V	19	Facilities NACE 49-53: transport, communications	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T103900	V	476	Facilities NACE 49-53: transport, communications	Combustion	kerosene	0.95	0.00	CEPMEIP default for combustion of gas/diesel oil
T103900	V	33	Facilities NACE 49-53: transport, communications	Combustion	lpg	1.00	1.00	CEPMEIP default for combustion of gaseous fuels
T103900	V	1	Facilities NACE 49-53: transport, communications	Combustion	natural gas	0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T103900	V	361	Facilities NACE 49-53: transport, communications	Combustion	natural gas	0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T103900	V	44	Facilities NACE 49-53: transport, communications	Combustion	refinery gas	1.00	0.75	CEPMEIP default for combustion of gaseous fuels
T101300	P	352	Facilities NACE 52.10/52.24: cargo handling and storage	Process		0.15	0.12	CEPMEIP, average for storage

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation new PM2.5 fraction**
T107400	V	30	Facilities NACE 68-82: renting and consultancy activities	Combustion	fuel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T107400	V	34	Facilities NACE 68-82: renting and consultancy activities	Combustion	fuel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T107400	V	52	Facilities NACE 68-82: renting and consultancy activities	Combustion	fuel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T107400	V	480	Facilities NACE 68-82: renting and consultancy activities	Combustion	fuel oil	0.85	0.67	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T107400	V	57	Facilities NACE 68-82: renting and consultancy activities	Combustion	fuel oil	0.85	0.79	CEPMEIP/Ehrlich default for combustion of heavy fuel oil
T107400	V	405	Facilities NACE 68-82: renting and consultancy activities	Combustion	gas/diesel oil	0.95	1.00	CEPMEIP default for combustion of gas/diesel oil
T107400	V	17	Facilities NACE 68-82: renting and consultancy activities	Combustion	gas/diesel oil	0.95	0.67	CEPMEIP default for combustion of gas/diesel oil
T107400	V	352	Facilities NACE 68-82: renting and consultancy activities	Combustion		0.35	1.00	CEPMEIP default for mechanically formed fugitive emissions
T107400	P	352	Facilities NACE 68-82: renting and consultancy activities	Process		0.35	0.33	CEPMEIP default for mechanically formed fugitive emissions
T107001	P	352	Facilities NACE 84.1: public administration services	Process		0.95	1.00	Average of last AERs, modern waste incineration.
T107201	H	26	Facilities NACE 85-88: education and healthcare	Combustion	wood, wood waste	0.75	0.77	CEPMEIP/Ehrlich medium sized wood-fired boiler

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8922701	1	51	NACE 08: other quarrying and mining	Combustion	coal	0,80	0,57	Similar to fraction of individual facilities in table A.1: Average of last AERs, Nedmag
8922701	1	33	NACE 08: other quarrying and mining	Combustion	lpg	0,80	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, Nedmag
8922701	1	1	NACE 08: other quarrying and mining	Combustion	Natural gas	0,80	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, Nedmag
8910000	P		NACE 10.1: processing and preserving of meat and poultry	Process		0,35	0,16	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8910300	P		NACE 10.4: manufacture of oils and fats	Process		0,15	0,16	Similar to fraction of individual facilities in table A.1: Average of last AERs, crushing/grinding installation
8910400	P		NACE 10.5: dairy industry	Process		0,20	0,16	Similar to fraction of individual facilities in table A.1: Average of last AERs, drying of milk powder
8910406	P		NACE 10.5: dairy industry, diffuus	Process		0,20	0,33	Similar to fraction of individual facilities in table A.1: Average of last AERs, drying of milk powder
8910500	P		NACE 10.6: manufacture of grain mill products, excl. starches and starch products	Process		0,35	0,16	Similar to fraction of individual facilities in table A.1: Average of last AERs, crushing/grinding installation
8910506	P		NACE 10.6: manufacture of grain mill products, excl.	Process		0,35	0,33	Similar to fraction of individual facilities in table A.1: Average of

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
			starches and starch products, diffuse					last AERs, crushing/grinding installation
8918000	P		NACE 10.8 (excluding NACE 10.81 and 10.82): other manufacture of food products	Process		0,35		Similar to fraction of individual facilities in table A.1: Average of last AERs, sugar production and drying installations
8918006	P		NACE 10.8 (excluding NACE 10.81 and 10.82): other manufacture of food products, diffuse	Process		0,35	0,33	CEPMEIP default for mechanically formed fugitive emissions
8910600	P		NACE 10.9: manufacture of prepared animal feeds	Process		0,15	0,16	Similar to fraction of individual facilities in table A.1: CEPMEIP, average for storage
8910606	P		NACE 10.9: manufacture of prepared animal feeds, diffuse	Process		0,35	0,33	CEPMEIP default for mechanically formed fugitive emissions
8900200	7	8	NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	Biomass gaseous	0,15	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, crushing/grinding installation
8900200	1	51	NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	coal	0,50		Similar to fraction of individual facilities in table A.1:
8900200	1	52	NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	fuel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil
8900200	1	33	NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	lpg	0,15	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, crushing/grinding installation

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8900200	1	1	NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	Natural gas	0,15	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, crushing/grinding installation
8900200	1	135	NACE 10-12: manufacture of food products, beverages and tobacco	Combustion	petroleum	0,95	1,00	CEPMEIP default for combustion of gas/diesel oil
8919700	4	193	NACE 13.20: textile weaving	Process	processed cotton	0,35	0,34	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8919700	4		NACE 13.20: textile weaving	Process		0,35	0,33	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8911400	4	155	NACE 13.3: finishing of textiles	Process	finished textiles	0,35	0,35	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8911500	4	186	NACE 13.93: manufacture of carpets and rugs	Process	manufactured carpets	0,35	0,33	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8911500	4		NACE 13.93: manufacture of carpets and rugs	Process		0,35	0,33	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8900300	1	51	NACE 13/14: manufacture of textiles and textile apparel	Combustion	coal	0,50	0,57	CEPMEIP default for combustion of coal in a medium sized combustor

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8900300	1	52	NACE 13/14: manufacture of textiles and textile apparel	Combustion	fuel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil
8900300	1	33	NACE 13/14: manufacture of textiles and textile apparel	Combustion	lpg	0,35	1,00	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8900300	1	1	NACE 13/14: manufacture of textiles and textile apparel	Combustion	Natural gas	0,35	1,00	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8900300	1	135	NACE 13/14: manufacture of textiles and textile apparel	Combustion	petroleum	0,95	1,00	CEPMEIP default for combustion of gas/diesel oil
8900300	4	177	NACE 13/14: manufacture of textiles and textile apparel	Process	manufactured other textiles	0,35	0,36	CEPMEIP default for mechanically formed fugitive emissions
8900300	4		NACE 13/14: manufacture of textiles and textile apparel	Process		0,35	0,33	CEPMEIP default for mechanically formed fugitive emissions
8918106	P		NACE 13: manufacture of textiles, diffuse	Process		0,35	0,33	CEPMEIP default for mechanically formed fugitive emissions
8911700	P		NACE 15.11: tanning of leather and fur preparation	Process		0,35	0,10	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8900400	1	1	NACE 15: leather industry and fur preparation	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8911900	4		NACE 16.1: sawmilling and planing of wood, impregnation of wood	Process		0,35	0,33	CEPMEIP default for mechanically formed fugitive emissions

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8912100	4		NACE 16.23: manufacture of builders' carpentry and joinery	Process		0,35	0,34	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8912101	1	52	NACE 16: manufacture of wooden products	Combustion	fuel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil
8912101	1	33	NACE 16: manufacture of wooden products	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8912101	1	1	NACE 16: manufacture of wooden products	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8912101	1	135	NACE 16: manufacture of wooden products	Combustion	petroleum	0,95	1,00	CEPMEIP default for combustion of gas/diesel oil
8912101	7	25	NACE 16: manufacture of wooden products	Combustion	wood	0,75	0,77	CEPMEIP/Ehrlich medium sized wood-fired boiler
8912106	P		NACE 16: manufacture of wooden products, diffuse	Process		0,35	0,33	CEPMEIP default for mechanically formed fugitive emissions
8900600	1	51	NACE 17.1/17.2: manufacture of pulp, paper and paperboard	Combustion	coal	0,50	0,57	CEPMEIP default for combustion of coal in a medium sized combustor
8900600	1	52	NACE 17.1/17.2: manufacture of pulp, paper and paperboard	Combustion	fuel oil	0,95	0,83	CEPMEIP default for combustion of gas/diesel oil
8900600	1	33	NACE 17.1/17.2: manufacture of pulp, paper and paperboard	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8900600	1	1	NACE 17.1/17.2: manufacture of pulp, paper and paperboard	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8912200	4	158	NACE 17.1: manufacture of pulp, paper and paperboard	Process	manufactured paper and paperboard	0,75	0,33	Similar to fraction of individual facilities in table A.1: Average of last AERs, Parenco

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8912200	4		NACE 17.1: manufacture of pulp, paper and paperboard	Process		0,75	0,33	Similar to fraction of individual facilities in table A.1: Average of last AERs, Parenco
8912406	P		NACE 17: manufacture of paper, paperboard and articles of paper and paperboard, diffuse	Process		0,35	0,33	CEPMEIP default for mechanically formed fugitive emissions
8900700	1	1	NACE 18/58: publishing, printing and reproduction of recorded media	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8900700	P		NACE 18/58: publishing, printing and reproduction of recorded media	Process		0,35	0,05	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8924200	1	1	NACE 19.2 (excluding NACE 19.202): manufacture of refined petroleum products	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8912500	1	52	NACE 19.202: manufacture of refined petroleum products - not oil refineries	Combustion	fuel oil	0,95	0,67	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8912500	1	1	NACE 19.202: manufacture of refined petroleum products - not oil refineries	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8901100	1	51	NACE 20.1: manufacture of basic chemicals	Combustion	coal	0,50	0,43	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of coal in a medium sized combustor
8901100	1	52	NACE 20.1: manufacture of basic chemicals	Combustion	fuel oil	0,95	0,83	Similar to fraction of individual facilities in table A.1: CEPMEIP

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
								default for combustion of gas/diesel oil
8901100	1	33	NACE 20.1: manufacture of basic chemicals	Combustion	lpg	0,75	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, production of chemical products
8901100	1	1	NACE 20.1: manufacture of basic chemicals	Combustion	natural gas	0,75		Similar to fraction of individual facilities in table A.1: Average of last AERs, production of chemical products
8901100	1	518	NACE 20.1: manufacture of basic chemicals	Combustion	other oil	0,95	0,83	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8901100	1	135	NACE 20.1: manufacture of basic chemicals	Combustion	petroleum	0,95	1,00	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8901100	1	54	NACE 20.1: manufacture of basic chemicals	Combustion	tar and asphalt	0,85	0,00	Similar to fraction of individual facilities in table A.1: CEPMEIP/Ehrlich default for combustion of heavy fuel oil
8901100	4	183	NACE 20.1: manufacture of basic chemicals	Process	manuafctured primary synthetic rubber	0,63	0,73	Similar to fraction of individual facilities in table A.1: Average of last AERs of fertilizer production and Ehrlich for chemical industry
8901100	4	143	NACE 20.1: manufacture of basic chemicals	Process	Production value industrial gases	0,63	0,09	Similar to fraction of individual facilities in table A.1: Average of last AERs of fertilizer production and Ehrlich for chemical industry

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8901100	4		NACE 20.1: manufacture of basic chemicals	Process		0,63		Similar to fraction of individual facilities in table A.1: Average of last AERs of fertilizer production and Ehrlich for chemical industry
8912600	4	170	NACE 20.12: manufacture of dyes and pigments	Process	manufactured dyes and pigments	0,35	0,73	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8912600	4		NACE 20.12: manufacture of dyes and pigments	Process		0,35	0,73	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8913000	4	172	NACE 20.13: manufacture of inorganic basic chemicals	Process	manuafctured primary plastics	0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8913000	4	161	NACE 20.13: manufacture of inorganic basic chemicals	Process	manufactured norganic basic chemicals	0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8913000	4		NACE 20.13: manufacture of inorganic basic chemicals	Process		0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8912900	4	175	NACE 20.149: manufacture of organic basic chemicals (no petrochemicals)	Process	manufactured organic basic chemicals	0,63	0,73	Similar to fraction of individual facilities in table A.1: Average of last AERs of fertilizer production and Ehrlich for chemical industry
8912900	4		NACE 20.149: manufacture of organic basic chemicals (no petrochemicals)	Process		0,63	0,73	Similar to fraction of individual facilities in table A.1: Average of last AERs of fertilizer production and Ehrlich for chemical industry

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8900900	1	52	NACE 20.15: manufacture of fertilizers and nitrogen compounds	Combustion	fuel oil	0,95	0,34	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8900900	1	33	NACE 20.15: manufacture of fertilizers and nitrogen compounds	Combustion	lpg	0,70	0,34	Similar to fraction of individual facilities in table A.1: Average of last AERs, drying installations in fertilizer production sector
8900900	1	1	NACE 20.15: manufacture of fertilizers and nitrogen compounds	Combustion	natural gas	0,70	0,34	Similar to fraction of individual facilities in table A.1: Average of last AERs, drying installations in fertilizer production sector
8900900	4	171	NACE 20.15: manufacture of fertilizers and nitrogen compounds	Process	manufactured fertilizers and nitrogen compounds	0,70	0,34	Similar to fraction of individual facilities in table A.1: Average of last AERs, drying installations in fertilizer production sector
8900900	4	2	NACE 20.15: manufacture of fertilizers and nitrogen compounds	Process	natural gas	0,70	0,34	Similar to fraction of individual facilities in table A.1: Average of last AERs, drying installations in fertilizer production sector
8913100	4	163	NACE 20.2: manufacture of pesticides	Process	manufactured pesticides	0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8913100	4		NACE 20.2: manufacture of pesticides	Process		0,55	0,72	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8913700	1	52	NACE 20.2-20.5: chemical products industry	Combustion	fuel oil	0,95	0,83	CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8913700	1	17	NACE 20.2-20.5: chemical products industry	Combustion	gas/diesel oil	0,95	0,83	CEPMEIP default for combustion of gas/diesel oil
8913700	1	33	NACE 20.2-20.5: chemical products industry	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8913700	1	1	NACE 20.2-20.5: chemical products industry	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8913700	1	135	NACE 20.2-20.5: chemical products industry	Combustion	petroleum	0,95	1,00	CEPMEIP default for combustion of gas/diesel oil
8913700	4	176	NACE 20.2-20.5: chemical products industry	Process	manufactured other chemicals	0,55	0,73	Ehrlich, average for chemical industry
8913700	4	178	NACE 20.2-20.5: chemical products industry	Process	manufactured perfumes and cosmetics	0,55	1,00	Ehrlich, average for chemical industry
8913700	4		NACE 20.2-20.5: chemical products industry	Process		0,55	0,73	Ehrlich, average for chemical industry
8913200	4	184	NACE 20.3: manufacture of paints, varnishes and similar coatings, printing ink and mastics	Process	manufactured paints, lacquers and ink	0,50	0,73	Similar to fraction of individual facilities in table A.1: Assumption for fugitive emissions from ovens
8913200	4		NACE 20.3: manufacture of paints, varnishes and similar coatings, printing ink and mastics	Process		0,50	0,72	Similar to fraction of individual facilities in table A.1: Assumption for fugitive emissions from ovens
8913400	4	187	NACE 20.41: manufacture detergents	Process	manufactured detergents	0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8913400	4		NACE 20.41: manufacture detergents	Process		0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8913600	4	173	NACE 20.52: manufacture of glues and adhesives	Process	manuafctured glues	0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8913600	4		NACE 20.52: manufacture of glues and adhesives	Process		0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8919300	4	166	NACE 20.59: manufacture of other chemical products n.e.c.	Process	manufactured photochemical products	0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8919300	4		NACE 20.59: manufacture of other chemical products n.e.c.	Process		0,55	0,72	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8913800	4		NACE 20.6: manufacture of synthetic and artificial fibres	Process		0,55	0,73	Similar to fraction of individual facilities in table A.1: Ehrlich, average for chemical industry
8901706	P		NACE 22.1: manufacture of rubber products, diffuse	Process		0,35	0,33	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8913900	P		NACE 22.2: manufacture of plastic products	Process		0,35	0,10	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8913906	P		NACE 22.2: manufacture of plastic products, diffuse	Process		0,35	0,33	Similar to fraction of individual facilities in table A.1: CEPMEIP

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
								default for mechanically formed fugitive emissions
8901702	1	52	NACE 22: manufacture of rubber and plastic products	Combustion	fuel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil
8901702	1	33	NACE 22: manufacture of rubber and plastic products	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8901702	V	33	NACE 22: manufacture of rubber and plastic products	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8901702	1	1	NACE 22: manufacture of rubber and plastic products	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8901702	V	1	NACE 22: manufacture of rubber and plastic products	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8914000	4	157	NACE 23.1: manufacture of glass and glassware	Process	manufactured glass	0,95	0,54	Similar to fraction of individual facilities in table A.1: Average of last AERs, glass production
8914000	4		NACE 23.1: manufacture of glass and glassware	Process		0,95	0,89	Similar to fraction of individual facilities in table A.1: Average of last AERs, glass production
8914100	4	169	NACE 23.2-23.4: manufacture of ceramic products	Process	manufactured ceramic products	0,25	0,92	Similar to fraction of individual facilities in table A.1: Ehrlich, fugitive emissions from ceramic industry
8914100	4		NACE 23.2-23.4: manufacture of ceramic products	Process		0,25	0,75	Similar to fraction of individual facilities in table A.1: Ehrlich, fugitive emissions from ceramic industry
8914200	4	83	NACE 23.32: manufacture of bricks and tiles	Process	Bricks	0,25	0,92	Similar to fraction of individual facilities in table A.1: Ehrlich, fugitive emissions from ceramic industry

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8914200	4		NACE 23.32: manufacture of bricks and tiles	Process		0,25	0,75	Similar to fraction of individual facilities in table A.1: Ehrlich, fugitive emissions from ceramic industry
8914300	4	180	NACE 23.6: manufacture of articles of concrete, plaster and cement	Process	manufactured cement, chalk and gipsum	0,10	0,45	Similar to fraction of individual facilities in table A.1: Ehrlich, cement production fugitive emissions
8914500	4	204	NACE 23.9: manufacture of other non-metallic mineral products	Process	value of manufactured other non-metallic products	0,80	0,70	Similar to fraction of individual facilities in table A.1: PRTR for Denmark, non-metallic mineral products
8914500	4		NACE 23.9: manufacture of other non-metallic mineral products	Process		0,80	0,70	Similar to fraction of individual facilities in table A.1: PRTR for Denmark, non-metallic mineral products
8914600	1	51	NACE 23: construction material and glass industry	Combustion	coal	0,50	0,45	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of coal in a medium sized combustor
8914600	1	13	NACE 23: construction material and glass industry	Combustion	cokes	0,50	0,54	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of coal in a medium sized combustor
8914600	1	52	NACE 23: construction material and glass industry	Combustion	fuel oil	0,95	0,83	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8914600	1	33	NACE 23: construction material and glass industry	Combustion	lpg	0,90	0,54	Similar to fraction of individual facilities in table A.1: Average of last AERs, cement and glass production
8914600	1	1	NACE 23: construction material and glass industry	Combustion	natural gas	0,90	0,54	Similar to fraction of individual facilities in table A.1: Average of last AERs, cement and glass production
8914600	1	135	NACE 23: construction material and glass industry	Combustion	petroleum	0,95	0,54	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8914606	P		NACE 23: construction material and glass industry, diffuse	Process		0,90	0,33	Similar to fraction of individual facilities in table A.1: Average of last AERs, cement and glass production
8924406	P		NACE 24.1-24.3 base metal industry, processing and manufacture of iron and steel, diffuse	Process		0,65		Similar to fraction of individual facilities in table A.1: CEPMEIP average integrated iron and steel plant class 2
8924407	1	33	NACE 24.1-24.3/24.51/24.52: base metal iron and steel	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8924407	4		NACE 24.1-24.3/24.51/24.52: base metal iron and steel	Process		0,70	0,64	Ehrlich, metallurgical sector
8914602	4	168	NACE 24.2: manufacture of tubes and pipes	Process	manufactured tubes and pipes	0,70	0,37	Similar to fraction of individual facilities in table A.1: Ehrlich, metallurgical sector
8914602	4		NACE 24.2: manufacture of tubes and pipes	Process		0,70	0,37	Similar to fraction of individual facilities in table A.1: Ehrlich, metallurgical sector

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8919200	4		NACE 24.3: other first processing of iron and steel	Process		0,70	0,50	Similar to fraction of individual facilities in table A.1: Ehrlich, metallurgical sector
8920100	1	13	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals	Combustion	cokes	0,50	0,43	CEPMEIP default for combustion of coal in a medium sized combustor
8920100	1	33	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals	Combustion	lpg	1,00	0,73	CEPMEIP default for combustion of gaseous fuels
8920100	1	1	NACE 24.4/24.53/24.54: manufacture and casting of light and other non-ferrous metals	Combustion	natural gas	1,00	0,73	CEPMEIP default for combustion of gaseous fuels
8914702	4		NACE 24.45: manufacture of non-ferrous metals, aluminium	Process		0,75	0,67	Similar to fraction of individual facilities in table A.1: CEPMEIP default for sec0ndary copper
8914900	4	111	NACE 24.5: casting of metals	Process	casting of metals	0,55	0,15	Similar to fraction of individual facilities in table A.1: Average of last AERs, Alucast
8914900	4		NACE 24.5: casting of metals	Process		0,55	0,15	Similar to fraction of individual facilities in table A.1: Average of last AERs, Alucast
8902100	1	33	NACE 25: manufacture of metal structures and parts of structures	Combustion	lpg	0,30	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, selection of companies in metal industry
8902100	1	1	NACE 25: manufacture of metal structures and parts of structures	Combustion	natural gas	0,30	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, selection of companies in metal industry

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8902100	1	135	NACE 25: manufacture of metal structures and parts of structures	Combustion	petroleum	0,30	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, selection of companies in metal industry
8915000	P		NACE 25-33/95 (excluding NACE 30.1/33.15): metal-electronic industry	Process		0,35	0,33	CEPMEIP default for mechanically formed fugitive emissions
8915006	P		NACE 25-33/95 (excluding NACE 30.1/33.15): metal-electronic industry, diffuse release of PM10	Process		0,35	0,33	CEPMEIP default for mechanically formed fugitive emissions
8902301	1	52	NACE 26/28: manufacture of machinery and electronic apparatus	Combustion	fuel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil
8902301	1	33	NACE 26/28: manufacture of machinery and electronic apparatus	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8902301	1	1	NACE 26/28: manufacture of machinery and electronic apparatus	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8902301	1	135	NACE 26/28: manufacture of machinery and electronic apparatus	Combustion	petroleum	0,95	1,00	CEPMEIP default for combustion of gas/diesel oil
8915300	1	51	NACE 26/31/32: manufacture of electronic apparatus and furniture	Combustion	coal	0,50	0,57	CEPMEIP default for combustion of coal in a medium sized combustor
8915300	1	52	NACE 26/31/32: manufacture of electronic apparatus and furniture	Combustion	fuel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8915300	1	33	NACE 26/31/32: manufacture of electronic apparatus and furniture	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8915300	1	1	NACE 26/31/32: manufacture of electronic apparatus and furniture	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8915300	1	135	NACE 26/31/32: manufacture of electronic apparatus and furniture	Combustion	petroleum	0,95	1,00	CEPMEIP default for combustion of gas/diesel oil
8902304	1	1	NACE 26: manufacture of computers and electronic and optical apparatus	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8902303	1	1	NACE 27: manufacture of electrical apparatus	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8902200	1	52	NACE 28: manufacture of machinery	Combustion	fuel oil	0,95	0,67	Similar to fraction of individual facilities in table A.1: Average last AERs, Komeco
8902200	1	33	NACE 28: manufacture of machinery	Combustion	lpg	0,35	1,00	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8902200	1	1	NACE 28: manufacture of machinery	Combustion	natural gas	0,35	1,00	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8902400	1	52	NACE 29: motor-industry	Combustion	fuel oil	0,95	0,67	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8902400	1	33	NACE 29: motor-industry	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8902400	1	1	NACE 29: motor-industry	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8902400	1	135	NACE 29: motor-industry	Combustion	petroleum	0,95	1,00	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8914800	P		NACE 30.1: ship-building, painting	Process		0,35	0,33	Similar to fraction of individual facilities in table A.1: CEPMEIP default for mechanically formed fugitive emissions
8908100	1	52	NACE 30: manufacture of other transport equipment	Combustion	fuel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil
8908100	1	33	NACE 30: manufacture of other transport equipment	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8908100	1	1	NACE 30: manufacture of other transport equipment	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8908100	1	135	NACE 30: manufacture of other transport equipment	Combustion	petroleum	0,95	1,00	CEPMEIP default for combustion of gas/diesel oil
8908000	1	52	NACE 31/32: manufacture of furniture and other goods	Combustion	fuel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil
8908000	1	33	NACE 31/32: manufacture of furniture and other goods	Combustion	lpg	1,00	1,00	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gaseous fuels
8908000	1	1	NACE 31/32: manufacture of furniture and other goods	Combustion	natural gas	1,00	1,00	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gaseous fuels

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8908000	7	25	NACE 31/32: manufacture of furniture and other goods	Combustion	wood	0,75		Similar to fraction of individual facilities in table A.1: CEPMEIP/Ehrlich medium sized wood-fired boiler
8908000	7	26	NACE 31/32: manufacture of furniture and other goods	Combustion	wood, wood waste	0,75	0,77	Similar to fraction of individual facilities in table A.1: CEPMEIP/Ehrlich medium sized wood-fired boiler
8920400	7	8	NACE 35: production and distribution of electricity and gas	Combustion	Biomass gaseous	0,75		Similar to fraction of individual facilities in table A.1: Average of last AERs, co-firing in coal fired power plants
8920400	1	51	NACE 35: production and distribution of electricity and gas	Combustion	coal	0,75	0,83	Similar to fraction of individual facilities in table A.1: Average of last AERs, large coal fired power plants
8920400	1	52	NACE 35: production and distribution of electricity and gas	Combustion	fuel oil	0,95	0,83	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8920400	1	17	NACE 35: production and distribution of electricity and gas	Combustion	gas/diesel oil	0,95	0,83	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8920400	1	1	NACE 35: production and distribution of electricity and gas	Combustion	natural gas	0,75		Similar to fraction of individual facilities in table A.1: Average of last AERs, co-firing in coal fired power plants
8920500	1	52	NACE 36: collection, purification and distribution of water	Combustion	fuel oil	0,95	0,80	CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8920500	1	17	NACE 36: collection, purification and distribution of water	Combustion	gas/diesel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil
8920500	1	33	NACE 36: collection, purification and distribution of water	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8920500	1	1	NACE 36: collection, purification and distribution of water	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8920500	1	135	NACE 36: collection, purification and distribution of water	Combustion	petroleum	0,95	1,00	CEPMEIP default for combustion of gas/diesel oil
E400109	7	8	NACE 37: collection and treatment of sewage	Combustion	Biomass gaseous	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
E400109	H	8	NACE 37: collection and treatment of sewage	Combustion	Biomass gaseous	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
E400109	1	17	NACE 37: collection and treatment of sewage	Combustion	gas/diesel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil
E400109	V	17	NACE 37: collection and treatment of sewage	Combustion	gas/diesel oil	0,95	0,67	CEPMEIP default for combustion of gas/diesel oil
E400109	1	1	NACE 37: collection and treatment of sewage	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
E400109	V	1	NACE 37: collection and treatment of sewage	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8921804	P		NACE 38.2/84.1 treatment of waste, including communal waste-incineration plants	Process		0,95	1,00	Similar to fraction of individual facilities in table A.1: Average of last AERs, modern waste incineration.
8916000	1	52	NACE 38.3: preparation to recycling of metal and non-metal waste and scrap	Combustion	fuel oil	0,95	0,83	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil

PRTR codes			Source category			PM2.5 fractions		Explanation
EMK	**SSE**	**EVE**	**Emission source**	**Emission type**	**Activity**	**New (2019)**	**Old (2018)**	**Explanation for the new PM2.5 fraction**
8916000	1	33	NACE 38.3: preparation to recycling of metal and non-metal waste and scrap	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8916000	1	1	NACE 38.3: preparation to recycling of metal and non-metal waste and scrap	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
8921900	1	52	NACE 39: sanitation and other waste management	Combustion	fuel oil	0,95	0,67	Similar to fraction of individual facilities in table A.1: CEPMEIP default for combustion of gas/diesel oil
8921900	1	33	NACE 39: sanitation and other waste management	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
0020401	1	51	NACE 41-43: construction and building industies	Combustion	coal	0,50	0,50	CEPMEIP default for combustion of coal in a medium sized combustor
0020401	1	33	NACE 41-43: construction and building industies	Combustion	lpg	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
0020401	1	1	NACE 41-43: construction and building industies	Combustion	natural gas	1,00	1,00	CEPMEIP default for combustion of gaseous fuels
0020401	7	25	NACE 41-43: construction and building industies	Combustion	wood	0,75	0,77	CEPMEIP/Ehrlich medium sized wood-fired boiler
0833400	P		NACE 52.10/52.24: cargo handling and storage	Process		0,15	0,27	Similar to fraction of individual facilities in table A.1: CEPMEIP, average for storage

Published by:

National Institute for Public Health and the Enviroment, RIVM
P.O. Box 1 | 3720 BA Bilthoven
The Netherlands
www.rivm.nl/en

March 2025

Committed to
health and sustainability